IRKUTSK

ATMOSPHERIC and OCEAN OPTICS. ATMOSPHERIC PHYSICS

Institute of Atmospheric Optics SB RAS
Institute of Solar-Terrestrial Physics SB RAS

VIII JOINT INTERNATIONAL SYMPOSIUM

ATMOSPHERIC AND OCEAN OPTICS. ATMOSPHERIC PHYSICS

Irkutsk

June 25 – 29, 2001

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ABSTRACT (Maximum 200 words)

This is an interdisciplinary conference. Topics include: Molecular Spectrocopy and Atmospheric Radiative Process; Optical Propagation in the Atmosphere and Ocean; Optical Investigation of the Atmosphere and Ocean; Physical Phenomena in the Thermosphere and Lonosphere; Structure and Dynamics of the Middle Atmosphere; and Dynamics of the Atmosphere and Climate of the Asian Region.

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Institute of Solar-Terrestrial Physics

Institute of Atmospheric Optics

SIBERIAN BRANCH OF THE RUSSIAN ACADEMY OF SCIENCES

IRKUTSK 2001

ATMOSPHERIC and OCEAN OPTICS. ATMOSPHERIC PHYSICS

ATMOSPHERIC AND OCEAN OPTICS. ATMOSPHERIC PHYSICS

VIII Joint International Symposium

June 25 – 29, 2001

Irkutsk

We wish to thank the following for their contribution to the success of this symposium:

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Optical Society of America

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VIII Joint International Symposium «Atmospheric and ocean optics. Atmospheric physics»
Symposium Proceedings. Edit by V.A. Banakh and O.V. Tikhomirova
Tomsk, Institute of Atmospheric Optics SB RAS, 2001

Digest contains the contributions on the fundamental and applied problems of the atmospheric and ocean optics and atmospheric physics. The abstracts present the following sessions:

Atmospheric and Ocean Optics

A. Molecular Spectroscopy and Atmospheric Radiative Processes
- A1. Molecular Spectroscopy of Atmospheric Gases
- A2. Absorption of Radiation in Atmosphere and Ocean, Radiative Regime and Climate Problems

B. Optical Radiation Propagation in the Atmosphere and Ocean
- B1. Wave Propagation in Random Inhomogeneous Media. Adaptive Optics
- B2. Nonlinear Effects at Radiation Propagation in Atmosphere and Water Media

C. Optical Investigation of Atmosphere and Ocean
- C1. Multiple Scattering in Optical Remote Sensing. Image Transfer and Processing
- C2. Laser and Acoustic Sounding of Atmosphere and Ocean
- C3. Airborne and Spaceborne Lidars and their Applications. Models of the Atmosphere. Laser Beams on High-altitude Paths in the Atmosphere and Space
- C4. Optical and Microphysical Properties of Atmospheric Aerosol and Suspension in Water Media
- C5. Transport and Transformation of Aerosol and Gas Components in the Atmosphere
- C6. Diagnostics of State and Functioning of Plants' Bio systems

Atmospheric Physics

D. Physical Processes and Phenomena in the Earth's Thermosphere and Ionosphere
- D1. Magnetosphere-Ionosphere Interactions
- D2. Inhomogeneous Structure of Ionosphere
- D3. Methods for Remote Sensing of Ionosphere and Thermosphere
- D4. Radio-wave Propagation in Ionosphere

E. Structure and Dynamics of the Middle Atmosphere
- E1. Atmospheric Waves and Turbulence
- E2. Gas composition of Middle Atmosphere
- E3. D-Area of Ionosphere
- E4. Models of Middle Atmosphere

F. Dynamics of the Atmosphere and Climate of the Asian Region
- F1. Long-period Trends of Atmospheric Parameters
- F2. Effect of Solar Activity on Weather and Climate

Abstracts were printed from the electronic forms presented by the authors. Digest is interesting for researchers and engineers working in the atmospheric physics, atmospheric and ocean optics, radiophysics, acoustics, meteorology, and ecology.

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Session A1. MOLECULAR SPECTROSCOPY OF ATMOSPHERIC GASES

Chairs: Prof. L.N. Sinitsa, Prof. A. Barbe

Monday, June 25, 11:00–13:15. Small hall

11:00 PHOTOACOUSTIC DETECTION OF GAS-AEROSOL IMPURITIES IN THE ATMOSPHERE
Yu.N. Ponomarev *(Institute of Atmospheric Optics of SB RAS, Tomsk, Russia)* **A1–01**

11:15 NEW ICLAS SPECTRA OF CO_2 AND N_2O IN THE NEAR INFRARED (10000–12000 cm^{-1})
G. Weirauch, A. Campargue *(Universite Joseph Fourier de Grenoble, France),* **V.I. Perevalov, S.A. Tashkun** *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **and J.-L. Teffo** *(Universite Pierre et Marie Curie, Paris, France)* **A1–02**

11:30 ESTIMATION OF LINE MIXING EFFECT ON WATER VAPOR SPECTRAL LINES
A.D. Bykov, N.N. Lavrent'eva, L.N. Sinitsa, and A.M. Solodov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **A1–03**

11:45 ON THE THEORY OF SPECTRAL LINE BROADENING BY COMBINED ACTION OF DOPPLER AND PRESSURE EFFECTS
M.R. Cherkasov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **A1–04**

12:00 EFFECT OF DISPERSION FOR DIPOLE MOMENTS OF MOLECULES IN DIFFERENT VIBRATIONAL AND ROTATIONAL STATES ON TRANSPORT PROPERTIES OF POLAR GASES
V.P. Kochanov and V.I. Starikov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **A1–05**

12:15 STUDY OF FORMATION OF NON-EQUILIBRIUM VIBRATIONAL STATE POPULATION FOR MOLECULES IN THE UPPER PLANETARY ATMOSPHERES
A.O. Semenov and G.M. Shved *(Institute of Physics of St. Petersburg State University, Russia)* **A1–06**

12:30 ROVIBRONIC PROBLEMS AND PECULIARITIES OF DEDUCTION OF THE HAMILTONIAN IN THE PRINCIPAL AXES AS THEIR BASIS
A.Ya. Tsaune, Ya.A. Podolyak *(Ukrainian State Chemical and Technological University, Dnepropetrovsk, Ukraine),* **and M.P. D'yachenko** *(Dnepropetrovsk National University, Ukraine)* **A1–07**

12:45 FOURIER – TRANSFORM ABSORPTION SPECTRA OF $H_2{}^{16}O$, $H_2{}^{17}O$, AND $H_2{}^{18}O$ IN THE 8000–9500 cm^{-1} SPECTRAL REGION
A.D. Bykov, O.V. Naumenko, L.N. Sinitsa, L.P. Vorobieva *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **C. Camy-Peyret, J.-Y. Mandin** *(Universite Pierre-et-Marie Curie, Paris, France),* **and J.-M. Flaud** *(Universite Paris Sud, Orsay, France)* **A1–08**

13:00 RADIATION BLOCK OF ICM RAS MODEL IN PROGRAM ICRCCM-III
V.Ya. Galin *(Institute of Computational Mathematics RAS, Moscow, Russia)* **A1–09**

POSTERS ***Monday, June 25, 18:00–20:00***

MEASUREMENT OF MOLECULAR ABSORPTION SPECTRUM OF O_2 WITHIN 755–775 nm RANGE **A1–10**
I.S. Tyryshkin and Yu.N. Ponomarev

GENERALIZED EILER TRANSFORMATION OF DANHAM SERIES FOR DIATOMIC MOLECULE **A1–11**
T.V. Kruglova, A.D. Bykov, O.V. Naumenko

Session A2. ABSORPTION OF RADIATION IN ATMOSPHERE AND OCEAN, RADIATIVE REGIME AND CLIMATE PROBLEMS

Chairs: RAS corresponding member S.D. Tvorogov, Prof. A. Arking

Monday, June 25, 14:00–16:00. Main hall

14:45 COMPARISONS BETWEEN CALCULATIONS AND MEASUREMENTS OF SOLAR DOWNWARD IRRADIANCE IN DIFFERENT ATMOSPHERIC CONDITIONS
A. Rublev[1], N. Chubarova[2], G. Gorchakov[3], A. Arking[4], and A. Kopylov[1] *([1]Kurchatov Institute, Moscow, Russia, [2]Moscow State University, Russia, [3]Institute of Atmospheric Physics RAS, Moscow, Russia, [4]Johns Hopkins University, Baltimore, USA)* **A2–03**

15:00 SOOT AEROSOL AS A SOURCE OF REDUNDANT ABSORPTION OF SHORT-WAVELENGTH RADIATION BY THE ATMOSPHERIC AIR
B.A. Tikhomirov, A.B. Tikhomirov, and K.M. Firsov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **A2–04**

15:15 APPLICATION OF A SERIES OF EXPONENTS TO CALCULATIONS OF RADIATIVE TRANSPORT IN THE SPATIALLY INHOMOGENEOUS GASEOUS AND AEROSOL EARTH'S ATMOSPHERE BY THE MONTE CARLO METHOD
K.M. Firsov, T.Yu. Chesnokova, V.V. Belov, A.B. Serebrennikov, and Yu.N. Ponomarev *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **A2–05**

15:30 APPLICATION OF THE GENERALIZED METHOD OF CONSTRUCTION OF LINEAR REGRESSION TO REVISE THE MODEL OF CONTINUOUS ABSORPTION OF RADIATION BY WATER VAPOR OVER THE SPECTRAL RANGE 10.6 μm
N.N. Shchelkanov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **A2–06**

15:45 INVESTIGATION OF DEPENDENCE OF SOLAR RADIATION CHARACTERISTICS OF THE ATMOSPHERE ON ATMOSPHERE, CLOUD AND UNDERLYING SURFACE PROPERTIES
L.R. Dmitrieva-Arrago and M.V. Shatunova *(Hydrometeorological Research Center of Russia, Moscow)* **A2–07**

POSTERS ***Monday, June 25, 18:00–20:00***

CORRELATION CONNECTIONS OF THE FLUCTUATIONS OF CUMULUS CLOUDS ENERGY BRIGHTNESS WITHIN THE RANGE OF 1.5–5.2 mcm
A.M. Allenov, N.P. Ivanova, A.A. Pechenev, and V.A. Solov'ev **A2–08**

RESULTS OF RESEARCHES OF OWN RADIATIONS OF THE CLOUDY SKY IN A RANGE 8 – 13 MICRONS IN WINTER TIME
A.M. Allenov, A.A. Pechenev, V.A. Solov'ev, and I.V. Jakimenko **A2–09**

COMPARISON BETWEEN THE RESULTS OF SATELLITE AND GROUND MEASUREMENTS OF UV IRRADIANCE IN THE RANGE OF 300–380 nm OVER MOSCOW IN 1979–2000
A.Yu. Yurova, N.Ye. Chubarova, N.A. Krotkov, and J.R. Herman **A2–10**

PPECULIARITIES OF SOLAR RADIATION ABSORPTION IN A CLOUDY ATMOSPHERE
B.V. Goryachev and S.B. Mogilnitsky **A2–11**

COMPARISON OF LINE-BY-LINE AND LUCK-UP-TABLES METHODS IN TASK OF GAS COMPOSITION RETRIEVING FROM FTIR MEASUREMENTS OF DIRECT SOLAR RADIATION
M.Yu. Kataev, A.A. Mitsel', H. Nakane, and I.G. Okladnikov **A2–12**

LUCK-UP-TABLES METHOD IN TASKS OF LIGHT PROPAGATION AND GASANALYSIS
M.Yu. Kataev, A.A. Mitsel', and I.G. Okladnikov **A2–13**

COMPARISON OF RETRIEVAL METHODS FOR STRATOSPHERIC GASES PROFILE FROM FTIR MEASUREMENTS OF IR DIRECT SOLAR RADIATION
M.Yu. Kataev and H. Nakane **A2–14**

Session B1. WAVE PROPAGATION IN RANDOM INHOMOGENEOUS MEDIA. ADAPTIVE OPTICS

Chairs: Prof. V.A. Banakh, Prof. V.P. Lukin, Dr. S. Clifford, Academician K. Du

Wednesday, June 27, 8:30–13:15. Main hall

8:30 Invited. LASER BEAMS CHARACTERISTICS UNDER THE CONDITIONS OF THE INTERMITTENCE OF SMALL SCALE ATMOSPHERIC TURBULENCE
T.I. Arsenyan, P.V. Korolenko, M.S. Maganova, A.V. Mesniankin, and A.M. Zotov *(Moscow State University, Russia)* **B1–01**

8:55 Invited. PROPAGATION EXPERIMENTS IN THE NEAR-INFRARED ALONG A 150 km PATH AND FROM STARS IN THE CANARIAN ARCHIPELAGO
A. Comeron, J.A. Rubio, A. Belmonte *(Polytechnic University of Catalonia, Barcelona, Spain),* **E. Garcнa, T. Prud'homme** *(Instituto de Astrofisica de Canarias, La Laguna, Spain),* **and Z. Sodnik** *(European Space Agency, Noordwijk, Netherlands)* **B1–02**

9:25 Invited. BASIC RESEARCH ON LASER PROPAGATION THROUGH ATMOSPHERE AND ADAPTIVE OPTICS
Du Xiang Wan *(China Academy of Engineering Physics, Beijing, China)* **B1–03**

9:50 Invited. MODERN PROBLEMS OF ADAPTIVE OPTICS
V.P. Lukin *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **B1–04**

10:15 DEVELOPMENT OF TWO INTERFEROMETRIC IMAGING TESTBEDS AT THE MAGDALENA RIDGE OBSERVATORY
G.C. Loos[1,2], V.L. Gamiz[1] *([1]U.S. Air Force Research Laboratory, Kirtland AFB, NM, USA, [2]New Mexico Institute of Mining and Technology, Socorro, NM, USA)* **B1–05**

10:30 NEW SCINTILLATION AND NEW PROBABILITY DENSITY FUNCTION (PDF) FOR THE IRRADIANCE OF A LASER BEAM PROPAGATING THROUGH ATMOSPHERIC TURBULENCE
M.A. Al-Habash *(Terabeam, Redmond, USA),* **L.C. Andrews, and R.L. Phillips** *(University of Central Florida, Orlando, USA)* **B1–06**

Coffee break 10:45–11:00

11:00 THEORETICAL ANALYSIS OF FULL APERTURE TILT MEASUREMENT WITH REFLECTED WAVE FROM TARGET
Hang Dong *(Institute of Applied Physics and Computational Mathematics, Beijing, China)* **B1–07**

11:15 ANGULAR DIVERGENCE OF LASER BEAMS DISTURBED BY A TURBOJET AERO-ENGINE EXHAUST STREAM
V.S. Sirazetdinov, D.I. Dmitriev, I.V. Ivanova *(Research Institute for Complex Testing of Optoelectronic Devices, Sosnovy Bor, Russia),* **and D.H. Titterton** *(DERA, Farnborough, UK)* **B1–08**

11:30 STATISTICAL CHARACTERISTICS OF THE WAVE IN THE CASE OF A STRONG SCATTERING IN THE LAYER WITH RANDOM INHOMOGENEITIES OF DIELECTRIC PERMITTIVITY
S.N. Kolesnik, N.T. Afanasiev, and M.V. Tinin *(Irkutsk State University, Russia)* **B1–09**

11:45 TIP-TILT IMAGE CORRECTION USING A CORRELATION TRACKER
P.A. Konyaev, V.P. Lukin, N.N. Botugina, and O.N. Emaleev *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **B1–10**

12:00 DENSITY OF THE OPTICAL VORTICES IN THE TURBULENT ATMOSPHERE
V.P. Aksenov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **B1–11**

12:15 NUMERICAL SIMULATION OF TURBULENCE EFFECT ON GROUND - TO - SATELLITE OPTICAL LINK
V.A. Banakh and A.V. Falits *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **B1–12**

12:30 SOLUTION OF THE TOMOGRAPHY PROBLEM FOR HETEROGENEOUS ABSORPTING MEDIA
V.P. Yakubov and D.V. Losev *(Tomsk State University, Russia)* **B1–13**

12:45 SIMULATION OF GAUSSIAN BEAM OPTICAL SCINTILLATION
A. Belmonte *(Polytechnic University of Catalonia, Barcelona, Spain)* **and L.C. Andrews** *(University of Central Florida, Orlando, USA)* **B1–14**

13:00 ADAPTIVE OPTICAL SYSTEM FOR TURBULENT FLUCTUATIONS OF THE LASER BEAM
A. Rukosuev, A. Aleksandrov, V. Zavalova, V. Samarkin, and A. Kudryashov *(Institute on Laser and Information Technologies RAS, Shatura, Russia)* **B1–15**

POSTERS ***Wednesday, June 27, 17:00–18:30***

ESTIMATE OF WIND VELOCITY FROM MEASUREMENT OF VARIANCE OF VELOCITY OF OBJECT IMAGE CENTROID DISPLACEMENT
A.L. Afanas'ev, V.A. Banakh, and A.P. Rostov **B1–16**

ITERATIVE ALGORITHMS TO SOLVE PHASE RETRIEVAL PROBLEM BASING ON NONCOHERENT SOURCE IMAGE
S. Chernyavskii, G. Degtyarev, A. Makhan'ko, and A. Chernyavskii **B1–17**

ACCURACY INCREASING OF CORRELATION MEASUREMENT BY NONLINEAR TRANSFORMATION OF SIGNALS
S.A. Chudinov **B1–18**

VARIABILITY OF COEFFICIENT OF TERRESRIAL REFRACTION IN TRANSBAIKALIAN REGION
N.Ts. Gomboyev **B1–19**

RESEARCH ON REFRACTIONAL INDEX OF ATMOSPHERE IN AN OPTICAL RANGE
N.Ts. Gomboyev **B1–20**

EQUATION FOR AN AVERAGE FIELD OF A WAVE IN STATISTICALLY ANISOTROPIC RANDOM MEDIUM
E.Z. Gribova and A.I. Saichev **B1–21**

RANDOM WANDERINGS OF LASER BEAMS UNDER THE EFFECT OF A TURBULENT JET OF AN AERO-ENGINE
I.V. Ivanova, D.I. Dmitriev, V.S. Sirazetdinov, and D.H. Titterton **B1–22**

FLUCTUATIONS OF INTENSITY OF A LASER BEACON REGISTERED SIGNAL
G.A. Kaloshin and V.V. Nosov **B1–23**

INFLUENCE OF THE TURBULENT ATMOSPHERE ON RANGE OF MEASURING OF DIRECTIONS BY AN OPTICO-ACOUSTIC INTERFEROMETRIC METHOD
G.A. Kaloshin and I.P. Lukin **B1–24**

METHODS OF REGISTRATION AND STATISTICS OF DISLOCATIONS ON THE PATH OF GAUSSIAN BEAM PROPAGATION
F. Yu. Kanev, V.P. Lukin, and L.N. Lavrinova **B1–25**

Session B2. NONLINEAR EFFECTS AT RADIATION PROPAGATION IN ATMOSPHERE AND WATER MEDIA

Chair: Prof. A.A. Zemlyanov

POSTERS *Wednesday, June 27, 17:00–18:30*

LASER ACCELERATION OF SUSPENDED MICROPARTICLES
S.E. Skipetrov and M.A. Kazaryan **B2–01**

PHOTOLYSIS OF AQUEOUS SOLUTIONS OF PHENOLS UNDER POWERFUL UV EXCITATION **B2–02**
V.A. Svetlitchnyi, I.V. Sokolova, T.N. Kopylova, R.T. Kuznetsova, O.N. Tchaikovskaya, and E.N. Telminov

FORMATION OF A SECONDARY AEROSOL FROM PLASMA WITH A DISPERSE PHASE
V.I. Bykaty and O.V. Gas'kova **B2–03**

EFFECT OF VAPOR CONDENSATION ON THE PARAMETERS OF STEAM-GASEOUS CLOUD WHEN IT IS EXTENDING FROM THE SURFACE OF HIGH-MELTING PARTICLE UNDER THE LASER ACTION **B2–04**
V.I. Bykaty and K.V. Solomatin

SIMULATION OF PROCESSES OF COMBUSTION AND VAPORIZATION OF FRAGMENTS IN A LASER FIELD **B2–05**
V.I. Bucaty, A.A. Popov, and A.M. Sajduk

PECULIARITIES OF RESONANCE EXCITATIONS INSIDE TRANSPARENT SPHERICAL PARTICLES BY FEMTOSECOND LASER RADIATION
A.A. Zemlyanov and Yu.E. Geints **B2–06**

NONSTATIONARY SCATTERING OF ULTRA SHORT LASER PULSES ON ISOLATED AEROSOL PARTICLES
A.A. Zemlyanov and Yu.E. Geints **B2–07**

STIMULATED RAMAN SCATTERING IN MICROPARTICLES UNDER THE CONDITIONS OF FIELDS DOUBLE RESONANCE
A.A. Zemlyanov, Yu.E. Geints, and E.K. Panina **B2–08**

HIGHT STIMULATED COMBINATIVE SCATTERING INFLUENCE ON LASER BEAM PROPAGATION IN THE ATMOSPHERE
A.B. Ignatyev and V.V. Morozov **B2–09**

PROPAGATION OF THE PARTIALLY COHERENT GAUSSIAN BEAM IN A TURBULENT REFRACTIVE MEDIUM
V.V. Kolosov, O.A. Kolosova, and V.V. Dudorov **B2–10**

LASER SPARK IN THE PROBLEM OF OUTFLOW OF LIGHTNING DISCHARGES
A.A. Zemlyanov, N.N. Bochkarev, A.M. Kabanov, and V.A. Pogodaev **B2–11**

Session C1. MULTIPLE SCATTERING IN OPTICAL REMOTE SENSING. IMAGE TRANSFER AND PROCESSING

Chairs: Prof. V.V. Belov and Prof. I.L. Katsev

Monday, June 25, 16:30–18:15. Main hall

16:30 REMOTE SENSING OF CLOUDS BY A LIDAR WITH VARIABLE FIELD-OF-VIEW ANGLES
V.V. Veretennikov *(Institute of Atmospheric Optics SB RAS, Tomsk Russia),* **A.I. Abramotchkin, and S.A. Abramotchkin** *(Institute for Optical Monitoring SB RAS, Tomsk, Russia)* **C1–01**

16:45 ANALYTICAL MODELING OF THE RAMAN LIDAR RETURN WITH MULTIPLE SCATTERING
A. Malinka and E. Zege *(Institute of Physics, National Academy of Sciences, Minsk, Belarus)* **C1–02**

17:00 SPATIAL-ANGULAR STRUCTURE OF THE SCATTERED RADIATION AT THE BOUNDARIES AND INSIDE THE OPTICALLY DENSE MEDIA
V.V. Belov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C1–03**

17:15 CONSIDERATION OF THE DISTORTING EFFECT OF THE ATMOSPHERE IN THE PROBLEM OF SATELLITE MONITORING OF SMALL-SIZED HIGH-TEMPEATURE ANOMALIES
V.V. Belov and S.V. Afonin *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C1–04**

17:30 METHODS OF MAPPING AND MEDIUM-TERM PREDICTION OF FIRE DANGER BY WEATHER CONDITIONS
A.I. Sukhinin and E.I. Ponomarev *(Institute of Forest SB RAS, Krasnoyarsk, Russia)* **C1–05**

17:45 COMPUTER SIMULATION AND EXPERIMENTAL RESULTS FOR OCEANIC LIDAR RETURN
I.L. Katsev, E.P. Zege, A.S. Prikhach, B.I. Stepanov *(Institute of Physics, National Academy of Sciences, Minsk, Belarus),* **D. Allocca, M. Contarino, L. Mullen** *(NAVAIR, Patuxent River, USA),* **and G. Ludbrook** *(DERA Malvern, Worcs, UK)* **C1–06**

18:00 SIMULATING TRANSFER OF THE OCEAN BOTTOM IMAGE IN VIEW OF THE RADIATION INTERCHANGE BETWEEN THE ATMOSPHERE AND OCEAN
T.A. Sushkevich, A.K. Kulikov, and S.V. Maksakova *(Keldysh Institute of Applied Mathematics RAS, Moscow, Russia)* **C1–07**

POSTERS ***Monday, June 25, 18:15–20:00***

ANALYSIS OF LIDAR SIGNAL SPATIAL PERFORMANCES WHEN SOUNDING THE OPTICALLY DENSE AEROSOL OBJECTS
S.A. Abramotchkin, A.I. Abramotchkin, and A.A. Tikhomirov **C1–08**

ANALYSIS OF THE EFFICIENCY OF SATELLITE MONITORING OF FOREST FIRES BY THE AVHRR/NOAA DEVICE (TOMSK REGION)
V.V. Belov and S.V. Afonin **C1–09**

ON THE APPLICABILITY LIMITS OF THE SMALL-ANGLE SCATTERING APPROXIMATION FOR A DESCRIPTION OF THE BEAM SPREAD FUNCTION WITH ALLOWANCE FOR THE DISPERSE COMPOSITION OF A SCATTERING MEDIUM
V.V. Belov, V.V. Veretennikov, and R.V. Vil'danov **C1–10**

VARIATIONS OF THE IMAGE CONTRAST AT OBSERVATION THROUGH A DISPERSE LAYER
B.D. Borisov **C1–11**

PROBLEM OF INCLUSION OF REFRACTION IN THE RADIATIVE TRANSFER EQUATION FOR THE ATMOSPHERE-OCEAN SPHERICAL SYSTEM
A.B. Gavrilovich **C1–12**

ESTIMATION OF THE BURNED AREAS BY USING AVHRR/NOAA DATA
N.P. Minko, V.V. Koshelev, N.A. Abushenko, D.A. Altyntsev, S.A. Naschilin, and A.V. Tatarnikov **C1–13**

USE OF INFORMATION TECHNOLOGIES IN SYSTEMS OF SATELLITE MONITORING OF FOREST FIRES
S.A. Bartalev, D.V. Ershov, E.A. Lupyan, A.A. Mazurov, N.P. Min'ko, A.A. Proshin, and E.V. Flitman **C1–14**

IMPROVEMENT OF SPATIAL RESOLUTION OF IMAGES RECORDED WITH THE AVHRR/NOAA DEVICE AND INTENDED FOR SOLVING PROBLEMS OF RESOURCE-ECOLOGICAL MONITORING
E.S. Artamonov and K.T. Protasov C1–15

IDENTIFICATION OF CLOUD FIELDS BY THE NONPARAMETRIC ALGORITHM OF PATTERN RECOGNITION FROM THE AVHRR/NOAA DATA
T.G. Pushkareva and K.T. Protasov C1–16

SOFTWARE COMPLEX FOR SOLVING THE DIRECT PROBLEMS OF ATMOSPHERIC OPTICS
A.B. Serebrennikov and V.V. Belov C1–17

SIMULATING TRANSFER OF THE NONORTHOTROPIC SURFACE IMAGE IN THE POLARIZED LIGHT
T.A. Sushkevich and S.A. Strelkov C1–18

SIMULATING TRANSFER OF THE TERRESTRIAL SURFACE IMAGE TAKING INTO ACCOUNT OF EARTH SPHERICITY
T.A. Sushkevich and E.V. Vladimirova C1–19

ANALYSIS OF DYNAMICAL IMAGES OF GAS-AEROSOL PLUMES AS A RESULT OF EXPLOSION OF MINE LAUNCHING INSTALLATION
B.N. Dmitriev and I.A. Sutorikhin C1–20

LIDAR EQUATION IN THE SECOND ORDER APPROXIMATION FOR MEDIA WITH A STRONGLY EXTENDED PHASE FUNCTION
V.V. Veretennikov C1–21

POLARIZATION ESTIMATION IN THE PROPAGATION OF A NARROW POLARIZED BEAM THROUGH A MULTIPLY SCATTERING MEDIUM
L.I. Chaikovskaja C1–22

RESULTS OF SATELLITE MONITORING OF FOREST FIRES ON THE YAKUTIYA TERRITIRY
V.S. Solov'ev and E.K. Vasil'ev C1–23

Workshop «SPACE MONITORING OF FOREST FIRES. RESULTS. PROSPECTS. PROBLEMS» will be held during the Session.

Session C2. LASER AND ACOUSTIC SOUNDING OF ATMOSPHERE AND OCEAN

Chairs: Dr. Yu.S. Balin and Prof. G.G. Matvienko

Tuesday, June 26, 8:30–13:15. Main hall

8:30 Invited. NUMERICAL MODELS OF LASER RADIATION PROPAGATION IN RANDOM INHOMOGENEOUS MEDIA
B.A. Kargin *(Institute of Computational Mathematics and Mathematical Geophysics SB RAS, Novosibirsk, Russia)* C2–01

9:00 Invited. LIDAR OBSERVATION OF SAHARAN DUST INJECTIONS IN THE EAST EUROPE REGION
A.P. Chaikovsky, A.P. Ivanov, F.P. Osipenko, M.M. Korol, A.C. Slesar, I.S. Hutko *(Institute of Physics, National Academy of Sciences, Minsk, Belarus)*, **S. Puchalski, and P. Sobolewski** *(Institute of Geophysics Polish Academy of Sciences, Warsaw, Poland)* C2–02

9:30 LIDAR INVESTIGATIONS OF THE DYNAMICS OF AEROSOL FIELDS OF THE BOUNDARY LAYER OF THE ATMOSPHERE
Yu.S. Balin, A.D. Ershov, and S.V. Samoilova *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C2–03**

9:45 OPTIMAL REGRESSIONS TO ESTIMATE AEROSOL PARAMETERS BY DATA OF TWO- AND THREE-WAVELENGTH LASER SOUNDING
V.V. Barun, A.I. Bryl, V.P. Kabashnikov, V.M. Popov, and A.P. Chaikovsky *(Institute of Physics, National Academy of Sciences, Minsk, Belarus)* **C2–04**

10:00 OPTICAL SENSING OF THE MIDDLE ATMOSPHERE AT SIBERIAN LIDAR STATION
V.D. Burlakov, S.L. Bondarenko, M.V. Grishaev, S.I. Dolgii, A.V. Elnikov, V.V. Zuev, A.V. Nevzorov, and S.V. Smirnov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C2–05**

10:15 GAS RECONSTRUCTION IN MULTICOMPONENT MEDIA USING GENETIC ALGORITHMS
Yu.V. Fedotov, M.L. Belov, V.A. Gorodnichev, and V.I. Kozintsev *(Bauman Moscow State Technical University, Russia)* **C2–06**

10:30 OZONE MEASUREMENTS BY UV-DIAL LIDAR AT HEFEI, CHINA
Shunxing Hu, Huanling Hu, Yonghua Wu, and Jun Zhou *(Anhui Institute of Optics and Fine Mechanics, Hefei, China)* **C2–07**

Coffee break 10:45-11:00

11:00 A MOBILE LIDAR SYSTEM FOR AIR POLLUTION MEASUREMENTS
Zhang Yinchao, Huanling Hu, Tan Kun, Yang Gaochao, Liu Xiaoqin, Shao Shisheng, Deng Min, and Zhang Gaoyong *(Anhui Institute of Optics and Fine Mechanics, Hefei, China)* **C2–08**

11:15 NEW METHOD OF THE MIXING DETERMINATION IN ATMOSPHERE
M.A. Lokoshchenko *(Moscow State University, Russia)* **C2–09**

11:30 DIAGNOSTICS OF INTENSE ATMOSPHERIC VORTICES OVER THE SATELLITE MICROWAVE RADIOMETRIC SOUNDING DATA
A.F. Nerushev, H.K. Kramchaninova *(Institute of Experimental Meteorology Russian Federal Service for Hydrometeorology and Environmental Monitoring, Obninsk, Russia),* **and B.Z. Petrenko** *(Institute of Radio Engineering and Electronics RAS, Frayzino, Russia)* **C2–10**

11:45 ANALYSIS OF THE DATA OF ACOUSTIC SOUNDING IN CONDITIONS OF STABLE STRATIFICATION OF THE BOUNDARY LAYER OF THE ATMOSPHERE
S.L. Odintsov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C2–11**

12:00 CONTINUOUS OBSERVATIONS OF BAROCLINIC DISTURBANCES IN LAKE BAIKAL WATER
S.V. Lovtsov, N.M. Budnev, Yu.V. Parfenov, V.Yu. Rubtzov *(Applied Physics Institute of Irkutsk State University, Russia),* **M. Schurter, M. Sturm, and A. Wuest** *(Swiss Federal Institute for Environmental Science and Technology, Duebendorf-Zuerich, Switzerland)* **C2–12**

12:15 LIDAR SIGNAL FLUCTUATIONS AT THE SEA SOUNDING THROUGH THE ROUGH SURFACE
W.L. Weber *(Institute of Applied Physics RAS, Nizhny Novgorod, Russia)* **C2–13**

12:30 ACTIVE-PASSIVE REMOTE SENSING OF THE BIOOPTICAL FEATURES OF THE SEA WATER
O.A. Bukin and M.I. Permyakov *(Pacific Oceanological Institute FEB RAS, Vladivostok, Russia)* **C2–14**

12:45 LASER SPECTROGRAPH FOR INVESTIGATION OF UNSTEADY PROCESSES IN ATMOSPHERE
V.P. Fokeev[1], Yu.A. Akimov[2], Yu.I. Grin[2], V.A. Levin[1], S.Yu. Mitichkin[1], and V.G. Testov[1] *([1]Institute of Mechanics of Moscow State University, Russia, [2]GUP «NPO – Astrophisika», Moscow, Russia)* **C2–15**

13:00 LIDAR AND SATELLITE MEASUREMENTS DETERMI NATION OF HIGH CLOUDS PROPERTIES
O. Lado-Bordowsky *(ENSSAT – Universite de Rennes, France* **C2–16**

POSTERS ***Tuesday, June 26, 18:00–20:00***

TEMPORAL ASPECTS OF FLUORESCENCE – IN-SITU ANALYSIS WITH A BISTATIC SUBMARINE LIDAR
U. Stute, M. Lehaitre, and O. Lado-Bordowsky **C2–17**

CW–DL–DR–LIDAR FOR REMOTE DETECTION OF GASES: MATHEMATICAL DESCRIPTION AND COMPARISON WITH OTHER METHODS
R.R. Agishev and R.K. Sagdiev **C2–18**

LIDAR COMPLEX SOUNDING LASERS WITH RESONANCE PUMPINTG SYSTEMS
L.R. Aibatov **C2–19**

LFM-CW LIDARS WITH RECTANGULAR PULSED SOUNDING SIGNALS
L.R. Aibatov **C2–20**

DETERMINATION ACCURACY OF ATMOSPHERIC GAS COMPONENT CONTENT WITH DIAL SYSTEMS
Y.M. Andreev and P.P. Geiko **C2–21**

MATHEMATICAL SIMULATION OF OPERATION OF THE OPTICAL CORRELATION GAS ANALYZER
S.F. Balandin, Yu.D. Kopytin, and V.I. Kokhanov **C2–22**

SOUNDING OF DENSE GAS PLUMES ON THE BASIS OF THE USE OF THE OPTICAL CORRELATION ANALYZER
S.F. Balandin, V.I. Kokhavov and S.A. Shishigin **C2–23**

REMOTE CONTROL OF OIL FILM THICKNESS ON WATER SURFACE USING LASER
S.V. Berezin, M.L. Belov, V.A. Gorodnichev, and V.I. Kozintsev **C2–24**

FLUORESCENT DIAGNOSTICS OF DISSOLVED ORGANIC MATTER IN NATURAL WATER
V.I. Yuzhakov, K.G. Blinova, L.V. Levshin, and S.V. Patsayeva **C2–25**

METEOROLOGICAL COMPLEXES AMK-01 AND BMK-01
A.Ya. Bogushevich, A.A. Azbukin, V.V. Burkov, V.V. Zanin, V.S. Ilichevskii, and V.A. Korolkov **C2–26**

SOFTWARE FOR ULTRASONIC ANEMOMETERS-THERMOMETERS
A.Ya. Bogushevich **C2–27**

EXPERIMENTAL RESEARCH OF THE METROLOGICAL CHARACTERISTICS OF A ULTRASONIC ANEMOMETER IN A WIND TUNNEL
A.Ya. Bogushevich, A.A. Azbukin, V.V.Burkov, V.S.Ilichevskii, and V.A.Korolkov **C2–28**

Session C3. AIRBORNE AND SPACEBORNE LIDARS AND THEIR APPLICATIONS. MODELS OF THE ATMOSPHERE. LASER BEAMS ON HIGH-ALTITUDE PATHS IN THE ATMOSPHERE AND SPACE

Chairs: Prof. G.G. Matvienko, Prof. U.G. Oppel, and Dr. U.N. Sing

Wednesday, June 27, 14:00–15:30. Main hall

14:45 METHOD FOR RECONSTRUCTION OF THE HEIGHT WIND PROFILES FROM THE DATA OF THE SPACE DOPPLER LIDAR
V.A. Banakh[1], Ch. Werner[2], N.P. Krivolutskii[1], I. Laike[2], I.N. Smalikho[1], and Y. Shtraikhert[2] *([1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia, [2]DLR Institute of Atmospheric Physics, Wessling, Germany)* **C3–04**

15:00 USING SATELLITE DATA FOR ESTIMATE TEMPERATURE CHARACTERISTICS OF AIR ON THE GROUND LEVEL
S.A. Tashchilin and N.A. Abushenko *(Institute of Solar – Terrestrial Physics SB RAS., Irkutsk, Russia)* **C3–05**

15:15 LIDAR SIGNAL IN THE DOUBLE SCATTERING APPROXIMATION AT PARAMETRIC SETTING OF THE SCATTERING PHASE FUNCTION
V.V. Bryukhanova and I.V. Samokhvalov *(Tomsk State University, Tomsk, Russia)* **C3–06**

POSTERS ***Tuesday, June 26, 18:00–20:00***

NUMERICAL SIMULATION OF DOPPLER LIDAR DETECTION OF CLEAR AIR TURBULENCE
V.A. Banakh, Ch. Werner, and I.N. Smalikho **C3–07**

COMPARATIVE ANALYSIS OF POLARIZATION CHARACTERISTICS OF SCANNERS FOR AIRBORNE LIDARS
A.V. Beresnev and A.A. Tikhomirov **C3–08**

LIDAR MEASURMENTS OF TIME VARIATIONS OF THE VOLUMETRIC BACKSCATTERING COEFFICIENT
B.T. Tashenov, V.A. Filippov, and R.V. Filippov **C3–09**

POLARIZING CHARACTERISTICS OF DOUBLE SCATTERING RADIATION FROM DROP AND CRYSTAL CLOUDS
I.V. Samokhvalov, V.V. Bryukhanova, and P.V.Kryganov **C3–10**

EMPIRICAL MODEL OF THE SPECTRAL BEHAVIOR OF THE AEROSOL OPTICAL THICKNESS OF THE ATMOSPHERE IN THE WAVELENGTH RANGE 0.44 TO 12 μm
N.N. Shchelkanov **C3–11**

Session C4. OPTICAL AND MICROPHYSICAL PROPERTIES OF ATMOSPHERIC AEROSOL AND SUSPENSION IN WATER MEDIA

Chairs: Prof. O.V. Kopelevich, Prof. M.V. Panchenko, and Prof. G. Wang

Tuesday, June 26, 14:00–18:15. Main Hall

14:00 Invited. ASSESSMENT OF OPTICAL CHARACTERISTICS OF ATMOSPHERE AND OCEAN BY DATA FROM SATELLITE OCEAN COLOR SENSORS
O.V. Kopelevich *(Institute of Oceanology RAS, Moscow, Russia)* **C4–01**

14:30 ABOUT OPTICAL, THERMAL AND DYNAMIC STRUCTURE OF COASTAL WATERS OF LAKE BAIKAL (DATA 1994, 1999)
P.P. Sherstyankin, M.N. Shimaraev, V.V. Khokhlov, V.N. Sergeeva, and V.N. Drozdov *(Limnological Institute SB RAS, Irkutsk, Russia)* **C4–02**

14:45 INFORMATION CONTENT OF SPECTRA OF FACTORS OF BRIGHTNESS FOR WATER ECOSYSTEMS
B.L.Sukhorukov and I.V.Novikov *(Institute of Water Problems RAS, Rostov-na-Donu, Russia)* **C4–03**

15:00 INFLUENCE OF HEAVY METALS ON OPTICAL CHARACTERISTICS OF AQUEOUS MEDIA
A.Ya. Khairullina and V.A. Lapina *(Institute of Physics, National Academy of Sciences, Minsk, Belarus)* **C4–04**

15:15 METHOD AND SOME RESULTS OF MEASUREMENT OF LIGHT ABSORPTION, DIRECT AND BACKSCATTERING SPECTRUMS IN LAKE BAIKAL WATER
B.A. Tarashansky, N.M. Budnev, and R.R. Mirgasov *(Applied Physics Institute of Irkutsk State University, Irkutsk, Russia)* **C4–05**

Coffee break 15:30–16:00

16:00 INFLUENCE OF CLOUD MICROPHYSICAL CHARACTERISTICS ON SOLAR RADIATION TRANSFER IN THE ATMOSPHERE
M.V. Shatunova *(Hydrometeorological Research Center of Russia, Moscow, Russia)* **C4–06**

16:15 AEROSOL RETRIEVAL FROM COMBINED SPECTRAL EXTINCTION AND AUREOLE MEASUREMENTS
M.A. Sviridenkov *(Institute of Atmospheric Physics RAS, Moscow, Russia)* **C4–07**

16:30 CARBONACEOUS PARTICLES IN THE URBAN ATMOSPHERE
Wang Gengchen, Kong Qinxin, Gu Zhifang, Wan Xiaowei *(Institute of Atmospheric Physics, Beijing, China),* **and A.S. Emilenko** *(Institute of Atmospheric Physics RAS, Moscow, Russia)* **C4–08**

16:45 ANALYSIS OF DAY SKY SPECTRAL BRIGHTNESS IN NEPHELOMETRIC ANGLES OF SCATTERING
V.N Korovchenko *(Abai Kazakh State Pedagogical University, Alma-Ata, Kazakhstan),*
V.K. Oshlakov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),*
V.E. Pavlov *(Institute for Water and Environmental Problems SB RAS, Barnaul, Russia),* **and A.S. Shestukhin** *(Polzunov Altai State Technical University, Barnaul, Russia)* **C4–09**

17:00 SEASONAL DYNAMICS OF THE AEROSOL EXTINCTION COEFFICIENTS IN THE HAZES OVER WEST SIBERIA
V.N. Uzhegov and Yu.A. Pkhalagov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C4–10**

17:15 ADVANTAGES OF USING CIRCULAR POLARIZED LIGHT IN LASER SENSING OF CRYSTAL CLOUDS
B.V. Kaul, D.N. Romashov (*Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **and I.V. Samokhvalov** *(Tomsk State University, Russia)* **C4–11**

17:30 LIGHT SCATTERING ON ICE CRYSTALS OF CIRRUS CLOUDS: JONES MATRIX
A.G. Borovoi, I.A. Grishin*(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **and U.G Oppel** *(Institute of Mathematics, Muenchen, Germany)* **C4–12**

17:45 ABOUT MODELING THE EFFECT OF HUMIDITY ON THE AEROSOL OPTICAL CHARACTERISTICS USING WIDE LOGNORMAL PARTICLE SIZE DISTRIBUTIONS
M.V. Panchenko, V.V. Pol'kin, and S.A. Terpugova *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C4–13**

18:00 LIGHT SCATTERING BY MIXED CLOUDS
A.G. Petrushin *(Institute of Experimental Meteorology, Obninsk, Russia)* **C4–14**

POSTERS *Tuesday, June 26, 18:00–20:00*

LIGHT SCATTERING BY HEXAGONAL ICE CRYSTALS
D.N. Romashov C4–30

VARIATIONS OF THE ATMOSPHERIC TRANSPARENCY CHARACTERISTICS OF DIFFERENT SCALES (TOMSK, 1992–2000)
S.M. Sakerin and D.M.Kabanov C4–31

ANALYTICAL APPROXIMATION OF RAINDROP SIZE DISTRIBUTION FUNCTIONS
S.V. Shamanaev C4–32

RESULTS OF TESTS OF A SPECTRAL INTEGRATING NEPHELOMETER FOR ATMOSPHERIC INVESTIGATIONS
I.A. Razenkov, A.P. Rostov, and N.A. Shefer C4–33

NUMERICAL INVESTIGATION OF CHARACTERISTICS OF REFLECTED RADIATION GENERATED THE LIGTH PILLARS IN ATMOSPHERE
O.V. Shefer C4–34

ABOUT OPTICAL, THERMAL AND DYNAMIC STRUCTURES SELENGA SHALLOW WATERS OF LAKE BAIKAL
P.P. Sherstyankin, L.N. Kuimova, I.V. Ivanovskaya C4–35

USE OF THE METHOD BY X-RAY SPECTROMETRY TO ANALYZE ATMOSPHERIC AEROSOLS
A.N.Smagunova, O.M.Karpukova, E.N.Korjova, and V.A.Kozlov C4–36

STUDY OF AEROSOL CONDENSATION ACTIVITY IN DIFFERENT AIR MASSES
S.A. Terpugova, M.V. Panchenko, and E.P. Yausheva C4–37

MODEL ESTIMATES OF REGULARITIES IN FORMATION OF NEAR-HORIZON SKY BRIGHTNESS IN THE VISIBLE AND THERMAL SPECTRAL RANGE
S.M. Sakerin, T.B. Zhuravleva, and I.M. Nasretdinov C4–38

VAPORIZATION OF THE AEROSOL PARTICLES BY TEA CO_2 LASER INSIDE SINGLE PARTICLE MASS SPECTROMETER
N.N. Belov, N.G. Belova, and T. Baer C4–39

DIFFERENT REMOTE SENSING METHODS FOR MEASURING BIOOPTICAL PARAMETERS OF THE SEA WATER
O.S. Tsareva and A.N. Pavlov C4–40

SP-4M SOLAR PHOTOMETER FOR SCIENTIFIC MONITORING OF THE ATMOSPHERIC TRANSPARENCY CHARACTERISTICS
S.M. Sakerin, D.M. Kabanov, and S.A. Turchinovich C4–41

NUMERICAL ANALYSIS OF THE INSTRUMENTATION MATRIX OF THE POLARIZATION MEASURER
V.G. Oshlakov and Yu.G. Borkov C4–42

Session C5. TRANSPORT AND TRANSFORMATION OF AEROSOL AND GAS COMPONENTS IN THE ATMOSPHERE

Chairs: Prof. B.D. Belan, Prof. G.S. Rivin, and Prof. V.N. Aref'ev

Wednesday, June 27, 8:30–13:00. Small Hall

8:30 PRELIMINARY RESULTS OF INVESTIGATION OF THE AEROSOL OPTICAL DEPTH AND COLUMNAR WATER VAPOR OF THE ATMOSPHERE IN THE IRKUTSK REGION C5–01
S.M. Sakerin, D.M. Kabanov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **V.V. Koshelev, and A.Yu. Shalin** *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)*

8:45 OBSERVATIONS ON LOCATION OF THE DYNAMICS OF OROGRAPHIC WAVE CLOUDS OVER THE BAIKAL LAKE
T.N. Bibikova and E.V. Jurba *(Moscow State University, Russia)* **C5–02**

9:00 ESTIMATION OFANTROPOGENEOUS LOAD ON PROTECTED REGION USING THE CLIMATIC INFORMATION
G.S. Rivin and P.V. Voronina *(Institute of Computational Technologies SB RAS, Novosibirsk, Russia)* **C5–03**

9:15 A MODEL OF LOCAL DYNAMIC INTERACTION OF A WATER RESERVOIR AND THE ATMOSPHERE AT SURFACE ROUGHNESS
V.A. Shlychkov *(Institute for Water and Environmental Problems SB RAS, Novosibirsk, Russia)* **C5–04**

9:30 GENERATION OF SULFATE AEROSOL BY A SURFACE OF DRIED UP LAKE
I.A. Sutorikhin *(Institute for Water and Environmental Problems SB RAS, Barnaul, Russia)* **and A.E. Kaplinsky** *(University of Antwerp UIA, Antwerpen, Belgium)* **C5–05**

9:45 FEATURES OF DISTRIBUTION OF GROUND LEVEL CONCENTRATIONS OF OZONE AND NITROGEN OXIDES UNDER PHOTOCHEMICAL PROCESSES IN THE BAIKAL REGION
V.P. Butukahnov, G.S. Zhamsueva, A.S. Zayakhanov, Yu.L. Lomukhin, and B.Z. Tzydypov *(Department of Physical Problems, Buryat Science Center SB RAS, Ulan-Ude, Russia)* **C5–06**

10:00 TRANSFORMATION OF A SEA AEROSOL UNDER ACTIVITY OF THE RADIOACTIVE FACTOR
T.V. Gubareva *(Bratsk State Technical University, Russia)* **C5–07**

10:15 PROPAGATION OF IMPURITY FROM PULSE SOURCE IN TURBULENT ATMOSPHERE: REMOTE SENSING AND MATHEMATICAL SIMULATION
Yu.S. Balin, A.D.Yershov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **A.I. Bril, V.P. Kabashnikov, V.M. Popov, and A.P. Chaikovskiy** *(Institute of Physics, National Academy of Sciences, Minsk, Belarus)* **C5–08**

10:30 BUOYANT PLUME RISE IN TURBULENT ATMOSPHERE
V.D. Perminov *(Central Aerohydrodynamic Institute, Zhukovsky, Russia)* **C5–09**

Coffee break 10:45-11:00

11:00 DISTRIBUTION OF KINETIC ENERGY OF TURBULENCE AND OPTICAL INSTABILITY OF A TERRESTRIAL ATMOSPHERE ABOVE TERRITORY OF THE CIS
P.G. Kovadlo *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **C5–10**

11:15 CERTAIN RESULTS OF COMPARISON FOR DATA OF SIMULATION OF ACID AEROSOL AND SATELLITE MONITORING OF RADIATION CHARACTERISTICS OF THE CLOUDY/CLOUDLESS ATMOSPHERE
V.V. Kozoderov and V.D. Egorov *(Institute of Computational Mathematics RAS, Moscow, Russia)* **C5–11**

11:30 A MATHEMATICAL MODEL OF AEROSOL CLOUD FORMATION
I.R. Abunyayev, I.N. Lazovik, and G.S. Kudryashev *(Irkutsk Military Aviation Engineering Institute, Russia)* **C5–12**

11:45 THERMODYNAMIC MODELING OF ANTHROPOGENIC IMPACT ON CHEMICAL COMPOSITION OF PRECIPITATION
Ye.V. Kuchmenko, B.M. Kaganovich, and Ye.V. Molozhnikova *(Institute for Power Engineering Systems SB RAS, Irkutsk)* **C5–13**

12:00 RESEARCH OF A TURBULENT STATE OF THE LOWER ATMOSPHERE
P.G. Stafeev, G.V. Buhlova, and N.P. Krasnenko *(Institute for Optical Monitoring SB RAS, Tomsk, Russia)* **C5–14**

12:15 METROLOGICAL SUPPLYING FOR GAS HUMIDITY MEASUREMENTS
N.I. Dubovikov, O.V. Podmurnaya, and O.I. Gudkov *(Eastern-Siberian Scientific-Research Institute for Physics-Technical and Radio Engineering Measurements, Irkutsk, Russia)* **C5–15**

12:30 DEVICE FOR INVESTIGATION OF HEAT, HUMIDITY, AND AEROSOL PARTICLES GROUND FLOWS
A.P. Rostov, A.L. Afanasiev, and A.P. Ivanov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C5–16**

12:45 OPTICAL AND MICROPHYSICAL URBAN AEROSOLS MODELS
L.S. Ivlev, A.V. Vasilyev *(Scientific Research Institute of Physics of St. Peterburg State University, Petrodvorets, Russia)*, **B.D. Belan, M.V. Panchenko, and S.A. Terpugova** *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C5–17**

POSTERS *Tuesday, June 26, 18:15–20:00*

MEASUREMENTS OF METHANE CONTENT IN THE ATMOSPHERIC BOUNDARY LAYER AND IN THE ATMOSPHERIC DEPTH
V.N. Aref'ev, Yu.I. Baranov, E.L. Baranova, G.I. Bougrim, N.Ye. Kamenogradsky, and F.V. Kashin **C5–18**

CARBON DIOXIDE IN THE CONTINENTAL ATMOSPHERE
V.N. Aref'ev, N.Ye. Kamenogradsky, F.V. Kashin, V.K. Semyonov, V.P. Sinyakov, and L.I. Sorokina **C5–19**

ATMOSPHERIC SPECTRAL TRANSPARENCY IN THE ISSYK KUL LAKE REGION
V.N. Aref'ev, K.N. Visheratin, F.V. Kashin, S.S. Khmelevtsov, V.K. Semyonov, and L.I. Sorokina **C5–20**

WATER VAPOR IN THE CONTINENTAL ATMOSPHERE
V.N. Aref'ev, N.Ye. Kamenogradsky, F.V. Kashin, V.P. Ustinov, V.K. Semyonov, V.P. Sinyakov, and L.I. Sorokina **C5–21**

INVESTIGATION OF PROCESSES OF TRANSPORTATION, DIFFUSION AND TRANSFORMATION OF SULPHUR AND NITROGEN COMPOUNDS ALONG THE ATMOSPHERE LAYER ADJACENT TO THE LAKE BAIKAL SURFACE BY MEANS OF THE NUMERICAL MODEL
V.L. Makukhin and B.K. Arguchintsev **C5–22**

QUANTITATIVE ESTIMATION OF THE VALUE OF SEDIMENTATION OF SOME HEAVY METALS ON THE SURFACE OF SOUTHERN BAIKAL AND ADJACENT SPECIALLY PROTECED TERRITORIES IN DIFFERENT SEASONS
V.L. Makukhin and V.L. Potemkin **C5–23**

ATMOSPHERIC CONVECTION AND ITS ROLE IN THE VERTICAL TRANSPORT OF AEROSOLS: MODELS AND ESTIMATES
V.M. Mal'bakhov, P.Yu. Pushistov, and B.A. Shlychkov **C5–24**

SURFACE OZONE MEASUREMENTS IN THE TRANSCONTINENTAL EXPERIMENTS «TROICA»
T.A. Markova, N.F. Elansky, N.P. Shakina, and A.P. Ivanova **C5–25**

OPTOACOUSTIC GAS-ANALYZER FOR THE MEASUREMENTS OF CARBON MONOXIDE CONCENTRATION IN THE FIRE AREA
V.S. Safonov and V.A. Kapitanov **C5–26**

RESULTS OF USE OF PARAMETRIC SPECTRAL ESTIMATION METHOD FOR PROCESSING OF METEOROLOGICAL DATA
N.A. Shefer, I.A. Razenkov, and A.P. Rostov **C5–27**

MORE ACCURATE DEFINITIION OF TECTONIC FAULTS LOCATION BY IN SITU MEASUREMENTS OF CLOUDINESS
T.N. Bibikova, T.A. Proskurjakova, E.V.Jurba, and V.A.Alekseev **C5–28**

MEASUREMENT OF TURBULENT FLUXES OF SCALARS IN THE SURFACE LAYER OF THE ATMOSPHERE
A.L. Afanas'ev, V.A. Banakh, and A.P. Rostov **C5–29**

CONNECTION BETWEEN TEMPERATURE VARIATIONS AND SEISMICITY IN CRIMEA REGION
T.N. Bibikova, E.S. Rembovskaya, T.A. Proskurjakova, E.V.Jurba, and V.A.Alekseev **C5–30**

Session C6. DIAGNOSTICS OF STATE AND FUNCTIONING OF PLANTS' BIO SYSTEMS

Chairs: Prof. Yu.N. Ponomarev and Prof. V.V. Kozoderov

Wednesday, June 27, 14:00–17:15. Small Hall

14:00 PHYSICAL AND BIOLOGICAL ASPECTS OF TRANSFORMATION OF SOLAR RADIATION IN THE «SNOW–ICE–WATER–AQUATIC PLANT SUSPENSION» SYSTEM AT THE DEVELOPMENT OF THE SPRING PENETRATING CONVECTION IN LAKES OF POLAR AND MID–LATITUDES
P.Yu. Pushistov, V.K. Ievlev, and V.A. Shlychkov *(Institute of Water and Environmental Problems SB RAS, Novosibirsk, Russia)* **C6–01**

14:15 ESTIMATION OF THE ADDITIONAL EMISSION OF CO_2 BY FOREST AREAS AT ANTHROPOGENIC POLLUTION OF AIR
B.G. Ageev, Yu.N. Ponomarev, V.A. Sapozhnikova, and K.M. Firsov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C6–02**

14:30 MEASUREMENT OF CHLOROPHYLL «A» CONCENTRATION ON THE SEA SURFACE WITH THE HELP OF SEAWIFS
E.A. Shtraikhert and S.P. Zakharkov *(Pacific Oceanological Institute FEB RAS, Vladivostok, Russia)* **C6–03**

14:45 THE CALIBRATION OF THE SEAWIFS DATA BY SHIPBORNE MEASUREMENTS
E.A. Shtraikhert and S.P. Zakharkov *(Pacific Oceanological Institute FEB RAS, Vladivostok, Russia)* **C6–04**

15:00 THE CONTENT OF CHLOROPHYLL IN TREES RESEARCH BY SPECTROPHOTOMETRIC AND LIDAR METHODS
N.L. Fateeva, G.G. Matvienko, A.I. Grishin, O.A. Romanovskii, O.V. Kharchenko *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)*, **N.A. Vorob'eva, and A.P. Zotikova** *(Forestry Institute SB RAS, Tomsk, Russia)* **C6–05**

15:15 VEGETATIVE COVER BY OBSERVATIONS FROM THE SPACE: ACCURACY CHARACTERISTICS FOR ESTIMATION OF PARAMETERS OF ITS CONDITION
V.V. Kozoderov and V.S. Kosolapov *(Institute of Computational Mathematics RAS, Moscow, Russia)* **C6–06**

Coffee break 15:30–16:00

16:00 RS DIAGNOSTICS OF FOREST ECOLOGICAL AND RESOURCE POTENTIAL IN BAIKAL BASIN
N.V. Malysheva, O.L. Orlova, I.A. Voukolova, S.V. Knjazeva, and T.A. Zolina *(All-Russian Scientific Research & Information Center for Forest Resources, Moscow, Russia)* **C6–07**

16:15 GEOINFORMATION ANALYSIS OF THE EFFECT OF ATMOSPHERIC POLLUTION ON VEGETATION BIOSYSTEMS USING PICTURES MADE FROM SPACE
Yu.M. Polischuk, V.V. Ryukhko, O.S. Tokareva, and M.N. Alekseeva *(Institute of Oil Chemistry SB RAS, Tomsk, Russia)* **C6–08**

16:30 USING THE SATELLITE DATA NOAA/AVHRR FOR MONITORING OF DYNAMIC VEGETATION COVER IN SIBERIA
S.A. Tashchilin and N.A. Abushenko *(Institute of Solar - Terrestrial Physics SB RAS, Irkutsk, Russia)* **C6–09**

16:45 IDENTIFICATION OF THE SPECIES COMPOSITION AND EVALUATION OF THE PRODUCTIVITY OF FOREST TERRITORIES FROM SATELLITE VIDEODATA
K.G. Kolodnikov and K.T. Protasov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C6–10**

17:00 NONPARAMETRIC CLASSIFICATION ALGORITHM OF CLUSTER ANALYSIS OF THE LARGE VASYUGAN BOG FROM THE DATA OF THE AVHRR/NOAA DEVICE
N.V. Tkalicheva and K.T. Protasov *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **C6–11**

Session D1. MAGNETOSPHERE-IONOSPHERE INTERACTIONS

Chairs: Prof. V.A. Kovalenko and Dr. V.I. Sazhin

Tuesday, June 26, 8:30–12:30. Main Hall

8:30 GEOMAGNETIC CONTROL OF THE SPECTRUM OF TRAVELING IONOSPHERIC DISTURBANCES BASED ON DATA FROM A GLOBAL GPS NETWORK
E.L. Afraimovich, E.A. Kosogorov, O.S. Lesyuta, and I.I. Ushakov *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia),* **and A.F. Yakovets** *(Institute of Ionosphere, Almaty, Kazakhstan)* **D1–01**

8:45 VARIATIONS OF EMISSION BRIGHTNESS OF 557.7 nm MORE EQUATORIAL THEN LOW-LATITUDE BOUNDARY OF AURORAL BACKGROUND GLOW BEFORE BREAKUP START
V.A. Velichko, R.N. Boroev, G.V. Borisov, and D.G. Baishev *(Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia)* **D1–02**

9:00 RELATIONSHIP OF PCA EVENTS AND ENERGETIC ELECTRON PRECIPITATIONS WITH FLUXES OF PROTONS AND RELATIVISTIC ELECTRONS ON THE GEOSTATIONARY ORBIT
V.A. Kuzmin *(Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia)* **D1–03**

9:15 IONOSPHERIC MANIFESTATIONS OF GEOMAGNETIC PULSATIONS IN HIGH LATITUDES
Y.V. Lipko, R.A. Rakhmatulin, A.Yu. Pashinin *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D1–04**

9:30 SOME OBSERVATIONAL FEATURES OF MID-LATITUDE AURORAS AND EMISSION PERTURBATIONS IN THE UPPER ATMOSPHERE DURING MAGNETIC STORMS OVER THE REGION OF EAST SIBERIA
A.V. Mikhalev *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D1–05**

9:45 NON THERMAL PROFILE OF THE 557.7 nm [OI] IN AURORA
V.M. Ignatyev and S.V. Nickolashkin *(Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia)* **D1–06**

10:00 Solar activity effects on the storm variation of fo F2 at middle latitudes
N.M. Polekh, O.M. Pirog, and L.V. Chistyakova *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D1–07**

10:15 USING OF THE INCOHERENT SCATTER DATA FOR THE ESTIMATION OF THE THERMOSPHERE GAS COMPOSITION
L.A. Shchepkin, G.P. Kushnarenko, and G.M. Kuznetsova *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D1–08**

10:30 IONOSPHERIC OBSERVATION DURING JULY 15–16, 2000 MAJOR GEOMAGNETIC STORM
B.G. Shpynev, A.V. Medvedev, V.E. Nosov, G.A. Zherebtsov, A.P. Potekhin, and A.V. Zavorin *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk)* **D1–09**

Coffee break 10:45-11:00

11:00 A MODEL STUDY OF THE RESPONSE OF THE MID-LATITUDE IONOSPHERE TO A GREAT GEOMAGNETIC STORM OF SEPTEMBER 25, 1998
A.V. Tashchilin, E.B. Romanova, and B.G. Shpynev *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D1–10**

11:15 LOCAL INCREASE OF FIELD-ALIGNED CURRENT INTENSITY BEFORE A SUBSTORM ONSET
V.A. Velichko, R.N. Boroyev, and D.G. Baishev *(Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia)* **D1–11**

11:30 SIGNATURES OF MAGNETIC FIELD LINE RECONNECTION
H.K. Biernat[1,2], V.S. Semenov[3], N.V. Erkaev[4], S. M'uhlbachler[1,2], C.J. Farrugia[5] *([1]Space Research Institute AAS, Graz, Austria, [2]University of Graz, Austria, [3]St.Petersburg State University, Russia, [4]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia, [5]University of New Hampshire, USA)* **D1–12**

11:45 GENERATION OF AN ELECTRIC POTENTIAL DIFFERENCE DUE TO MHD SLOW SHOCKS PROPAGATING ALONG THE IO FLUX TUBE
D. Langmayr[1,2], N.V. Erkaev[3], V.S. Semenov[4], V.A. Shaidurov[3,5], H.K. Biernat[1,2], H.O. Rucker[1,2], D.F. Vogl[1], S. M'uhlbachler[1,2] *([1]Space Research Institute AAS, Graz, Austria, [2]University of Graz, Austria, [3]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia, [4]St.Petersburg State University, Russia, [5]Krasnoyarsk State University, Russia)* **D1–13**

12:00 THE ANALYSIS OF THE INCLINED FAST SHOCK INCLUDING PRESSURE ANISOTROPY
D.F. Vogl[1], N.V. Erkaev[2], H.K. Biernat[1,3], H.O. Rucker[1,3], S. M'uhlbachler[1,3], D. Langmayr[1,3] *([1]Space Research Institute AAS, Graz, Austria, [2]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia, [3]University of Graz, Austria)* **D1–14**

12:15 STUDIES OF DAYSIDE MAGNETOPAUSE EROSION ON GEOSTATIONARY ORBIT USING WIND AND GOES DATA (1995–1998)
S. M'uhlbachler[1,2], C.J. Farrugia[3], H.K. Biernat[1,2], V.S. Semenov[4], N.V. Erkaev[5], D.F. Vogl[1], D. Langmayr[1,2], R.P. Lepping[6], K.W. Ogilvie[6], H. Singer[7] *([1]Space Research Institute AAS, Graz, Austria, [2]University of Graz, Austria, [3]University of New Hampshire, USA, [4]St.Petersburg State University, [5]Institute of Computational Modelling SB RAS, Krasnoyarsk, [6]NASA Goddard Space Flight Center, USA, [7]NOAA Space Environment Center, Boulder, USA)* **D1–15**

POSTERS *Tuesday, June 26, 18:15–20:00*

INSTANTANEOUS IONOSPHERE RESPONSE TO THE MAGNETIC FIELD CHANGE
E.L. Afraimovich, E.A. Kosogorov, L.A. Leonovich, O.S. Lesyuta, and I.I. Ushakov **D1–16**

BEHAVIOR OF IONOSPHERE OVER KHARKOV DURING THE GEOMAGNETIC STORMS
Ye.I. Grigorenko, V.N. Lysenko, and S.V.Chernyayev **D1–17**

ENERGETIC ELECTRON PRECIPITATION AND CONVECTION ELECTRIC FIELD DURING THE HIGH SPEED SOLAR WIND STREAMS
V.A. Kuzmin **D1–18**

LONGITUDE-DEPENDENT PECULIARITIES IN THE RESPONSE OF IONOSPHERE TO GEOMAGNETIC STORM **D1–19**
E.S. Kazimirovsky, O.M. Pirog, N.M. Polekh, and L.V. Chistyakova

REACTION OF F1 IONOSPHERIC LAYER ON THE ACTION OF MAGNETOSPHERIC PROCESSES IN THERMOSPHERE
L.A. Shchepkin and G.P. Kushnarenko **D1–20**

ESTIMATIONS OF THE YEAR TO YEAR CHANGEABILITY OF GAS COMPOSITION AT 120 km OVER IRKUTSK WITH HELP OF MEASUREMENTS OF THE F1-LAYER DEGREE DEVELOPMENT
L.A. Shchepkin, G.P. Kushnarenko, and G.M. Kuznetsova **D1–21**

MAIN IONOSPHERIC TROUGH POLAR WALL BOUNDARY IN MORNING SECTOR DURING MAGNETO-QUIET CONDITIONS
A.E. Stepanov, V.L. Khalipov, and E.D. Bondar **D1–22**

IONOSPHERE EFFECTS OF SOLAR ECLIPSE ON AUGUST 11, 1999
V.I.Taran and Ye.I. Grigorenko **D1–23**

PECULIARITIES OF TOPSIDE HYDROGEN ION BEHAVIOR OVER KHARKOV
V.I. Taran, Ye.I. Grigorenko, and G.A. Kiyashko **D1–24**

IONIZED AND NEUTRAL UPPER ATMOSPHERE COMPONENT PARAMETERS OBTAINED FROM INCOHERENT SCATTER DATA
D.A. Dzyubanov, V.I. Taran, and V.K. Bogovsky **D1–25**

AZIMUTHAL ASYMMETRY OF IONOSPHERE REGIONS WITH FLOWING IN AND FLOWING OUT FIELD-ALIGNED CURRENTS DURING THE SUBSTORM EXPANSION PHASE ONSET
V.A. Velichko, R.N. Boroyev, and M.G. Gelberg **D1–26**

E-LAYER PEAK HEIGHT VARIATIONS DURING GEOMAGNETIC DISTURBANCES
T.G. Zhivolup **D1–27**

IMF INFLUENCE ON THE IONOSPHERE FMIN PARAMETER VARIATIONS
E.K. Zikrach and L.D. Filippov **D1–28**

SIMULTANEOS OBSERVATIONS OF NARROW TROUGHS OF IONIZATION IN BOTH HEMISPHERES **D1–29**
L.V. Shestakova, E.K. Zikrach, and A.E. Stepanov

ELECTRIC FIELD GENERATION IN THE PLASMA SHEET
V.V. Denissenko and A.V. Kitaev **D1–30**

PROPAGATION OF SLOW MHD WAVES ALONG THE DIPOLE MAGNETIC TUBES
N.V. Erkaev and V.A. Shaidurov **D1–31**

INFLUENCE OF THE CURVATURE AND THICKNESS OF THE MAGNETOPAUSE ON ITS INSTABILITY **D1–32**
I.L. Archoukova and N.V. Erkaev

INVESTIGATION OF RESPONSE FUNCTION OF EARTH RADIATION BELT ON THE LARGE-SCALE INCREASE OF SOLAR WIND **D1–33**
I.V. Koshlyak

CONSERVATION PRINCIPLE IN SIMULATION OF SELF-ORGANIZATION FOR ATMOSPHERIC AND IONOSPHERIC PROCESSES **D1–34**
Yu.I. Rusinov

Session D2. INHOMOGENEOUS STRUCTURE OF IONOSPHERE

Chairs: Prof. V.E. Kunitsyn and Dr. A.P. Potekhin

Tuesday, June 26, 14:00–16:15. Small Hall

14:00 RESPONSE OF THE IONOSPHERE TO SMALL AND LARGE SOLAR FLARES AS DEDUCED USING DATA FROM THE GLOBAL GPS NETWORK **D2–01**
E.L. Afraimovich, A.T. Altynsev, V.V. Grechnev, and I.A. Leonovich *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)*

14:15 AIRGLOW CHARACTERISTICS OF ARTIFICIAL FEATURES AT THE TWILIGHT TIME AT UPPER-ATMOSPHERIC HEIGHTS **D2–02**
G.S. Kudryashev and V.G. Kovtunenko *(Irkutsk Military Aviation Engineering Institute, Irkutsk, Russia)*

14:30 OBSERVATION OF POWERFUL COHERENT ECHOES DURING JULY 15–16, 2000 MAJOR GEOMAGNETIC STORM **D2–03**
O.I. Berngardt, G.A. Zherebtsov, A.P. Potekhin, and B.G. Shpynev *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)*

14:45 ON KINETIC THEORY OF THE ION-ACOUSTIC INSTABILITY IN THE IONOSPHERIC E-REGION **D2–04**
Yu.A. Sukovatov *(Altai State University, Barnaul, Russia)*

15:00 ANNUAL AND INTERANNUAL CHANGES OF PARAMETERS SPORADIC E-REGION OF IONOSPHERE ABOVE EAST SIBERIA AND NORTHEAST OF RUSSIA **D2–05**
A.V. Vinitskij, V.V. Kazantseva *(Institute of Space Researches and Distributions of Radio Waves, Paratunka, Kamchatka, Russia),* **V.F. Petrukhin, E.A. Ponomarev, and N.A. Sutyrin** *(Institute of Solar – Terrestrial Physics SB RAS, Irkutsk, Russia)*

15:15 ANOMALOUS STATE OF THE UPPER ATMOSPHERE IN 1984–1985 **D2–06**
A.V. Vinitsky, V.V. Kazantseva *(Institute of Space Research and Radio Waves Propagation, Paratunka, Kamchatka, Russia),* **V.D. Kokourov, V.F. Petrukhin, and N.A. Sutyrin** *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk)*

Coffee break 15:30-16:00

16:00 ANALYSIS OF STABILITY OF TOPSIDE IONOSPHERE PLASMA **D2–07**
M.V. Tolstikov and V.B. Ivanov *(Irkutsk State University, Russia)*

POSTERS ***Tuesday, June 26, 18:15–20:00***

INHOMOGENEOUS STRUCTURE OF THE HIGH-LATITUDE IONOSPHERE AS OBSERVED AT NORILSK
Yu.V. Lipko **D2–08**

VARIATION OF SPECTRUM OF IONOSPHERIC INHOMOGENEITIES DURING SOLAR ECLIPSE
I.N. Poddelsky **D2–09**

COMPARISON OF THE DATA FROM THE IRKUTSK INCOHERENT SCATTER RADAR WITH INTERNATIONAL IONOSPHERIC MODEL IRI-95
A.P. Potekhin, O.I. Berngardt, A.V. Zavorin, B.G. Shpynev, and A.V. Tashilin **D2–10**

INFLUENCE OF THE DYNAMIC ATMOSPHERE CONDITIONS ON ABSORPTION AND REFLECTION OF RADIOWAVES AND ON PROBABILITY OF OBSERVATIONS OF THE SPORADIC E-LAYER IONOSPHERE
V.F. Petrukhin, E.A. Ponomarev, and N.A. Sutyrin **D2–11**

SEASONAL VARIABILITY OF DIURNAL VARIATIONS OF PROBABILITIES OBSERVATIONS OF A SPORADIC E-LAYERS OF AN IONOSPHERE ABOVE EAST SIBERIA IN A DEPENDENCE OF THE SOUNDING FREQUENCY
V.F. Petrukhin, E.A. Ponomarev, and N.A. Sutyrin **D2–12**

ORIGIN AND EVOLUTION OF ATMOSPHERE AND IONOSPHERE STRATIFIED STRUCTURE **D2–13**
Yu.I. Rusinov

Session D3. METHODS FOR REMOTE SENSING OF IONOSPHERE AND THERMOSPHERE

Chairs: Prof. E.L. Afraimovich and Dr. V.D. Tereshchenko

Wednesday, June 27, 16:00–18:30. Main Hall

16:00 Invited. RADIOTOMOGRAPHY OF IONOSPHERE AND ATMOSPHERE
V.E. Kunitsin *(Moscow State University, Russia)* **and V.D. Tereshchenko** *(Polar Geophysics Institute, Murmansk, Russia)* **D3–01**

16:30 DIAGNOSTICS OF IONOSPHERE INHOMOGENEITIES BY THE METHOD OF VERTICAL DOPPLER SOUNDING: NUMERICAL EXPERIMENT
A.V. Barabanov and V.B. Ivanov *(Irkutsk State University, Russia)* **D3–02**

16:45 RECONSTRUCTING OF HIGH-ALTITUDE PROFILE OF ELECTRON CONCENTRATION IN IONOSPHERE WITH USING SIGNALS OF SATELLITE RADIONAVIGATIONAL SYSTEMS
D.A. Rizshkov and V.V. Chernuhov *(Irkutsk Military Aviation Institute, Russia)* **D3–03**

17:00 METHODS FOR DESCRIBING OUTPUT SIGNALS OF THE CHIRP-SONDE
M.A. Davydenko, O.I. Berngardt, N.V. Ilyin, S.Ya. Mikhailov, and V.E. Nosov *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D3–04**

17:15 USE OF METHODS OF INTEGRAL REPRESENTATION FOR FIELD MOMENTS IN PROBLEMS OF TOMOGRAPHIC DIAGNOSTICS OF THE EARTH'S TROPOSPHERE AND IONOSPHERE
A.V. Kulizhsky, S.N. Kolesnik, and M.V. Tinin *(Irkutsk State University, Russia)* **D3–05**

17:30 LOW-LATITUDE IONOSPHERE DIAGNOSTIC USING IONOGRAM OF TRANSEQUATORIAL HF PROPAGATION
V.I. Kurkin, G.V. Kotovich, S.N. Ponomarchuk *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia),* **S.J. Anderson, and B.D. Ward** *(Defense Science Technology Organization, Australia)* **D3–06**

17:45 RECONSTRUCTION OF E-LAYER ELECTRON DENCITY PROFILE FROM FARADAY MEASUREMENT AT IRKUTSK IS RADAR
B.G. Shpynev *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D3–07**

18:00 MF RADAR SOUNDING OF THE POLAR MESOSPHERE IN SUMMER 1999
V.D. Tereshchenko, E.B. Vasil'ev, S.M. Chernyakov, M.V. Yakimov, N.A. Ovchinnikov, V.A. Tereshchenko, and A.M. Tarichenko *(Polar Geophysical Institute RAS, Murmansk, Russia)* **D3–08**

18:15 SOLAR-TERRESTRIAL OPTICS AS AN INFORMATION BASIS FOR MODELLING AND FORECASTING OF THE IONOSPHERIC AND SPACE WEATHER
S.V. Avakyan *(Federal Research Center «Vavilov State Optical Institute», St.Petersburg, Russia)* **D3–09**

POSTERS

Tuesday, June 26, 18:15–20:00

FEATURES OF THE IONOSPHERE PARAMETERS MEASUREMENT BY CORRELATION PROCESSING OF INCOHERENT SCATTER SIGNAL
V.N. Lysenko, A.N. Eryomin, and Yu.V. Cherniak **D3–10**

INVESTIGATIONS OF THE IRKUTSK INCOHERENT RADAR DIRECTIONAL PATTERN BASED ON RESULTS OF RADIO ASTRONOMICAL OBSERVATIONS
A.V. Medvedev, A.V. Zavorin, V.P. Lebedev, B.I. Lubyshev, and V.E. Nosov **D3–11**

SEPARATION OF OVERLAPPING SIGNALS AT IONOSPHERIC WAVE SOUNDINGS
K.G. Ratovsky and A.V. Medvedev **D3–12**

USE OF OBLIQUE-INCIDENCE IONOSPHERIC SOUNDING DATA TO DETERMINE ITS FINE STRUCTURE
N.T. Afanasiev, A.A. Zhzhenykh, M.K. Ivelskaya, V.I. Sazhin, M.V. Tinin, and V.E. Unuchkov **D3–13**

IDENTIFICATION OF DIRECT ULTRAVIOLET RADIATION IN MEASUREMENTS WITH THE SPECTROPHOTOMETER WITH A WIDE ENTRANCE APERTURE
A.Yu. Shalin and A.V. Mikhalev **D3–14**

HF DOPPLER OBSERVATIONS DURING THE NORTH STAR ACTIVE PLASMA EXPERIMENT **D3–15**
K.I. Gorely, N.F. Blagoveshchenskaya, V.V. Klimenko, and P.V. Nagorsky

INFLUENCE OF GLOBAL IRREGULARITIES OF IONOSPHERE ON THE DOPPLER SHIFT OF SEPARATE MODE OF RADIOLINE KHABAROVSK - IOSHKAR OLA
B.A. Ivanov and A.A. Kolchev **D3–16**

ESTIMATION OF PARAMETERS OF IONOSPHERIC IRREGULARITIES ON THE BASIS OF DISPERSIVE CHARACTERISTICS OF RADIOLINES
V.A. Ivanov, D.V. Ivanov, and A.A. Kolchev **D3–17**

INFLUENCE SEASONAL AND PERIODIC VARIATIONS OF TERMOSPHERIC PARAMETERS UPON NIGHT INTENSITY OF ATOMIC OXYGEN RED LINE
R.A. Kononov and A.V. Taschilin **D3–18**

ADAPTIVE REGIONAL THE MODEL OF TOTAL ELECTRON CONTENT
V.V. Chernuhov, A.D. Bazarzhapov, and M.A. Mezhetov **D3–19**

INTEGRAL REPRESENTATION FOR THE FIELD OF THE WAVE PROPAGATING IN A MEDIUM WITH RANDOM INHOMOGENEITIES OF DIFFERENT SCALES
M.V. Tinin and S.N. Kolesnik **D3–20**

MEASUREMENT RESULTS OF THE TEMPERATURE AND DENSITY OF NEUTRAL ATMOSPHERE AT HEIGHTS 90 – 110 KM IN SUMMER 1999 – 2000 KM USING ARTIFICIAL PERIODIC INHOMOGENEITIES
A.V. Tolmacheva and V.V. Belikovich **D3–21**

UPPER ATMOSPHERE PARAMETERS MEASUREMENTS USING ARTIFICIAL PERIODIC INHOMOGENEITIES
A.V. Tolmacheva, V.V. Belikovich, and N.V. Bakhmet'eva **D3–22**

NEW WAY TO SPACE ERGODICITY PROBLEM AT INCLINED SOUNDIG OF RANDOM-INHOMOGENEOUS REFRACTED MEDIA
A.G. Vologdin, V.D. Gusev, L.I. Prikhodko **D3–23**

OPTIMIZATION OF IONOSPHERIC PLASMA DRIFT VELOCITY MEASUREMENT BY INCOHERENT SCATTER TECHNIQUE
L.Ya. Yemelyanov **D3–24**

Session D4. RADIO-WAVE PROPAGATION IN IONOSPHERE

Chairs: Prof. I.I. Orlov and Prof. M.V. Tinin

Tuesday, June 26, 16:15–17:00. Small Hall

16:15 MAGNETOSPHERIC DISTURBANCES, AND THE GPS OPERATION
E.L. Afraimovich, O.S. Lesyuta, and I.I. Ushakov *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D4–01**

16:30 BACKSCATTERING FROM THE STRATIFIED-IRREGULAR, NONSTATIONARY IONOSPHERE
I.I. Orlov *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **D4–02**

16:45 A SET OF TECHNIQUES FOR UPDATING THE BASIC MODEL OF THE IONOSPHERIC DECAMETRIC RADIO CHANNEL TO CURRENT CONDITIONS
V.I. Sazhin *(Irkutsk State University, Russia)* **D4–03**

POSTERS ***Tuesday, June 26, 18:15–20:00***

ON ASYMMETRY OF DISTRIBUTIONS OF REFRACTION INDEX IN EASTERN REGIONS OF RUSSIA
N.Ts. Gomboyev, A.S. Batoroyev, and V.E. Munkoyev **D4–04**

ON THE SIGNAL STRUCTURE OF THE OVER-THE-HORIZON SEA SURFACE RADAR
M.V. Ignatenko and M.V. Tinin **D4–05**

RESEARCHES OF TIME-AND-FREQUENCY CHARACTERISTICS OF PEDERSEN MODES ON THE RUSSIAN OBLIQUE CHIRPSOUNDERS NETWORK
V.A. Ivanov, N.V. Ryabova, D.V. Skvortsov, I.N. Poddel'skiy, and S.V.Rozanov **D4–06**

ADAPTATION CAPABILITIES OF THE IRI FOR HF PROPAGATION
G.V. Kotovich and S.Ya. Mikhailov **D4–07**

CALCULATION OF THE COMPLEX REFLECTION COEFFICIENTS AND FIELD'S STRUCTURE IN INHOMOGENEOUS ABSORBING IONOSPHERE BY THREE – DIAGONAL MATRIX ALGORITHM
L.I. Prikhodko, V.D. Gusev, and A.G. Vologdin **D4–08**

Sessions E1-E4. STRUCTURE AND DYNAMICS OF THE MIDDLE ATMOSPHERE

Chairs: RAS corresponding member V.V. Zuev and Prof. V.V. Koshelev

Monday, June 25, 9:30–13:15. Main Hall

9:15 Invited. MODERN PROBLEMS OF SOLAR-TERRESTRIAL PHYSICS
G.A. Zherebtsov *(Institute of Solar – Terrestrial Physics SB RAS., Irkutsk, Russia)* **E–01**

9:45 Invited. HISTORY OF ACADEMIC RESEARCH AND DEVELOPMENT IN TOMSK
V.E. Zuev *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* **E–02**

10:15 Invited. INFLUENCE OF STRATOSPHERIC WARMING ON THE PARAMETERS OF THE MIDDLE AND LOW ATMOSPHERE
V.V. Koshelev, G.A. Zherebtsov, N.A. Abushenko, S.A. Tashchilin, A.V. Mikhalev, R.A. Kononov, I.V. Medvedeva, A.Yu. Shalin, E.L. Afraimovich, and O.S. Lesuta *(Institute of Solar- Terrestrial Physics SB RAS, Irkutsk, Russia)* **E–03**

Coffee break 10:45–11:00

11:00 Invited. ACTIVE RADIATION ATMOSPHERIC CONSTITUENTS IN THE ATMOSPHERIC DEPTH OVER CENTRAL EURASIA
V.N. Aref'ev, F.V. Kashinn *(Institute of Experimental Meteorology, Obninsk, Russia),* **E–04**
and V.K. Semyonov *(Kyrgyz State National University, Kyrgyzstan)*

11:30 STUDY OF THE EFFECT OF GRAVITY WAVE PROPAGATION ON MINOR SPECIES DISTRIBUTION IN MIDDLE ATMOSPHERE
Jiyao Xu *(Center for Space Sciences and Applied Research CAS, Beijing, China)* **E–05**

11:45 LOWER THERMOSPHERE TEMPERATURE BEHAVIOR DURING WINTER STRATOSPHERIC WARMING
V.M. Ignatyev and S.V. Nickolashkin *(Institute of Cosmophysical Researches and Aeronomy SB RAS, Yakutsk, Russia)* **E–06**

12:00 RESEARCH OF SPATIAL-TEMPORAL CONNECTIONS BETWEEN METEOROLOGICAL PARAMETERS OF STRATOSPHERE AND TOTAL OZONE DYNAMICS
A.Yu. Belinskaya, Ed.S. Kazimirovsky, N.A. Abushenko *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **E–07**

12:15 ADAPTIVE FORECASTING OF THE OZONE LAYER DYNAMICS
I.Yu. Sakash, V.B. Kashkin, J.P. Lankin *(Krasnoyarsk State Technical University, Russia)* **E–08**

12:30 SENSITIVITY OF STRATOSPHERE AND MESOSPHERE CLIMATE TO OBSERVED CHANGES OF OZONE AND CARBON DIOXIDE CONCENTRATION
E.M. Volodin *(Institute for Numerical Mathematics RAS, Moscow, Russia)* **E–09**

12:45 RECONSTRUCTION SPATIALLY – TEMPORARY DISTRIBUTIONS OF METEOROLOGICAL FIELDS ON OBSERVATIONAL DATA
E.G. Klimova *(Institute for Computational Technology SB RAS, Novosibirsk, Russia)* **E–10**

13:00 THEORETICAL SIMULATION OF FAR WAVE ACTION OF ANTARCTIC OZONE SOURCE OF ATMOSPHERIC THERMAL TIDES ON THERMOHYDRODYNAMIC STATE OF THE UPPER ATMOSPHERE OF NORTHERN HEMISPHERE
A.A.Gavrilov[1], A.P.Kapitsa[2], and O.V.Kaidalov[1] *([1]Institute of Experimental Meteorology, Obninsk, Russia, [2]Moscow State University, Russia)* **E–11**

POSTERS *Monday, June 25, 18:15–20:00*

LOWER POLAR IONOSPHERE RESEARCHES BY THE PARTIAL RADIOREFLECTIONS TECHNIQUE
V.D. Tereshchenko, M.V. Yakimov, E.B. Vasil'ev, S.M. Chernyakov, and O.F. Ogloblina E–28

ADAPTIVE SIMULATION OF ATMOSPHERIC PHENOMENA
J.P. Lankin E–29

INVESTIGATION of VERTICAL PROPAGATION of NONLINEAR WAVES IN THE ATMOSPHERE
S.P. Kshevetskii and N.M. Gavrilov E–30

Session F1. Long-period Trends of Atmospheric Parameters

Chairs: RAS corresponding member M.V. Kabanov and Prof. V.V. Koshelev

Friday, June 29, 9:00–11:00. Main Hall

9:00 Invited. MODERN NATURE-CLIMATE CHANGES IN SIBERIA: NEW METHODS AND RESULTS OF ANALYSIS AND INSTRUMENTAL OBSERVATIONS
M.V. Kabanov *(Institute of Optical Monitoring SB RAS, Tomsk, Russia)* F1–01

9:30 INTER-YEARLY VARIATIONS OF SURFACE TEMPERATURE OF AIR IN TOMSK
I.I. Ippolitov, M.V. Kabanov, and S.V. Loginov *(Institute of Optical Monitoring SB RAS, Tomsk, Russia)* F1–02

9:45 LONG-TERM DYNAMICS OF CHARACTERISTICS OF STRATOSPHERIC AEROSOL LAYER ACCORDING TO DATA OF LIDAR OBSERVATIONS IN TOMSK (56.5°N, 85.0°E)
V.D. Burlakov, A.V. Elnikov, and V.V. Zuev *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* F1–03

10:00 OBSERVATION OF OPTICAL FLASHES OF THE NIGHT STAR SKY ON THE ATMOSPHERIC CHERENKOV INSTALLATION TUNKA
O.A. Gress, T.I. Gress, L.V. Pan'kov, Yu.V. Parfenov, Yu.A. Semeney *(Applied Physics Institute of Irkutsk State University, Russia),* **and L.A. Kuzmichev** *(Moscow State University, Russia)* F1–04

10:15 LIDAR INVESTIGATIONS OF FEATURES OF WINTER STRATOSPHERIC WARMING ABOVE TOMSK FOR THE PERIOD 1996–2000
V.N. Marichev *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia)* F1–05

10:30 LONG-TERM DYNAMICS OF THE ATMOSPHERIC AIR METEOPARAMETERS NEAR THE LARGE INDUSTRIAL CENTERS OF ALTAI DISTRICT
G.S. Zinchenko, I.A.Sutorikhin, and N.N. Bezuglova *(Institute of Water and Environmental Problems SB RAS, Barnaul, Russia)* F1–06

10:45 LAKE BAIKAL AS THE SOURCE AND RECEPTOR OF PERTURBATIONS IN CLIMATE-ECOLOGY SYSTEM OF SIBERIA
V.V. Penenko and E.A. Tsvetova *(Institute of Computational Mathematics and Mathematical Geophysics SB RAS, Novosibirsk, Russia)* F1–07

POSTERS ***Wednesday, June 27, 17:00–18:30***

SOURCES OF POLLUTION OF THE ATMOSPHERE WITH THE POLYCYCLIC AROMATIC HYDROCARBONS IN INDUSTRIAL PRIBAIKALYE
L.I. Belykh, Yu.M. Malykh, E.E. Penzina, and A.N. Smagunova F1–08

TOTAL LIQUID WATER CONTENT DISTRIBUTION IN CLOUD LAYER FROM MICROWAVE REMOTE SENSING
M.Yu. Shoom, L.M. Mitnik, and A.A. Nabiullin F1–09

AMPLITUDE-PHASE CHARACTERISTICS OF SAT ANNUAL CYCLE IN ASIA: TENDENCIES OF CHANGE DERIVED FROM OBSERVATIONS AND REANALYSES AND FROM NUMERICAL EXPERIMENTS WITH IAP RAS CM
A.V. Eliseev, and I.I. Mokhov **F1–10**

LONG-PERIOD TRENDS IN LOWER SUB-AURORAL IONOSPHERE
S.E. Koyakova and V.F. Smirnov **F1–11**

PECULIARITIES OF TOTAL CIRCULATION OF THE ATMOSPHERE OF NORTH HEMISPHERE DURING THE WARM AND COLD WINTERS AT SIBERIA TERRITORY
A.A. Karakhanyan and V.I. Mordvinov **F1–12**

ANALYSIS OF CLIMATIC CHANGES ON THE PHASE PORTRAITS
E.A. Dyukarev and V.I. Shihlov **F1–13**

ESTIMATION OF APERIODIC CLIMATE PARAMETERS CHANGES
E.A. Dyukarev and V.I. Shihlov **F1–14**

CHANGES of a REGIONAL CLIMATE, CAUSED by the NATURAL FACTORS Both BY ANTROPOGENEOUS INFLUENCE
K.A Karimov and R.D.Gainutdinova **F1–15**

VARIATIONS AND LONG-TERM TRENDS OF TOTAL OZONE AND STRATOSPHERIC NITROGEN DIOXIDE OVER NORTHERN TIEN SHAN
V.K. Semyonov, V.P. Sinyakov, L.I. Sorokina, N.I. Ignatova, F.V. Kashin, and K.N. Visheratin **F1–16**

INFLUENCE OF QUASI-BIANNUAL STRATOSPHERE CIRCULATION CYCLICITY ON THE VERTICAL DISTRIBUTION OF OZONE AND TEMPERATURES ABOVE WESTERN SIBERIA
V.N. Marichev **F1–17**

CURRENT STATE AND LONG-TERM CHANGES OF THE OZONOSPHERE OVER TOMSK
S.V. Smirnov and V.V. Zuev **F1–18**

NUMERICAL MODEL OF THE ATMOSPHERIC BOUNDARY LAYER WITH THE SURFACE INHOMOGENEITY
N.N. Bezuglova, Yu.A. Sukovatov, and I.A. Sutorikhin **F1–19**

Session F2. Effect of Solar Activity on Weather and Climate

Chairs: Prof. E.A. Ponomarev and Prof. V.V. Penenko

Friday, June 29, 11:30-12:45. Main Hall

11:30 NATURE OF LONG-TERM VARIATIONS OF GROUND AIR TEMPERATURE FOR BAIKAL REGION AND ITS CONNECTION WITH SOLAR ACTIVITY
G.A. Zherebtsov and V.A. Kovalenko *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **F2–01**

11:45 COSMIC RAYS AND GLOBAL WARMING ON THE EARTH
P.E. Pokrevsky[1,2] and Y.I. Stozhkov[2] *([1]Fedorov Institute of Applied Geophysics, Roskomgidromet, Moscow, Russia, [2]Lebedev Physical Institute RAS, Moscow, Russia)* **F2–02**

12:00 EFFECT OF SOLAR AND GEOPHYSICAL FACTORS ON THE AEROSOL CHARACTERISTICS. THE PLANS OF ATMOSPHERIC INVESTIGATIONS IN IRKUTSK
M.V. Panchenko, S.M. Sakerin *(Institute of Atmospheric Optics SB RAS, Tomsk, Russia),* **V.V. Koshelev, V.A. Kovalenko** *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia),* **and T.V. Khodzher** *(Limnological Institute SB RAS, Irkutsk, Russia)* **F2–03**

12:15 SOLAR FLUX VARIABILITY AND GLOBAL CLIMATE
Yu.A. Sklyarov, Yu.I. Brichkov, A.I. Kotuma, and N.V. Fomina *(Saratov State University, Russia)* **F2–04**

12:30 SOLAR ACTIVITY AND EARTH CLIMATE AT THE BEGINNING OF 21 CENTURY
V.S. Bashkirtsev and G.P. Mashnich *(Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia)* **F2–05**

POSTERS ***Wednesday, June 27, 17:00–18:30***

GLOBAL AND LOCAL VARIATIONS OF AN ELECTRICAL FIELD OF AN ATMOSPHERE
U.V. Shamansky **F2–06**

RELATION OF THUNDERSTORM ACTIVITY TO COSMIC RAY VARIATIONS
V.A. Mullayarov, V.I. Kozlov, and R.R. Karimov **F2–07**

RELATIONSHIPS OF LOW ATMOSPHERIC PARAMETERS WITH IONOSPHERIC AND GEOMAGNETIC CHARACTERISTICS IN THE NORTH-EAST OF RUSSIA
A.V. Vinitsky and V.V. Kazantseva **F2–08**

AGENDA

Main Hall Small Hall

June 24

9:00-19:00 Registration

19:00 Reception

June 25

8:30 Opening remarks/information

9:15 – 13:15 Sessions E1 - E4

10:45 - 11:00 *Coffee-break*

11:00 – 13:15 Session A1

13:15 - 14:00 *Lunch*

14:00 18:15 Sessions A2, C1

16:00 - 16:30 *Coffee-break*

18:15 – 20:00 Poster Sessions A1, A2, C1, E1 – E4

June 26

8:30 – 13:15 Session C2

8:30 – 12:30 Session C4

10:45 - 11:00 *Coffee-break*

13:15 - 14:00 *Lunch*

14:00 – 17:00 Sessions D2, D4

14:00 – 18:15 Session D1

16:00 - 16:30 *Coffee-break*

18:15 – 20:00 Poster Sessions C2, C3, C4, C5, D1, D2, D3, D4

19:00 Tour of the city Irkutsk

June 27

8:30 – 13:15 Sessions B1, B2

8:30 – 13:00 Session C5

10:45 - 11:00 *Coffee-break*

13:15 - 14:00 *Lunch*

14:00 – 15:30 Session C3

14:00 – 17:15 Session C6

16:00 – 18:30 Session D3

16:00 - 16:30 *Coffee-break*

17:00 – 18:30 Poster Sessions B1, B2, F1, F2

19:00 Party

June 28

Baikal Session (Irkutsk-Listvyanka-Baikal-Kadil'nyi)

June 29

9:00 – 12:45 Sessions F1, F2

11:00 - 11:30 *Coffee-break*

12:45 End of Symposium

14:00 Visit to Baikal Museum and Baikal Astrophysics Observatory (Listvyanka)

Институт солнечно-земной физики

Институт оптики атмосферы

СИБИРСКОЕ ОТДЕЛЕНИЕ АКАДЕМИИ НАУК РОССИИ

IRKUTSK 2001

ATMOSPHERIC and OCEAN OPTICS. ATMOSPHERIC PHYSICS

ОПТИКА АТМОСФЕРЫ И ОКЕАНА. ФИЗИКА АТМОСФЕРЫ

VIII Объединенный международный симпозиум

25 – 29 июня 2001 г.

Иркутск

Оргкомитет благодарит организации, внесшие свой вклад в проведение и публикацию трудов симпозиума:

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SPIE The International Society for Optical Engineering

The International Society for Optical Engineering

OSA Optical Society of America

The Optical Society of America

VIII Объединенный Международный симпозиум «Оптика атмосферы и океана»
Материалы симпозиума. Под общей редакцией В.А. Банаха, О.В. Тихомировой
Томск: Институт оптики атмосферы СО РАН, 2001, 276 с.

В сборник включены материалы по фундаментальным и прикладным вопросам оптики атмосферы и океана и физики атмосферы. Представленные тезисы докладов отражают работу следующих секций симпозиума:

Оптика атмосферы и океана

A. Молекулярная спектроскопия и радиационные процессы в атмосфере
- A1. Молекулярная спектроскопия атмосферных газов
- A2. Поглощение излучения в атмосфере и океане, радиационный режим и проблемы климата

B. Распространение оптического излучения в атмосфере и океане
- B1. Распространение волн в случайно-неоднородных средах. Адаптивная оптика
- B2. Нелинейные эффекты при распространении излучения в атмосфере и водных средах

C. Оптические исследования атмосферы и океана
- C1. Многократное рассеяние в оптическом зондировании. Перенос и обработка изображений
- C2. Лазерное и акустическое зондирование атмосферы и океана
- C3. Авиационные и космические лидары и их применения. Модели атмосферы. Лазерные пучки на высотных атмосферных и космических трассах
- C4. Оптические и микрофизические свойства атмосферного аэрозоля и взвесей в водных средах
- C5. Перенос и трансформация аэрозоля и газовых компонентов в атмосфере
- C6. Диагностика состояния и функционирования растительных биосистем

Физика атмосферы

D. Физические процессы и явления в термосфере и ионосфере Земли
- D1. Магнитосферно-ионосферные взаимодействия
- D2. Неоднородная структура ионосферы
- D3. Дистанционные методы зондирования ионосферы и термосферы
- D4. Распространение радиоволн в ионосфере

E. Структура и динамика средней атмосферы
- E1. Атмосферные волны и турбулентность
- E2. Газовый состав средней атмосферы
- E3. Область D ионосферы
- E4. Модели средней атмосферы

F. Динамика атмосферы и климата Азиатского региона
- F1. Долгопериодные тренды параметров атмосферы
- F2. Воздействие солнечной активности на погоду и климат

Тезисы печатаются на основе электронных форм, представленных авторами. Сборник представляет интерес для исследователей и инженеров, работающих в области физики атмосферы, оптики атмосферы и океана, радиофизики, акустики, метеорологии и экологии.

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Dr. N.S. Kopeika	*Ben-Gurion University of the Negev, Beer-Sheva, Israel*
Д.ф.-м.н. Г.М. Крученицкий	*Центральная аэрологическая обсерватория, Долгопрудный, Россия*
Д.ф.-м.н. И.И. Морозов	*Институт химической физики РАН, Москва, Россия*
Prof. U.G. Oppel	*Institute of Mathematics, Muenchen, Germany*
Dr. J.L. Otten	*Kestrel Corporation, Albuquerque, USA*
Dr. L. Radke	*National Center for Atmospheric Research, Boulder, USA*
Dr. M. Roggemann	*Michigan Technical University, Houghton, USA*
Проф. И.В. Самохвалов	*Томский государственный университет, Россия*
Prof. M.W. Sigrist	*Institute of Quantum Electronics, Zurich, Switzerland*
Dr. O. Steinvall	*Defense Research Establishment, Linkoping, Sweden*
Д.ф.-м.н. И.А. Суторихин	*Институт водных и экологических проблем СО РАН, Барнаул, Россия*
Д.ф.-м.н. Г.Ф. Тулинов	*Институт прикладной геофизики, Москва, Россия*
Д.ф.-м.н. Э.С. Казимировский	*Институт солнечно-земной физики СО РАН, Иркутск, Россия*
Д.ф.-м.н. В.А. Коваленко	*Институт солнечно-земной физики СО РАН, Иркутск, Россия*
Д.ф.-м.н. И.И. Орлов	*Институт солнечно-земной физики СО РАН, Иркутск, Россия*
Д.ф.-м.н. А.С. Потапов	*Институт солнечно-земной физики СО РАН, Иркутск, Россия*
Д.ф.-м.н. Е.А. Пономарев	*Институт солнечно-земной физики СО РАН, Иркутск, Россия*
Д.ф.-м.н. Б.Д. Белан	*Институт оптики атмосферы СО РАН, Томск, Россия*
Д.ф.-м.н. В.В. Белов	*Институт оптики атмосферы СО РАН, Томск, Россия*
Д.ф.-м.н. А.А. Землянов	*Институт оптики атмосферы СО РАН, Томск, Россия*
Д.ф.-м.н. В.П. Лукин	*Институт оптики атмосферы СО РАН, Томск, Россия*
Д.ф.-м.н. М.В. Панченко	*Институт оптики атмосферы СО РАН, Томск, Россия*
Д.ф.-м.н. Ю.Н. Пономарев	*Институт оптики атмосферы СО РАН, Томск, Россия*
Д.ф.-м.н. Л.Н. Синица	*Институт оптики атмосферы СО РАН, Томск, Россия*

Ученые секретари симпозиума

К.ф.-м.н. А.В. Михалев	*Институт солнечно-земной физики СО РАН, Иркутск, Россия*
О.В. Тихомирова	*Институт оптики атмосферы СО РАН, Томск, Россия*

Секция А1. МОЛЕКУЛЯРНАЯ СПЕКТРОСКОПИЯ АТМОСФЕРНЫХ ГАЗОВ

Сопредседатели секции: д.ф.-м.н. Л.Н. Синица, проф. А. Барб

УСТНЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 11:00–13:15. Малый зал***

11:00 ФОТОАКУСТИЧЕСКОЕ ДЕТЕКТИРОВАНИЕ ГАЗОВО-АЭРОЗОЛЬНЫХ ПРИМЕСЕЙ В АТМОСФЕРЕ
Ю.Н. Пономарев *(Институт оптики атмосферы СО РАН, Томск)* **А1–01**

11:15 НОВЫЕ ВНУТРИРЕЗОНАТОРНЫЕ СПЕКТРЫ МОЛЕКУЛ CO_2 И N_2O В БЛИЖНЕМ ИК-ДИАПАЗОНЕ ДЛИН ВОЛН (10000 – 12000 $см^{-1}$)
Г. Вейро, А. Кампарг *(Université Joseph Fourier de Grenoble, France),*
В.И. Перевалов, С.А. Ташкун *(Институт оптики атмосферы СО РАН, Томск),*
Ж.-Л. Теффо *(Université Pierre et Marie Curie, Paris-cedex)* **А1–02**

11:30 ОЦЕНКИ ВЛИЯНИЯ ИНТЕРФЕРЕНЦИИ НА ПАРАМЕТРЫ КОНТУРА СПЕКТРАЛЬНЫХ ЛИНИЙ ВОДЯНОГО ПАРА
А.Д. Быков, Н.Н. Лаврентьева, Л.Н. Синица, А.М Солодов *(Институт оптики атмосферы СО РАН, Томск)* **А1–03**

11:45 К ТЕОРИИ УШИРЕНИЯ СПЕКТРАЛЬНЫХ ЛИНИЙ ПРИ СОВМЕСТНОМ ДЕЙСТВИИ ЭФФЕКТОВ ДОПЛЕРА И ДАВЛЕНИЯ
М.Р. Черкасов *(Институт оптики атмосферы СО РАН, Томск)* **А1–04**

12:00 ВЛИЯНИЕ ДИСПЕРСИИ ДИПОЛЬНЫХ МОМЕНТОВ МОЛЕКУЛ ДЛЯ РАЗЛИЧНЫХ КОЛЕБАТЕЛЬНЫХ И ВРАЩАТЕЛЬНЫХ СОСТОЯНИЙ НА ТРАНСПОРТНЫЕ СВОЙСТВА ПОЛЯРНЫХ ГАЗОВ
В.П. Кочанов, В.И. Стариков *(Институт оптики атмосферы СО РАН, Томск)* **А1–05**

12:15 ИССЛЕДОВАНИЕ ФОРМИРОВАНИЯ НЕРАВНОВЕСНОЙ НАСЕЛЕННОСТИ КОЛЕБАТЕЛЬНЫХ СОСТОЯНИЙ МОЛЕКУЛ В ВЕРХНИХ АТМОСФЕРАХ ПЛАНЕТ
А.О. Семёнов, Г.М. Швед *(НИИ физики Санкт-Петербургского государственного университета)* **А1–06**

12:30 РОВИБРОННЫЕ ЗАДАЧИ И ОСОБЕННОСТИ ВЫВОДА ГАМИЛЬТОНИАНА В ГЛАВНЫХ ОСЯХ КАК ИХ ОСНОВЫ
А.Я. Цауне, Я.А. Подоляк *(Украинский государственный химико-технологический университет, Днепропетровск),*
М.П. Дьяченко *(Днепропетровский национальный университет)* **А1–07**

12:45 ФУРЬЕ-СПЕКТРЫ ПОГЛОЩЕНИЯ $H_2{}^{16}O$, $H_2{}^{17}O$ И $H_2{}^{18}O$ В ДИАПАЗОНЕ 8000 – 9500 $см^{-1}$
А.Д. Быков, Л.П. Воробьева, О.В. Науменко, Л.Н. Синица *(Институт оптики атмосферы СО РАН, Томск),*
К. Ками-Пере, Ж.-И. Мандин *(Universite Pierre-et-Marie Curie, Paris, France),*
Ж.-М. Фло *(Universite Paris Sud, Orsay, France)* **А1–08**

13:00 РАДИАЦИОННЫЙ БЛОК МОДЕЛИ ИВМ РАН В ПРОГРАММЕ ICRCCM III
В.Я. Галин *(Институт вычислительной математики РАН, Москва)* **А1–09**

СТЕНДОВЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 18:00–20:00***

ИЗМЕРЕНИЕ СПЕКТРА ПОГЛОЩЕНИЯ МОЛЕКУЛЯРНОГО КИСЛОРОДА В ДИАПАЗОНЕ 755 – 775 нм
И.С. Тырышкин, Ю.Н. Пономарев **А1–10**

ПРИМЕНЕНИЕ ОБОБЩЕННОГО ПРЕОБРАЗОВАНИЯ ЭЙЛЕРА ДЛЯ СУММИРОВАНИЯ РЯДА ДАНХЭМА ДВУХАТОМНЫХ МОЛЕКУЛ
Т.В. Круглова, А.Д. Быков, О.В. Науменко **А1–11**

АНАЛИЗ КОЛЕБАТЕЛЬНОЙ ЗАВИСИМОСТИ СРЕДНЕЙ ПОЛЯРИЗУЕМОСТИ H_2O
В.Н. Стройнова, В.М. Михайлов **А1–42**

ПАРАМЕТРЫ ФУНКЦИИ ДИПОЛЬНОГО МОМЕНТА ДЛЯ ИЗОТОПА ОЗОНА $^{18}O_3$
О.Н. Сулакшина, Ю.Г. Борков, А. Барб, Вл.Г. Тютерев, А. Шишери **А1–43**

ОЦЕНКИ ИНТЕНСИВНОСТЕЙ ЛИНИЙ ГОРЯЧИХ ПЕРЕХОДОВ, ФОРМИРУЮЩИХ 6,3 мкм ПОЛОСУ ВОДЯНОГО ПАРА
О.Н. Сулакшина, Ю.Г. Борков, Р.О. Мануйлова **А1–44**

ОСОБЕННОСТИ ГЕНЕРАЦИИ ОА-СИГНАЛОВ В ПОГЛОЩАЮЩИХ ЯЧЕЙКАХ С МАЛЫМИ И БОЛЬШИМИ РАЗМЕРАМИ И ИХ ЗАВИСИМОСТЬ ОТ ДРУГИХ УСЛОВИЙ ЭКСПЕРИМЕНТА
Б.А. Тихомиров, А.Б. Тихомиров **А1–45**

СПЕКТРЫ ИЗЛУЧЕНИЯ ГОРЯЩИХ ЛЕСНЫХ МАТЕРИАЛОВ
Р.Ш. Цвык, А.А. Долгов **А1–46**

О СВОЙСТВАХ СПЕКТРОВ НИЗКОЧАСТОТНОГО ИК-ПОГЛОЩЕНИЯ НЕКОТОРЫХ ПОЛИЦИКЛИЧЕСКИХ УГЛЕВОДОРОДОВ
Ю.С. Демчук, А.Е. Вандюков, Е.А. Вандюков **А1–47**

ПРИМЕНЕНИЕ МОДИФИЦИРОВАННОЙ МОДЕЛИ СИММЕТРИЧНОГО ВОЛЧКА ДЛЯ АНАЛИЗА ВЫСОКОТЕМПЕРАТУРНЫХ СПЕКТРОВ ВОДЯНОГО ПАРА
О.К. Войцеховская, А.А. Котов, В.Н. Черепанов **А1–48**

НОВЫЙ АНАЛИЗ ВОДЯНОГО ПАРА В ДИАПАЗОНЕ 9500–11500 $см^{-1}$
А.Д. Быков, Б.А. Воронин, О.В. Науменко, Л.Н. Синица, К. Ками-Пере, Ж.-И. Манден, Ж.-М. Фло **А1–49**

ТЕОРЕТИЧЕСКОЕ ОПИСАНИЕ ФОТОДИССОЦИОННОГО СПЕКТРА МОНОМЕРНОЙ И ДИМЕРНОЙ ФОРМ ВОДЫ
Н.А. Зверева **А1–50**

РАСЧЕТ УРОВНЕЙ ВИБРАЦИЙ МЕТАНА ИЗ *AB-INITIO* ПОТЕНЦИАЛЬНОГО РЕЛЬЕФА
А. Никитин, Я. Макаревич **А1–51**

АНАЛИЗ ФУРЬЕ-СПЕКТРА ПОГЛОЩЕНИЯ МОЛЕКУЛЫ $H_2{}^{17}O$ В ДИАПАЗОНЕ 11600–14550 $см^{-1}$ **А1–52**
А.Д. Быков, Л.П. Воробьева, О.В. Науменко, Л.Н. Синица, К. Ками-Пере, Ж.-И. Манден, Ж.-М. Фло

СПЕКТРОФОТОМЕТРИЧЕСКИЙ ГАЗОАНАЛИЗАТОР
Ю.А. Поплавский, В.И. Сердюков, Л.Н. Синица Ф.П. Щербаков **А1–53**

Секция А2. ПОГЛОЩЕНИЕ ИЗЛУЧЕНИЯ В АТМОСФЕРЕ И ОКЕАНЕ, РАДИАЦИОННЫЙ РЕЖИМ И ПРОБЛЕМЫ КЛИМАТА

Сопредседатели секции: член-корр. РАН С.Д. Творогов, проф. А. Аркинг

ПРИГЛАШЕННЫЙ ДОКЛАД ***Понедельник, 25 июня, 14:00–14:30. Большой зал***

14:00 АТМОСФЕРНАЯ АБСОРБЦИЯ СОЛНЕЧНОГО ИЗЛУЧЕНИЯ: ВОЗМОЖНЫЕ ОБЪЯСНЕНИЯ РАСХОЖДЕНИЙ МЕЖДУ МОДЕЛЯМИ И НАБЛЮДЕНИЯМИ
А. Аркинг *(Johns Hopkins University, Baltimore, USA)* **А2–01**

УСТНЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 14:30–16:00. Большой зал***

14:30 ПОЛЯ ЯРКОСТИ В УСЛОВИЯХ КРИСТАЛЛИЧЕСКОЙ РАЗОРВАННОЙ ОБЛАЧНОСТИ
Т.Б. Журавлева *(Институт оптики атмосферы СО РАН, Томск),*
А.Г. Петрушин *(Институт экспериментальной метеорологии, Обнинск)* **А2–02**

14:45 СРАВНЕНИЕ МЕЖДУ РАСЧЕТАМИ И ИЗМЕРЕНИЯМИ СОЛНЕЧНЫХ ПОТОКОВ НА ПОВЕРХНОСТИ ЗЕМЛИ ПРИ РАЗЛИЧНЫХ АТМОСФЕРНЫХ УСЛОВИЯХ
А. Рублев, А. Копылов *(Российский научный центр «Курчатовский институт», Москва),* **Н. Чубарова** *(Московский государственный университет),*
Г. Горчаков *(Институт физики атмосферы РАН, Москва),*
А. Аркинг *(Johns Hopkins University, USA)* **А2–03**

15:00 САЖЕВЫЙ АЭРОЗОЛЬ – ИСТОЧНИК ИЗБЫТОЧНОГО ПОГЛОЩЕНИЯ КОРОТКОВОЛНОВОГО ИЗЛУЧЕНИЯ АТМОСФЕРНЫМ ВОЗДУХОМ
Б.А. Тихомиров, А.Б. Тихомиров, К.М. Фирсов *(Институт оптики атмосферы СО РАН, Томск)* **А2–04**

15:15 ПРИМЕНЕНИЕ РЯДОВ ЭКСПОНЕНТ В РАСЧЕТАХ ПЕРЕНОСА ИЗЛУЧЕНИЯ МЕТОДОМ МОНТЕ-КАРЛО В ПРОСТРАНСТВЕННО НЕОДНОРОДНОЙ ГАЗОВО-АЭРОЗОЛЬНОЙ АТМОСФЕРЕ ЗЕМЛИ
К.М. Фирсов, Т.Ю. Чеснокова, В.В. Белов, А.Б. Серебренников, Ю.Н. Пономарев **А2–05**
(Институт оптики атмосферы СО РАН, Томск)

15:30 ПРИМЕНЕНИЕ ОБОБЩЕННОГО МЕТОДА ПОСТРОЕНИЯ ЛИНЕЙНОЙ РЕГРЕССИИ ДЛЯ УТОЧНЕНИЯ МОДЕЛИ КОНТИНУАЛЬНОГО ПОГЛОЩЕНИЯ ИЗЛУЧЕНИЯ ВОДЯНЫМ ПАРОМ В ОБЛАСТИ СПЕКТРА 10,6 мкм
Н.Н. Щелканов *(Институт оптики атмосферы СО РАН, Томск)* **А2–06**

15:45 ИССЛЕДОВАНИЕ ЗАВИСИМОСТИ РАДИАЦИОННЫХ ХАРАКТЕРИСТИК АТМОСФЕРЫ ОТ ВАРИАЦИЙ ПАРАМЕТРОВ АТМОСФЕРЫ, ОБЛАКОВ И ПОДСТИЛАЮЩЕЙ ПОВЕРХНОСТИ В СОЛНЕЧНОМ ДИАПАЗОНЕ СПЕКТРА
Л.Р. Дмитриева-Арраго, М.В. Шатунова *(Гидрометеорологический научно-исследовательский центр Российской Федерации, Москва)* **А2–07**

СТЕНДОВЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 18:00–20:00***

КОРРЕЛЯЦИОННЫЕ СВЯЗИ МЕЖДУ ФЛУКТУАЦИЯМИ ЭНЕРГЕТИЧЕСКОЙ ЯРКОСТИ КУЧЕВОЙ ОБЛАЧНОСТИ В ИНТЕРВАЛАХ ДИАПАЗОНА 1,5–5,2 мкм
А.М. Алленов, Н.П. Иванова, А.А. Печенев, В.А. Соловьев **А2–08**

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ СОБСТВЕННЫХ ИЗЛУЧЕНИЙ ОБЛАЧНОГО НЕБА В ДИАПАЗОНЕ 8 – 13 мкм В ЗИМНЕЕ ВРЕМЯ
А.М. Алленов, А.А. Печенев, В.А. Соловьев, И.В. Якименко **А2–09**

СРАВНЕНИЕ РЕЗУЛЬТАТОВ СПУТНИКОВЫХ И НАЗЕМНЫХ ИЗМЕРЕНИЙ УФ-РАДИАЦИИ В ДИАПАЗОНЕ 300–380 нм В РАЙОНЕ МОСКВЫ ЗА ПЕРИОД 1979–2000 гг.
А.Ю. Юрова, Н.Е. Чубарова, Н.А. Кротков, Д.Р. Херман **А2–10**

НЕКОТОРЫЕ ОСОБЕННОСТИ ПОГЛОЩЕНИЯ СОЛНЕЧНОГО ИЗЛУЧЕНИЯ В ОБЛАЧНОЙ АТМОСФЕРЕ
Б.В. Горячев, С.Б. Могильницкий **А2–11**

СРАВНЕНИЕ LINE-BY-LINE И LUCK-UP-TABLES МЕТОДОВ В ЗАДАЧЕ ВОССТАНОВЛЕНИЯ ПРОФИЛЕЙ ГАЗОВЫХ СОСТАВЛЯЮЩИХ ИЗ ДАННЫХ ФУРЬЕ СПЕКТРОМЕТРИРОВАНИЯ ПРЯМОГО СОЛНЕЧНОГО ИЗЛУЧЕНИЯ
М.Ю. Катаев, А.А. Мицель, Х. Накане, И.Г. Окладников **А2–12**

ОЦЕНКА ПОГЛОЩЕНИЯ ЛАЗЕРНОГО ИЗЛУЧЕНИЯ НА РАЗЛИЧНЫХ АТМОСФЕРНЫХ ТРАССАХ НА ОСНОВЕ ЭКСПЕРИМЕНТАЛЬНЫХ ДАННЫХ О СПЕКТРАЛЬНОМ СОСТАВЕ ИЗБРАННЫХ ХИМИЧЕСКИХ ЛАЗЕРОВ **A2–27**
В.А. Филимонова, М.Л. Сентис

ОПЫТ ПРИМЕНЕНИЯ СПЕКТРОСКОПИЧЕСКОЙ МЕТОДИКИ ДЛЯ ОПРЕДЕЛЕНИЯ СОДЕРЖАНИЯ ОКИСИ УГЛЕРОДА В АТМОСФЕРЕ В ФОНОВЫХ УСЛОВИЯХ И В ГОРОДАХ **A2–28**
Е.В. Фокеева , Е.И. Гречко, А.В. Джола, Л.Н. Юрганов

ОЦЕНКИ ЛАКУНАРНОСТИ ОПТИЧЕСКИХ СПЕКТРОВ **A2–29**
Ю.В. Кистенев

Секция В1. РАСПРОСТРАНЕНИЕ ВОЛН В СЛУЧАЙНО-НЕОДНОРОДНЫХ СРЕДАХ. АДАПТИВНАЯ ОПТИКА

Сопредседатели секции: д.ф.-м.н. В.А. Банах, д.ф.-м.н. В.П. Лукин, доктор С. Клиффорд, академик Ксанг Ван Ду

ПРИГЛАШЕННЫЕ ДОКЛАДЫ ***Среда, 27 июня, 8:30–10:15. Большой зал***

8:30 ХАРАКТЕРИСТИКИ ЛАЗЕРНЫХ ПУЧКОВ В УСЛОВИЯХ ПЕРЕМЕЖАЕМОСТИ МЕЛКОМАСШТАБНОЙ АТМОСФЕРНОЙ ТУРБУЛЕНТНОСТИ
Т.И. Арсеньян, П.В. Короленко, А.М. Зотов, М.С. Маганова, А.В. Меснянкин *(Московский государственный университет)* **B1–01**

8:55 ЭКСПЕРИМЕНТАЛЬНЫЕ ИССЛЕДОВАНИЯ РАСПРОСТРАНЕНИЯ ЛАЗЕРНОГО ИЗЛУЧЕНИЯ ИНФРАКРАСНОГО ДИАПАЗОНА НА ТРАССЕ 150 км И ТУРБУЛЕНТНЫХ ИСКАЖЕНИЙ ИЗОБРАЖЕНИЙ ЗВЕЗД В РАЙОНЕ КАНАРСКИХ ОСТРОВОВ
А. Комерон, Дж.А. Рубио, А. Бельмонте *(Polytechnic University of Catalonia, Barcelona, Spain)*, **Э. Гарча, Т. Прудхомм** *(Instituto de Astrofisica de Canarias, La Laguna, Spain)*, **З. Содник** *(European Space Agency, Noordwijk, Netherlands)* **B1–02**

9:25 ФУНДАМЕНТАЛЬНЫЕ ИССЛЕДОВАНИЯ ПО РАСПРОСТРАНЕНИЮ ЛАЗЕРНОГО ИЗЛУЧЕНИЯ В АТМОСФЕРЕ И АДАПТИВНОЙ ОПТИКЕ
Ксанг Ван Ду *(China Academy of Engineering Physics, Beijing, China)* **B1–03**

9:50 СОВРЕМЕННЫЕ ПРОБЛЕМЫ АДАПТИВНОЙ ОПТИКИ
В.П. Лукин *(Институт оптики атмосферы СО РАН, Томск)* **B1–04**

УСТНЫЕ ДОКЛАДЫ ***Среда, 27 июня, 10:15–13:15. Большой зал***

10:15 РАЗРАБОТКА ДВУХ ИНТЕРФЕРОМЕТРИЧЕСКИХ ИСПЫТАТЕЛЬНЫХ СТЕНДОВ ПО ПОЛУЧЕНИЮ ИЗОБРАЖЕНИЯ В ОБСЕРВАТОРИИ МАГДАЛЕНСКОГО КРЯЖА
Г.К. Лус, В.Л. Гамиц *(USAF Research Laboratory, Kirtland AFB, USA)* **B1–05**

10:30 ИНДЕКС МЕРЦАНИЙ И ПЛОТНОСТЬ ВЕРОЯТНОСТЕЙ ИНТЕНСИВНОСТИ ЛАЗЕРНОГО ИЗЛУЧЕНИЯ, РАСПРОСТРАНЯЮЩЕГОСЯ В ТУРБУЛЕНТНОЙ АТМОСФЕРЕ (НОВЫЙ ВЗГЛЯД)
М.А. Ал-Хабаш *(Terabeam, Redmond, USA)*, **Л.С. Эндрюс, Р.Л. Филлипс** *(University of Central Florida, Orlando, USA)* **B1–06**

Перерыв 10:45–11:00

11:00 ТЕОРЕТИЧЕСКИЙ АНАЛИЗ ПОЛНОАПЕРТУРНЫХ ИЗМЕРЕНИЙ НАКЛОНОВ ПРИ ОТРАЖЕНИИ ВОЛНЫ ОТ МИШЕНИ
Хэнг Донг *(Institute of Applied Physics and Computational Mathematics, Beijing, China)* **В1–07**

11:15 УГЛОВАЯ РАСХОДИМОСТЬ ЛАЗЕРНЫХ ПУЧКОВ, ВОЗМУЩЕННЫХ СТРУЕЙ ТУРБОРЕАКТИВНОГО АВИАЦИОННОГО ДВИГАТЕЛЯ
В.С. Сиразетдинов, Д.И. Дмитриев, И.В. Иванова *(НИИ комплексных испытаний оптико-электронных приборов и систем, Сосновый Бор),* **Д.Г. Титтертон** *(DERA, Farnborough, UK)* **В1–08**

11:30 СТАТИСТИЧЕСКИЕ ХАРАКТЕРИСТИКИ ВОЛНЫ ПРИ СИЛЬНОМ РАССЕЯНИИ В СЛОЕ СО СЛУЧАЙНЫМИ НЕОДНОРОДНОСТЯМИ ДИЭЛЕКТРИЧЕСКОЙ ПРОНИЦАЕМОСТИ
С.Н. Колесник, Н.Т. Афанасьев, М.В. Тинин *(Иркутский государственный университет)* **В1–09**

11:45 КОРРЕКЦИЯ ДРОЖАНИЯ ИЗОБРАЖЕНИЯ МЕТОДОМ КОРРЕЛЯЦИОННОГО СЛЕЖЕНИЯ
П.А. Коняев, В.П. Лукин, Н.Н. Ботыгина, О.Н. Емалеев *(Институт оптики атмосферы СО РАН, Томск)* **В1–10**

12:00 ПЛОТНОСТЬ ОПТИЧЕСКИХ ВИХРЕЙ В ТУРБУЛЕНТНОЙ АТМОСФЕРЕ
В. П. Аксенов *(Институт оптики атмосферы СО РАН, Томск)* **В1–11**

12:15 ТУРБУЛЕНТНЫЕ ИСКАЖЕНИЯ ЛАЗЕРНЫХ ПУЧКОВ НА ТРАССАХ ЗЕМЛЯ–СПУТНИК
В.А. Банах, А.В. Фалиц *(Институт оптики атмосферы СО РАН, Томск)* **В1–12**

12:30 РЕШЕНИЕ ЗАДАЧИ ТОМОГРАФИИ НЕОДНОРОДНЫХ СРЕД С ПОГЛОЩЕНИЕМ
В.П. Якубов, Д.В. Лосев *(Томский государственный университет)* **В1–13**

12:45 МОДЕЛИРОВАНИЕ ФЛУКТУАЦИЙ ИНТЕНСИВНОСТИ ГАУССОВА ПУЧКА
А. Белмонте *(Polytechnic University of Catalonia, Barcelona, Spain),* **Л.С. Эндрюс** *(University of Central Florida, Orlando, USA)* **В1–14**

13:00 ОПТИЧЕСКАЯ СИСТЕМА АДАПТАЦИИ ТУРБУЛЕНТНЫХ ФЛУКТУАЦИЙ ЛАЗЕРНОГО ПУЧКА
А. Рукосуев, А. Александров, В. Завалова, В. Самаркин, А. Кудряшов *(Институт проблем лазерных и информационных технологий СО РАН, Шатура)* **В1–15**

СТЕНДОВЫЕ ДОКЛАДЫ *Среда, 27 июня, 17:00–18:30*

ОПРЕДЕЛЕНИЕ ПОПЕРЕЧНОЙ СКОРОСТИ ВЕТРА ИЗ ИЗМЕРЕНИЙ ДИСПЕРСИЙ СКОРОСТИ ИЗМЕНЕНИЯ КООРДИНАТ ЭНЕРГЕТИЧЕСКОГО ЦЕНТРА ТЯЖЕСТИ ИЗОБРАЖЕНИЯ ОБЪЕКТА **В1–16**
А. Л. Афанасьев, В. А. Банах, А. П. Ростов

ИТЕРАЦИОННЫЕ МЕТОДЫ ВОССТАНОВЛЕНИЯ ВОЛНОВОГО ФРОНТА ПО ИЗОБРАЖЕНИЯМ НЕКОГЕРЕНТНОГО ИСТОЧНИКА
С.М. Чернявский, Г.Л. Дегтярев, А.В. Маханько, А.С. Чернявский **В1–17**

ПРИМЕНЕНИЕ НЕЛИНЕЙНЫХ ПРЕОБРАЗОВАНИЙ СИГНАЛОВ ДЛЯ УВЕЛИЧЕНИЯ ТОЧНОСТИ КОРРЕЛЯЦИОННЫХ ИЗМЕРЕНИЙ
С.А. Чудинов **В1–18**

ИЗМЕНЧИВОСТЬ КОЭФФИЦИЕНТА ЗЕМНОЙ РЕФРАКЦИИ В ЗАБАЙКАЛЬЕ
Н.Ц. Гомбоев **В1–19**

Секция В2. НЕЛИНЕЙНЫЕ ЭФФЕКТЫ ПРИ РАСПРОСТРАНЕНИИ ИЗЛУЧЕНИЯ В АТМОСФЕРЕ И ВОДНЫХ СРЕДАХ

Председатель секции: д.ф.-м.н. А.А. Землянов

СТЕНДОВЫЕ ДОКЛАДЫ ***Среда, 27 июня, 17:00–18:30***

ВЫНУЖДЕННОЕ РАССЕЯНИЕ СВЕТА В КОМБИНАЦИОННО-АКТИВНЫХ МИКРОЧАСТИЦАХ В УСЛОВИЯХ ДВОЙНОГО РЕЗОНАНСА ВЗАИМОДЕЙСТВУЮЩИХ ПОЛЕЙ
А.А. Землянов, Ю.Э. Гейнц, Е.К. Панина **В2–08**

ВЛИЯНИЕ ВЫНУЖДЕННОГО КОМБИНАЦИОННОГО РАССЕЯНИЯ СВЕТА НА РАСПРОСТРАНЕНИЕ МОЩНОГО ЛАЗЕРНОГО ПУЧКА В АТМОСФЕРЕ
А.Б. Игнатьев, В.В. Морозов **В2–9**

ДИНАМИКА ЭНЕРГЕТИЧЕСКИХ И КОГЕРЕНТНЫХ ХАРАКТЕРИСТИК ЧАСТИЧНО КОГЕРЕНТНЫХ ПУЧКОВ В НЕЛИНЕЙНОЙ СРЕДЕ
В.В. Колосов, О.А. Колосова, В.В. Дудоров **В2–10**

ЛАЗЕРНАЯ ИСКРА В ЗАДАЧЕ СТОКА МОЛНИЕВЫХ РАЗРЯДОВ
А.А. Землянов, Н.Н. Бочкарев, А.М. Кабанов, В.А. Погодаев **В2–11**

Секция С1. МНОГОКРАТНОЕ РАССЕЯНИЕ В ОПТИЧЕСКОМ ЗОНДИРОВАНИИ. ПЕРЕНОС И ОБРАБОТКА ИЗОБРАЖЕНИЙ

Сопредседатели секции: д.ф.-м.н. В.В. Белов, д.ф.-м.н. И.Л. Кацев

УСТНЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 16:30–18:15. Большой зал***

16:30 ЛАЗЕРНОЕ ЗОНДИРОВАНИЕ ОБЛАКОВ ЛИДАРОМ С ПЕРЕМЕННЫМ УГЛОМ ПОЛЯ ЗРЕНИЯ ПРИЕМА
В.В. Веретенников *(Институт оптики атмосферы СО РАН, Томск),*
А.И. Абрамочкин, С.А. Абрамочкин *(Институт оптического мониторинга СО РАН, Томск)* **С1–01**

16:45 АНАЛИТИЧЕСКОЕ МОДЕЛИРОВАНИЕ СИГНАЛА РАМАНОВСКОГО ЛИДАРА С УЧЕТОМ МНОГОКРАТНОГО РАССЕЯНИЯ
А.В. Малинка, Э.П. Зеге *(Институт физики Национальной академии наук Беларуси, Минск)* **С1–02**

17:00 ПРОСТРАНСТВЕННО-УГЛОВАЯ СТРУКТУРА РАССЕЯННОГО ИЗЛУЧЕНИЯ НА ГРАНИЦАХ И ВНУТРИ ОПТИЧЕСКИ ПЛОТНЫХ СРЕД
В.В. Белов *(Институт оптики атмосферы СО РАН, Томск)* **С1–03**

17:15 РОЛЬ ИСКАЖАЮЩЕГО ВЛИЯНИЯ АТМОСФЕРЫ В ЗАДАЧЕ КОСМОМОНИТОРИНГА МАЛОРАЗМЕРНЫХ ВЫСОКОТЕМПЕРАТУРНЫХ АНОМАЛИЙ
В.В. Белов, С.В. Афонин *(Институт оптики атмосферы СО РАН, Томск)* **С1–04**

17:30 МЕТОДИКА КАРТИРОВАНИЯ И СРЕДНЕСРОЧНОГО ПРОГНОЗИРОВАНИЯ ПОЖАРНОЙ ОПАСНОСТИ В ЛЕСУ ПО УСЛОВИЯМ ПОГОДЫ
А.И. Сухинин, Е.И. Пономарев *(Институт леса СО РАН, Красноярск)* **С1–05**

17:45 КОПЬЮТЕРНОЕ МОДЕЛИРОВАНИЕ И ЭКСПЕРИМЕНТАЛЬНЫЕ РЕЗУЛЬТАТЫ ЛИДАРНОГО ЗОНДИРОВАНИЯ ОКЕАНА
И.Л. Кацев, Э.П. Зеге, А.С. Прихач, Б.И. Степанов *(Институт физики Национальной академии наук Беларуси, Минск),*
Д. Алокка, М. Контарино, Л. Миллен *(NAVAIR, Patuxent River, USA),*
Г. Лудбрук *(DERA Malvern, Worcs, UK)* **С1–06**

18:00 О МОДЕЛИРОВАНИИ ПЕРЕНОСА ИЗОБРАЖЕНИЯ ДНА ОКЕАНА С УЧЕТОМ ОБМЕНА ИЗЛУЧЕНИЕМ МЕЖДУ АТМОСФЕРОЙ И ОКЕАНОМ
Т.А. Сушкевич, А.К. Куликов, С.В. Максакова *(Институт прикладной математики РАН, Москва)* **С1–07**

СТЕНДОВЫЕ ДОКЛАДЫ *Понедельник, 25 июня, 18:15–20:00*

АНАЛИЗ ПРОСТРАНСТВЕННЫХ ХАРАКТЕРИСТИК ЛИДАРНОГО СИГНАЛА ПРИ ЗОНДИРОВАНИИ ОПТИЧЕСКИ ПЛОТНЫХ АЭРОЗОЛЬНЫХ ОБЪЕКТОВ
С.А. Абрамочкин, А.И. Абрамочкин, А.А. Тихомиров **С1–08**

АНАЛИЗ ЭФФЕКТИВНОСТИ КОСМОМОНИТОРИНГА ЛЕСНЫХ ПОЖАРОВ СИСТЕМОЙ AVHRR/NOAA (ТОМСКАЯ ОБЛАСТЬ)
В.В. Белов, С.В. Афонин **С1–09**

О ПРИМЕНИМОСТИ МАЛОУГЛОВОГО ПРИБЛИЖЕНИЯ ПРИ ОПИСАНИИ ФУНКЦИИ РАССЕЯНИЯ ПУЧКА С УЧЕТОМ ДИСПЕРСНОГО СОСТАВА РАССЕИВАЮЩЕЙ СРЕДЫ
В.В. Белов, В.В. Веретенников, Р.В. Вильданов **С1–10**

ВАРИАЦИИ КОНТРАСТА ИЗОБРАЖЕНИЯ ПРИ НАБЛЮДЕНИИ ЧЕРЕЗ ДИСПЕРСНЫЙ СЛОЙ
Б.Д. Борисов **С1–11**

ПРОБЛЕМА УЧЕТА РЕФРАКЦИИ В УРАВНЕНИИ ПЕРЕНОСА ИЗЛУЧЕНИЯ ДЛЯ СФЕРИЧЕСКОЙ СИСТЕМЫ АТМОСФЕРА – ОКЕАН
А.Б. Гаврилович **С1–12**

ОПРЕДЕЛЕНИЕ ВЫГОРЕВШИХ ПЛОЩАДЕЙ ПО ИНФОРМАЦИИ AVHRR/NOAA
Н.П. Минько, Н.А. Абушенко, Д.А. Алтынцев, В.В. Кошелев, С.А. Тащилин, А.В. Татарников **С1–13**

ИСПОЛЬЗОВАНИЕ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ В СИСТЕМАХ СПУТНИКОВОГО МОНИТОРИНГА ЛЕСНЫХ ПОЖАРОВ
С.А. Барталев, Д.В. Ершов, Е.А. Лупян, А.А. Мазуров, Н.П. Минько, А.А. Прошин, Е.В. Флитман **С1–14**

ПОВЫШЕНИЕ РАЗРЕШАЮЩЕЙ СПОСОБНОСТИ ИЗОБРАЖЕНИЙ ПРИБОРА AVHRR СПУТНИКОВ NOAA ДЛЯ ЗАДАЧ РЕСУРСНО-ЭКОЛОГИЧЕСКОГО МОНИТОРИНГА
Е.С. Артамонов, К.Т. Протасов **С1–15**

ИДЕНТИФИКАЦИЯ ПОЛЕЙ ОБЛАЧНОСТИ НЕПАРАМЕТРИЧЕСКИМ АЛГОРИТМОМ РАСПОЗНАВАНИЯ ОБРАЗОВ ПО ДАННЫМ ПРИБОРА AVHRR СПУТНИКОВ NOAA
Т.Г. Пушкарева, К.Т. Протасов **С1–16**

ПРОГРАММНЫЙ КОМПЛЕКС ДЛЯ РЕШЕНИЯ ПРЯМЫХ ЗАДАЧ АТМОСФЕРНОЙ ОПТИКИ
А.Б. Серебренников, В.В. Белов **С1–17**

О МОДЕЛИРОВАНИИ ПЕРЕНОСА ИЗОБРАЖЕНИЯ НЕОРТОТРОПНОЙ ПОВЕРХНОСТИ В ПОЛЯРИЗОВАННОМ СВЕТЕ
Т.А. Сушкевич, С.А. Стрелков **С1–18**

О МОДЕЛИРОВАНИИ ПЕРЕНОСА ИЗОБРАЖЕНИЯ ЗЕМНОЙ ПОВЕРХНОСТИ С УЧЕТОМ СФЕРИЧНОСТИ ЗЕМЛИ
Т.А. Сушкевич, Е.В. Владимирова **С1–19**

АНАЛИЗ ДИНАМИЧЕСКИХ ИЗОБРАЖЕНИЙ ГАЗОПЫЛЕВОГО ОБЛАКА ОТ ВЗРЫВА ШАХТНЫХ ПУСКОВЫХ УСТАНОВОК
Б.Н. Дмитриев, И.А. Суторихин **С1–20**

ЛИДАРНОЕ УРАВНЕНИЕ В ПРИБЛИЖЕНИИ ВТОРОГО ПОРЯДКА ДЛЯ СРЕД С СИЛЬНО ВЫТЯНУТОЙ ИНДИКАТРИСОЙ РАССЕЯНИЯ
В.В. Веретенников **С1–21**

ОЦЕНКИ ПОЛЯРИЗАЦИОННЫХ ХАРАКТЕРИСТИК В ПРОБЛЕМЕ РАСПРОСТРАНЕНИЯ УЗКОГО ПОЛЯРИЗОВАННОГО ПУЧКА В МНОГОКРАТНО РАССЕИВАЮЩЕЙ СРЕДЕ
Л.И. Чайковская **С1–22**

РЕЗУЛЬТАТЫ СПУТНИКОВОГО МОНИТОРИНГА ЛЕСНЫХ ПОЖАРОВ НА ТЕРРИТОРИИ ЯКУТИИ
В.С. Соловьев, Е.К. Васильев **С1–23**

В работе секции предлагается проведение круглого стола «КОСМОМОНИТОРИНГ ЛЕСНЫХ ПОЖАРОВ. РЕЗУЛЬТАТЫ. ПЕРСПЕКТИВЫ. ПРОБЛЕМЫ».

Секция С2. ЛАЗЕРНОЕ И АКУСТИЧЕСКОЕ ЗОНДИРОВАНИЕ АТМОСФЕРЫ И ОКЕАНА

Сопредседатели секции: к.ф.-м.н. Ю.С. Балин, д.ф.-м.н. Г.Г. Матвиенко

ПРИГЛАШЕННЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 8:30–9:30. Большой зал***

8:30 ЧИСЛЕННЫЕ МОДЕЛИ ПЕРЕНОСА ЛАЗЕРНОГО ИЗЛУЧЕНИЯ В СЛУЧАЙНО-НЕОДНОРОДНЫХ СРЕДАХ
Б.А. Каргин *(Институт вычислительной математики и математической геофизики СО РАН, Новосибирск)* **С2–01**

9:00 ЛИДАРНЫЕ НАБЛЮДЕНИЯ ПРОЦЕССОВ ИНЖЕКЦИИ ПЫЛЕВОГО АЭРОЗОЛЯ САХАРЫ В РЕГИОНЕ ВОСТОЧНОЙ ЕВРОПЫ
А.П. Чайковский, А.П. Иванов, Ф.П. Осипенко, М.М. Король, А.С. Слесарь, И.С. Хутко *(Институт физики Национальной академии наук Беларуси, Минск),*
С. Пухальский, П. Соболевский *(Институт геофизики Польской академии наук, Польша)* **С2–02**

УСТНЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 9:30–13:15. Большой зал***

9:30 ЛИДАРНЫЕ ИССЛЕДОВАНИЯ ДИНАМИКИ АЭРОЗОЛЬНЫХ ПОЛЕЙ ПОГРАНИЧНОГО СЛОЯ АТМОСФЕРЫ
Ю.С. Балин, А.Д. Ершов, С.В. Самойлова *(Институт оптики атмосферы СО РАН, Томск)* **С2–03**

9:45 ПОСТРОЕНИЕ ОПТИМАЛЬНЫХ РЕГРЕССИЙ ДЛЯ ОЦЕНКИ ПАРАМЕТРОВ АЭРОЗОЛЯ ПО ДАННЫМ ЛАЗЕРНОГО ЗОНДИРОВАНИЯ НА ДВУХ И ТРЕХ ДЛИНАХ ВОЛН
В.В. Барун, А.И. Брыль, В.П. Кабашников, В.М. Попов, А.П. Чайковский *(Институт физики Национальной академии наук Беларуси, Минск)* **С2–04**

10:00 ОПТИЧЕСКОЕ ЗОНДИРОВАНИЕ СРЕДНЕЙ АТМОСФЕРЫ НА СИБИРСКОЙ ЛИДАРНОЙ СТАНЦИИ
В.Д. Бурлаков, С.Л. Бондаренко, М.В. Гришаев, С.И. Долгий, А.В. Ельников, В.В. Зуев, А.В. Невзоров, С.В. Смирнов *(Институт оптики атмосферы СО РАН, Томск)* **С2–05**

10:15 ВОССТАНОВЛЕНИЕ КОНЦЕНТРАЦИЙ ГАЗОВ В МНОГОКОМПОНЕНТНОЙ СМЕСИ МЕТОДОМ ПОИСКА КВАЗИРЕШЕНИЯ С ИСПОЛЬЗОВАНИЕМ ЭВОЛЮЦИОННО-ГЕНЕТИЧЕСКОГО АЛГОРИТМА
Ю.В. Федотов, М.Л. Белов, В.А. Городничев, В.И. Козинцев *(НИИ РЛ МГТУ им. Н.Э. Баумана, Москва)* **С2–06**

10:30 ОЗОННЫЕ ИЗМЕРЕНИЯ УФ-ЛИДАРОМ ДИФФЕРЕНЦИАЛЬНОГО ПОГЛОЩЕНИЯ В ХЭФЭЕ, КИТАЙ
Жунксинг Ху, Хуанлинг Ху, Янгхуа Ву, Джун Жоу *(Anhui Institute of Optics and Fine Mechanics, Hefei, China)* **С2–07**

Перерыв 10:45–11:00

11:00 МОБИЛЬНАЯ ЛИДАРНАЯ СИСТЕМА ДЛЯ ИЗМЕРЕНИЙ ЗАГРЯЗНЕНИЯ ВОЗДУХА
Юинчао Жанг, Хуанлинг Ху, Тэн Кун, Янг Гаочао, Лиу Лсаогин, Шао Шишенг, Денг Мин, Жанг Гаоянг *(Anhui Institute of Optics and Fine Mechanics, Hefei, China)* **С2–08**

11:15 НОВЫЙ ПОДХОД К ОПРЕДЕЛЕНИЮ ХАРАКТЕРИСТИК ПЕРЕМЕШИВАНИЯ В АТМОСФЕРЕ
М.А. Локощенко *(Московский государственный университет)* **С2–09**

11:30 ДИАГНОСТИКА ИНТЕНСИВНЫХ АТМОСФЕРНЫХ ВИХРЕЙ ПО ДАННЫМ СПУТНИКОВОГО СВЧ-РАДИОМЕТРИЧЕСКОГО ЗОНДИРОВАНИЯ
А.Ф. Нерушев, Е.К. Крамчанинова *(Институт экспериментальной метеорологии, Обнинск),*
Б.З. Петренко *(Институт радиотехники и электроники РАН, Фрязино Московской обл.)* **С2–10**

11:45 АНАЛИЗ ДАННЫХ АКУСТИЧЕСКОГО ЗОНДИРОВАНИЯ В УСЛОВИЯХ УСТОЙЧИВОЙ СТРАТИФИКАЦИИ ПОГРАНИЧНОГО СЛОЯ АТМОСФЕРЫ
С.Л. Одинцов *(Институт оптики атмосферы СО РАН, Томск)* **С2–11**

12:00 НЕПРЕРЫВНЫЕ НАБЛЮДЕНИЯ БАРОКЛИННЫХ ВОЗМУЩЕНИЙ ВОД ОЗЕРА БАЙКАЛ
С.В. Ловцов, Н.М. Буднев, Ю.В. Парфенов, В.Ю. Рубцов *(Научно-исследовательский институт прикладной физики Иркутского государственного университета),* **С2–12**
М. Шуртер, М. Штурм, А. Вьюст *(Swiss Federal Institute for Environmental Science and Technology, Duebendorf-Zuerich, Switzerland)*

12:15 ФЛУКТУАЦИИ ЛИДАРНОГО СИГНАЛА ПРИ ЗОНДИРОВАНИИ МОРЯ ЧЕРЕЗ ВЗВОЛНОВАННУЮ ПОВЕРХНОСТЬ
В.Л. Вебер *(Институт прикладной физики РАН, Нижний Новгород)* **С2–13**

12:30 ИСПОЛЬЗОВАНИЕ АКТИВНО-ПАССИВНЫХ МЕТОДОВ ДИСТАНЦИОННОГО ЗОНДИРОВАНИЯ ДЛЯ ИССЛЕДОВАНИЯ БИООПТИЧЕСКИХ ХАРАКТЕРИСТИК ВЕРХНЕГО СЛОЯ ОКЕАНА
О.А. Букин, М.И. Пермяков *(Тихоокеанский океанологический институт ДВО РАН, Владивосток)* **С2–14**

12:45 ЛАЗЕРНЫЙ СПЕКТРОГРАФ ДЛЯ ИССЛЕДОВАНИЯ НЕСТАЦИОНАРНЫХ ПРОЦЕССОВ В АТМОСФЕРЕ
В.П. Фокеев[1], Ю.А. Акимов[2], Ю.И. Гринь[2], В.А. Левин[1], С.Ю. Митичкин[1], В.Г. Тестов[1] *([1]Институт механики Московского государственного университета, [2]ГУП «НПО – Астрофизика», Москва)* **С2–15**

13:00 ЛИДАРНЫЕ И СПУТНИКОВЫЕ ИЗМЕРЕНИЯ. ОПРЕДЕЛЕНИЕ СВОЙСТВ ОБЛАКОВ ВЕРХНЕГО ЯРУСА
О. Ладо-Бордовски *(ENSSAT – Universite de Rennes, France)* **С2–16**

СТЕНДОВЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 18:00–20:00***

ВРЕМЕННЫЕ АСПЕКТЫ ФЛУОРЕСЦЕНЦИИ – *IN-SITU* АНАЛИЗ С БИСТАТИЧЕСКИМ ПОДВОДНЫМ ЛИДАРОМ
У. Стут, М. Лиэйт, О. Ладо-Бордовски **С2–17**

CW-DL-DR-ЛАДАР ДЛЯ ДИСТАНЦИОННОГО ДЕТЕКТИРОВАНИЯ ГАЗОВ: МАТЕМАТИЧЕСКОЕ ОПИСАНИЕ И СОПОСТАВЛЕНИЕ С ДРУГИМИ МЕТОДАМИ
Р.Р. Агишев, Р.К. Сагдиев **С2–18**

ЗОНДИРУЮЩИЕ ОКГ ЛИДАРНОГО КОМПЛЕКСА С РЕЗОНАНСНЫМИ СИСТЕМАМИ НАКАЧКИ
Л.Р. Айбатов **С2–19**

ОБЪЕМНОЕ РАССЕЯНИЕ ЗВУКА В ОКЕАНЕ
В.Е. Скляров, А.В. Березуцкий С2–48

ИССЛЕДОВАНИЕ СТРУКТУРНЫХ ОСОБЕННОСТЕЙ РАСПРЕДЕЛЕНИЯ БИООПТИЧЕСКИХ И ГИДРОЛОГИЧЕСКИХ ПАРАМЕТРОВ МОРСКОЙ ВОДЫ
Г.В. Скороход, О.А. Букин, М.С. Пермяков, А.Ю. Майор, Т.И. Тархова С2–49

ОПЫТ ЛАЗЕРНОГО ЗОНДИРОВАНИЯ БАЙКАЛЬСКОЙ ВОДЫ С ПОВЕРХНОСТИ ЛЕДОВОГО ПОКРОВА
Г.П. Коханенко, И.Э. Пеннер, В.С. Шаманаев, Н.П. Буднев, Б.А. Таращанский, П.П. Шерстянкин С2–50

Секция С3. АВИАЦИОННЫЕ И КОСМИЧЕСКИЕ ЛИДАРЫ И ИХ ПРИМЕНЕНИЯ. МОДЕЛИ АТМОСФЕРЫ. ЛАЗЕРНЫЕ ПУЧКИ НА ВЫСОТНЫХ АТМОСФЕРНЫХ И КОСМИЧЕСКИХ ТРАССАХ

Сопредседатели секции: д.ф.-м.н. Г.Г. Матвиенко, проф. У.Г. Оппель, доктор У.Н. Синг

ПРИГЛАШЕННЫЕ ДОКЛАДЫ *Среда, 27 июня, 14:00–14:30. Большой зал*

14:00 НАСКОЛЬКО ТОЧНО ЛИДАРНОЕ УРАВНЕНИЕ ДОЛЖНО УЧИТЫВАТЬ МНОГОКРАТНОЕ РАССЕЯНИЕ, ЧТОБЫ СТАЛО ВОЗМОЖНЫМ ВОССТАНОВЛЕНИЕ ПАРАМЕТРОВ ОБЛАКОВ ИЗ ИЗМЕРЕНИЙ ЛИДАРОМ КОСМИЧЕСКОГО БАЗИРОВАНИЯ?
А.Г. Боровой[1], Г. Червински[2], Д. Динг[3], У. Оппель[2], Л. Ксу[3] *([1]Институт оптики атмосферы СО РАН, Томск, [2]Institute of Mathematics, L-M-University of Munich, Germany, [3]Chengdu College of Information Engineering, China)* С3–01

ПРИМЕНЕНИЕ БЕЗОПАСНОГО ДЛЯ ГЛАЗ ЛАЗЕРНОГО ПЕРЕДАТЧИКА В АТМОСФЕРНОМ ДИСТАНЦИОННОМ ЗОНДИРОВАНИИ
У.Н. Синг *(NASA Langley Research Center, USA)* С3–02

УСТНЫЕ ДОКЛАДЫ *Среда, 27 июня, 14:30–15.30. Большой зал*

14:30 ПРОЕКТЫ ЛИДАРНЫХ ИССЛЕДОВАНИЙ ЗЕМЛИ С БОРТА МАЛЫХ КОСМИЧЕСКИХ ПЛАТФОРМ
Г.Г. Матвиенко *(Институт оптики атмосферы СО РАН, Томск)* С3–03

14:45 МЕТОД ВОССТАНОВЛЕНИЯ ВЫСОТНЫХ ПРОФИЛЕЙ ВЕТРА ПО ДАННЫМ КОСМИЧЕСКОГО ДОПЛЕРОВСКОГО ЛИДАРА
В.А. Банах[1], Х. Вернер[2], Н.П. Криволуцкий[1], И.Лайке[2], И.Н. Смалихо[1], Й. Штрайхер[2] *([1]Институт оптики атмосферы СО РАН, Томск, [2]DLR Institute of Atmospheric Physics, Wessling, Germany)* С3–04

15:00 ИСПОЛЬЗОВАНИЕ СПУТНИКОВЫХ ДАННЫХ ДЛЯ ИЗМЕРЕНИЯ ТЕМПЕРАТУРНЫХ ХАРАКТЕРИСТИК ПРИЗЕМНОГО СЛОЯ ВОЗДУХА
С.А. Тащилин, Н.А. Абушенко *(Институт солнечно-земной физики СО РАН, Иркутск)* С3–05

15:15 ЛИДАРНЫЙ СИГНАЛ В ПРИБЛИЖЕНИИ ДВУКРАТНОГО РАССЕЯНИЯ ПРИ ПАРАМЕТРИЧЕСКОМ ЗАДАНИИ ИНДИКАТРИСЫ
В.В. Брюханова, И.В. Самохвалов *(Томский государственный университет)* С3–06

СТЕНДОВЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 18:00–20:00***

ЛИДАРНОЕ ЗОНДИРОВАНИЕ ТУРБУЛЕНТНОСТИ ЯСНОГО НЕБА. ЧИСЛЕННОЕ МОДЕЛИРОВАНИЕ
В.А. Банах, Х. Вернер, И.Н. Смалихо **С3–07**

СРАВНИТЕЛЬНЫЙ АНАЛИЗ ПОЛЯРИЗАЦИОННЫХ ХАРАКТЕРИСТИК СКАНЕРОВ ДЛЯ САМОЛЁТНЫХ ЛИДАРОВ
А.В. Береснев, А.А. Тихомиров **С3–08**

ЛИДАРНЫЕ ИЗМЕРЕНИЯ ВРЕМЕННЫХ ВАРИАЦИЙ ОБЪЕМНОГО КОЭФФИЦИЕНТА ОБРАТНОГО РАССЕЯНИЯ
Б.Т. Ташенов, В.А. Филиппов, Р.В. Филиппов **С3–09**

ПОЛЯРИЗАЦИОННЫЕ ХАРАКТЕРИСТИКИ ДВУКРАТНО РАССЕЯННОГО ИЗЛУЧЕНИЯ ОТ КАПЕЛЬНЫХ И КРИСТАЛЛИЧЕСКИХ ОБЛАКОВ
И.В. Самохвалов, В.В. Брюханова, П.В. Крыганов **С3–10**

ЭМПИРИЧЕСКАЯ МОДЕЛЬ СПЕКТРАЛЬНОГО ХОДА АЭРОЗОЛЬНОЙ ОПТИЧЕСКОЙ ТОЛЩИ АТМОСФЕРЫ В ОБЛАСТИ СПЕКТРА 0,4–12 мкм
Н.Н. Щелканов **С3–11**

Секция С4. ОПТИЧЕСКИЕ И МИКРОФИЗИЧЕСКИЕ СВОЙСТВА АТМОСФЕРНОГО АЭРОЗОЛЯ И ВЗВЕСЕЙ В ВОДНЫХ СРЕДАХ

Сопредседатели секции: д.ф.-м.н. О.В. Копелевич, д.ф.-м.н. М.В. Панченко, проф. Г. Ванг

ПРИГЛАШЕННЫЙ ДОКЛАД ***Вторник, 26 июня, 14:00–14:30. Большой зал***

14:00 ОЦЕНКА ОПТИЧЕСКИХ ХАРАКТЕРИСТИК АТМОСФЕРЫ И ОКЕАНА ПО ДАННЫМ СПУТНИКОВЫХ СКАНЕРОВ ЦВЕТА
О.В. Копелевич *(Институт океанологии РАН, Москва)* **С4–01**

УСТНЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 14:30–18:15. Большой зал***

14:30 ОБ ОПТИКО-ТЕРМО-ДИНАМИЧЕСКОЙ СТРУКТУРЕ ПРИБРЕЖНЫХ ВОД оз. БАЙКАЛ (ПО МАТЕРИАЛАМ 1994 И 1999 гг.)
П.П. Шерстянкин, М.Н. Шимараев, В.В. Хохлов, В.Н. Сергеева, В.Н. Дроздов *(Лимнологический институт СО РАН, Иркутск)* **С4–02**

14:45 ИНФОРМАЦИОННОЕ СОДЕРЖАНИЕ СПЕКТРОВ КОЭФФИЦИЕНТОВ ЯРКОСТИ ВОДНЫХ ЭКОСИСТЕМ
Б.Л. Сухоруков, И.В. Новиков *(Институт водных проблем РАН, Ростов-на-Дону)* **С4–03**

15:00 ВЛИЯНИЕ ТЯЖЕЛЫХ МЕТАЛЛОВ НА ОПТИЧЕСКИЕ ХАРАКТЕРИСТИКИ ВОДНЫХ СРЕД
А.Я. Хайруллина, В.А. Лапина *(Институт физики Национальной академии наук Беларуси, Минск)* **С4–04**

15:15 МЕТОД И НЕКОТОРЫЕ РЕЗУЛЬТАТЫ ИЗМЕРЕНИЙ СПЕКТРОВ ПОГЛОЩЕНИЯ И РАССЕЯНИЯ СВЕТА В БАЙКАЛЬСКОЙ ВОДЕ
Б.А. Таращанский, Н.М. Буднев, Р.Р. Миргазов *(НИИ прикладной физики Иркутского государственного университета, Иркутск)* **С4–05**

Перерыв 15:30–16:00

16:00 ВЛИЯНИЕ МИКРОФИЗИЧЕСКИХ СВОЙСТВ ОБЛАКОВ НА ПЕРЕНОС СОЛНЕЧНОГО ИЗЛУЧЕНИЯ В АТМОСФЕРЕ
М.В. Шатунова *(Гидрометеорологический научно-исследовательский центр Российской Федерации, Москва)* **С4–06**

16:15 ОПРЕДЕЛЕНИЕ ХАРАКТЕРИСТИК АТМОСФЕРНОГО АЭРОЗОЛЯ ПО СПЕКТРАЛЬНЫМ ИЗМЕРЕНИЯМ ПРОЗРАЧНОСТИ И МАЛОУГЛОВОГО РАССЕЯНИЯ
М.А. Свириденков *(Институт физики атмосферы РАН, Москва)* **С4–07**

16:30 УГЛЕРОДНЫЕ ЧАСТИЦЫ В ГОРОДСКОЙ АТМОСФЕРЕ
Ванг Генгчен, Конг Кинксинг, Гу Жифанг, Ван Ксаовей *(Institute of Atmospheric Physics, Beijing, China),*
А.С. Емиленко *(Институт физики атмосферы РАН, Москва)* **С4–08**

16:45 АНАЛИЗ СПЕКТРАЛЬНОЙ ЯРКОСТИ НЕБА В ОБЛАСТИ НЕФЕЛОМЕТРИЧЕСКИХ УГЛОВ РАССЕЯНИЯ
В.Н. Коровченко *(Казахский государственный педагогический университет, Алма-Ата),* **В.К. Ошлаков** *(Институт оптики атмосферы СО РАН, Томск),* **В.Е. Павлов** *(Институт водных и экологических проблем СО РАН, Барнаул),* **А.С. Шестухин** *(Алтайский государственный технический университет, Барнаул)* **С4–09**

17:00 СЕЗОННАЯ ДИНАМИКА КОЭФФИЦИЕНТОВ АЭРОЗОЛЬНОГО ОСЛАБЛЕНИЯ В ДЫМКАХ ЗАПАДНОЙ СИБИРИ
В.Н. Ужегов, Ю.А. Пхалагов *(Институт оптики атмосферы СО РАН, Томск)* **С4–10**

17:15 О ПРЕИМУЩЕСТВЕ ИСПОЛЬЗОВАНИЯ КРУГОВОЙ ПОЛЯРИЗАЦИИ ИЗЛУЧЕНИЯ В ЛАЗЕРНОМ ЗОНДИРОВАНИИ КРИСТАЛЛИЧЕСКИХ ОБЛАКОВ
Б.В. Кауль, Д.Н. Ромашов *(Институт оптики атмосферы СО РАН, Томск),* **И.В. Самохвалов** *(Томский государственный университет)* **С4–11**

17:30 РАССЕЯНИЕ СВЕТА НА ЛЕДЯНЫХ КРИСТАЛЛАХ ПЕРИСТЫХ ОБЛАКОВ: МАТРИЦА ДЖОНСА
А.Г. Боровой, И.А. Гришин *(Институт оптики атмосферы СО РАН, Томск),* **У.Г. Оппель** *(Institute of Mathematics, Muenchen, Germany)* **С4–12**

17:45 О МОДЕЛИРОВАНИИ ВЛИЯНИЯ ВЛАЖНОСТИ НА ОПТИЧЕСКИЕ ХАРАКТЕРИСТИКИ АЭРОЗОЛЯ С ИСПОЛЬЗОВАНИЕМ ШИРОКИХ ЛОГНОРМАЛЬНЫХ РАСПРЕДЕЛЕНИЙ ЧАСТИЦ ПО РАЗМЕРАМ
М.В. Панченко, В.В. Полькин, С.А. Терпугова *(Институт оптики атмосферы СО РАН, Томск)* **С4–13**

18:00 РАССЕЯНИЕ ОПТИЧЕСКОГО ИЗЛУЧЕНИЯ СМЕШАННЫМИ ОБЛАКАМИ
А.Г. Петрушин *(Институт экспериментальной метеорологии, Обнинск)* **С4–14**

СТЕНДОВЫЕ ДОКЛАДЫ — ВТОРНИК, 26 ИЮНЯ, 18:00–20:00

КОМБИНИРОВАННЫЙ (СПЕКТРАЛЬНЫЙ И ЛЕНГМЮРОВСКИЙ) МЕТОД ОПРЕДЕЛЕНИЯ ВОДОЕМОВ, ЗАГРЯЗНЕННЫХ НЕФТЕПРОДУКТАМИ
М.И. Алленов, В.Г. Бирюков, Н.Д. Третьяков, С.Г. Юдин **С4–15**

ОПРЕДЕЛЕНИЕ ЗАМУТНЕННОСТИ ВОДНЫХ БАССЕЙНОВ МИНЕРАЛЬНЫМИ ВЫНОСАМИ РЕК
М.И. Алленов, Н.П. Иванова, В.В. Овчинников, Н.Д. Третьяков **С4–16**

ГОЛОГРАФИЧЕСКАЯ ДИАГНОСТИКА БИОЛОГИЧЕСКИХ МИКРООБЪЕКТОВ В ВОДНЫХ СРЕДАХ
В.В. Демин, В.А. Мазур, А.В. Макаров, Н.Г. Мельник, О.А. Тимошкин **С4–17**

Секция С5. ПЕРЕНОС И ТРАНСФОРМАЦИЯ АЭРОЗОЛЯ И ГАЗОВЫХ КОМПОНЕНТОВ В АТМОСФЕРЕ

Сопредседатели секции: д.ф.-м.н. Б.Д. Белан, д.ф.-м.н. Г.С. Ривин, проф. В.Н. Арефьев

УСТНЫЕ ДОКЛАДЫ ***Среда, 27 июня, 8:30–13:00. Малый зал***

8:30 ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ АЭРОЗОЛЬНОЙ ТОЛЩИ И ВЛАГОСОДЕРЖАНИЯ АТМОСФЕРЫ В РАЙОНЕ ИРКУТСКА
С.М. Сакерин, Д.М. Кабанов *(Институт оптики атмосферы СО РАН, Томск),*
В.В. Кошелев, А.Ю. Шалин *(Институт солнечно-земной физики СО РАН, Иркутск)* **С5–01**

8:45 НАТУРНЫЕ НАБЛЮДЕНИЯ ЗА ДИНАМИКОЙ ВОЛНОВЫХ ОРОГРАФИЧЕСКИХ ОБЛАКОВ НАД оз. БАЙКАЛ
Т.Н. Бибикова, Е.В. Журба *(Московский государственный университет)* **С5–02**

9:00 ОЦЕНКА АНТРОПОГЕННОЙ НАГРУЗКИ НА ОХРАНЯЕМЫЙ РЕГИОН С ПОМОЩЬЮ КЛИМАТИЧЕСКОЙ ИНФОРМАЦИИ
Г.С. Ривин, П.В. Воронина *(Институт вычислительных технологий СО РАН, Новосибирск)* **С5–03**

9:15 МОДЕЛЬ ЛОКАЛЬНОГО ДИНАМИЧЕСКОГО ВЗАИМОДЕЙСТВИЯ ВОДОЕМА И АТМОСФЕРЫ ПРИ ПОВЕРХНОСТНОМ ВОЛНЕНИИ
В.А. Шлычков *(Институт водных и экологических проблем СО РАН, Новосибирск)* **С5–04**

9:30 ГЕНЕРАЦИЯ СУЛЬФАТНОГО АЭРОЗОЛЯ ПОВЕРХНОСТЬЮ ВЫСОХШЕГО ОЗЕРА
И.А. Суторихин *(Институт водных и экологических проблем СО РАН, Барнаул),* **А.Е. Каплинский** *(University of Antwerpen, Belgium)* **С5–05**

9:45 ОСОБЕННОСТИ РАСПРЕДЕЛЕНИЯ ПРИЗЕМНЫХ КОНЦЕНТРАЦИЙ ОЗОНА И ОКИСЛОВ АЗОТА ПРИ ФОТОХИМИЧЕСКИХ ПРОЦЕССАХ В БАЙКАЛЬСКОМ РЕГИОНЕ
В.П. Бутуханов, Г.С. Жамсуева, А.С. Заяханов, Ю.Л. Ломухин, Б.З. Цыдыпов *(Отдел физических проблем при Президиуме БНЦ СО РАН, Улан-Удэ)* **С5–06**

10:00 ТРАНСФОРМАЦИЯ МОРСКОГО АЭРОЗОЛЯ ПОД ДЕЙСТВИЕМ РАДИАЦИОННОГО ФАКТОРА
Т.В. Губарева *(Братский государственный технический университет)* **С5–07**

10:15 ЭКСПЕРИМЕНТАЛЬНОЕ И ЧИСЛЕННОЕ ИССЛЕДОВАНИЯ РАСПРОСТРАНЕНИЯ ПРИМЕСИ ОТ ИМПУЛЬСНОГО ИСТОЧНИКА В ТУРБУЛЕНТНОЙ АТМОСФЕРЕ
Ю.С. Балин, А.Д. Ершов *(Институт оптики атмосферы СО РАН, Томск),* **А.И. Бриль, В.П. Кабашников, В.М. Попов, А.П.Чайковский** *(Институт физики Национальной академии наук Беларуси, Минск)* **С5–08**

10:30 РАСЧЕТ РАСПРОСТРАНЕНИЯ ДЫМОВЫХ СТРУЙ В ТУРБУЛЕНТНОЙ АТМОСФЕРЕ
В.Д. Перминов *(Центральный аэрогидродинамический институт, Жуковский)* **С5–09**

Перерыв 10:45–11:00

11:00 РАСПРЕДЕЛЕНИЕ КИНЕТИЧЕСКОЙ ЭНЕРГИИ ТУРБУЛЕНТНОСТИ ВОЗДУХА И ОПТИЧЕСКОЙ НЕСТАБИЛЬНОСТИ ЗЕМНОЙ АТМОСФЕРЫ НАД ТЕРРИТОРИЕЙ СНГ
П.Г. Ковадло *(Институт солнечно-земной физики СО РАН, Иркутск)* **С5–10**

11:15 НЕКОТОРЫЕ РЕЗУЛЬТАТЫ СРАВНЕНИЯ ДАННЫХ МОДЕЛИРОВАНИЯ КИСЛОТНОГО АЭРОЗОЛЯ И СПУТНИКОВОГО МОНИТОРИНГА РАДИАЦИОННЫХ ХАРАКТЕРИСТИК ОБЛАЧНОЙ/БЕЗОБЛАЧНОЙ АТМОСФЕРЫ
В.В. Козодеров, В.Д. Егоров *(Институт вычислительной математики РАН, Москва)* **С5–11**

11:30 МАТЕМАТИЧЕСКАЯ МОДЕЛЬ ФОРМИРОВАНИЯ АЭРОЗОЛЬНОГО ОБЛАКА
И.Р. Абуняев, И.Н. Лазовик, Г.С. Кудряшев *(Иркутский военный авиационный инженерный институт)* **С5–12**

11:45 ТЕРМОДИНАМИЧЕСКОЕ МОДЕЛИРОВАНИЕ АНТРОПОГЕННОГО ВЛИЯНИЯ НА ХИМИЧЕСКИЙ СОСТАВ ОСАДКОВ
Е.В. Кучменко, Б.М. Каганович, Е.В. Моложникова *(Институт систем энергетики СО РАН, Иркутск)* **С5–13**

12:00 ИССЛЕДОВАНИЕ ТУРБУЛЕНТНОГО РЕЖИМА НИЖНЕЙ АТМОСФЕРЫ
П.Г. Стафеев, Г.В. Бухлова, Н.П. Красненко *(Институт оптического мониторинга СО РАН, Томск)* **С5–14**

12:15 МЕТРОЛОГИЧЕСКОЕ ОБЕСПЕЧЕНИЕ ИЗМЕРЕНИЙ ВЛАЖНОСТИ ГАЗОВ
Н.И. Дубовиков, О.В. Подмурная, О.И. Гудков *(Восточно-Сибирский НИИ физико-технических и радиотехнических измерений, Иркутск)* **С5–15**

12:30 ПРИБОР ДЛЯ ИССЛЕДОВАНИЯ ПРИЗЕМНЫХ ПОТОКОВ ТЕПЛА, ВЛАЖНОСТИ И АЭРОЗОЛЬНЫХ ЧАСТИЦ
А.П. Ростов, А.Л. Афанасьев, А.П. Иванов *(Институт оптики атмосферы СО РАН, Томск)* **С5–16**

12:45 ОПТИКО-МИКРОФИЗИЧЕСКИЕ МОДЕЛИ ГОРОДСКИХ АЭРОЗОЛЕЙ
Л.С. Ивлев, А.В. Васильев *(НИИ физики Санкт-Петербургского государственного университета),* **Б.Д. Белан, М.В. Панченко, С.А. Терпугова** *(Институт оптики атмосферы СО РАН, Томск)* **С5–17**

СТЕНДОВЫЕ ДОКЛАДЫ *Вторник, 26 июня, 18:15–20:00*

ИЗМЕРЕНИЯ СОДЕРЖАНИЯ МЕТАНА В ПРИЗЕМНОМ СЛОЕ И ТОЛЩЕ АТМОСФЕРЫ
В.Н. Арефьев, Ю.И. Баранов, Е.Л. Баранова, Г.И. Бугрим, Н.Е. Каменоградский, Ф.В. Кашин **С5–18**

УГЛЕКИСЛЫЙ ГАЗ В КОНТИНЕНТАЛЬНОЙ АТМОСФЕРЕ
В.Н. Арефьев, Н.Е. Каменоградский, Ф.В. Кашин, В.К. Семенов, В.П. Синяков, Л.И. Сорокина **С5–19**

СПЕКТРАЛЬНАЯ ПРОЗРАЧНОСТЬ АТМОСФЕРЫ В РАЙОНЕ оз. ИССЫК-КУЛЬ
В.Н. Арефьев, К.Н. Вишератин, Ф.В. Кашин, С.С. Хмелевцов В.К. Семенов, Л.И. Сорокина **С5–20**

ВОДЯНОЙ ПАР В КОНТИНЕНТАЛЬНОЙ АТМОСФЕРЕ
В.Н. Арефьев, Н.Е. Каменоградский, Ф.В. Кашин, В.П. Устинов, В.К. Семенов, В.П. Синяков, Л.И. Сорокина **С5–21**

ИССЛЕДОВАНИЕ ПРОЦЕССОВ ПЕРЕНОСА, ДИФФУЗИИ И ТРАНСФОРМАЦИИ СОЕДИНЕНИЙ СЕРЫ И АЗОТА В ПОГРАНИЧНОМ СЛОЕ АТМОСФЕРЫ оз. БАЙКАЛ С ПОМОЩЬЮ ЧИСЛЕННОЙ МОДЕЛИ
В.Л. Макухин, В.К. Аргучинцев **С5–22**

КОЛИЧЕСТВЕННАЯ ОЦЕНКА ВЕЛИЧИНЫ ОСАЖДЕНИЯ РЯДА ТЯЖЁЛЫХ МЕТАЛЛОВ НА ПОВЕРХНОСТЬ ЮЖНОГО БАЙКАЛА И ПРИЛЕГАЮЩИЕ ОСОБО ОХРАНЯЕМЫЕ ТЕРРИТОРИИ В РАЗЛИЧНЫЕ СЕЗОНЫ ГОДА
В.Л. Макухин, В.Л. Потёмкин **С5–23**

АТМОСФЕРНАЯ КОНВЕКЦИЯ И ЕЕ РОЛЬ В ВЕРТИКАЛЬНОМ ПЕРЕНОСЕ АЭРОЗОЛЯ: МОДЕЛИ И ОЦЕНКИ
В.М. Мальбахов, П.Ю. Пушистов, В.А. Шлычков **С5–24**

ТРАНСКОНТИНЕНТАЛЬНЫЕ НАБЛЮДЕНИЯ КОНЦЕНТРАЦИИ ПРИЗЕМНОГО ОЗОНА В ЭКСПЕРИМЕНТАХ TROICA
Т.А. Маркова, Н.Ф. Еланский, Н.П. Шакина, А.Р. Иванова **С5–25**

ОПТИКО-АКУСТИЧЕСКИЙ ГАЗОАНАЛИЗАТОР ДЛЯ ОПРЕДЕЛЕНИЯ КОНЦЕНТРАЦИИ *CO* В ЗОНЕ ПОЖАРА
В.С. Сафонов, В.А. Капитанов **С5–26**

РЕЗУЛЬТАТЫ ИСПОЛЬЗОВАНИЯ МЕТОДА ПАРАМЕТРИЧЕСКОГО СПЕКТРАЛЬНОГО ОЦЕНИВАНИЯ ПРИ ОБРАБОТКЕ МЕТЕОРОЛОГИЧЕСКИХ ДАННЫХ
Н.А. Шефер, И.А. Разенков, А.П. Ростов **С5–27**

УТОЧНЕНИЕ МЕСТ ТЕКТОНИЧЕСКИХ РАЗЛОМОВ ПО НАТУРНЫМ ИЗМЕРЕНИЯМ ОБЛАЧНОСТИ
Т.Н. Бибикова, Т.А. Проскурякова, Е.В. Журба, В.А. Алексеев **С5–28**

ИЗМЕРЕНИЕ ТУРБУЛЕНТНЫХ ПОТОКОВ СКАЛЯРНЫХ ПРИМЕСЕЙ В ПРИЗЕМНОМ СЛОЕ АТМОСФЕРЫ
А. Л. Афанасьев, В. А. Банах, А. П. Ростов **С5–29**

СВЯЗЬ ВАРИАЦИЙ ТЕМПЕРАТУРЫ И СЕЙСМИЧНОСТИ В РАЙОНЕ ПОЛУОСТРОВА КРЫМ
Т.Н. Бибикова, Е.С. Рембовская, Т.А. Проскурякова, Е.В. Журба, В.А. Алексеев **С5–30**

Секция С6. ДИАГНОСТИКА СОСТОЯНИЯ И ФУНКЦИОНИРОВАНИЯ РАСТИТЕЛЬНЫХ БИОСИСТЕМ

Сопредседатели секции: д.ф.-м.н. Ю.Н. Пономарев, д.ф.-м.н. В.В. Козодеров

УСТНЫЕ ДОКЛАДЫ ***Среда, 27 июня, 14:00–17:15. Малый зал***

14:00 ФИЗИЧЕСКИЕ И БИОЛОГИЧЕСКИЕ АСПЕКТЫ ПРЕОБРАЗОВАНИЯ СОЛНЕЧНОГО ИЗЛУЧЕНИЯ В СИСТЕМЕ «СНЕГ – ЛЕД – ВОДА – СУСПЕНЗИЯ ВОДОРОСЛЕЙ» ПРИ РАЗВИТИИ ВЕСЕННЕЙ ПРОНИКАЮЩЕЙ КОНВЕКЦИИ В ОЗЕРАХ УМЕРЕННЫХ И ПОЛЯРНЫХ ШИРОТ
П.Ю. Пушистов, В.К. Иевлев, В.А. Шлычков *(Институт водных и экологических проблем СОРАН, Новосибирск)* **С6–01**

14:15 ОЦЕНКА ДОПОЛНИТЕЛЬНОЙ ЭМИССИИ CO_2 ЛЕСНЫМИ МАССИВАМИ ПРИ АНТРОПОГЕННОМ ЗАГРЯЗНЕНИИ ВОЗДУХА
Б.Г. Агеев, Ю.Н. Пономарев, В.А. Сапожникова, К.М. Фирсов *(Институт оптики атмосферы СО РАН, Томск)* **С6–02**

14:30 ИЗМЕРЕНИЕ КОНЦЕНТРАЦИИ ХЛОРОФИЛЛА «А» НА ПОВЕРХНОСТИ МОРЯ С ПОМОЩЬЮ СКАНЕРА ЦВЕТНОСТИ SeaWiFS
Е.А. Штрайхерт, С.П. Захарков *(Тихоокеанский океанологический институт, Владивосток)* **С6–03**

14:45 КАЛИБРОВКА ДАННЫХ SeaWiFS СУДОВЫМИ ИЗМЕРЕНИЯМИ
Е.А. Штрайхерт, С.П. Захарков *(Тихоокеанский океанологический институт, Владивосток)* **С6–04**

15:00 ИССЛЕДОВАНИЕ СОДЕРЖАНИЯ ХЛОРОФИЛЛА У РЯДА ДРЕВЕСНЫХ РАСТЕНИЙ СПЕКТРОФОТОМЕТРИЧЕСКИМ И ЛИДАРНЫМ МЕТОДАМИ
Н.Л. Фатеева, А.И. Гришин, Г.Г. Матвиенко, О.А. Романовский, О.В. Харченко, Н.А. Воробьева, А.П. Зотикова *(Институт оптики атмосферы СО РАН, Томск)* **С6–05**

15:15 РАСТИТЕЛЬНЫЙ ПОКРОВ ПО НАБЛЮДЕНИЯМ ИЗ КОСМОСА: ТОЧНОСТНЫЕ ХАРАКТЕРИСТИКИ ОЦЕНКИ ПАРАМЕТРОВ ЕГО СОСТОЯНИЯ
В.В. Козодеров, В.С. Косолапов *(Институт вычислительной математики РАН, Москва)* **С6–06**

Перерыв 15:30–16:00

16:00 ДИСТАНЦИОННАЯ ДИАГНОСТИКА ЭКОЛОГИЧЕСКОГО И РЕСУРСНОГО ПОТЕНЦИАЛА ЛЕСОВ БАССЕЙНА оз. БАЙКАЛ
Н.В. Малышева, О.Л. Орлова, И.А. Вуколова, С.В. Князева, Т.А. Золина *(ВНИИЦлесресурс, Москва)* **С6–07**

16:15 ГЕОИНФОРМАЦИОННЫЙ АНАЛИЗ ВОЗДЕЙСТВИЙ ЗАГРЯЗНЕНИЯ АТМОСФЕРЫ НА РАСТИТЕЛЬНЫЕ БИОСИСТЕМЫ С ИСПОЛЬЗОВАНИЕМ КОСМОСНИМКОВ
Ю.М. Полищук, В.В. Рюхко, О.С. Токарева, М.Н. Алексеева *(Институт химии нефти СО РАН, Томск)* **С6–08**

16:30 МОНИТОРИНГ ДИНАМИКИ РАСТИТЕЛЬНОГО ПОКРОВА НА ТЕРРИТОРИИ СИБИРИ ПО ДАННЫМ NOAA/AVHRR
С.А. Тащилин, Н.А. Абушенко *(Институт солнечно-земной физики СО РАН, Иркутск)* **С6–09**

16:45 ИДЕНТИФИКАЦИЯ ПОРОДНОГО СОСТАВА И ПРОДУКЦИОННЫХ ПОКАЗАТЕЛЕЙ ЛЕСНЫХ ТЕРИТОРИЙ ПО СПУТНИКОВЫМ ВИДЕОДАННЫМ
К.Г. Колодников, К.Т. Протасов *(Институт оптики атмосферы СО РАН, Томск)* **С6–10**

17:00 КЛАСТЕРНЫЙ АНАЛИЗ БОЛЬШОГО ВАСЮГАНСКОГО БОЛОТА ПО ДАННЫМ ПРИБОРА AVHRR СПУТНИКОВ NOAA НЕПАРАМЕТРИЧЕСКИМ АЛГОРИТМОМ КЛАССИФИКАЦИИ
Н.В. Ткаличева, К.Т. Протасов *(Институт оптики атмосферы СО РАН, Томск)* **С6–11**

Секция D1. МАГНИТОСФЕРНО-ИОНОСФЕРНЫЕ ВЗАИМОДЕЙСТВИЯ

Сопредседатели секции: д.ф.-м.н. В.А. Коваленко, к.ф.-м.н. В.И. Сажин

УСТНЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 8:30–12:30. Малый зал***

8:30 ГЕОМАГНИТНЫЙ КОНТРОЛЬ СПЕКТРА ПЕРЕМЕЩАЮЩИХСЯ ИОНОСФЕРНЫХ ВОЗМУЩЕНИЙ ПО ДАННЫМ ГЛОБАЛЬНОЙ СЕТИ GPS
Э.Л. Афраймович, Е.А. Косогоров, О.С. Лесюта, И.И. Ушаков, А.Л. Яковец *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–01**

8:45 ВАРИАЦИИ ЯРКОСТИ ЭМИССИИ 557,7 нм ЭКВАТОРИАЛЬНЕЕ НИЗКОШИРОТНОЙ ГРАНИЦЫ АВРОРАЛЬНОГО ФОНОВОГО СВЕЧЕНИЯ ДО НАЧАЛА БРЕЙКАПА
В.А. Величко, Р.Н. Бороев, Г.В. Борисов, Д.Г. Баишев *(Институт космофизических исследований и аэрономии СО РАН, Якутск)* **D1–02**

9:00 СВЯЗЬ СОБЫТИЙ РСА И ВЫСЫПАНИЙ ЭНЕРГИЧНЫХ ЭЛЕКТРОНОВ С ПОТОКАМИ ПРОТОНОВ И РЕЛЯТИВИСТСКИХ ЭЛЕКТРОНОВ НА ГЕОСТАЦИОНАРНОЙ ОРБИТЕ
В.А. Кузьмин *(Институт космофизических исследований и аэрономии СО РАН, Якутск)* **D1–03**

9:15 ИОНОСФЕРНЫЕ ПРОЯВЛЕНИЯ ГЕОМАГНИТНЫХ ПУЛЬСАЦИЙ В ВЫСОКИХ ШИРОТАХ
Ю.В. Липко, Р.А. Рахматулин, А. Ю. Пашинин *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–04**

9:30 НЕКОТОРЫЕ ОСОБЕННОСТИ НАБЛЮДЕНИЙ СРЕДНЕШИРОТНЫХ СИЯНИЙ И ВОЗМУЩЕНИЙ ЭМИССИЙ ВЕРХНЕЙ АТМОСФЕРЫ ВО ВРЕМЯ МАГНИТНЫХ БУРЬ В РЕГИОНЕ ВОСТОЧНОЙ СИБИРИ
А.В. Михалев *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–05**

9:45 НЕТЕПЛОВОЙ КОНТУР ЭМИССИИ 557,7 нм [OI] В ПОЛЯРНЫХ СИЯНИЯХ
В.М. Игнатьев, С.В. Николашкин *(Институт космофизических исследований и аэрономии СО РАН, Якутск)* **D1–06**

10:00 ВАРИАЦИИ КРИТИЧЕСКИХ ЧАСТОТ ВО ВРЕМЯ БУРЬ В ЦИКЛЕ СОЛНЕЧНОЙ АКТИВНОСТИ
Н.М. Полех, О.М. Пирог, Л.В. Чистякова *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–07**

10:15 ИСПОЛЬЗОВАНИЕ ДАННЫХ НЕКОГЕРЕНТНОГО РАССЕЯНИЯ РАДИОВОЛН ДЛЯ ОЦЕНОК ГАЗОВОГО СОСТАВА ТЕРМОСФЕРЫ
Л.А. Щепкин, Г.П. Кушнаренко, Г.М. Кузнецова *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–08**

10:30 НАБЛЮДЕНИЯ ИОНОСФЕРЫ ВО ВРЕМЯ МОЩНОЙ ГЕОМАГНИТНОЙ БУРИ 15–16 ИЮЛЯ 2000 г.
Б.Г. Шпынев, А.В. Медведев, В.Е. Носов, А.В. Заворин, Г.А. Жеребцов, А.П. Потехин *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–09**

Перерыв 10:45–11:00

11:00 МОДЕЛЬНОЕ ИЗУЧЕНИЕ ОТКЛИКА СРЕДНЕШИРОТНОЙ ИОНОСФЕРЫ НА БОЛЬШУЮ ГЕОМАГНИТНУЮ БУРЮ 25 СЕНТЯБРЯ 1998 г.
А.В. Тащилин, Е.Б. Романова, Б.Г. Шпынев *(Институт солнечно-земной физики СО РАН, Иркутск)* **D1–10**

11:15 ЛОКАЛЬНОЕ УВЕЛИЧЕНИЕ ИНТЕНСИВНОСТИ ПРОДОЛЬНЫХ ТОКОВ ДО НАЧАЛА ВЗРЫВНОЙ ФАЗЫ СУББУРИ
В.А. Величко, Р.Н. Бороев, Д.Г. Баишев *(Институт космофизических исследований и аэрономии СО РАН, Якутск)* **D1–11**

11:30 ХАРАКТЕРИСТИКИ ВОССОЕДИНЕНИЯ ЛИНИЙ МАГНИТНОГО ПОЛЯ
Х.К. Бирнет[1,2], В.С. Семенов[3], Н.В. Еркаев[4], С. Мьюлбачлер[1,2], К.Дж. Фарругиа[5] *([1]Space Research Institute of Austrian Academy of Sciences, Graz, Austria, [2]University of Graz, Austria, [3]Санкт-Петербургский государственный университет, [4]Институт вычислительного моделирования СО РАН, Красноярск, [5]University of New Hampshire, USA)* **D1–12**

11:45 ГЕНЕРАЦИЯ РАЗНОСТИ ЭЛЕКТРИЧЕСКИХ ПОТЕНЦИАЛОВ ВСЛЕДСТВИЕ МЕДЛЕННЫХ УДАРНЫХ ВОЛН МГД, РАСПРОСТРАНЯЮЩИХСЯ ВДОЛЬ ТРУБКИ МАГНИТНОГО ПОТОКА ИО
Д. Лангмейр[1,2], Н.В. Еркаев[3], В.С. Семенов[4], В.А. Шайдуров[3,5], Х.К. Бирнет[1,2], Х.О. Рукер[1,2], Д.Ф. Вогл[1], С. Мьюлбачлер[1,2] *([1]Space Research Institute of Austrian Academy of Sciences, Graz, Austria, [2]University of Graz, Austria, [3]Институт вычислительного моделирования СО РАН, Красноярск, [4]Санкт-Петербургский государственный университет, [5]Красноярский государственный университет)* **D1–13**

12:00 АНАЛИЗ НАКЛОННЫХ БЫСТРЫХ УДАРНЫХ ВОЛН С УЧЕТОМ АНИЗОТРОПИИ ДАВЛЕНИЯ
Д.Ф. Вогл[1], Н.В. Еркаев[2], Х.К. Бирнет[1,3], Х.О. Рукер[1,3], С. Мьюлбачлер[1,3], Д. Лангмейр[1,3] *([1]Space Research Institute of Austrian Academy of Sciences, Graz, Austria, [2]Институт вычислительного моделирования СО РАН, Красноярск, [3]University of Graz, Austria)* **D1–14**

12:15 ИССЛЕДОВАНИЯ ЭРОЗИИ МАГНИТОПАУЗЫ ДНЕВНОЙ СТОРОНЫ НА СТАЦИОНАРНОЙ ОРБИТЕ С ИСПОЛЬЗОВАНИЕМ ДАННЫХ WIND И GOES (1995–1998)
С.М. Мьюлбачлер[1,2], К.Дж. Фарругиа[3], Х.К. Биернат[1,2], В.С. Семенов[4], Н.В. Еркаев[5], Д.Ф. Вогл[1], Д. Лангмайр[1,2], Р.П. Лепинг[6], К.В. Огилви[6], Х. Сингер[7] *([1]Space Research Institute of Austrian Academy of Sciences, Graz, Austria, [2]University of Graz, Austria, [3]University of New Hampshire, USA, [4]Санкт-Петербургский государственный университет, [5]Институт вычислительного моделирования СО РАН, Красноярск, [6]NASA Goddard Space Flight Center, USA, [7]NOAA Space Environment Center, Boulder, USA)* **D1–15**

СТЕНДОВЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 18:15–20:00***

МГНОВЕННЫЙ ОТКЛИК ИОНОСФЕРЫ НА ВНЕЗАПНОЕ НАЧАЛО СИЛЬНЫХ МАГНИТНЫХ БУРЬ
Э.Л. Афраймович, В.В. Козодеров, Л.А. Леонович, О.С. Лесюта, И.И. Ушаков **D1–16**

ПОВЕДЕНИЕ ИОНОСФЕРЫ НАД ХАРЬКОВОМ В ПЕРИОДЫ ГЕОМАГНИТНЫХ БУРЬ
Е.И. Григоренко, В.Н. Лысенко, С.В. Черняев **D1–17**

ВЫСЫПАНИЕ ЭНЕРГИЧНЫХ ЭЛЕКТРОНОВ И ЭЛЕКТРИЧЕСКОЕ ПОЛЕ КОНВЕКЦИИ В ПЕРИОД ПРОХОЖДЕНИЯ ВЫСОКОСКОРОСТНЫХ ПОТОКОВ СОЛНЕЧНОГО ВЕТРА
В.А. Кузьмин **D1–18**

ДОЛГОТНЫЕ ВАРИАЦИИ ИОНОСФЕРНЫХ ПРОЯВЛЕНИЙ ГЕОМАГНИТНОЙ БУРИ
Э.С. Казимировский, О.М. Пирог, Н.М. Полех, Л.В. Чистякова **D1–19**

РЕАКЦИЯ СЛОЯ F1 ИОНОСФЕРЫ НА ВОЗДЕЙСТВИЕ НА ТЕРМОСФЕРУ МАГНИТОСФЕРНЫХ ПРОЦЕССОВ
Л.А. Щепкин, Г.П. Кушнаренко **D1–20**

ОЦЕНКИ МЕЖГОДОВОЙ ИЗМЕНЧИВОСТИ СОСТАВА ГАЗА НА ВЫСОТЕ 120 км НАД ИРКУТСКОМ ПО ИЗМЕРЕНИЯМ СТЕПЕНИ РАЗВИТИЯ СЛОЯ F1
Л.А. Щепкин, Г.П. Кушнаренко, Г.М. Кузнецова **D1–21**

ПОЛОЖЕНИЕ ПОЛЯРНОЙ СТЕНКИ ГЛАВНОГО ИОНОСФЕРНОГО ПРОВАЛА В УТРЕННЕМ СЕКТОРЕ В МАГНИТОСПОКОЙНЫХ УСЛОВИЯХ
А.Е. Степанов, В.Л. Халипов, Е.Д. Бондарь **D1–22**

ИОНОСФЕРНЫЕ ЭФФЕКТЫ СОЛНЕЧНОГО ЗАТМЕНИЯ 11 АВГУСТА 1999 г.
В.И. Таран, Е.И. Григоренко **D1–23**

ОСОБЕННОСТИ ПОВЕДЕНИЯ ИОНОВ ВОДОРОДА ВО ВНЕШНЕЙ ИОНОСФЕРЕ НАД ХАРЬКОВОМ
В.И. Таран, Е.И. Григоренко, Г.А. Кияшко **D1–24**

ПАРАМЕТРЫ ИОНИЗИРОВАННОЙ И НЕЙТРАЛЬНОЙ КОМПОНЕНТ ВЕРХНЕЙ АТМОСФЕРЫ, ПОЛУЧЕННЫЕ ПО ДАННЫМ НЕКОГЕРЕНТНОГО РАССЕЯНИЯ
Д.А. Дзюбанов, В.И. Таран, В.К. Боговский **D1–25**

АЗИМУТАЛЬНАЯ АСИММЕТРИЯ ОБЛАСТЕЙ ВТЕКАЮЩИХ И ВЫТЕКАЮЩИХ ИЗ ИОНОСФЕРЫ ПРОДОЛЬНЫХ ТОКОВ В МОМЕНТ НАЧАЛА ВЗРЫВНОЙ ФАЗЫ СУББУРИ
В.А. Величко, Р.Н. Бороев, М.Г. Гельберг **D1–26**

ВАРИАЦИИ ВЫСОТЫ МАКСИМУМА СЛОЯ *E* ВО ВРЕМЯ ГЕОМАГНИТНЫХ ВОЗМУЩЕНИЙ
Т.Г. Живолуп **D1–27**

ВЛИЯНИЕ ЗНАКА ММП НА ВАРИАЦИИ FMIN
Э.К. Зикрач, Л.Д. Филиппов **D1–28**

ОДНОВРЕМЕННЫЕ НАБЛЮДЕНИЯ УЗКИХ ПРОВАЛОВ ИОНИЗАЦИИ В ДВУХ ПОЛУШАРИЯХ
Л.В. Шестакова, Э.К. Зикрач, А.Е. Степанов **D1–29**

ГЕНЕРАЦИЯ ЭЛЕКТРИЧЕСКОГО ПОЛЯ В ПЛАЗМЕННОМ СЛОЕ
В.В. Денисенко, А.В. Китаев **D1–30**

РАСПРОСТРАНЕНИЕ МЕДЛЕННЫХ МГД-ВОЛН ВДОЛЬ ДИПОЛЬНЫХ МАГНИТНЫХ ТРУБОК
Н.В. Еркаев, В.А. Шайдуров **D1–31**

ВЛИЯНИЕ КРИВИЗНЫ И ТОЛЩИНЫ МАГНИТОПАУЗЫ НА ЕЕ НЕУСТОЙЧИВОСТЬ
И.Л. Аршукова, Н.В. Еркаев **D1–32**

ИССЛЕДОВАНИЕ ФУНКЦИИ ОТКЛИКА ВНЕШНЕГО РАДИАЦИОННОГО ПОЯСА ЗЕМЛИ НА КРУПНОМАСШТАБНЫЕ ВОЗМУЩЕНИЯ СОЛНЕЧНОГО ВЕТРА
И.В. Кошляк **D1–33**

ПРИНЦИП СОХРАНЕНИЯ В МОДЕЛИРОВАНИИ САМООРГАНИЗАЦИИ АТМОСФЕРНЫХ И ИОНОСФЕРНЫХ ПРОЦЕССОВ
Ю.И. Русинов **D1–34**

Секция D2. НЕОДНОРОДНАЯ СТРУКТУРА ИОНОСФЕРЫ

Сопредседатели секции: д.ф.-м.н. В.Е. Куницын, к.ф.-м.н. А.П. Потехин

УСТНЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 14:00–16:15. Малый зал***

14:00 РЕАКЦИЯ ИОНОСФЕРЫ НА МАЛЫЕ И БОЛЬШИЕ СОЛНЕЧНЫЕ ВСПЫШКИ ПО ДАННЫМ ГЛОБАЛЬНОЙ СЕТИ GPS
Э.Л. Афраймович, А.Т. Алтынцев, В.В. Гречнев, Л.А. Леонович *(Институт солнечно-земной физики СО РАН, Иркутск)* **D2–01**

14:15 ОСОБЕННОСТИ СВЕЧЕНИЯ ИСКУССТВЕННЫХ ОБРАЗОВАНИЙ В СУМЕРЕЧНОЕ ВРЕМЯ НА ВЫСОТАХ ВЕРХНЕЙ АТМОСФЕРЫ
Г.С. Кудряшев, В.Г. Ковтуненко *(Иркутский военный авиационный инженерный институт)* **D2–02**

14:30 НАБЛЮДЕНИЕ МОЩНЫХ КОГЕРЕНТНЫХ ЭХО ВО ВРЕМЯ МАГНИТНОЙ БУРИ 15–16 ИЮЛЯ 2000 г.
О.И. Бернгардт, Г.А. Жеребцов, А.П. Потехин, Б.Г. Шпынев *(Институт солнечно-земной физики СО РАН, Иркутск)* **D2–03**

14:45 О КИНЕТИЧЕСКОЙ ТЕОРИИ ИОННО-ЗВУКОВОЙ НЕУСТОЙЧИВОСТИ В *E*-СЛОЕ ИОНОСФЕРЫ
Ю.А. Суковатов *(Алтайский государственный университет, Барнаул)* **D2–04**

15:00 ГОДОВЫЕ И МЕЖГОДОВЫЕ ИЗМЕНЕНИЯ ПАРАМЕТРОВ СПОРАДИЧЕСКОГО СЛОЯ *E* ИОНОСФЕРЫ НАД ВОСТОЧНОЙ СИБИРЬЮ И СЕВЕРО-ВОСТОКОМ РОССИИ
А.В. Виницкий, В.В. Казанцева *(Институт космических исследований и распространения радиоволн, Паратунка Камчатской обл.),*
В.Ф. Петрухин, Е.А. Пономарев, Н.А. Сутырин *(Институт солнечно-земной физики СО РАН, Иркутск)* **D2–05**

15:15 АНОМАЛЬНОЕ СОСТОЯНИЕ ВЕРХНЕЙ АТМОСФЕРЫ В 1984–1985 гг.
А.В. Виницкий, В.В. Казанцева *(Институт космических исследований и распространения радиоволн, Паратунка Камчатской обл.),* **В.Д. Кокоуров, В.Ф. Петрухин, Н.А. Сутырин** *(Институт солнечно-земной физики СО РАН, Иркутск)* **D2–06**

Перерыв 15:30–16:00

16:00 АНАЛИЗ УСТОЙЧИВОСТИ ПЛАЗМЫ ВНЕШНЕЙ ИОНОСФЕРЫ
М.В. Толстиков, В.Б. Иванов *(Иркутский государственный университет)* **D2–07**

СТЕНДОВЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 18:15–20:00***

НЕОДНОРОДНАЯ СТРУКТУРА ВЫСОКОШИРОТНОЙ ИОНОСФЕРЫ ПО НАБЛЮДЕНИЯМ В НОРИЛЬСКЕ
Ю.В. Липко **D2–08**

ИЗМЕНЕНИЕ СПЕКТРА ИОНОСФЕРНЫХ НЕОДНОРОДНОСТЕЙ В ПЕРИОД ЗЕМЛЕТРЯСЕНИЯ
И.Н. Поддельский **D2–09**

СРАВНЕНИЕ ДАННЫХ ИРКУТСКОГО РАДАРА НЕКОГЕРЕНТНОГО РАССЕЯНИЯ С МЕЖДУНАРОДНОЙ СПРАВОЧНОЙ МОДЕЛЬЮ ИОНОСФЕРЫ IRI-95
А.П. Потехин, О.И. Бернгардт, А.В. Заворин, Б.Г. Шпынев, А.В. Тащилин **D2–10**

ВЛИЯНИЕ ДИНАМИЧЕСКОГО РЕЖИМА АТМОСФЕРЫ НА УСЛОВИЯ ПОГЛОЩЕНИЯ И ОТРАЖЕНИЯ РАДИОВОЛН И НА ВЕРОЯТНОСТИ НАБЛЮДЕНИЙ СПОРАДИЧЕСКИХ СЛОЕВ *E* ИОНОСФЕРЫ
В.Ф. Петрухин, Е.А. Пономарев, Н.А. Сутырин **D2–11**

СЕЗОННАЯ ИЗМЕНЧИВОСТЬ СУТОЧНЫХ ВАРИАЦИЙ ВЕРОЯТНОСТЕЙ НАБЛЮДЕНИЯ СПОРАДИЧЕСКОГО СЛОЯ *E* ИОНОСФЕРЫ НАД ВОСТОЧНОЙ СИБИРЬЮ В ЗАВИСИМОСТИ ОТ ЧАСТОТЫ ЗОНДИРОВАНИЯ
В.Ф. Петрухин, Е.А. Пономарев, Н.А. Сутырин **D2–12**

ПРОИСХОЖДЕНИЕ И ЭВОЛЮЦИЯ СЛОИСТОЙ СТРУКТУРЫ ИОНОСФЕРЫ И АТМОСФЕРЫ
Ю.И. Русинов **D2–13**

Секция D3. ДИСТАНЦИОННЫЕ МЕТОДЫ ЗОНДИРОВАНИЯ ИОНОСФЕРЫ И ТЕРМОСФЕРЫ

Сопредседатели секции: д.ф.-м.н. Э.Л. Афраймович, к.ф.-м.н. В.Д. Терещенко

ПРИГЛАШЕННЫЙ ДОКЛАД ***Среда, 27 июня, 16:00–16:30. Большой зал***

16:00 РАДИОТОМОГРАФИЯ ИОНОСФЕРЫ И АТМОСФЕРЫ
В.Е. Куницын *(Московский государственный университет),*
В.Д. Терещенко *(Полярный геофизический институт, Мурманск)* **D3–01**

УСТНЫЕ ДОКЛАДЫ ***Среда, 27 июня, 16:30–18:30. Малый зал***

16:30 ДИАГНОСТИКА ИОНОСФЕРНЫХ НЕОДНОРОДНОСТЕЙ МЕТОДОМ ВЕРТИКАЛЬНОГО ДОПЛЕРОВСКОГО ЗОНДИРОВАНИЯ: ЧИСЛЕННЫЙ ЭКСПЕРИМЕНТ
А.В. Барабанов, В.Б. Иванов *(Иркутский государственный университет)* **D3–02**

16:45 ВОССТАНОВЛЕНИЕ ВЫСОТНОГО ПРОФИЛЯ ЭЛЕКТРОННОЙ КОНЦЕНТРАЦИИ В ИОНОСФЕРЕ ПО ДАННЫМ РЕГИОНАЛЬНОЙ СЕТИ GPS
Д.А. Рыжков, В.В. Чернухов *(Иркутский военный авиационный инженерный институт)* **D3–03**

17:00 МЕТОДЫ ОПИСАНИЯ ВЫХОДНЫХ СИГНАЛОВ ЛЧМ-ЗОНДА
М.А. Давыденко, О.И. Бернгардт, Н.В. Ильин, С.Я. Михайлов, В.Е. Носов *(Институт солнечно-земной физики СО РАН, Иркутск)* **D3–04**

17:15 ИСПОЛЬЗОВАНИЕ МЕТОДОВ ИНТЕГРАЛЬНОГО ПРЕДСТАВЛЕНИЯ ДЛЯ МОМЕНТОВ ПОЛЯ В ЗАДАЧАХ ТОМОГРАФИЧЕСКОЙ ДИАГНОСТИКИ ТРОПОСФЕРЫ И ИОНОСФЕРЫ ЗЕМЛИ
А.В. Кулижский, С.Н. Колесник, М.В. Тинин *(Иркутский государственный университет)* **D3–05**

17:30 ДИАГНОСТИКА НИЗКОШИРОТНОЙ ИОНОСФЕРЫ ПО ИОНОГРАММАМ ТРАНСЭКВАТОРИАЛЬНОГО КВ-РАСПРОСТРАНЕНИЯ
В.И. Куркин, Г.В. Котович, С.Н. Пономарчук *(Институт солнечно-земной физики СО РАН, Иркутск),* **С.Дж. Андерсон, Б.Д. Вэрд** *(Defense Science Technology Organization, Australia)* **D3–06**

17:45 ВОССТАНОВЛЕНИЕ ПРОФИЛЯ ЭЛЕКТРОННОЙ КОНЦЕНТРАЦИИ ОБЛАСТИ *E* ИОНОСФЕРЫ ПО ИЗМЕРЕНИЯМ ЭФФЕКТА ФАРАДЕЯ НА ИРКУТСКОМ РАДАРЕ НР
Б.Г. Шпынев *(Институт солнечно-земной физики СО РАН, Иркутск)* **D3–07**

18:00 СРЕДНЕВОЛНОВАЯ РАДИОЛОКАЦИЯ ПОЛЯРНОЙ МЕЗОСФЕРЫ ЛЕТОМ 1999 г.
В.Д. Терещенко, Е.Б. Васильев, С.М. Черняков, М.В. Якимов, Н.А. Овчинников, В.А. Терещенко, А.М. Тариченко *(Полярный геофизический институт, Мурманск)* **D3–08**

18:15 СОЛНЕЧНО-ЗЕМНАЯ ОПТИКА – ИНФОРМАЦИОННАЯ БАЗА ДЛЯ МОДЕЛИРОВАНИЯ И ПРОГНОЗА ИОНОСФЕРНОЙ И КОСМИЧЕСКОЙ ПОГОДЫ
С.В. Авакян *(Государственный оптический институт, Санкт-Петербург)* **D3–09**

СТЕНДОВЫЕ ДОКЛАДЫ *Вторник, 26 июня, 18:15–20:00*

ОСОБЕННОСТИ ИЗМЕРЕНИЯ ПАРАМЕТРОВ ИОНОСФЕРЫ СРЕДСТВАМИ КОРРЕЛЯЦИОННОЙ ОБРАБОТКИ НЕКОГЕРЕНТНО РАССЕЯННОГО СИГНАЛА
В.Н. Лысенко, А.Н. Еремин, Ю.В. Черняк **D3–10**

ИССЛЕДОВАНИЯ ДИАГРАММЫ НАПРАВЛЕННОСТИ ИРКУТСКОГО РАДАРА НЕКОГЕРЕНТНОГО РАССЕЯНИЯ ПО РЕЗУЛЬТАТАМ РАДИОАСТРОНОМИЧЕСКИХ НАБЛЮДЕНИЙ
А.В. Медведев, А.В. Заворин, В.А. Лебедев, Б.И. Лубышев, В.Е. Носов **D3–11**

РАЗДЕЛЕНИЕ ДВУХ ПЕРЕКРЫВАЮЩИХСЯ СИГНАЛОВ ПРИ ВОЛНОВОМ ЗОНДИРОВАНИИ ИОНОСФЕРЫ
К.Г. Ратовский, А.В. Медведев **D3–12**

ИСПОЛЬЗОВАНИЕ ДАННЫХ НАКЛОННОГО ЗОНДИРОВАНИЯ ИОНОСФЕРЫ ДЛЯ ОПРЕДЕЛЕНИЯ ЕЁ ТОНКОЙ СТРУКТУРЫ
В.И. Сажин, Н.Т. Афанасьев, А.А. Жжёных, М.К. Ивельская, М.В. Тинин, В.Е. Унучков **D3–13**

ВЫДЕЛЕНИЕ ПРЯМОЙ УЛЬТРАФИОЛЕТОВОЙ РАДИАЦИИ ПРИ ИЗМЕРЕНИЯХ СПЕКТРОФОТОМЕТРОМ С ШИРОКОЙ ВХОДНОЙ АПЕРТУРОЙ
А.Ю. Шалин, А.В. Михалев **D3–14**

ДОПЛЕРОВСКИЕ ИЗМЕРЕНИЯ ВО ВРЕМЯ ПРОВЕДЕНИЯ АКТИВНОГО ПЛАЗМЕННОГО ЭКСПЕРИМЕНТА «NORTH STAR»
Н.Ф. Благовещенская, К.И. Горелый, В.В. Клименко, П.М. Нагорский **D3–15**

ВЛИЯНИЕ ГЛОБАЛЬНЫХ ВОЗМУЩЕНИЙ ИОНОСФЕРЫ НА ДОПЛЕРОВСКИЕ СПЕКТРЫ ОТДЕЛЬНЫХ МОД РАДИОЛИНИИ ХАБАРОВСК – ЙОШКАР-ОЛА
В.А. Иванов, А.А. Колчев **D3–16**

ОЦЕНКА ПАРАМЕТРОВ ИОНОСФЕРНЫХ НЕОДНОРОДНОСТЕЙ ПО ДИСПЕРСИОННЫМ ХАРАКТЕРИСТИКАМ РАДИОЛИНИЙ
В.А. Иванов, Д.В. Иванов, А.А. Колчев **D3–17**

ВЛИЯНИЕ СЕЗОННЫХ И ЦИКЛИЧЕСКИХ ВАРИАЦИЙ ТЕРМОСФЕРНЫХ ПАРАМЕТРОВ НА НОЧНУЮ ИНТЕНСИВНОСТЬ КРАСНОЙ ЛИНИИ АТОМАРНОГО КИСЛОРОДА
Р.А. Кононов, А.В. Тащилин **D3–18**

АДАПТИВНАЯ РЕГИОНАЛЬНАЯ МОДЕЛЬ ПОЛНОГО ЭЛЕКТРОННОГО СОДЕРЖАНИЯ
В.В. Чернухов, А.Д. Базаржапов, М.А. Межетов **D3–19**

ИНТЕГРАЛЬНОЕ ПРЕДСТАВЛЕНИЕ ДЛЯ ПОЛЯ ВОЛНЫ, РАСПРОСТРАНЯЮЩЕЙСЯ В СРЕДЕ СО СЛУЧАЙНЫМИ НЕОДНОРОДНОСТЯМИ РАЗЛИЧНЫХ МАСШТАБОВ
М.В. Тинин, С.Н. Колесник **D3–20**

РЕЗУЛЬТАТЫ ИЗМЕРЕНИЙ ТЕМПЕРАТУРЫ И ПЛОТНОСТИ НЕЙТРАЛЬНОЙ АТМОСФЕРЫ НА ВЫСОТАХ 90 – 110 км ЛЕТОМ 1999–2000 гг. С ПОМОЩЬЮ ИСКУССТВЕННЫХ ПЕРИОДИЧЕСКИХ НЕОДНОРОДНОСТЕЙ
А.В. Толмачева, В.В. Беликович **D3–21**

ОПРЕДЕЛЕНИЕ ПАРАМЕТРОВ ВЕРХНЕЙ АТМОСФЕРЫ С ПОМОЩЬЮ ИСКУССТВЕННЫХ ПЕРИОДИЧЕСКИХ НЕОДНОРОДНОСТЕЙ
А.В. Толмачева, Н.В. Бахметьева, В.В. Беликович **D3–22**

НОВЫЙ ПОДХОД К ПРОБЛЕМЕ ПРОСТРАНСТВЕННОЙ ЭРГОДИЧНОСТИ ПРИ НАКЛОННОМ ЗОНДИРОВАНИИ СЛУЧАЙНО-НЕОДНОРОДНЫХ РЕФРАГИРУЮЩИХ СРЕД
А.Г. Вологдин, В.Д. Гусев, Л.И. Приходько **D3–23**

ОПТИМИЗАЦИЯ ИЗМЕРЕНИЯ СКОРОСТИ ДРЕЙФА ИОНОСФЕРНОЙ ПЛАЗМЫ МЕТОДОМ НЕКОГЕРЕНТНОГО РАССЕЯНИЯ
Л.Я. Емельянов **D3–24**

Секция D4. РАСПРОСТРАНЕНИЕ РАДИОВОЛН В ИОНОСФЕРЕ

Сопредседатели секции: д.ф.-м.н. И.И. Орлов, д.ф.-м.н. М.В. Тинин

УСТНЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 16:15–17:00. Малый зал***

16:15 ГЕОМАГНИТНЫЕ ВОЗМУЩЕНИЯ И ФУНКЦИОНИРОВАНИЕ НАВИГАЦИОННОЙ СИСТЕМЫ GPS
Э.Л. Афраймович, О.С. Лесюта, И.И. Ушаков *(Институт солнечно-земной физики СО РАН, Иркутск)* **D4–01**

16:30 ОБРАТНОЕ РАССЕЯНИЕ ОТ СЛОИСТО-НЕОДНОРОДНОЙ, НЕСТАЦИОНАРНОЙ ИОНОСФЕРЫ
И.И. Орлов *(Институт солнечно-земной физики СО РАН, Иркутск)* **D4–02**

16:45 КОМПЛЕКС МЕТОДИК КОРРЕКЦИИ БАЗОВОЙ МОДЕЛИ ИОНОСФЕРНОГО ДЕКАМЕТРОВОГО РАДИОКАНАЛА НА ТЕКУЩИЕ УСЛОВИЯ
В.И. Сажин *(Иркутский государственный университет)* **D4–03**

СТЕНДОВЫЕ ДОКЛАДЫ ***Вторник, 26 июня, 18:15–20:00***

ОБ АСИММЕТРИИ РАСПРЕДЕЛЕНИЙ ИНДЕКСА РЕФРАКЦИИ В ВОСТОЧНЫХ РЕГИОНАХ РОССИИ
Н.Ц. Гомбоев, А.С. Батороев, В.Е. Мункоев **D4–04**

О СТРУКТУРЕ СИГНАЛА ЗАГОРИЗОНТНОГО РАДИОЛОКАТОРА МОРСКОЙ ПОВЕРХНОСТИ
М.В. Игнатенко, М.В. Тинин **D4–05**

ИССЛЕДОВАНИЯ ЧАСТОТНО-ВРЕМЕННЫХ ХАРАКТЕРИСТИК ПЕДЕРСЕНОВСКИХ МОД НА ТРАССАХ РОССИЙСКОЙ СЕТИ ЛЧМ-ИОНОЗОНДОВ
В.А.Иванов, Н.В. Рябова, Д.В. Скворцов, И.Н. Поддельский, С.В. Розанов **D4–06**

АДАПТАЦИОННЫЕ ВОЗМОЖНОСТИ МОДЕЛИ IRI В ПРОГНОЗИРОВАНИИ ХАРАКТЕРИСТИК ДЕКАМЕТРОВЫХ РАДИОТРАСС
Г.В. Котович, С.Я. Михайлов **D4–07**

ВЫЧИСЛЕНИЕ КОМПЛЕКСНЫХ КОЭФФИЦИЕНТОВ ОТРАЖЕНИЯ И СТРУКТУРЫ ПОЛЯ В НЕОДНОРОДНОЙ ПОГЛОЩАЮЩЕЙ ИОНОСФЕРЕ МЕТОДОМ ПРОГОНКИ
Л.И. Приходько, В.Д. Гусев, А.Г. Вологдин **D4–08**

Секции E1–E4. СТРУКТУРА И ДИНАМИКА СРЕДНЕЙ АТМОСФЕРЫ

Сопредседатели секций: член-корр. РАН В.В. Зуев, д.ф.-м.н. В.В. Кошелев

ПРИГЛАШЕННЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 9:15–10:30. Большой зал***

9:15 СОВРЕМЕННЫЕ ПРОБЛЕМЫ СОЛНЕЧНО-ЗЕМНОЙ ФИЗИКИ
Г.А. Жеребцов *(Институт солнечно-земной физики СО РАН, Иркутск)* **E–01**

9:45 ИСТОРИЯ СОЗДАНИЯ И РАЗВИТИЯ АКАДЕМИЧЕСКОЙ НАУКИ В ТОМСКЕ
В.Е. Зуев *(Институт оптики атмосферы СО РАН, Томск)* **E–02**

10:15 ВОЗДЕЙСТВИЕ СТРАТОСФЕРНОГО ПОТЕПЛЕНИЯ НА ПАРАМЕТРЫ СРЕДНЕЙ И ВЕРХНЕЙ АТМОСФЕРЫ
В.В. Кошелев, Г.А. Жеребцов, Н.А. Абушенко, С.А. Ташилин, А.В. Михалев, Р.А. Кононов, И.В. Медведева, А.Ю. Шалин, Э.Л. Афраймович, О.С. Лесюта *(Институт солнечно-земной физики СО РАН, Иркутск)* **E–03**

Перерыв 10:45–11:00

11:00 РАДИАЦИОННО-АКТИВНЫЕ СОСТАВЛЯЮЩИЕ В ТОЛЩЕ АТМОСФЕРЫ ЦЕНТРАЛЬНОЙ ЧАСТИ ЕВРАЗИИ
В.Н. Арефьев, Ф.В. Кашин *(Институт экспериментальной метеорологии, Обнинск)*
В.К. Семенов *(Киргизский государственный национальный университет, Бишкек)* **E–04**

УСТНЫЕ ДОКЛАДЫ ***Понедельник, 25 июня, 10:30–13:15. Большой зал***

11:30 ИССЛЕДОВАНИЕ ВЛИЯНИЯ РАСПРОСТРАНЕНИЯ ГРАВИТАЦИОННОЙ ВОЛНЫ НА РАСПРЕДЕЛЕНИЕ ВТОРОСТЕПЕННЫХ ИЗОТОПОВ В СРЕДНИХ СЛОЯХ АТМОСФЕРЫ
Джи Яо Ксу *(Center for Space Sciences and Applied Research of the Chinese Academy of Sciences, Beijing, China)* **E–05**

11:45 ПОВЕДЕНИЕ ТЕМПЕРАТУРНОГО РЕЖИМА НИЖНЕЙ ТЕРМОСФЕРЫ ВО ВРЕМЯ ЗИМНЕГО СТРАТОСФЕРНОГО ПОТЕПЛЕНИЯ
В.М. Игнатьев, С.В. Николашкин *(Институт космофизических исследований и аэрономии СО РАН, Якутск)* **E–06**

12:00 ИССЛЕДОВАНИЯ ПРОСТРАНСТВЕННО-ВРЕМЕННЫХ СВЯЗЕЙ МЕЖДУ МЕТЕОРОЛОГИЧЕСКИМИ ПАРАМЕТРАМИ СТРАТОСФЕРЫ И ДИНАМИКОЙ ОБЩЕГО СОДЕРЖАНИЯ ОЗОНА
А.Ю. Белинская, Э.С. Казимировский, Н.А. Абушенко *(Институт солнечно-земной физики СО РАН, Иркутск)* **E–07**

12:15 АДАПТИВНОЕ ПРОГНОЗИРОВАНИЕ ДИНАМИКИ ОЗОНОВОГО СЛОЯ
И.Ю. Сакаш, В.Б. Кашкин, Ю.П. Ланкин *(Красноярский государственный технический университет)* **E–08**

12:30 ЧУВСТВИТЕЛЬНОСТЬ КЛИМАТА СТРАТОСФЕРЫ И МЕЗОСФЕРЫ К НАБЛЮДАЕМОМУ ИЗМЕНЕНИЮ КОНЦЕНТРАЦИИ ОЗОНА И УГЛЕКИСЛОГО ГАЗА
Е.М. Володин *(Институт вычислительной математики РАН, Москва)* **E–09**

12:45 ВОССТАНОВЛЕНИЕ ПРОСТРАНСТВЕННО-ВРЕМЕННОГО РАСПРЕДЕЛЕНИЯ МЕТЕОРОЛОГИЧЕСКИХ ПОЛЕЙ ПО ДАННЫМ НАБЛЮДЕНИЙ
Е.Г. Климова *(Институт вычислительных технологий СО РАН, Новосибирск)* **E–10**

13:00 ТЕОРЕТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ДАЛЬНЕГО ВОЛНОВОГО ВОЗДЕЙСТВИЯ АНТАРКТИЧЕСКОГО ОЗОНОВОГО ИСТОЧНИКА АТМОСФЕРНЫХ ТЕРМИЧЕСКИХ ПРИЛИВОВ НА ТЕРМОГИДРОДИНАМИЧЕСКОЕ СОСТОЯНИЕ ВЕРХНЕЙ АТМОСФЕРЫ СЕВЕРНОГО ПОЛУШАРИЯ
А.А Гаврилов[1], А.П. Капица[2], О.В. Кайдалов[1] *([1]НПО «Тайфун», Обнинск, [2]Московский государственный университет)* **E–11**

СТЕНДОВЫЕ ДОКЛАДЫ *Понедельник, 25 июня, 18:15–20:00*

ДИАГНОСТИКА ДИНАМИЧЕСКОГО РЕЖИМА МЕЗОСФЕРЫ-ТЕРМОСФЕРЫ ПО ДАННЫМ ИОНОСФЕРНЫХ И ГЕОМАГНИТНЫХ НАБЛЮДЕНИЙ
А.В. Виницкий **E–12**

АКУСТИКО-ГРАВИТАЦИОННЫЕ ВОЛНЫ В НИЖНЕЙ ИОНОСФЕРЕ: НАБЛЮДЕНИЕ МЕТОДОМ ИСКУССТВЕННЫХ ПЕРИОДИЧЕСКИХ НЕОДНОРОДНОСТЕЙ И ТЕОРЕТИЧЕСКОЕ МОДЕЛИРОВАНИЕ
Н.В. Бахметьева, Г.И. Григорьев **E–13**

ИССЛЕДОВАНИЕ ДИНАМИКИ СТРАТОСФЕРНОГО ПОТЕПЛЕНИЯ В АЗИАТСКОМ РЕГИОНЕ НА ОСНОВЕ ДАННЫХ СПУТНИКОВЫХ НАБЛЮДЕНИЙ
В.В. Кошелев, Н.А. Абушенко, С.А. Ташилин **E–14**

МИКРОВОЛНОВАЯ УЛЬТРАРЕФРАКТОМЕТРИЯ АТМОСФЕРЫ
Р.З. Шарипов, А.В. Алексеев **E–15**

ТЕОРЕМЫ МАТЕМАТИЧЕСКОЙ ФИЗИКИ О СОБСТВЕННОЙ И ВНУТРЕННЕЙ ГРАВИТАЦИОННОЙ НЕУСТОЙЧИВОСТИ СФЕРОИДАЛЬНОЙ АТМОСФЕРЫ
Р.В. Филиппов **E–16**

К ВОЗМОЖНОСТИ ИССЛЕДОВАНИЯ ВОЛНОВЫХ ПРОЦЕССОВ В ПРИЗЕМНОЙ АТМОСФЕРЕ С ПОМОЩЬЮ СОЛНЕЧНОГО ТЕЛЕСКОПА
Н.И. Кобанов **E–17**

МОДЕЛИРОВАНИЕ ТРАЕКТОРИЙ РАСПРОСТРАНЕНИЯ ВНУТРЕННИХ ГРАВИТАЦИОННЫХ ВОЛН В МЕЗОСФЕРЕ И НИЖНЕЙ ТЕРМОСФЕРЕ
Н.К. Барсукова, Н.А. Сутырин **E–18**

СЕЗОННЫЕ ОСОБЕННОСТИ ПРОЯВЛЕНИЯ ПЛАНЕТАРНЫХ ВОЛН В ОЗОНЕ НА СРЕДНИХ ШИРОТАХ
Г.В. Вергасова, Э.С. Казимировский, А.Ю. Белинская **E–19**

КОМПЛЕКСНЫЕ ИЗМЕРЕНИЯ ОСО, УФ-В И NO_2 В БУРЯТИИ
Е.В. Батуева, А.В. Базаров М.В. Гришаев, В.В. Зуев, С.В. Смирнов **E–20**

ВЗАИМОСВЯЗЬ ВАРИАЦИЙ ОБЩЕГО СОДЕРЖАНИЯ ОЗОНА И ВЕТРОВОГО РЕЖИМА В НИЖНЕЙ ТЕРМОСФЕРЕ В ЦИКЛЕ СОЛНЕЧНОЙ АКТИВНОСТИ
Г.В. Вергасова, Э.С. Казимировский **E–21**

НЕРЕГУЛЯРНЫЕ ВАРИАЦИИ ПРИЗЕМНОЙ УЛЬТРАФИОЛЕТОВОЙ РАДИАЦИИ
А.В. Михалев, М.А. Черниговская, А.Ю. Шалин **E–22**

СРАВНЕНИЕ ИЗМЕНЕНИЙ ДВУОКИСИ АЗОТА В СТРАТОСФЕРЕ НАД ЗВЕНИГОРОДОМ И ТОМСКОМ
М.В. Гришаев, В.В. Зуев, А.С. Елохов **E–23**

ВЕРТИКАЛЬНОЕ РАСПРЕДЕЛЕНИЕ ОЗОНА НАД ТОМСКОМ ПО ДАННЫМ ЛИДАРНЫХ НАБЛЮДЕНИЙ В 1996–2001 гг.
С.И. Долгий, С.Л. Бондаренко, В.В. Зуев, А.В. Невзоров, С.В. Смирнов **E–24**

ПЫЛЬ В СТРАТОСФЕРЕ ПО СУМЕРЕЧНЫМ ФОТОМЕТРИЧЕСКИМ ИЗМЕРЕНИЯМ
Н. Матешвили, Ю. Матешвили, Дж. Матешвили, О. Авсаджанишвили **E–25**

ИССЛЕДОВАНИЕ СРЕДНЕЙ АТМОСФЕРЫ (D-ОБЛАСТИ ИОНОСФЕРЫ) С ПОМОЩЬЮ ИСКУССТВЕННЫХ ПЕРИОДИЧЕСКИХ НЕОДНОРОДНОСТЕЙ
В.В. Беликович, Е.А. Бенедиктов **E–26**

ИЗМЕНЕНИЕ ХАРАКТЕРИСТИК СДВ-СИГНАЛОВ В ПЕРИОД ЗЕМЛЕТРЯСЕНИЙ
И.Н. Поддельский **E–27**

ИССЛЕДОВАНИЯ НИЖНЕЙ ПОЛЯРНОЙ ИОНОСФЕРЫ МЕТОДОМ ЧАСТИЧНЫХ РАДИООТРАЖЕНИЙ
В.Д. Терещенко, М.В. Якимов, Е.Б. Васильев, С.М. Черняков, О.Ф. Оглоблина **E–28**

АДАПТИВНОЕ МОДЕЛИРОВАНИЕ АТМОСФЕРНЫХ ЯВЛЕНИЙ
Ю.П. Ланкин **E–29**

ИССЛЕДОВАНИЕ ВЕРТИКАЛЬНОГО РАСПРОСТРАНЕНИЯ НЕЛИНЕЙНЫХ ВОЛН В АТМОСФЕРЕ
С.П. Кшевецкий, Н.М. Гаврилов **E–30**

Секция F1. ДОЛГОПЕРИОДНЫЕ ТРЕНДЫ ПАРАМЕТРОВ АТМОСФЕРЫ

Сопредседатели секции: член-корр. РАН М.В. Кабанов, д.ф.-м.н. В.В. Кошелев

ПРИГЛАШЕННЫЙ ДОКЛАД ***Пятница, 29 июня, 9:00–9:30. Большой зал***

9:00 СОВРЕМЕННЫЕ ПРИРОДНО-КЛИМАТИЧЕСКИЕ ИЗМЕНЕНИЯ В СИБИРИ: НОВЫЕ МЕТОДЫ И РЕЗУЛЬТАТЫ АНАЛИЗА И ИНСТРУМЕНТАЛЬНЫХ НАБЛЮДЕНИЙ
М.В. Кабанов *(Институт оптического мониторинга СО РАН, Томск)* **F1–01**

УСТНЫЕ ДОКЛАДЫ ***Пятница, 29 июня, 9:30–11:00. Большой зал***

9:30 МЕЖГОДОВЫЕ КОЛЕБАНИЯ ПРИЗЕМНОЙ ТЕМПЕРАТУРЫ ВОЗДУХА В ТОМСКЕ
И.И. Ипполитов, М.В. Кабанов, С.В. Логинов *(Институт оптического мониторинга СО РАН, Томск)* **F1–02**

9:45 ДОЛГОВРЕМЕННАЯ ДИНАМИКА ХАРАКТЕРИСТИК СТРАТОСФЕРНОГО АЭРОЗОЛЬНОГО СЛОЯ ПО ДАННЫМ ЛИДАРНЫХ НАБЛЮДЕНИЙ В ТОМСКЕ (56.5° С.Ш., 85.0° В.Д.)
В.Д. Бурлаков, А.В. Ельников, В.В. Зуев *(Институт оптики атмосферы СО РАН, Томск)* **F1–03**

10:00 НАБЛЮДЕНИЕ ОПТИЧЕСКИХ ВСПЫШЕК НОЧНОГО ЗВЕЗДНОГО НЕБА НА АТМОСФЕРНОЙ ЧЕРЕНКОВСКОЙ УСТАНОВКЕ ТУНКА
О.А. Гресс, Т.И. Гресс, Л.В. Паньков, Ю.В.Парфенов, Ю.А. Семеней *(НИИ прикладной физики Иркутского государственного университета),* **Л.А. Кузьмичев** *(НИИЯФ им. Д.В.Скобельцына Московского государственного университета)* **F1–04**

10:15 ЛИДАРНЫЕ ИССЛЕДОВАНИЯ ОСОБЕННОСТЕЙ ЗИМНИХ СТРАТОСФЕРНЫХ ПОТЕПЛЕНИЙ НАД ТОМСКОМ ЗА ПЕРИОД 1996–2000 гг.
В.Н. Маричев *(Институт оптики атмосферы СО РАН, Томск)* **F1–05**

10:30 МНОГОЛЕТНЯЯ ДИНАМИКА МЕТЕОПАРАМЕТРОВ АТМОСФЕРНОГО ВОЗДУХА В ОКРЕСТНОСТЯХ КРУПНЫХ ПРОМЫШЛЕННЫХ ЦЕНТРОВ АЛТАЙСКОГО КРАЯ
Г.С. Зинченко, И.А. Суторихин, Н.Н. Безуглова *(Институт водных и экологических проблем СО РАН, Барнаул)* **F1–06**

10:45 ОЗЕРО БАЙКАЛ КАК ИСТОЧНИК И РЕЦИПИЕНТ ВОЗМУЩЕНИЙ В КЛИМАТО-ЭКОЛОГИЧЕСКОЙ СИСТЕМЕ СИБИРИ
В.В. Пененко, Е.А. Цветова *(Институт вычислительной математики и математической геофизики СО РАН, Новосибирск)* **F1–07**

СТЕНДОВЫЕ ДОКЛАДЫ *Среда, 27 июня, 17:00–18:30*

ИСТОЧНИКИ ЗАГРЯЗНЕНИЯ АТМОСФЕРЫ ПОЛИЦИКЛИЧЕСКИМИ АРОМАТИЧЕСКИМИ УГЛЕВОДОРОДАМИ В ПРОМЫШЛЕННОМ ПРИБАЙКАЛЬЕ
Л.И. Белых, Ю.М. Малых, Э.Э. Пензина, А.Н. Смагунова **F1–08**

ИЗМЕНЧИВОСТЬ ВОДОЗАПАСА ОБЛАЧНОГО СЛОЯ ПО ДАННЫМ ДИСТАНЦИОННОГО СВЧ-ЗОНДИРОВАНИЯ
М.Ю. Шум, Л.М. Митник, А.А. Набиуллин **F1–09**

ТЕНДЕНЦИИ ИЗМЕНЕНИЯ АМПЛИТУДНО-ФАЗОВЫХ ХАРАКТЕРИСТИК ГОДОВОГО ХОДА ПРИПОВЕРХНОСТНОЙ ТЕМПЕРАТУРЫ В АЗИИ ПО ДАННЫМ НАБЛЮДЕНИЙ, РЕАНАЛИЗОВ И РЕЗУЛЬТАТАМ РАСЧЕТОВ С КМ ИФА РАН
А.В. Елисеев, И.И. Мохов **F1–10**

ДОЛГОПЕРИОДНЫЕ ТРЕНДЫ В НИЖНЕЙ СУБАВРОРАЛЬНОЙ ИОНОСФЕРЕ
С.Е. Кобякова, В.Ф. Смирнов **F1–11**

ОСОБЕННОСТИ ОБЩЕЙ ЦИРКУЛЯЦИИ АТМОСФЕРЫ СЕВЕРНОГО ПОЛУШАРИЯ ВО ВРЕМЯ ТЕПЛЫХ И ХОЛОДНЫХ ЗИМ НА ТЕРРИТОРИИ СИБИРИ
А.А. Караханян, В.И. Мордвинов **F1–12**

АНАЛИЗ КЛИМАТИЧЕСКИХ ИЗМЕНЕНИЙ ПО ФАЗОВЫМ ПОРТРЕТАМ
Е.А. Дюкарев, В.И. Шишлов **F1–13**

ОЦЕНКА НЕПЕРИОДИЧЕСКИХ ИЗМЕНЕНИЙ КЛИМАТИЧЕСКИХ ПАРАМЕТРОВ
Е.А. Дюкарев, В.И. Шишлов **F1–14**

ИЗМЕНЕНИЯ РЕГИОНАЛЬНОГО КЛИМАТА,ОБУСЛОВЛЕННЫЕ ПРИРОДНЫМИ ФАКТОРАМИ И АНТРОПОГЕННЫМ ВОЗДЕЙСТВИЕМ
К.А. Каримов, Р.Д. Гайнутдинова **F1–15**

ВАРИАЦИИ И ДОЛГОВРЕМЕННЫЕ ТРЕНДЫ СУММАРНОГО ОЗОНА И СТРАТОСФЕРНОГО ДИОКСИДА АЗОТА НАД СЕВЕРНЫМ ТЯНЬ-ШАНЕМ
В.К. Семенов, В.П. Синяков, Л.И. Сорокина, Н.И. Игнатова, Ф.В. Кашин, К.Н. Вишератин **F1–16**

ВЛИЯНИЕ КВАЗИДВУХЛЕТНЕЙ ЦИКЛИЧНОСТИ ЦИРКУЛЯЦИИ СТРАТОСФЕРЫ НА ВЕРТИКАЛЬНОЕ РАСПРЕДЕЛЕНИЕ ОЗОНА И ТЕМПЕРАТУРЫ НАД ЗАПАДНОЙ СИБИРЬЮ
В.Н. Маричев **F1–17**

СОВРЕМЕННОЕ СОСТОЯНИЕ И ДОЛГОПЕРИОДНЫЕ ИЗМЕНЕНИЯ ОЗОНОСФЕРЫ НАД ТОМСКОМ
С.В. Смирнов, В.В. Зуев **F1–18**

ЧИСЛЕННАЯ МОДЕЛЬ ПОГРАНИЧНОГО СЛОЯ АТМОСФЕРЫ С ДВУМЕРНОЙ ГОРИЗОНТАЛЬНОЙ НЕОДНОРОДНОСТЬЮ ПОДСТИЛАЮЩЕЙ ПОВЕРХНОСТИ
Н.Н. Безуглова, Ю.А. Суковатов, И.А. Суторихин **F1–19**

Секция F2. ВОЗДЕЙСТВИЕ СОЛНЕЧНОЙ АКТИВНОСТИ НА ПОГОДУ И КЛИМАТ

Сопредседатели секции: д.ф.-м.н. Е.А. Пономарев, д.ф.-м.н. В.В. Пененко

УСТНЫЕ ДОКЛАДЫ

Пятница, 29 июня, 11:30–12:45. Большой зал

11:30 ПРИРОДА ДОЛГОВРЕМЕННЫХ ВАРИАЦИЙ ПРИЗЕМНОЙ ТЕМПЕРАТУРЫ ВОЗДУХА ПРИБАЙКАЛЬЯ И ИХ СВЯЗЬ С СОЛНЕЧНОЙ АКТИВНОСТЬЮ
Г.А. Жеребцов, В.А. Коваленко *(Институт солнечно-земной физики СО РАН, Иркутск)* **F2–01**

11:45 КОСМИЧЕСКИЕ ЛУЧИ И ГЛОБАЛЬНОЕ ПОТЕПЛЕНИЕ НА ЗЕМЛЕ
П.Е. Покревский *(Институт прикладной геофизики, Москва)*, **Ю.И. Стожков** *(Физический институт РАН, Москва)* **F2–02**

12:00 О ВЛИЯНИИ СОЛНЕЧНО-ГЕОФИЗИЧЕСКИХ ФАКТОРОВ НА АЭРОЗОЛЬНЫЕ ХАРАКТЕРИСТИКИ. ПЛАНЫ АТМОСФЕРНЫХ ИССЛЕДОВАНИЙ В ИРКУТСКЕ
М.В. Панченко, С.М. Сакерин *(Институт оптики атмосферы СО РАН, Томск)*, **В.В. Кошелев, В.А. Коваленко** *(Институт солнечно-земной физики СО РАН, Иркутск)*, **Т.В. Ходжер** *(Лимнологический институт СО РАН, Иркутск)* **F2–03**

12:15 ПЕРЕМЕННОСТЬ СОЛНЕЧНОГО ПОТОКА И ГЛОБАЛЬНЫЙ КЛИМАТ
Ю.А. Скляров, Ю.И. Бричков, А.И. Котума, Н.В. Фомина *(Саратовский государственный университет)* **F2–04**

12:30 СОЛНЕЧНАЯ АКТИВНОСТЬ И КЛИМАТ ЗЕМЛИ В НАЧАЛЕ XXI в.
В.С. Башкирцев, Г.П. Машнич *(Институт солнечно-земной физики СО РАН, Иркутск)* **F2–05**

СТЕНДОВЫЕ ДОКЛАДЫ

Среда, 27 июня, 17:00–18:30

ГЛОБАЛЬНЫЕ И ЛОКАЛЬНЫЕ ВАРИАЦИИ ЭЛЕКТРИЧЕСКОГО ПОЛЯ АТМОСФЕРЫ
Ю.В. Шаманский **F2–06**

СВЯЗЬ ГРОЗОВОЙ ДЕЯТЕЛЬНОСТИ С ВАРИАЦИЯМИ КОСМИЧЕСКИХ ЛУЧЕЙ
В.А. Муллаяров, В.И. Козлов, Р.Р. Каримов **F2–07**

ВЗАИМОСВЯЗЬ ИЗМЕНЕНИЙ ПАРАМЕТРОВ НИЖНЕЙ АТМОСФЕРЫ. ХАРАКТЕРИСТИКИ ИОНОСФЕРЫ И ГЕОМАГНИТНОГО ПОЛЯ НА СЕВЕРО-ВОСТОКЕ РОССИИ
А.В. Виницкий, В.В. Казанцева **F2–08**

	Большой зал	Малый зал
24 июня		
9:00-19:00	Регистрация	
19:00	Фуршет	
25 июня		
8:30	Открытие симпозиума	
9:15 – 13:15	Секции E1 - E4	
10:45 - 11:00		*Coffee-break*
11:00 – 13:15		Секция A1
13:15 - 14:00		*Обед*
14:00 18:15	Секции A2, C1	
16:00 - 16:30		*Coffee-break*
18:15 – 20:00	Стендовые доклады A1, A2, C1, E1 – E4	
26 июня		
8:30 – 13:15	Секция C2	
8:30 – 12:30	Секция C4	
10:45 - 11:00		*Coffee-break*
13:15 - 14:00		*Обед*
14:00 – 17:00		Секции D2, D4
14:00 – 18:15		Секция D1
16:00 - 16:30		*Coffee-break*
18:15 – 20:00	Стендовые доклады C2, C3, C4, C5, D1, D2, D3, D4	
19:00	Экскурсия по Иркутску	
27 июня		
8:30 – 13:15	Секции B1, B2	
8:30 – 13:00		Секции C5
10:45 - 11:00		*Coffee-break*
13:15 - 14:00		*Обед*
14:00 – 15:30	Секция C3	
14:00 – 17:15		Секция C6
16:00 – 18:30		Секция D3
16:00 - 16:30		*Coffee-break*
17:00 – 18:30	Стендовые доклады B1, B2, F1, F2	
19:00	Банкет	
28 июня		
Выездная сессия (Иркутск - Листвянка - Байкал - Кадильный)		
29 июня		
9:00 – 12:45	Секции F1, F2	
11:00 - 11:30	*Coffee-break*	
12:45	Закрытие Симпозиума	
14:00	Экскурсия в Листвянку с посещением Байкальского музея и Байкальской астрофизической обсерватории	

Session A1. MOLECULAR SPECTROSCOPY OF ATMOSPHERIC GASES

A1-01

PHOTOACOUSTIC DETECTION OF GAS-AEROSOL IMPURITIES IN THE ATMOSPHERE

Yu.N. Ponomarev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
yupon@iao.ru

In the paper the analysis of last achievements for the method of photoacoustic detection of gas and aerosol components of the atmosphere including greenhouse gases, antropogeneous impurities, and soot aerosol is given.

The special attention is given to the analysis of multicomponent media including media with varying concentration of molecules (for example, during photofragmentation), the measurement of humidity for negative temperatures, and the measurements in a flow.

Variants of the combine of photoacoustic detectors with other optical systems are considered, in particular, a possibility of simultaneous measurements of radiation attenuation in high-quality resonator with photoacoustic detection.

A1-02

NEW ICLAS SPECTRA OF CO_2 AND N_2O IN THE NEAR INFRARED (10000–12000 cm^{-1})

G. Weirauch,[1] A. Campargue,[1] V.I. Perevalov,[2] S.A. Tashkun,[2] and J.-L. Teffo[3]
[1]*Université Joseph Fourier de Grenoble, France*
[2]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
vip@lts.iao.ru
[3]*Université Pierre et Marie Curie, Paris, France*
teffo@ccr.jussieu.fr

Three of four bands of the $3\nu_1+3\nu_3$ tetrad of $^{12}C^{16}O_2$ and $^{13}C^{16}O_2$, namely, 30031–00001, 30032–00001 and 30033–00001 have been detected by Intracavity Laser Absorption Spectroscopy in the 10450–11000 cm^{-1} region. The observed values for the line positions are found in very good agreement with those predicted from the recently published effective Hamiltonian parameters.[1,2]

With the help of the same technique, 14 new absorption bands of N_2O have been observed in the 10000–12000 cm^{-1} region. A good agreement is obtained between the observed line positions and those predicted with the help of new set of parameters of effective Hamiltonian developed in Ref. 3.

1. S.A. Tashkun, V.I. Perevalov, J.-L. Teffo, L.S. Rothman, and Vl.G. Tyuterev, JQSRT **60**, 785–801 (1998).
2. S.A. Tashkun, V.I. Perevalov, J.-L. Teffo, M. Lecoutre, T.R. Huet, A. Campargue, D. Bailly, and M.P. Esplin, J.Mol.Spectrosc. **200**, 162–176 (2000).
3. J.-L. Teffo, V.I. Perevalov, and O.M. Lyulin, J.Mol.Spectrosc. **168**, 390–403 (1994).

A1-03

ESTIMATION OF LINE MIXING EFFECT ON WATER VAPOR SPECTRAL LINES

A.D. Bykov, N.N. Lavrent'eva, L.N. Sinitsa, and A.M. Solodov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lnn@asd.iao.ru

The estimations of atmospheric radiation absorption require the accurate values both line positions, strengths and broadening and shift coefficients for atmospheric gases. At the present time H_2O halfwidths and shifts are studied in detail, but influence of line mixing remains unknown. The only investigation devoted to direct calculation of water vapor spectral lines cross-relaxation parameters is Ref. 1.

The present report is devoted to experimental and theoretical study of line mixing between water vapor spectral lines and connection between intramolecular resonances and line shift non-linear dependences on pressure.

The water vapor spectra between 5000 and 6000 cm^{-1} broadened by N_2 pressure were measured using the FT-spectrometers of NIST, USA at buffer gas pressures from 148.5 to 3800 Torr. The measurements were made for lines of (011)–(000) and (110)–(000) bands with spectral resolution 0.007 cm^{-1}.

The theoretical analysis was performed within the perturbative approach, proposed in Ref. 2. The direct calculations of non-diagonal matrix elements of relaxation matrix, half width and the line center shift were made. It was found that the line mixing effects are small in general, but for some lines involved in Coriolis or Fermi resonance it is significant resulting in non-linear dependences of shift coefficients on pressure.

The authors acknowledge the support by the Russian Foundation of Fundamental Research (Grants No. 98–02–16375 and No. 00–15–98589).

1. K.S. Lam, J.Quant. Spectrosc. Radiat.Transfer **17**, 351–383 (1977).
2. F. Thibault, Profils spectraux et collisions moleculaires. These de docteur en sciences, l' universite Paris XI Orsay (1992).

A1-04

ON THE THEORY OF SPECTRAL LINE BROADENING BY COMBINED ACTION OF DOPPLER AND PRESSURE EFFECTS

M.R. Cherkasov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

The forming of spectral line shapes in the IR spectral region is realised by combined action of the Doppler and collision mechanisms. There are described in the literature[1–3] some possible approaches to the problem, which are leading in simple situations to models suitable for numerical calculations. There are given in this report some results obtained on the basis of the approach developed in Ref. 4 which enables to include all effects due to statistical dependence of mentioned mechanisms in the relaxation theory formalism. In particular, there is pointed out that although it is impossible in the general case to sort out the collision effects on the parts which provoke the line broadening and the Doppler spectrum narrowing, in the some particular situations the model where the optical cross-section is considerably more than the kinetic one is acceptable. The optical collisions are responsible for the line broadening whereas the kinetic ones only perturb the translation of the absorbing molecule. The acceptance of this model gave us the possibility to introduce some simplifications and obtain the analytical results suitable for the analysis and computations.

1. R.H. Dicke , Phys. Rev. **89**, 157 (1953).
2. S.G. Rautian and I.I. Sobel'man, *Soviet Phys. Usp.* **9**, 701 (1967).
3. J.Ward, J.Cooper, and E.W. Smith, JQSRT **14**, 555 (1974).
4. M.R. Cherkasov , Optics and Spectrosc. **85**, 194 (1998).

A1-05

EFFECT OF DISPERSION FOR DIPOLE MOMENTS OF MOLECULES IN DIFFERENT VIBRATIONAL AND ROTATIONAL STATES ON TRANSPORT PROPERTIES OF POLAR GASES

V.P. Kochanov and V.I. Starikov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
star@lts.iao.ru

The classical scheme for calculation of transport characteristics of polar gases[1] is generalized on the case of the molecular dipole moments depending on rotational – vibrational states. The efficient method of averaging the collision integrals over relative orientations of dipole moments of colliding molecules is developed, which consist in single integration over the quantity of angular form-factor in intermolecular potential. Collision integrals determining diffusion and viscosity coefficients have been calculated as functions of dimensionless temperature and energy of dipole – dipole interaction (δ_{max}) for interval of δ_{max} 5.6 times greater than that given in Ref. 1. The tables of integrals determining the diffusion and viscosity coefficients were approximated by simple algebraic expressions with mean inaccuracy of 1%. The differences in the diffusion and viscosity coefficients for water vapor being excited up to the third bending vibrational state were found to be less than 3% in a wide temperature range. The parameters of the Lennard – Jones (12 – 6) potential have been determined with the use of the recommended experimental data on the viscosity coefficient of water vapor at different temperatures and the calculated dependencies of a viscosity coefficient on these parameters and temperature.

1. L. Monchick and E.A. Mason, J. Chem. Phys. **35**, №5, 1676–1697 (1961).

A1-06

STUDY OF FORMATION OF NON-EQUILIBRIUM VIBRATIONAL STATE POPULATION FOR MOLECULES IN THE UPPER PLANETARY ATMOSPHERES

A.O. Semenov and G.M. Shved
Institute of Physics of St.Petersburg State University, St.Petersburg, Russia
semenov@lmupa.phys.spbu.ru

Based on the model of two vibrational states of a linear molecule, standard problem of radiative transfer in a vibration-rotation band in a planetary atmosphere is formulated. The solution of the problem in the approximation of isothermal atmosphere describes the effect of decrease with height of population of the exited vibrational state, comparing to the equilibrium value, caused by the "open" upper boundary of the atmosphere. In a real non-isothermal atmosphere the location of height, above which population becomes non-equilibrium, depends on a particular temperature profile. This dependence is investigated by representation of temperature maximums and minimums as perturbations to some constant "background" temperature of atmosphere. In order to describe all possible conditions, which can be realized in planetary atmospheres, the parameters of similarity were constructed from the input parameters and a convenient dimensionless height was used. For rough estimation of the height, above which population of the excited vibrational states of molecules becomes non-equilibrium, the approximate formula was proposed, that can be used for any rotation-vibration band in any planetary atmosphere.

A1-07

ROVIBRONIC PROBLEMS AND PECULIARITIES OF DEDUCTION OF THE HAMILTONIAN IN THE PRINCIPAL AXES AS THEIR BASIS

A.Ya. Tsaune,[1] Ya.A. Podolyak,[1] and M.P. D'yachenko[2]
[1]*Ukrainian State Chemical and Technological University, Dnepropetrovsk, Ukraine*
ugxtu@dicht.dnepropetrovsk.ua
[2]*Dnepropetrovsk National University, Dnepropetrovsk, Ukraine*
uipapr@a-teleport.com

We showed previously (J. Mol. Struct., **266** (1992) 241–246), that it is convenient to build calculation schemes of characteristics of rovibronic states on the basis of Hamiltonians in the principal axes. However in the theory of molecular spectra these Hamiltonians are rarely used. One of the reasons is that the Hamiltonians contain anomalous coefficients leading to singularities due to remainders of the principal moments of inertia. This difficulty has long been known: C. Eckart (1934); J.O. Hirshfelder and E.P. Wigner (1935); J.H. Van Vleck (1935) – nevertheless it has not been solved until recently. Through the correct use of infinitesimal non-holonomic variables that define the angular momentum of a molecule and deformation of a molecular configuration, it is possible to obtain the Hamiltonian without such singularity. This enables one to develop not only the simplest schemes for description of rotational states, but also ones for solution of variation problems of vibronic states. The latter will be presented in the communication.

A1-08

FOURIER – TRANSFORM ABSORPTION SPECTRA OF $H_2{}^{16}O$, $H_2{}^{17}O$, AND $H_2{}^{18}O$ IN THE 8000–9500 cm^{-1} SPECTRAL REGION

A.D. Bykov,[1] O.V. Naumenko,[1] L.N. Sinitsa,[1] L.P. Vorobieva,[1]
C. Camy-Peyret,[2] J.-Y. Mandin,[2] and J.-M. Flaud[3]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
sln@iao.ru
[2]*Universite Pierre-et-Marie Curie, Paris, France*
camy@ccr.jussieu.fr
[3]*Universite Paris Sud, Orsay, France*

Theoretical treatment of $H_2{}^{16}O$, $H_2{}^{17}O$, and $H_2{}^{18}O$ FT absorption spectra recorded at the National Solar Observatory (Kitt Peak, AZ), at a total pressure of 1.5 and 17 Torr, and absorption path of 43396 cm between 8000 – 9500 cm^{-1} is presented[1]. Spectra assignment has been performed using both *ab initio* predictions[2], and calculations based on the effective Hamiltonian represented in the form of the Pade – Borel approximants[3]. Absorption spectra of the $H_2{}^{17}O$, and $H_2{}^{18}O$ molecules have been investigated for the first time, while the main isotope species spectrum has been already studied in details in Ref. 1. As a result 1149 rovibrational transitions were assigned to the $H_2{}^{17}O$, and $H_2{}^{18}O$ absorption leading to derivation of 536 precise energy levels for the (111), (210), (012), (031), and (130) vibrational states. About 2400 rovibrational transitions were identified in the $H_2{}^{16}O$ spectrum including the

(121) – (010), (201) – (010) hot bands transitions, the (210) – (000) HDO band lines, as well as transitions belonging to the ^{17}O and ^{18}O species. About 30% of new energy levels were derived for the main isotope species.

Transitions involving the highly – excited (050) and (060) states were also found in the analyzed spectra for all three isotopes. They borrow their intensities through resonance interactions with the (111) – (000) and (012) – (000) strong bands. The accuracy of the theoretical approaches applied will be discussed.

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A1-09

RADIATION BLOCK OF ICM RAS MODEL IN PROGRAM ICRCCM-III

V.Ya. Galin
Institute of Computational Mathematics RAS, Moscow, Russia
galin@inm.ras.ru

Project ICRCCM-III has a bearing on the calculation of flux and influx of solar radiation in the atmosphere in the presence of complex cloud formations in a single cell of integration of the models of total atmospheric circulation. Cases of the clouds of penetrating convection, frontal clouds, clouds of small convection, clouds from a set of experiments in the boundary layer etc. are considered. Clouds can be both consisting of drops and combined, distributed at the area about 400 × 400 km and having a complex configuration.

Calculations are performed by one-dimensional radiation codes from climatic models by the reduction of 3-dimensional structure of clouds to amounts and characteristics averaged over a cell, i.e., to the characteristics which are accessible to models. To estimate an accuracy of calculations the authors of the project recruit specialists in the Monte Carlo method which perform "accurate" calculations by 3-dimensional spatially inhomogeneous fields of clouds. The project pursues an end to obtain a concept on an accuracy of the algorithms of calculation of radiation fields in the atmospheric models and estimate the possibilities of models in reproduction of such complex cloud formations. The climatic model of ICM RAS successfully takes part in this project. In the paper our results will be shown comparing with others and accurate ones. Among 26 participants of the project with different radiation schemes the ICM RAS model looks very cogently accurate.

A1-10

MEASUREMENT OF MOLECULAR ABSORPTION SPECTRUM OF O_2 WITHIN 755–775 nm RANGE

I.S. Tyryshkin and Yu.N. Ponomarev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
yupon@asd.iao.ru

Table

Specifications of near IR laser spectrophotometer

I. Parameters of MPGC	
length, m	30
diameter, m	1
pressure range, mm of m.c.	$5 \cdot 10^{-5} - 10^{3}$
temperature range, K	288–350
II. Laser parameters	
tuning range, nm	720–780
width of radiation spectrum, cm^{-1}	$5 \cdot 10^{-3}$
repetition frequency, Hz	≤ 10
pulse length, s	$180 \cdot 10^{-9}$
pulse energy, J	≥ 0.1
III. Parameters of registration system	
error of line center determination, cm^{-1}	$\leq 5 \cdot 10^{-3}$
measurement error of gas cell transmission, %	≤ 1

The absorption spectrum of molecular oxygen within 755–775 nm wavelength range was measured with the help of laser spectrophotometer with the multipass gas cell providing the optical path length of more than 2 km.

The main specifications of the spectrophotometer are given in the Table.

The pure oxygen spectrum at different pressures (up to several Torrs) was recorded at discrete tuning of the alexandrite laser with the resolution no worse than $5 \cdot 10^{-3}$ cm^{-1}. All the recorded spectral lines were processed and the measured values of the line intensities and their halfwidths were compared with those available in the "HITRAN-86" database.

The cases of significant differences between line parameter values from the "HITRAN-86" and measured by us were identified and analyzed.

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A1-11
GENERALIZED EILER TRANSFORMATION OF DANHAM SERIES FOR DIATOMIC MOLECULE

T.V. Kruglova, A.D. Bykov, and O.V. Naumenko
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
bykov@iao.ru

To solve some problems in atmospheric spectroscopy one needs to know the spectral parameters for lines connected with transitions to highly excited molecule states. Vibration- rotation energy levels of a diatomic molecule are usually represented as Danham series that can diverge. Hence, one should use special methods to sum correctly these series. In the present report the results of application of well known Eiler series transformation for Danham series summation are presented. The exact solution of Kratzer oscillator is used as approximant.

A1-12
INTERACTION POLARIZABILITY OF TWO N_2 AND O_2 MOLECULES

M.A. Buldakov,[1] V.N. Cherepanov,[2] B.V. Korolev,[2] I.I. Matrosov[1]
[1]Institute for Optical Monitoring SB RAS, Tomsk, Russia
bvk@phys.tsu.ru
[2]Tomsk State University, Tomsk, Russia
vnch@phys.tsu.ru

The polarizability of pair $N_2 - N_2$, $O_2 - O_2$ and $N_2 - O_2$ molecules were considered when an approach of them is occurred. The classical electrostatic theory of Silberstein was used for tensor polarizability calculation of pair molecules. Within the framework of this theory the polarizability of pair molecules was calculated using the polarizabilities of isolated molecules, distances between molecules and there mutual orientation. The classical point dipole interaction theory of Silberstein was used to investigate different calculation methods for polarizability components of pair interacted N_2 and O_2 molecules. The comparison of results obtained with *ab initio* ones of other authors was done.

The polarizability tensor components of N_2 and O_2 molecule dimers at there equilibrium stable configuration were obtained.

A1-13
INTRAMOLECULAR INTERACTIONS ROLE IN RAMAN SCATTERING OF N_2 AND O_2 MOLECULES

M.A. Buldakov,[1] V.N. Cherepanov,[2] B.V. Korolev,[2] I.I. Matrosov[1]
[1]Institute for Optical Monitoring SB RAS, Tomsk, Russia
bvk@phys.tsu.ru
[2]Tomsk State University, Tomsk, Russia
vnch@phys.tsu.ru

In this paper the influence of anharmonic vibrations and vibration-rotation interactions on the matrix elements of polarizability tensor invariants of N_2 and O_2 molecules were investigated. The vibration-rotation Raman transitions $vJ \rightarrow v'J'$ ($v' = v + n$, $n = 0, 1, 2, 3$ and $J' = J$, $J \pm 2$) were considered. The matrix elements of polarizability tensor invariants of diatomic molecules were written as

$$\langle vJ|\alpha|v'J'\rangle^2 = F_{vv'}(m)\,\langle v|\alpha|v'\rangle^2,$$

where Herman-Wallis factor

$$F_{vv'}(m) = 1 + A_{vv'} + B_{vv'}m + C_{vv'}\,m^2$$

takes into account the vibration-rotation interactions within an accuracy to the order $(2B_e/\omega_e)^2$. Thereby the first and second polatizability derivatives of N_2 and O_2 molecules obtained by us before allowed firstly to determine the vibration-rotation interactions parameters $A_{vv'}$, $B_{vv'}$, $C_{vv'}$ $A_{vv'}$,$B_{vv'}$,$C_{vv'}$ for vibration-rotation Raman transitions considered above.

The analysis of intramolecular interactions influence on the Raman cross sections of N_2 and O_2 molecules has been carried out. The estimation of Q-branch Raman cross sections of N_2 and O_2 molecules for $v = 0 \rightarrow v = 3$ band unknown before has been made.

A1-14

NARROWING OF THE ABSORPTION LINE SHAPE AT HIGH PRESSURES

V.F. Golovko
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
gvf@lts.iao.ru

The super- and sub-Lorentzian behavior of the absorption in the infrared region was used to consider as one of the main theoretical problems of the line shape theory and it has many atmospheric applications at the radiation propagation. The description of the narrowing effect at high pressures is demonstrated on the example of absorption in the mixture CO_2-He for Q-, P-, and R-branches and for the head of the R-branch. The effect is represented in the approximation of the single line without the conventional line mixing. A narrowing function is introduced that links the absorption in the resonance region with the one in far wings. The parameters of this function have been found by the methods of probes and errors and they are used for prediction of the absorption at other mixing ratios and pressures. The pressure dependence of collisional halfwidths and the physical meaning of the narrowing are discussed.

A1-15

STUDY OF RADIATION SPECTRA OF MOLECULAR OXYGEN ARISING DURING THE RECOMBINATION OF O ATOMS IN CARBON DIOXIDE

L.E. Khvorostvskaya, I.Yu. Potekhin, and O.M. Anisimova
Physics Scientific Research Institute of St.Petersburg State University, St.Petersburg, Russia
ijp@svegapro.ru

In planet atmospheres consisting of CO_2 mainly the illuminations of molecular oxygen that is a secondary product of the process of dissociation of CO_2 and subsequent recombination of O atoms are observed. In spectra of atmospheric emissions in the oxygen Hertzberg bands at Venus the radiation from zero oscillation levels of electron-excited states is observed on the whole. Collision processes of CO_2 molecules with electron-excited molecules of O_2 in zero oscillation state are not studied at present also.

The study of O_2 radiation has been carried out in a gas discharge under the conditions of a hollow cathode in pure CO_2 of low pressure. High degree of CO_2 dissociation in the given type of discharge is caused by a specific function of distribution of electrons by energies. In the emission spectrum from the discharge in CO_2 in the region 450–700 nm the transitions from different oscillation states v' of the electron levels $O_2(A^3\Sigma_u^+, A'^3\Delta_u, c^1\Sigma_u)$ at $O_2(X)$ v'' (Hertzberg bands I, II, and III) have been separated. The most intensive transitions are the transitions from zero oscillation levels that corresponds to observations in the atmosphere of Venus. Conditions of the experiment are such that a contribution of recombination of O atoms into a population of states $O_2(A^3\Sigma_u^+, A'^3\Delta_u, c^1\Sigma_u)$ exceeds 90%. Within a sensitivity of a unit the radiation from the level $O_2(b)$ has not been observed. From absolute measurements of intensity in the transitions v'=o → v''=8,9,10,11 the populations of levels $O_2(A^3\Sigma_u^+, A'^3\Delta_u, c^1\Sigma_u)_{v'=0}$ have been determined. Suppression of the Hertzberg emissions from zero oscillation levels by CO_2 molecules has been studied and the constants of the rate of collision deactivation for T ~ 300 K have been determined.

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A1-16

LABORATORY MEASUREMENT OF TEMPERATURE DEPENDENCE OF THE CONSTANT OF DEACTIVATION RATE OF DEFORMATION OSCILLATION MODE CO_2 BY MONATOMIC OXYGEN OVER INTERVAL 206–340 K

L.E. Khvorostvskaya, I.Yu. Potekhin, and T.V. Uzyukova
Physics Scientific Research Institute of St.Petersburg State University, St.Petersburg, Russia
ijp@svegapro.ru

Heat balance of the atmosphere of Earth in neighborhood of the mesopause (heights 90–120 km) determines the rate of radiant cooling in the 15 μm band of CO_2. The absence of laboratory measurements of the rate constant for the process of collision deactivation of state $CO_2(01^10)$ by the monatomic oxygen K_{010} for the temperatures that are lower then 300 K has been up to the present a basic reason impeding the study of this mechanism of atmosphere cooling. In neighborhood of the mesopause T is essentially lower 300 K reaching sometimes 130 K. For the first time the rate constant K_{010} has been measured by the method of gas discharge with a hollow cathode in 1991 by our group for the temperatures about 300 K. In the given paper the measurements have been extended in the region of cryogenic temperatures.

The rate constant for deactivation of $CO_2(01^10)$ by the atoms $O(^3P)$ has been measured over the temperature interval 205–340 K in the glow gas discharge in CO_2 with a hollow cathode under the regime of thermostatting for the continuous monitoring of gas temperature. Detailed kinetic analysis has been carried out on the base of the experimental measurements of the component composition, optical and electric characteristics of discharge. Proposed kinetic model establishes the relations between the frequency of pulses of discharge power which is measured by the radiation intensity and the total probability of deactivation of oscillation states in discharge afterglow. Obtained temperature dependence of the rate constant for deactivation of $CO_2(01^10)$ by the atoms $O(^3P)$ K_{010} is not monotone and decreases with the increase of temperature from (1.60 ± 0.10) to $(1.35 \pm 0.10) \times 10^{-12}$ cm s^{-1}.

Authors acknowledge the Russian Foundation of Basic Research for the support of their work (Grant No. 99–05–64102).

A1-17

TEMPERATURE DEPENDENCE OF THE INTENSITY OF THE INDUCED ABSORPTION OF OXYGEN IN THE REGION OF THE HERZBERG PHOTODISSOCIATION CONTINUUM

M.B. Kiseleva, G.Ya. Zelikina, M.V. Buturlimova, and A.P. Burtsev
Physics Scientific Research Institute of St.Petersburg State University, St.Petersburg, Russia
mkiseleva@ak4748.spb.edu

In the present paper the results of the investigation of the temperature effect on the intensity of induced absorption of molecular oxygen in the region of the Herzberg photodissociation continuum (200 – 242 nm) are presented. For the first time the values of the binary absorption coefficient μ_{11} for gaseous oxygen were measured in the temperature range 110 – 200 K. It was found that as the temperature decreases from 295 to 110 K the values of μ_{11} increase by 45 %. The dependence $\mu_{11}(T)$ determined from the experiment was compared with corresponding dependences $\mu_{11}^*(T)$ obtained theoretically using the function of induced transition dipole moment M(r) in the exponential form and two different intermolecular potentials for $O_2 - O_2$ interaction – isotropic and anisotropic. Both curves $\mu_{11}^*(T)$ were found to fit the experimental data well enough, revealing the fact that consideration of anisotropy does not produce qualitative changing of the form of the curve $\mu_{11}^*(T)$. Along with the function M(r) in the exponential form, the more complicated function of induced transition dipole moment was which included the terms related to short-range interactions as well as to long-range interactions, resulting from interaction of the transient quadrupole moments. The choice of this function M(r) allowed to improve theoretical description of the temperature dependence of the binary absorption coefficient of oxygen in the whole temperature range studied.

A1-18

NARROWING OF UNRESOLVED DOPPLER – BROADENED MULTIPLETS BY INELASTIC COLLISIONS

V.P. Kochanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
koch@iao.ru

It was shown on the basis of the developed theory, that the inelastic collisions which lead to line mixing narrow unresolved Doppler – broadened multiplets, as a buffer gas pressure increases. In the case of pronounced line mixing, the narrowing caused by inelastic collisions enhances the Dicke collision line narrowing due to elastic collisions and can exceed it much times. It was found that the collision line narrowing and mixing lead to nonlinear dependence of a line shift on pressure, so that the shift can change its sign. It was shown that the line asymmetry caused by statistical dependence of collision and Doppler mechanisms of line broadening may serve as a sensitive indicator of line narrowing and mixing.

A1-19

DETERMINATION OF MAIN PARAMETERS OF MOLECULAR DIFFERENTIAL CROSS-SECTION ON THE BASIS OF LINEAR AND NONLINEAR SPECTROSCOPY

V.P. Kochanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
koch@iao.ru

It was shown with the aid of the developed theories of a nonlinear spectroscopy method and a collision line narrowing, that the diffraction scattering of molecules gives the main contribution in the width of nonlinear resonance in the region of low pressures, being negligible in the Dicke's line narrowing. As a result, after processing the data on certain spectral line obtained with methods of linear and nonlinear spectroscopy, it becomes possible to obtain nontraditional for spectroscopy quantitative data on total collision cross-sections, mean angles of diffraction of molecules, and its contributions into collision broadening constants and total collision cross-section. Thus, it is

possible to determine all the main characteristics of a differential collision cross-section, namely, its square (i.e. the total cross-section), a width and an amplitude of the narrow diffraction peak. These quantities are determined for the methane molecule.

A1-20

DEPENDENCE OF THE THERMOPHYSICAL PARAMETERS OF WATER VAPOR ON THE VIBRATIONAL STATES OF H_2O MOLECULE

A.E. Protasevich, V.I. Starikov, and V.P. Kochanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
star@lts.iao.ru

The dependence of the thermodynamic and transport properties of water vapor on vibrational quantum states (v1, v2, v3) of H_2O molecule is investigated. The dipole – dipole interaction between vibrationally excited H_2O molecules is taken into account by usage of the Stockmayer intermolecular potential. The ranges of variations of the thermodynamic parameters as functions of the value of H_2O dipole moment at different rotational – vibrational states have been established. It was found that the dipole moment of H_2O molecule is most sensitive to the excitation of the bending mode. This leads to the significant variations of the thermodynamic parameters of bending-excited water vapor. The diffusion and viscosity coefficients have been calculated for gas mixtures of vibrationally excited H_2O molecules with some other polar and nonpolar molecules.

A1-21

BROADENING AND SHIFT COEFFICIENTS AND THERMAL DEPENDENCE COEFFICIENTS FOR CARBON DIOXIDE LINES

N.N. Lavrent'eva, A.D. Bykov, and L.N. Sinitsa
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lnn@asd.iao.ru

Various problems of atmospheric physics, astrophysics, and laser physics require acknowledge of accurate spectral line shape parameters for carbon dioxide and its main isotopic species in a wide temperature range for different vibrational bands from the mid-infrared to visible spectral region.

The impact theory has been modified on the wider use of empiric data by introducing of the additional parameters taking into account the trajectory bending, effects of vibrational excitation, corrections to the scattering matrix obtained from the perturbation theory, etc. Model parameters were determined by fitting the broadening and shifting coefficients to experimental data. This allows sufficiently accurate prediction of the parameters of line profiles, which were not measured. When calculating the shifts, we used one more fitting parameter – the mean dipole polarizability in the excited vibrational state which is responsible for the contribution of the isotropic part of the potential to the shift value. The isotropic part, in its turn, is responsible for the vibrational dependence of the shift coefficient. We would like to note the presence of the strong vibrational effect. At excitation of three quanta of the asymmetric stretching mode, the polarizability changes from 2.601 to 2.683 A^3. At the same time, the shift of lines corresponding to the same rotational transitions changes more than three times.

The coefficients of CO_2 spectral lines broadening and shifting by air and nitrogen pressure are presented, as well as the coefficients of thermal dependence of line profiles. The calculated parameters are intended for use in spectroscopic databases.

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A1-22

STUDY OF THE WATER VAPOR LINE SHIFT BY N_2 PRESSURE FOR 011 AND 110 BANDS

A.M. Solodov and N.N. Lavrent'eva
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lnn@asd.iao.ru

Results of measurements and calculations of H2O line shifts in 5000–5600 cm^{-1} induced by N_2 pressure are presented.

The measurements have been performed with BOMEM DA3.002 Fourier-spectrometer with resolution of 0.007 cm^{-1} and optical path lengths of 84.05 m. The water vapor pressure does not exceed 1 Torr, N_2 pressure varies from 179 Torr to 1800 Torr. The values of line shift coefficients for more than 100 water vapor absorption lines have been obtained; their values are within 0.001 cm^{-1}/atm – 0.02 cm^{-1}/atm interval.

The water vapor line shift coefficients were calculated using the Anderson-Tsao-Curnutte impact theory: dipole-quadrupole, quadrupole-quadrupole, induction and dispersion interactions were taken into account. In the calculations one fitted parameter – the mean dipole polarizability of upper vibrational state – has been used. Besides semiempirical approach for lines broadening and shifting calculations has been used which includes different corrections for Anderson-Tsao-Curnutte approximation. The model parameters are determined to fit the experimental broadening and shifting coefficients, that allows the accurate predictions for contour parameters for lines not measured. Good agreement of calculated and experimental data has been obtained.

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A1-23

REDUCED EFFECTIVE VIBRATIONAL-ROTATIONAL HAMILTONIAN FOR GLOBAL FITTING OF PH_3 MOLECULE

E. I. Lobodenko
Institute of Atmospheric Optics, SB RAS, Tomsk, Russia
lena@lts.iao.ru

Within the framework of theory for the global treatment of the vibrational-rotational energy levels in the ground electronic state the effective Hamiltonian for PH_3 molecule has been written up to fourth order in Amat – Nielsen ordering scheme using symmetry arguments. PH_3 molecule is a four atomic molecule which has C_{3V} symmetry group. This molecule has four vibrational modes. Two of them $\omega_1(A_1)$ and $\omega_2(A_1)$ are nondegenerate modes and two others $\omega_3(E)$ and $\omega_4(E)$ are degenerate modes This effective Hamiltonian is based on the polyad scheme arising due to the approximate relations between the harmonic frequencies

$$\omega_1 \approx 2\,\omega_2 \approx \omega_3 \approx 2\omega_4\ . \tag{1}$$

Within this scheme a polyad can be labeled by a polyad number

$$P = 2V_1 + V_2 + 2V_3 + V_4\ . \tag{2}$$

An important feature of the polyad scheme is that the vibrational transitions belong to series corresponding to a given polyad quantum number difference ΔP. In the case of PH_3, according to Eq. (2), it means that for each series of transitions has to satisfy the condition

$$2\Delta V_1 + \Delta V_2 + 2\Delta V_3 + \Delta V_4 = \Delta P. \tag{3}$$

This Hamiltonian contains all resonance interaction terms within polyad scheme.

The effective Hamiltonian presented above is ambiguous because of the feasibility of small real unitary transformations

$$\tilde{H}^{\text{eff}} = e^{iS_{CT}} H^{\text{eff}} e^{-iS_{CT}} \tag{4}$$

which preserve its operator form but contribute considerably to its parameters. The transformations to the reduced form have been suggested.

A1-24

FLUORESCENCE OF THE ATMOSPHERE UNDER THE EFFECT OF RADIATION OF 5 HARMONIC OF ND:YAG LASER (212.8 nm)

M.M. Makogon and A.N. Kuryak
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
mmm@asd.iao.tsc.ru

Results of the experiments to reveal a nature of fluorescence of the atmosphere for the excitation by radiation of 5 harmonic of Nd:YAG laser are presented. The energy of radiation at the wavelength 212.8 nm has been 2 mJ for the duration of a pulse about 2 ns. Measurements have been carried out at the remote fluorescent spectrometer, the analyzed gas medium filled 3-meter cell. Fluorescence spectrum has been recorded with the double monochromator MDR-6, additional selection has been carried out by the measurement of temporal scanning in several successive intervals with the duration 50 nm. Signals have been recorded in the photon-counting mode.

Measurements of atmosphere fluorescence, gaseous nitrogen (obtained by the vaporization of liquid nitrogen), industrial oxygen, and water vapor (obtained by the vaporization of the medical water for injection) have been carried out. Measurements have been carried out for the temperature about 18 C.

Radiation of the atmosphere occurs the region 260–420 nm, the spectrum has a bell shape with the maximum about 330 nm. Under the conditions of the atmospheric pressure a signal is almost whole concentrated in the first 50-ns interval, a decrease of the pressure causes the lengthening of a signal, in this case a spectrum shape remains.

It is established that the atmosphere fluorescence is determined basically by the oxygen, for the atmospheric pressure the nitrogen and water vapor do not make an essential contribution in the air fluorescence, with a decrease of the pressure a contribution of the water vapor becomes more appreciable. Sections of the fluorescence of oxygen and water vapor and factors of its suppression have been measured.

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A1-25

NON-EQUILIBRIUM MIDDLE ATMOSPHERE RADIATION IN THE INFRARED RO-VIBRATIONAL WATER VAPOR BANDS

R.O. Manuilova,[1] V.A. Yankovskii,[1] O.A. Gusev,[2] A.A. Kutepov,[2] O.N. Sulakshina,[3] and Yu.G. Borkov[3]

[1]Physics Scientific Research Institute of St.Petersburg State University, St.Petersburg, Russia
manulova@snoopy.phys.spbu.ru
[2]Institute for Astronomy and Astrophysics, University of Munich, Munich, Germany
avk@kutepov.usm.uni-muenchen.de
[3]Institute of Atmospheric Optics SB RAS, Tomck, Russia
son@iao.ru

The new kinetic model of 13 excited vibrational levels of the H_2O molecule was developed. In the model all vibrational-translational (V-T) and vibrational-vibrational (V-V) processes of energy exchange at collisions of H_2O with N_2, O_2 and O, which are important at the atmospheric conditions, were taken into account. Different variants of possible values of the rate constants of non-elastic collisional processes were analyzed considering the new experimental data. The 33 ro-vibrational transitions forming 1.4, 1.9, 2.7, 3.2, 4.7, and 6.3 μm water vapor bands were taken into account. In addition to the spectroscopic information contained in HITRAN-92 the frequencies and intensities of 9 ro-vibrational bands were calculated with the purpose of creation of the entire spectroscopic data base for all 33 ro-vibrational bands. The calculations of the non-equilibrium populations of the vibrational levels of the H_2O molecule using the effective accelerated lambda-iteration technique gave the opportunity to consider the radiative transfer and absorption of the solar radiation correctly for the all spectroscopic lines of the 33 ro-vibrational bands. The calculated populations of the 13 excited vibrational levels of the H_2O molecule for the middle latitude in day- and night-time and examples of the calculated spectral limb radiation of the middle atmosphere are presented.

A1-26

NEW ANALYSIS OF ROTATION-VIBRATION SPECTRA OF HCL IN THE GROUND ELECTRONIC STATE

T.I. Velichko[1] and S.N. Mikhailenko[2]

[1]Academy of Architecture and Building, Tumen, Russia
[2]Institute of Atmospheric Optics, SB RAS, Tomsk, Russia
semen@lts.iao.ru

The importance of the analysis of HCl spectra is explained by two reasons. First of, all this molecule was detected in upper atmosphere of the Earth. Second, there are a lot of high precision data used as secondary spectroscopic standards for experimental technique and theoretical studies.

New mass-independent spectroscopic parameters have been obtained from a complete analysis of IR and MW data of six isotopic species of HCl molecule. Potential parameters have been derived. A complete calculation of all IR bands is presented. The influence of violation of the Born-Oppenheimer approximation on the calculation of molecular energy levels was studied.

A1-27

NEW ANALYSIS OF THE (211)/(140)/(310)/(004)/(103) INTERACTING STATES OF OZONE

S.N. Mikhailenko,[1] A. Barbe,[2] Vl.G. Tyuterev,[2] and J.J. Plateaux[2]

[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
semen@lts.iao.ru
[2]Universite de Reims, Reims, France
alain.barbe@univ-reims.fr

The 3800–4100 cm^{-1} and 2850–3000 cm^{-1} spectral ranges are revisited for an accurate determination of highly excited rotational levels of (211), (140), (310), (004) and (103) vibrational states of ozone. For calculations of these states were taking into account the Coriolis resonances between (103) and (004), (103) and (310), (211) and (140),

(211) and (310) states as well anharmonic resonance between (004) and (310) states. The set of more than 1600 experimental energy levels was determined from observed transitions with Jmax ≤ 55 and Ka max ≤ 20. The rotational energy levels of mentioned above vibrational states have been satisfactorily reproduced with an accuracy around 0.002 cm^{-1}.

These calculations will be interesting for the spectroscopic data banks. The complete line listing in the 3800–4100 cm^{-1} region is available on request from the authors.

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A1-28

ASYMPTOTIC BEHAVIOUR OF ROTATIONAL ENERGY LEVELS OF H_2O MOLECULE

V.I. Starikov and S.N. Mikhailenko
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
star@lts.iao.ru, semen@lts.iao.ru

The analytical model for asymptotic behavior of H_2O rotational energy levels with the quantum number Ka ($J/2 \approx Ka \leq J$) is proposed. The dependence of these levels on the vibrational quantum number V_i (i = 1, 2, 3) is taken into account.

The optimal set of the parameters for the proposed model was obtained from the simultaneous fitting of experimental rotational energy levels of different vibrational states ($V_1V_2V_3$) ($V_1 \leq 3$, $V_3 \leq 3$, and $V_2 \leq 6$) of water molecule.

The proposed model allows one to calculate the highly excited rotational energy levels with large values of quantum numbers J and Ka for correct identification of water emission spectrum.

The systematic comparison of obtained results with a variational calculations is discussed.

A1-29

ANOMALIES IN THE IR-SPECTRA OF HYDRIDES OF THE VIA GROUP ELEMENTS

V.I. Starikov,[1] Sh.Sh. Nabiev,[2] P.G. Sennikov,[3] and K.G. Tokhadze[4]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
star@lts.acad.tomsk.su
[2]*Russian Research Center "Kurchatov Institute", Moscow, Russia*
nabiev@imp.kiae.ru
[3]*Institute of Chemistry of High Purity Substances RAS, Nizhni Novgorod, Russia*
sen@hp.nnov.su
[4]*Physics Scientific Research Institute of St.Petersburg State University, St.Petersburg, Russia*
tokhadze@molspec.phys.lgu.spb.ru

The results of IR-absorption spectra investigation for volatile inorganic hydrides of VIA group elements in the gas phase and the in the liquid state over wide ranges of frequencies (9000–600 cm^{-1}) and temperatures (80–300 K) have been analyzed. A number of anomalies have been detected in the spectra of these hydrides manifesting themselves as an excursion in the behavior of the band intensity of fundamental and combined vibrations on the gas to condensed state transition.

Proceeding from the experimental data on the effective dipole moment parameters, the first, the second and the third derivatives of the dipole moment of a H_2S molecule in normal coordinates have been reconstructed. The values of the first derivative in the coordinates related to the valent vibrations are found to be anomalously small as compared to the derivatives of the higher order. It is shown, that the calculated values of these derivative are strongly dependent on the involved force field of the H_2S molecule.

The variation of the dipole moment of a H_2S molecule under the effect of intermolecular forces on the gas to liquid transition has been examined. It is shown that the anomalously strong (more than 200-fold) increase of the absolute intensity of the fundamental band, ν_{str}, related to valent modes, cannot be ascribed to anomalously strong intermolecular interaction forces. This increase is due to anomalously small first derivatives of the dipole moment of a molecule in the gaseous environment. A comparison was made with the action of intermolecular forces on the dipole moment of a H_2O molecule.

The study has been performed with the financial support from the Russian Foundation for Basic Research (Project No. 00–05–64919).

A1-30

BINARY MOLECULAR COMPLEXES OF SILICON TETRAFLUORIDE WITH WATER, METHANOL, AND DIMETHYL ETHER FROM THE IR SPECTROSCOPY AND QUANTUM CHEMICAL DATA

S.K. Ignatov,[1] P.G. Sennikov,[2] A.G. Razuvaev,[1] Sh.Sh. Nabiev,[3] and L.A. Chuprov[1]
[1]Nizhny Novgorod State University, Nizhny Novgorod, Russia
ignatov@ichem.unn.runnet.ru
[1]Institute of Chemistry of High-Purity Substances RAS, Nizhny Novgorod, Russia
sen@hp.nnov.su
[3]Russian Research Center "Kurchatov Institute", Moscow, Russia
nabiev@imp.kiae.ru

The molecular structure, binding energies, and vibrational spectrum of binary molecular complexes of silicon tetrafluoride with water, methanol and dimethyl ether molecules observed earlier by the IR spectroscopy in the low temperature (12–15K) inert matrices were studied with the quantum chemical electron correlated *ab initio* method (MP2) using the different basis sets up to 6–311++G(2d,2p). It was found that the molecular structure of these adducts is a trigonal bipyramide with the five-coordinated silicon atom and the donor-acceptor bond between silicon and oxygen. This structure is additionally stabilized by the hydrogen bonds between hydrogen and fluorine atoms. No local minima of the potential energy surface corresponding to the pure hydrogen-bonded structures were located. The estimation of the binding energy corrected by the basis set superposition error and the zero point energy are 6.5, 9.7, and 12.5 kJ/mol for the $SiF_4 \cdot H_2O$, $SiF_4 \cdot O(H)CH_3$, $SiF4 \cdot O(CH_3)_2$ complexes, correspondingly. The calculated IR shifts of the monomer molecules in the $SiF_4 \cdot H_2O$ and $SiF_4 \cdot O(CH_3)_2$ complexes are in a good agreement with the experimental values whereas the band 844 cm^{-1} observed under matrix isolation conditions in the case of $SiF_4 \cdot O(H)CH_3$ complex can not be unambiguously assigned in the framework of models used. The most probable explanation of this band is a formation of essentially anharmonic hydrogen bond O...H...F or even ionic structure $F...H^+...O^-$ resulting to the very large shifts of the H–F or O–H vibrations.

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A1-31

COMPLETE INTERMOLECULAR POTENTIAL ENERGY HYPERSURFACE OF COMPLEXES $CH_4 \cdot H_2O$ AND $SIH_4 \cdot H_2O$

S.K. Ignatov,[1] A.G. Razuvaev,[1] P.G. Sennikov,[2] and Sh.Sh. Nabiev[3]
[1]Nizhny Novgorod State University, Nizhny Novgorod, Russia
ignatov@ichem.unn.runnet.ru
[2]Institute of Chemistry of High-Purity Substances RAS, Nizhny Novgorod, Russia
sen@hp.nnov.su
[3]Russian Research Center "Kurchatov Institute", Moscow, Russia
nabiev@imp.kiae.ru

An original method of fast evaluation of the intermolecular interaction potential energy for a study of the potential energy hypersurface (PEHS) of weakly-coupled systems has been applied for a PEHS investigation in two types of systems where the major contribution into the interaction energy comes from Van der Waals forces. They are binary molecular complexes of methane and silane with water $CH_4 \cdot H_2O$ and $SiH_4 \cdot H_2O$. The distinctive feature of these systems is an extremely plain character of PEHS, its strong anharmonicity and the presence of feebly marked minima caused by weak undirected interactions of various origins.

In this work we analyze the complete PEHS of the molecular systems $CH_4 \cdot H_2O$ and $SiH_4 \cdot H_2O$ with the method of adaptive scanning. The method consists in the calculation of the system energy in uniform mesh points on PEHS with subsequent interpolation and more accurate definition of the mesh near the interpolation function minima. By this strategy we investigated complete PEHS movements of an H_2O molecule participating in the formation of binary complex $X \cdot H_2O$ ($X=CH_4$, SiH_4) in respect to molecule X with the frozen internal molecular structure of monomers. The energy was calculated by the quantum-chemical method in approximations of various levels up to MP2/6-311++G(2d,2p). All the results were obtained with the adaptive scanning program ADANIMEHS specially developed for this study. The PEHS analysis data were compared against the observed PEHS parameters of the system CH_4+H_2O obtained on the basis of the available microwave spectroscopy data.

The work has been performed with the financial support from the Russian Foundation for Basic Research (Project codes 00–03–32094 and 00–05–64919)

A1-32

STRUCTURALLY NONRIGID MOLECULAR COMPLEXES OF WATER WITH ATMOSPHERIC GASES: PROBLEMS, APPROACHES, SOLUTION

Sh.Sh. Nabiev,[1] N.A. Zvereva,[2] S.K. Ignatov,[3] P.G. Sennikov,[4] V.I. Starikov,[5] K.M. Firsov,[5] B.A. Fomin,[1] E.A. Zhitnitskii,[1] and Yu.N. Ponomarev[5]

[1]Russian Research Center "Kurchatov Institute", Moscow, Russia
nabiev@imp.kiae.ru
[2]Tomsk State University, Tomsk, Russia
zvereva-natalia@aport.ru
[3]Nizhny Novgorod State University, Nizhny Novgorod, Russia
ignatov@ichem.unn.runnet.ru
[4]Institute of Chemistry of High Purity Substances RAS, Nizhny Novgorod, Russia
sen@hp.nnov.su
[5]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
yupon@iao.ru

Chemically active and toxic molecules of the man-made origin interact easily with basic atmospheric gases and, first and foremost, with water vapor. Hence, molecular complexes with participation of water are likely to be formed in the atmosphere alongside with the products of chemical/photochemical reactions proper. The energy of these complexes may vary from several tens of calories up to several kilocalories and their optical activity may be rather high. Therefore these compounds may cause additional radiative losses in the atmosphere of industrial regions and variations of solar radiation fluxes. Vapor-phase complexes feature several forms of large amplitude motions (LAM), which results in the transformation of the spectra of their constituents and the appearance of new bands responsible for intermolecular vibrations. These factors pose serious difficulties for detection and validation of the concentration of complexes in atmosphere with remote laser sounding.

The conditions of the formation of the above-mentioned complexes, which are stable and long-lived in free atmosphere, as well as their spectroscopic characteristics, which would make the basis for effective diagnostics of these ecologically hazardous compounds, are little studied for today. Besides, the presence of several LAMs in these complexes prevents the researchers from restricting themselves with the traditional views on the mechanics and geometry of polyatomic molecules. Therefore the solution of tasks concerning the spectra and the structure of such systems lies in the use of unconventional experimental and theoretical approaches.

This work discusses the possibilities of acquisition of new fundamental data on structurally non-rigid molecular systems being accumulated in atmosphere as a result of anthropogenic activity with the use of special integrated experimental (multiwave Fourier- and laser spectroscopy of electron-vibration-rotational transitions) and theoretical (quantum chemistry, the theory of intra- and intermolecular interactions) approaches and the analysis of the contribution from the molecular complexes into atmospheric radiating processes with the application of advanced methods of fast calculation of optical characteristics of atmosphere.

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A1-33

METHODICAL FEATURES OF THE CALCULATIONS OF STRUCTURAL, ENERGY AND SPECTROSCOPIC PARAMETERS OF NONRIGID COMPLEXES $(HHAL)_N...(H_2O)_M$ (HAL=F,CL; N+M≥2) IN AN ATMOSPHERE

N.A. Zvereva,[1] Sh.Sh. Nabiev,[2] and Yu.N. Ponomarev[3]

[1]Tomsk State University, Tomsk, Russia
zvereva-natalia@aport.ru
[2]Russian Research Center "Kurchatov Institute, Moscow, Russia
nabiev@imp.kiae.ru
[3]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
yupon@iao.ru

Comparative *ab initio* calculation for intermolecular complexes $(H_2O)_n...(HCl)_m$ and $(H_2O)_n...(HF)_m$ $(n+m \geq 2)$ using the software package MONSTERGAUSS are performed. For calculations the split-valence 6–31G** basis containing polarization functions on all atoms was chosen. The frequencies of intermolecular and intramolecular vibrations, energies of interaction and stable configurations of these complexes were determined. On the basis of the analysis of the received results the conclusion is made. The stability of a complex $(H_2O)_m ... (HCl)_n$ $(n + m \geq 2)$ is much lower than stability of a complex $(H_2O)_m ... (HF)_n$ $(n + m \geq 2)$.

The accuracy of the calculated geometric parameters in comparison with the experimental data and calculation on Müller-Plesset perturbation theory of second order (MP2) is ~0.01–0.02 Å for intramolecular distances r, and

~0.12 Å for intermolecular distances R, for intramolecular deformation angles the accuracy is ~1.5, for intermolecular deformation angles accuracy is ~1.5°– 10°. Harmonic force constants calculated at the RHF level for molecular systems are overestimated by ~10–20 % and harmonic vibrational frequencies – by 5–10 %. Allowance made for electronic correlations in the method of configuration interactions (CI) or in the Moller-Plesset perturbation theory of second order (MP2) brings about reducing the normal vibrational frequencies by ~4 %. However, the values of bond vibrational frequencies remain to be overestimated in contrast to the experimental ones (for instance, for H_2O molecules and HF divergence of frequencies is ~200 cm^{-1}).

The given work suggests correcting the oscillatory frequencies using a single-line calibration function

$$\nu_{corr} = a\,\nu_{calc} + b$$

The value of average absolute deflection of the predicted values from the experimentally observed harmonic frequencies of H_2O, HF and HCl is ~50 cm^{-1}. The interaction of complex molecules results in long-wave shift and new low frequencies belong to intermolecular vibrations.

The study has been performed with the financial support from the Russian Foundation for Basic Research (Project No. 00–05–64919)

A1-34

CALCULATION OF LINE INTENSITIES OF THE ACETYLENE MOLECULE IN THE 13.6 μm REGION WITHIN THE FRAMEWORK OF THE EFFECTIVE OPERATORS METHOD

V.I. Perevalov,[1] O.M. Lyulin,[1] and J.-L. Teffo[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
vip@asd.iao.ru
[2]Université Pierre et Marie Curie, Paris, France

The simultaneous fitting of observed[1,2] line intensities in the cold and hot bands of acetylene lying in the 13.6 μm region has been performed within the framework of the method of effective operators. The μ_5 parameter of the effective dipole moment operator has been derived. This parameter allows for reproducing the line intensities of 440 lines of the five bands: ν_5, $2\nu_5^0 - \nu_5^1$, $2\nu_5^2 - \nu_5^1$, $\nu_4^1 + \nu_5^{-1} - \nu_4^1$, $\nu_4^1 + \nu_5^1 - \nu_4^1$, with a root mean squares of the residuals equal to 5%. Such a deviation corresponds to the accuracy of the line intensity determination in Refs. 1, 2. The eigenfunctions of the effective Hamiltonian developed for the global treatment of the vibration-rotation line positions of acetylene[3] have been used in the fitting. A comparison between our predicted line intensities in the above bands with those presented in HITRAN-2000 exhibits considerable disagreements for high values of J quantum numbers.

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A1-35

ABSORPTION COEFFICIENT IN THE 1.4, 2.7 AND 4.3 μM CO_2 BAND WINGS

L.I. Nesmelova, O.B. Rodimova, and S.D.Tvorogov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
rod@iao.ru

Spectral behavior of the absorption coefficient in the 1.4, 2.7, and 4.3 μm CO_2 band wings is described making use of the spectral line wing theory developed by the authors. As is known, according to this theory the expression for the absorption coefficient includes the quantum intermolecular interaction potential of two molecules, which is fitted by the inverse power of the separation in a bounded interval of separations. The corresponding parameters are extracted from the comparison between calculated and experimental absorption coefficients. The emphasis is centered on the differences in quantum interaction potentials describing the absorption in the wings of different bands.

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A1-36

TEMPERATURE DEPENDENCE OF THE WATER VAPOR CONTINUUM ABSORPTION COEFFICIENT

L.I. Nesmelova, O.B. Rodimova, and S.D. Tvorogov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
rod@iao.ru

Temperature dependence of the absorption coefficient in the line and band wings is determined by the temperature dependence of intensities and half-widths and, besides, according to the line wing theory, by the

temperature dependence of the averaged intermolecular interaction potential. In the present work the experimental data on the water vapor absorption coefficients at different temperatures in the 8–12 μm region are used to obtain the temperature dependence of the averaged intermolecular interaction potential represented as the Lennard – Jones potential. The temperature dependence of the potential parameters is compared to that obtained in the literature from the analysis of the second virial coefficient data.

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A1-37
LINEWIDTH COEFFICIENTS INDUCED BY N_2 AND O_2 PRESSURE IN THE $3\nu_3$ BAND OF METHANE

V.N. Saveliev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
savel@asd.iao.tsc.ru

Linewidth coefficients of the CH_4 molecule are calculated within the framework of Anderson-Tsao-Curnutte theory. We consider the line-width coefficients for the $3\nu_3$ band of methane broadened by N_2 and O_2. Calculations of the coefficients for the transitions belonging to the F_1 and F_2 species can be easily performed, though there are difficulties in the orthogonalization of rotational wave functions of the A and E species. In this work the compact symmetry-adapted-wave functions for the A_1, A_2, E species derived by Cheglokov, Ulenikov, and Itano are used. Formulas for the interruption functions for a variety of interactions were earlier derived by the author of Ref. 1. These interactions are octopole-quadrupole, octopole-octopole, hexadecapole-quadrupole, hexadecapole-hexadecapole and dispersion. These expressions were used to calculate line-width coefficients for transitions belonging to the A_1, A_2, E, F_1, F_2 species in the $3\nu_3$ band of CH_4.

The contribution of different interactions to line broadening is determined. The resultes are compared with the literature data. Using of the complete orthonormal set of functions leads to the difference in the width coefficients for lines of the A_1, A_2, E species. A contribution of multipole interactions to the linewidth coefficients is less than 5–6%, and reaches 10–15% only for several lines. The J-dependence of linewidth coefficients is determined.

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A1-38
MESUREMENTS OF COLLISIONAL BROADENING AND NARROWING FOR H_2O DOUBLETS NEAR 2000 cm^{-1}

V.N. Saveliev, N.N. Lavrentieva, and L.N. Sinitsa
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
savel@asd.iao.tsc.ru

A few resolved and unresolved H_2O doublets near 2000 cm^{-1} broadened by N_2 and Ar have been recorded with the Fourier transform spectrometer of Paris VI University with the spectral resolution of 0.005 cm^{-1}. The measurements were made for gas mixture pressures ($P(H_2O)$ = 0.366–12 Torr and $P(N_2)$=0–400 Torr, P(Ar) = 0–700 Torr).

As apparatus function of Fourier transform spectrometer close to the Doppler line shape it has been possible to determine it with an accuracy high enough to analyze the pressure broadened absorption line profiles and to find the deviations from the Voigt profile. The apparatus function was determined as the sum of two gaussians by using low pressure CO reference lines recorded simultaneously with H_2O ones..

The line parameters were determined by nonlinear least-squares fitting of a calculated line, described by the Rautian-Sobelman profile, to the measured one. The N_2-broadening and Ar-broadening coefficients have been deduced for the different gas pressures. The narrowing parameter has been determined for some lines. Calculations of N_2-induced linewidth coefficients were performed using Anderson-Tsao-Curnutte theory considering dipole-quadrupole, quadrupole-quadrupole, induction and dispersive interactions.

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A1-39
HIHGTEMPERATURE SPECTRUM OF WATER VAPOR IN 1.2 SPECTRAL REGION

N.Y. Karpova, T.M. Petrova, V.I. Serdyukov, and L.N. Sinitsa
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
petrova@asd.iao.ru

This work is devoted to the water vapor analysis in the near IR-region. The water vapor spectrum was studied using intracavity laser spectrometer in 8250–9100 cm^{-1} region with the spectral resolution of 0.05 cm^{-1} and at temperature of 1000 K. The spectra identification was done. More that 10 vibrational bands were obtained

($\nu_1+\nu_2+\nu_3$, $2\nu_1+\nu_2$, $\nu_2+2\nu_3$, $\nu_1+3\nu_2$, $3\nu_2+\nu_3$, $\nu_1+2\nu_2+\nu_3-\nu_2$, $4\nu_2+\nu_3-\nu_2$, $2\nu_1+2\nu_2+\nu_3$-, $\nu_1+4\nu_2-\nu_2$, $2\nu_1+\nu_2-\nu_2$, $2\nu_1+\nu_3-\nu_2$ and $2\nu_2+2\nu_3-\nu_2$).

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A1-40

INTRACAVITY SPECTROSCOPY OF CARBON-CONTAINING MOLECULES IN PLASMA

T.M. Petrova, Yu.A. Poplavskii, and L.N. Sinitsa
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
petrova@asd.iao.ru

The given paper is devoted to the investigation of plasma absorption spectra of carbon-containing molecules. Molecules C_x, C_xH_y, CO_2 (x and y are integer) is of importance in the combustion processes, for diamond film deposition, in processes of the atmospheric chemistry. However, up to recent time we had insufficiently data on the kinetics of reactions even for the very simple carbon-containing molecules in gas phase. The reason of it consists of the difficulty of obtaining of such molecules under the good controlled conditions.

In the present paper obtaining the molecules in excited states with a laser flare on the intracavity spectrometer at the glass with neodymium the absorption spectra of some carbon-containing radicals and stable molecules have been recorded. It has been revealed that in the range of laser radiation on the glass with neodymium the electronic spectra of C_2, OH, CH, C_3 are observed.

The work is supported by the Russian Foundation of Basic Research (No. 99–03–33210).

A1-41

AN EXACT VIBRATION-ROTATION HAMILTONIAN FOR AMMONIA LIKE MOLECULES

A.S. Skalozub[1] and J. Makarewicz[2]
[1]Ukrainian State Chemical & Technological University, Dnepropetrovsk, Ukraine
skalozub@cyberworld.dp.ua
[2]A. Mickiewicz University, Poznan', Poland
jasiu@rovib.amu.edu.pl

Internal valence coordinates defined by chemical bonds, interbond angles and dihedral angles are a better choice than normal coordinates if large-amplitude intramolecular motions have to be considered. A problem of constructing the exact vibration Hamiltonian in these coordinates for arbitrary molecules was solved by us in Ref. 1. However, for highly symmetric molecules like NH_3, it is not always possible to choose the valence coordinates in accordance with the bonding pattern in a molecule. In this case, such coordinate sets are not complete. They do not span the full configuration space since they cannot distinguish a given configuration from inverted one. As a consequence, the inversion motion of NH_3 cannot be described by using these coordinates. So, for solving the inversion problem in ammonia like molecules we have entered a new set of internal coordinates and a such molecular axis system for which the total vibrational angular momentum of the nuclei equals to zero. A new exact vibration-rotation Hamiltonian has been derived for these coordinates. Preliminary variational calculations of the vibrational spectrum, which are obtained from the *ab initio* potential energy surface of NH_3, will be presented.

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A1-42

ANALYSIS OF THE VIBRATIONAL DEPENDENCE OF H_2O MEAN POLARIZABILITY

V.N. Stroinova[1] and V.M. Mikhailov[2]
[1]Tomsk Polytechnical University, Tomsk, Russia
vns@mmlab.cctpu.edu.ru
[2]Institute of Atmospheric Optics SB RAS, Tomsk, Russia

In the paper the conception of Pade-approximants in the framework of broadening theory of spectral lines was presented as an example of the generation of effective polarizability operators in excited vibrational states of three atomic quasi-rigid molecules. This conception is a part of the theory of linked ordering schemes of intra- and intermolecular interactions in polyatomic molecules. In the framework of the theory of linked ordering schemes in the limited ordering scheme corresponding to super excited oscillator model the vibrational dependence of mean polarizability for H_2O molecule in the form of Taylor series on the power of vibrational quantum numbers is proved. Taylor series was summed up using Pade-approximants technique. Thus, new analytical expressions and numerical results are obtained for the vibrational dependence of mean polarizability of H_2O molecule.

A1-43

PARAMETERS OF THE DIPOLE MOMENT FUNCTION FOR ISOTOPE $^{18}O_3$ OF OZONE MOLECULE

O.N. Sulakshina,[1] Yu.G. Borkov,[1] A. Barbe,[2] Vl.G. Tyuterev,[2] and A. Chichery[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
son@iao.ru
[2]Universite de Reims, Reims, France

The parameters of the dipole moment function for isotope $^{18}O_3$ including third order contributions have been evaluated from new available experimental data The spectra for this isotope were recorded with the Fourier transform spectrometer of Reims, France, in the group of Molecular Spectroscopy and Atmosphere.

The calculations were based on the formalism of effective dipole moment operators. This method allows one to recover the derivatives of the dipole moment function from model parameters using the perturbation formulas. The transition moment parameters determined from experimental intensities using a least-squares fitting have been taken like input data. It must be emphasize that the dipole moment function with optimal choice of signs for the ozone molecule O_3 were determined by authors of Ref. 1.

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A1-44

ESTIMATION OF THE LINE INTENSITIES FOR HOT BANDSIN THE 6.3 μm REGION FOR WATER MOLECULE

O.N. Sulakshina,[1] Yu.G. Borkov,[1] and R.O. Manuilova[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
son@iao.ru
[2]St.Petersburg State University, St.Petersburg, Russia

For investigation of kinetics of vibrational states of water in the middle atmosphere and non – LTE emissions a renovation of the spectroscopic data was done. The estimations of line intensities for hot bands in the region 1500–2100 cm^{-1} of water have been performed.

The hot bands in this region include the transitions from the energy levels of the first triad to energy levels of the second triad (110, 011, 030). The line position calculations were realized taking into account the Generating function model. The transition moment parameters were recalculated using dipole moment derivatives determined by the authors of this work.

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A1-45

PECULIARITIES OF GENERATION OF OA SIGNALS IN ABSORBING CELLS OF SMALL AND LARGE DIMENSIONS AND THEIR DEPENDENCE ON EXPERIMENT CONDITIONS

B.A.Tikhomirov and A.B.Tikhomirov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
boris@ra9hai.tomsk.ru

Detailed study of the methodological questions of experimental investigations allows us to carry out a correct interpretation of the measurement results and more effectively make the subsequent experiments.

In present paper the methodological questions of the optical-acoustic (OA) measurements of the factors of resonant and nonresonanse absorption of radiation by molecular gases and the constants of the relaxation of excited molecules with laser sources of UV, visible, and IR spectral ranges for different pressures of studied gases and the laser radiation parameters are discussed.

In particular, it is shown based on the solution of balance equations for the level populations that for the excitation of molecules at the oscillation levels of energy which are lain highly by the amplitude-modulated radiation the contributions into the periodic OA signal of the pressure from the subsequent transitions of molecules from top to down are carried out with the lesser effectiveness then from previous collisional transitions. Owing to it the dependences of sensitivity of OA detector on the pressure of gas in a cell and the frequencies of radiation modulation for the composite oscillation bands of absorption and overtones (multi-level models) differ essentially from analogous dependences for the lowest oscillation state (two-level model).

It is established that during the excitation of molecules by a short radiation pulse in the cylinder cells with a small diameter (d ~ 1 cm) equally with "thermal" and "audible" OA signals[1] the OA pulse of "propagation" of a sound from laser beam to microphone which acts at the membrane of microphone in the first instance effects essentially at the shape of a signal of OA detector.

Advantages of the use of the method of electric activation in OA measurements of the molecular absorption factors and the constants of relaxation of excited molecules are demonstrated.

Design of OA detectors with the spatial-temporal resolution of signals which, in opinion of authors, allows us to reach a sensitivity by the absorption factor $k_v^{min} \sim 10^{-12}$ cm^{-1} for the energy of laser pulse 1 J are discussed.

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A1-46

RADIATION SPECTRUMS OF A FLAME AT COMBUSTION OF WOOD MATERIALS

R.Sh. Tsvyk[1] and A.A. Dolgov[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
tsvyk@iao.ru
[2]Tomsk State University, Tomsk, Russia

The paper presents the results of measurements of radiation spectrums at combustion the fallen of trees (cedar, pine, birch) in the spectral range 0.4–6 microns. The monochromator MDR-6 with diffraction gratings from 1200 up to 75 strokes was used. Time of scanning of a spectrum with one diffraction grating 6 seconds. The flame (combustion of products of a pyrolysis) is exhibited, that is not a stimulus source of an ideal black body. On a background of solid radiation heated aerosol particles the strong lines of radiation heated are watched products of combustion, basically CO_2, H_2O. Specter of radiation in IR area is close to a radiation spectrum of a gas burner. Specter of radiation of a condensed phase is close to radiation of an ideal black body.

The work was supported by Russian Foundation for Basic Researches (Project No. 00–02–16747).

A1-47

PROPERTIES OF LOW-FREQUENCY IR ABSORPTION SPECTRA OF SOME POLYCYCLIC HYDROCARBONS

Yu.S. Demchuk,[1] A.E. Vandyukov,[2] and E.A. Vandyukov[1]
[1]State Institute of Applied Optics, Kazan, Russia
postmaster@gipo.kazan.ru
[2]Arbusov's Institute of Organic and Physical Chemistry, Kazan, Russia
sasha@iopc.kcn.ru

The attention of astrophysicists to optical and spectral properties of polycyclic aromatic hydrocarbons (PAHs) is due the problem of identifying the diffuse bands being in IR spectra of an interstellar medium.[1,2] Various hypotheses on possible states of PAHs in astrophysical objects have been voiced, one of which supposes the presence of molecular associates (aggregates) or microcrystalline patches in small carbon particles. Associates of polyatomic molecules are the intermediate link between a crystalline state of a substance and a dissolved state of molecules. The comparison of laboratory investigations data on PAHs IR spectra and astrophysical measurements data can confirm or refute one or the other hypothesis on the origin of diffuse bands in IR spectra of an interstellar medium.

The report presents the results of investigating the regularities in IR absorption spectra of the following PAHs: naphtalene, anthracene, phenantrene, pyrene, and coronene in fine-dispersed state in KBr matrices, polyethylene and vaseline oil according to the procedure.[3] The investigation of PAHs IR spectra were performed with IR Fourier spectrometer Bruker IFS-66v. Results of the fine-dispersed state investigations are compared with the data for the same molecules in the dissolved state.[4] The formation of associates or fine-dispersed states of PAHs is found to be characterized by own spectral properties other than those of free or dissolved molecules. It should be referred to them:

1. Appearance of IR bands at composite vibrations with participation of molecule deformational vibrations.
2. Presence of a doublet structure of some bands.

The spectral regularities of a PAHs fine-dispersed fraction in dependence on temperature and concentration in the large range of their changes are found. The investigations of PAHs fine-dispersed samples by powder X-raying did not allow to separate structure changes to explain the distinctive spectral properties of fractions. To explain the peculiar distinctive properties of PAHs fine-dispersed states spectra, the representations about the Van der Waals weak interaction between neutral molecules of polycyclic aromatic hydrocarbons are used.[5]

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A1-48

USE OF MODIFIED MODEL OF SYMMETRIC GYROSCOPE TO ANALYZE THE HIGH-TEMPERATURE SPECTRA OF WATER VAPOR

O.K. Voitsekhovskaya, A.A. Kotov, and V.N. Cherepanov
Tomsk State University, Tomsk, Russia
vok@elefot.tsu.ru

Supposition on a possible transformation of a molecule (symmetric ←→ asymmetric) during the thermal or optical excitation which was not used earlier in the molecular spectroscopy has served as a base of proposed paper. A new model has been constructed to interpret the high-temperature spectrum of molecules of asymmetric gyroscope type. In high-exited oscillation-rotation (OR) states with the rotation quantum numbers $j \approx k_a$ the Hamiltonian of a molecule is written as the Hamiltonian of symmetric gyroscope in Pade-form. To determine the constants of new model Hamiltonian the processing of the energy levels with values of the rotation quantum numbers $J < 20$ which are known from the experiment for standard temperatures (T = 296 K) for the water vapor molecule (which traditionally is related to asymmetric gyroscope) has been performed for the first time. It allows us to predict the levels up to $J \cong 40$ and $K (\cong K_a) > J/2$. For exceptional simplicity of the model (the levels are calculated by the fraction-rational analytic expression) the calculation error of energy levels is compared with the error of the experiment for prediction of OR energies. Accentuate that the similar event is impossible for the traditional model used for the water vapor molecule since in the approximation of asymmetric gyroscope the OR levels are found by the numerical diagonalization of Hamiltonian matrix only. Preliminary testing of calculations for the proposed model has been performed, and the identification of OR lines in the high-temperature spectra (published in the literature and presented to the authors by foreign colleagues) has been refined.

A1-49

REANALYSIS OF WATER VAPOR SPECTRA IN THE 9500–11500 cm^{-1} SPECTRAL REGION

A.D. Bykov,[1] O.V. Naumenko,[1] L.N. Sinitsa,[1] B.A. Voronin,[1] C. Camy-Peyret,[2] J.-Y. Mandin,[2] and J.-M. Flaud[3]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
bor@asd.iao.ru
[2]*Universite Pierre et Marie Curie, Paris, France*
[3]*Universite Paris Sud, Orsay, France*

Water vapor Fourier-transform spectra recorded at the National Solar Observatory (Kitt Peak, AZ), at a total pressure of 1.5 and 17 Torr, and absorption path of 43396 cm between 9500 and 11500 cm^{-1} were revisited[1] for the purpose of identifying weak absorption lines not included into the previous study. Recent high accuracy ab initio calculations by Partridge and Schwenke[2], as well as our own predictions of line positions and intensities within the effective Hamiltonian method were used in the spectrum analysis. As a result more than 35% of new energy levels belonging to the first decade resonating states were derived including that for the (140) and (060) states. Several energy levels of the highly excited (070) state were also retrieved from the transitions borrowing their intensities via strong local interpolyad resonance with the (121) and (220) states. Large number of lines were attributed to the $H_2{}^{17}O$ and $H_2{}^{18}O$ absorption as well as to the (131)–(010) and (211)–(010) $H_2{}^{16}O$ hot band transitions. Overall more than 4000 absorption lines were identified in the analyzed spectral region.

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A1-50

THEORETICAL DESCRIPTION OF THE PHOTODISSOCIATION SPECTRUM OF MONOMER AND DIMER FORMS OF WATER

N.A. Zvereva
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
zvereva@phys.tsu.ru

The theoretical research of electronic absorption spectra caused by transition on repulsive electronic term (A^1B_1) for a monomer and dimer of water is carried out. For description of cross absorption section in a continuous spectrum the model of linear potential $U(x) = E(R_0) - Fx$ ($x = R - R_0$ – coordinate counted from equilibrium internucleus distance R_0) is offered. At that potential the repulsive term of the excited electronic state is described with the help of Eiri functions (as the decision of the Schrцdinger equation in a homogeneous field). The form of potential $U(x)$ is determined using *ab initio* calculated potential energy $U(x)$ for the appropriate $x = R - R_0$. The cross sections of potential surfaces of the low electronic states are determined from the *ab initio* calculations using methods Hartree-Fock (HF), configuration interaction (CI) and multiconfiguration interaction (MC SSP). On the basis of the analysis of influence of various oscillatory modes on the form of complete absorption section the monomer of water and mixing of various oscillatory modes at the formation of water dimer and also analysis of change of electronic density for $S_0 \rightarrow S_1$ transition at movement along coordinate of reaction is established validity of offered model for the description photodissociation spectra (for the first band of absorption) monomer and dimer forms of water. The dependence of cross section of absorption on frequency of radiation ω for monomer and dimmer form of water is obtained. The comparison of cross section of absorption of a water molecule calculated using the offered model with experimental cross section of absorption and cross section of absorption designed at replacement of Eiri functions on δ-function is done. The good enough consent the results received within the framework of model using the Eiri functions with the experimental data is marked. The replacement of Eiri functions on δ-function results in more significant deviation of the form of a absorption band from experimental one. For water dimer $(H_2O)_2$ absorption band have the same unstructured form as for a water monomer. The shift of the absorption band (with maximum at $\lambda \sim 162$ нм) into short lengths of waves in comparison with of water monomer H_2O ($\lambda \sim 167$ нм) is observed.

A1-51

CALCULATION OF VIBRATIONAL LEVELS OF METHANE FROM *AB-INITIO* POTENTIAL ENERGY SURFACE

A. Nikitin[1] and J. Makarewicz[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
[2]Mickiewicz University, Poznan, Poland

The Gaussian94 program was used for calculation 11000 points in CCSD(T) method in conjunction with cc-pVTZ basis set. The methane *ab-initio* energy surface was determined in several forms using symmetry internal mass dependent and mass independent coordinates. The cubic force constants have been derived. The kinetic energy operator have been determined in terms of internal coordinates. Several algorithms have been applied for vibrational levels calculation. Localized and delocalized basis sets for the expansion of the total wave function ware proposed and convergence of the variational method was investigated.

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A1-52

ANALYSIS OF FOURIER – TRANSFORM SPECTRUM OF $H_2{}^{17}O$ MOLECULE IN THE 11600–14550 cm^{-1} SPECTRAL REGION

A.D. Bykov,[1] O.V. Naumenko,[1] L.N. Sinitsa,[1] L.P. Vorobieva,[1]
C. Camy-Peyret,[2] J.-Y. Mandin,[2] and J.-M. Flaud[3]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lily@asd.iao.ru
[2]Universite Pierre et Marie Curie, Paris, France
[3]Universite Paris Sud, Orsay, France

This contribution represents the theoretical analysis of the $H_2{}^{17}O$ molecule absorption spectrum in the 11600–14550 cm^{-1} spectral range recorded for the first time at the National Solar Observatory (Kitt Peak, AZ) at a total pressure of 1.5 and 17 Torr, and absorption path of 43396 cm. The spectrum is formed by transitions involving vibrational states belonging to the second decade and first pentadecade, and represents a weak absorption, that is why the accurate predictional calculations are needed to identify it. Partridge and Schwenke[1] database was used in the spectrum assignment. As a result, 99 energy levels for the (211), (013), and (112) second decade vibrational states were derived, as well as 195 energy levels for the (221), (301), (103), and (400) belonging to the first pentadecade.

All investigated vibrational states seemed to be strongly perturbed through rovibrational and anharmonic interactions with other "dark" states. In particular, separate transitions involving energy levels of the highly excited (071) state were found in the spectrum stealing their intensities from stronger line-partners of the (301)–(000) band. On the whole, the new information obtained completes and verifies the existing databases on water vapor absorption in the spectral range under study.

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A1-53

SPECTRAL-PHOTOMETRIC GAS ANALYZER

Yu.A. Poplavskii, V.I. Serdyukov, L.N. Sinitsa, and F.P. Shcherbakov
Institute of Atmospheric Optics of SB RAS, Tomsk, Russia
sln@iao.ru

The monitoring of greenhouse gases and harmful substances in the atmospheric air is one from basic problems in the ecology and climatology. To solve this problem it is necessary to have highly sensitive and reliable techniques and instruments. The most reliable and selective instruments of the gas analysis are the IR-spectrometers.

In Institute of Atmospheric Optics of SB RAS the spectral-photometric gas analyzer is developed to determine a content of greenhouse gases in the IR-range in the atmospheric air and for the operational qualitative and quantitative analysis and dynamic monitoring of the concentration of gas components during technological cycles. The instrument is the highly scanning IR-spectrophotometer with the recording and processing of a spectral signal in PC.

High sensitivity of measurements and efficiency of the spectrophotometer enable the simultaneous determination of concentration of several gases. It allows the gas analyzer to be used effectively for the investigation and monitoring of products of the pyrolysis and combustion of forest materials.

Spectra of the combustion products for fallen needles of Siberian pine with the moisture content 1% for the burning of five tests 0.4 kg each with the interval 30 min and intake of gas from a plume of flame at different levels on a height have been recorded on the spectrophotometer.

The experiments have shown that on the spectrum analyzer (during 1–5 min) the basic greenhouse gases (H_2O, CO_2, CO etc.), methane (CH_4) at the level 0.3–0.5 ppm (background content of methane in the atmosphere is 1.7 ppm), acetylene (C_2H_2) at the level 0.5–1 ppm, and total content of volatile fractions of light hydrocarbons at the level 1–2 ppm are reliably registered.

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Session A2. ABSORPTION OF RADIATION IN ATMOSPHERE AND OCEAN, RADIATIVE REGIME AND CLIMATE PROBLEMS

A2-01

ATMOSPHERIC ABSORPTION OF SOLAR RADIATION: POSSIBLE EXPLANATIONS FOR THE DISCREPANCY BETWEEN MODELS AND OBSERVATIONS

A. Arking
Dept of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD, USA
arking@jhu.edu

Measurements of atmospheric absorption generally exceed model calculations by 15–30 W/m^2. Despite intensive field measurements at various sites over the past five years, and numerous analyses and model comparisons, there remains a sharp disagreement amongst investigators with respect to the source of the discrepancy. Some investigations show that the discrepancy occurs only in the presence of clouds, while other show no dependence on clouds. Some show that highly absorbing aerosols are the source, while others show that at least in some locations, the aerosols have no effect. Studies of the 3-dimensional effects associated with inhomogeneous cloud fields have not revealed any systematic effects that could account for higher absorption. Finally, attempts to explain the discrepancy by dimers of water vapor or other polymers that are not included in the models, or the presence of nitrogen dioxide from lightning discharge or industrial pollution, have shown their effects to be too small. In the present study, we compare spectral and broadband measurements in order to pinpoint the spectral features of the discrepancy, and to examine the extent to which the response of broadband radiometers is affected by changes in the spectrum of the measured flux, thereby biasing the measurement.

A2-02

BRIGHTNESS FIELDS UNDER CONDITIONS OF ICE CRYSTAL BROKEN CLOUDS

T.B. Zhuravleva[1] and A.G. Petrushin[2]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
sms@iao.ru
[2]*Institute of Experimental Meteorology, Obninsk, Russia*

To calculate the brightness fields of atmosphere-surface system, one must take into consideration the variations of spatial structure of real cloud fields on spatial scales much smaller than the resolution (of most) used in GCMs. Over last two decades, the radiative transfer modelers basically concentrated on horizontally or/and vertically inhomogeneous liquid-droplet clouds. The present work discusses how horizontally inhomogeneous ice crystal clouds influence the angular structure of transmitted and reflected radiation in shortwave spectral range.

Since mesoscale atmospheric studies have to take stochastic cloud structure into account, for adequate treatment of cloud and radiation fields it is necessary to use the statistical approach:

– the mathematical model of broken clouds is constructed based on the Poisson point fluxes on the straight lines;

– the mean brightness fields are calculated by the method of closed equations, based on the solution of system of equations for mean intensity by the Monte Carlo method.

The microstructure model of ice crystal cloud, consisting of solid hexagonal plates or columns randomly oriented in space, is presented by A.G. Petrushin.[1] For calculation of main optical characterstics of ice crystals (phase scattering function, scattering and extinction coefficients) in shortwave spectral range, the method of geometric optics with account of diffraction is used.

The mean intensity in the visible range (0.63 μm) and in absorption band of ice (2.6 μm) is calculated for optical and geometrical parameters of high- and middle-level ice clouds. The influence of effects caused by the stochastic cloud geometry on the formation of brightness fields is estimated by comparison with calculations based on horizontally homogeneous model.

The work is supported partially by Russian Fund for Basic Research (Grant 00–05–65456).

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A2-03

COMPARISONS BETWEEN CALCULATIONS AND MEASUREMENTS OF SOLAR DOWNWARD IRRADIANCE IN DIFFERENT ATMOSPHERIC CONDITIONS

A. Rublev,[1] N. Chubarova,[2] G. Gorchakov,[3] A. Arking,[4] and A. Kopylov[1]
[1]Russian Research Center "Kurchatov Institute", Moscow, Russia
rublev@imp.kiae.ru
[2]Moscow State University, Moscow, Russia
[3]Institute of Atmospheric Physics RAS, Moscow, Russia
[4]Dept of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD, USA

The best way to confirm the applicability of any radiative computational code is a direct comparison between its results and field experimental data. In this context, the Monte Carlo RT code developed for exact calculations of solar fluxes has been carefully validated against ground-based solar radiation measurements under various atmospheric conditions. The comparisons have been fulfilled for downward solar fluxes using the developed aerosol optical models, which take into account for the relations between aerosol optical characteristic and meteorological parameters.

In order to represent different atmospheric properties we have chosen the ground-based radiation measurements over different geographical regions including the ARM sites at the Southern Great Plains (SGP), Tropical Western Pacific (TWP) and North Slope of Alaska (NSA) as well as the measurements at Meteorological Observatory of Moscow State University (MO MSU). This enables us to cover the variety of the observed atmospheric optical peculiarities at mid-latitude continental (SGP and MO MSU), maritime (TWP) and arctic conditions (NSA), under which the Monte-Carlo RT code can be validated.

A2-04

SOOT AEROSOL AS A SOURCE OF REDUNDANT ABSORPTION OF SHORT-WAVELENGTH RADIATION BY THE ATMOSPHERIC AIR

B.A. Tikhomirov, A.B. Tikhomirov, and K.M. Firsov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
boris@ra9hai.tomsk.ru

Quantitative experimental data on the coefficient of nonresonance absorption of the ruby laser radiation by water vapor in a mixture with nitrogen have been obtained for the first time. The measurement results coincide with the results of calculation of the molecular absorption factor which has been performed using the spectral data bank HITRAN-96 and the Claff model for the absorption lines of H_2O.

The results of measurements of dependences on the humidity of the nonresonance absorption factor for the atmospheric air and the mixture of H_2O with nitrogen, their comparison with each other and the results of calculations of the molecular absorption factors confirm the data of the experiments[1] performed in the open atmosphere on the presence in the atmospheric air of a source of the redundant absorption of short-wavelength radiation. It is established that the redundant absorption of the ruby laser radiation is not connected with the molecular absorption.

Correlation of the time dependence of the nonresonance absorption of the ruby laser radiation by the street air and the concentration of soot aerosol in the atmospheric air which has been recorded in IAO of SB RAS by the synchronically independent method, and also the experiments using the aerosol filters for the intake of air samples show synonymously that a source of the redundant absorption of short-wavelength radiation in the atmosphere is the soot aerosol.

The work was supported by the Russian Foundation for Basic Research (Grant 99-05-64564).

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A2-05

APPLICATION OF A SERIES OF EXPONENTS TO CALCULATIONS OF RADIATIVE TRANSPORT IN THE SPATIALLY INHOMOGENEOUS GASEOUS AND AEROSOL EARTH'S ATMOSPHERE BY THE MONTE CARLO METHOD

K.M. Firsov, T.Yu. Chesnokova, V.V. Belov, A.B. Serebrennikov, and Yu.N. Ponomarev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
fkm@iao.ru

In the last decades, a wide class of experts in atmospheric optics has addressed themselves to a solution of the problem on the nonmonochromatic radiation propagation in a multicomponent medium with complex and spatially-dependent absorption spectra of its individual components. This is due to the necessity of a more correct allowance for the interaction of the optical solar radiation with the Earth's atmosphere in weather and climate forecast models. To take into account a fine structure of the molecular absorption spectrum, the stationary radiative transfer equation is solved for each radiation wavelength and the result obtained is integrated over the given wavelength region. This solution method is called *line by line*. The standard practice, though providing an asymptotically correct solution, appears extremely cumbersome even for modern computers. The letter gave an impetus to the development of a parametric method for considering a huge amount of spectroscopic information based on the expansion of the broadband transmission function in a series of exponents. This ensures high efficiency of calculating the integral spectral characteristics of radiation transmitted through a spatially homogeneous multicomponent gaseous and aerosol medium. However, only a molecular nonscattering atmosphere has been examined successively as a spatially inhomogeneous medium. In the present report, the applicability of a series of exponents for the spatially inhomogeneous multicomponent atmosphere is analyzed. It is demonstrated that the calculated illumination of the Earth's surface upon exposure to radiation in the 0.943–0.952 μm wavelength range with the use of a short series of exponents (including only 7 terms) leads only to a 0.2% accuracy loss with a simultaneous more than 350-fold reduction of the computational time.

The work was supported by the Russian Foundation for Basic Research (Project 00–05–64919).

A2-06

APPLICATION OF THE GENERALIZED METHOD OF CONSTRUCTION OF LINEAR REGRESSION TO REVISE THE MODEL OF CONTINUOUS ABSORPTION OF RADIATION BY WATER VAPOR OVER THE SPECTRAL RANGE 10.6 μm

N.N. Shchelkanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
snn@iao.ru

In the paper the unified analytical expression allowing one to find the regression coefficients for the linear equation $Y = K_0 + K_1X$ for a common case when the spread of points in the correlation between values X and Y is caused both the physical factors and the random measurement errors is presented. It is shown that all known formulae for the regression coefficients are the particular cases of the proposed analytical expression.

Obtained expression has been used to revise the temperature relation of the continuous absorption of radiation by water vapor over the spectrum range 10.6 μm. It is shown that the second term in the model of continuous absorption[1] which is characterized by the linear dependence on the absolute air humidity has not positive but negative temperature dependence. The reasons of a distinction of a value of the continuous absorption of radiation in the models in Refs. 1 and 2 are discussed.

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A2-07

INVESTIGATION OF DEPENDENCE OF SOLAR RADIATION CHARACTERISTICS OF THE ATMOSPHERE ON ATMOSPHERE, CLOUD AND UNDERLYING SURFACE PROPERTIES

L.R. Dmitrieva-Arrago and M.V. Shatunova
Hydrometeorological Research Center of Russia, Moscow, Russia
ldmitr@mecom.ru

The solar radiation fluxes and flux divergences dependence on atmosphere, cloud and underlying surface properties is investigated. The developed algorithm of solar radiation calculation based upon the delta-Eddington

method is used as investigation method. To test an algorithm its results were compared with line-by-line calculations for different geographical regions. Radiation characteristics of water and ice clouds are calculated with taking into account cloud microphysical parameters, which are results of humidity transformation model.

The variations of the atmospheric radiation characteristics in real-time scale on the base on data for short period of time and on climatic data for different geographical zones are analyzed.

The influence of the variations of atmospheric gases content – water vapor, carbon dioxide and ozone are discussed. The cloud phase influence on cloud optical characteristics, radiation fluxes and atmospheric absorption are also examined.

The research showed that increase of specific humidity within the limits of 20% courses decrease of radiation budget on the underlying surface within a few percents, and courses rise of absorption up to 5% within the lower atmosphere, and some greater for the whole atmosphere. The variation of the lower level cloud albedo in the range of 10–15% changes the flux divergences within the whole atmosphere up 40%. Increase the surface albedo in the range of 0.16–0.6 leads to change surface radiation budget within the limits of 50%.

Investigation showed that the requested accuracy of atmospheric parameters information is not equivalent for different part of radiation algorithm.

As example the distributions of the different radiative characteristics of the atmosphere for the Northern Hemisphere are presented.

A2-08

CORRELATION CONNECTIONS OF THE FLUCTUATIONS OF CUMULUS CLOUDS ENERGY BRIGHTNESS WITHIN THE RANGE OF 1.5–5.2 mcm

A.M. Allenov, N.P. Ivanova, A.A. Pechenev, and V.A. Solov'ev
Institute of Experimental Meteorology, Obninsk, Russia
post@typhoon.obninsk.org

The results of long-term studies of a spatial temporal structure of cumulus clouds (Cu) energy brightness referred from simultaneous measurements within the range of 1.5–5.2 mcm are presented.

The correlation connections of Cu cloud brightness fluctuations were revealed for different azimuthal and zenith sun angles at different cloud amounts and the sun positions. Determined were the wavelength intervals and conditions for observations, the angles towards the sun and the "center" of the cloud field studied when the coefficients of mutual correlation over the cross sections of the fields with a length of 60^0 were close to unity and became negative in value. The scattered solar radiation fluctuations were estimated in the sky within the range of 1.5–3 mcm.

The results were obtained with the help of a highly-sensitive scanning instrumentation with the sensitivity threshold from 10^{-6} $W \cdot cm^{-2} \cdot sr^{-1}$ and a spatial resolution of about 2–3 minutes of arc.

The results of preliminary studies of stratocumulus (Sc), altocumulus (Ac) cloud fields radiation structure are given.

A2-09

RESULTS OF RESEARCHES OF OWN RADIATIONS OF THE CLOUDY SKY IN A RANGE 8 – 13 MICRONS IN WINTER TIME

A.M. Allenov, A.A. Pechenev, V.A. Solov'ev, and I.V. Jakimenko
Military University of Army Air Defense, Smolensk, Russia
zav@keytown.com

Within last decades regular supervision of own radiations of the cloudy sky in interests of objective parametrization of forms of overcast on their existential structure of radiation in a range of lengths of waves 8–13 microns was spent. The saved up results of measurements allow to construct mathematical models of own radiations of the cloudy sky only for summer and in part for the spring and autumn periods. However, for practical purposes interest is represented also with characteristics of radiation of the winter sky. With the purpose of their reception during 1999 and 2000 measurements of power brightness was spent during scanning the sky in rectangular rasters with the help of scanning equipment of the high spatial resolution. Dependences of average values and dispersions of fluctuations of brightness of the winter cloudy sky on a corner of a place for the cloudless sky, cumulus (Cu), stratocumulus (Sc), and altocumulus (As) clouds are received.

A2-10

COMPARISON BETWEEN THE RESULTS OF SATELLITE AND GROUND MEASUREMENTS OF UV IRRADIANCE IN THE RANGE OF 300–380 nm OVER MOSCOW IN 1979–2000

A.Yu. Yurova,[1] N.Ye. Chubarova,[1] N.A. Krotkov,[2] and J.R. Herman[3]
[1]Moscow State University, Moscow, Russia
chubarova@imp.kiae.ru
[2]Raytheon ITSS Co., Lanham, MD, USA
[3]Laboratory for Atmospheres, NASA Goddard Space Flight Center, USA

The results of long-term satellite measurements by TOMS instrument are frequently used in papers which are devoted to the UV radiation study. The standard method applied in calculation of UV downward flux is based on the accurate radiation transfer equations (Krotkov, 1998). However due to uncertainties in optical parameters and large size of TOMS footprint area (S_{min} = 50 × 50km^2) the errors in downward UV retrievals can be significant.

Based on long-term UV radiation ground measurements in the range of 300–380 nm at Meteorological Observatory of Moscow State University since 1968, which are supported by meteorological and optical information, we suggested to estimate the uncertainties of UV retrievals from TOMS data under different optical and meteorological conditions. The methodical questions concerning the choosing of optimal period of ground data temporal averaging, the effects of pixel position via ground measurement point and etc. are analyzed. We also calculated downward UV flux from TOMS data using the simple Li code (Li et al, 2000), which had been modified to fit the analyzed wavelength range. The comparison of the UV retrievals obtained by both methods and the estimates of their uncertainties in comparison with ground measurements enable us to understand how the errors associated with large spatial averaging of satellite measurements and with the uncertainties of the input optical properties of atmosphere relate with the uncertainties due to the application of simplified radiation code.

A2-11

PPECULIARITIES OF SOLAR RADIATION ABSORPTION IN A CLOUDY ATMOSPHERE

B.V. Goryachev and S.B. Mogilnitsky
Tomsk Polytechnic University, Tomsk, Russia
msb@tpu.ru

The paper discusses the influence of a cloud cover upon the regional radiation balance, in particular, the problem of radiation transfer in a partly overcast sky, and a component of this problem – radiation transfer in a separate cloud. Radiation responses of a separate cloud have been studied properly. Variable parameters of a cloud, which influence the radiation balance are as follows:

– scattering phase function;
– photon survival probability;
– optical dimensions;
– the cloud formation form

However, while examining the dynamics of motion and development of a cloud, the scattering phase function and the photon survival probability can be considered constant during a definite period of time. Only optical dimensions defined by geometric dimensions may vary in such a way that the optical volume of a cloud be constant. The similar situation is often put into practice when clouds, which formed above the water area move above the land without changing their water reserves. Investigations have resulted in the following:

– Absorption in clouds with the fixed optical depth does not depend on the volume at a certain value of the optical volume.

– The maximum displacement of the particle distribution curve by dimensions into the largest area results in the significant increase of absorption. The maximum radiation absorption corresponds to clouds with the most right form, the increase of cross optical dimensions of a cloud practically is not influencing the value of radiation absorption.

The findings obtained will allow the improving of analytical accuracy of the radiation balance in the cloudy atmosphere.

A2-12

COMPARISON OF LINE-BY-LINE AND LUCK-UP-TABLES METHODS IN TASK OF GAS COMPOSITION RETRIEVING FROM FTIR MEASUREMENTS OF DIRECT SOLAR RADIATION

M.Yu. Kataev,[1] A.A. Mitsel',[2] H. Nakane,[3] and I.G. Okladnikov[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kmy@asd.iao.ru
[2]Tomsk University of Automatic Control Systems and Radioelectronics, Tomsk, Russia
[3]National Institute for Environmental Studies, Tsukuba, Japan

In the report comparison line-by-line and luck-up-tables methods of absorption coefficients of atmospheric gases calculation with reference to the inverse problem decision is submitted. Is shown advantages and defects of specified methods in a problem of retrieving of atmospheric gas profile from FTIR measurements of direct solar radiation. Results of modeling and data processing of real measurements are described.

A2-13

LUCK-UP-TABLES METHOD IN TASKS OF LIGHT PROPAGATION AND GASANALYSIS

M.Yu. Kataev,[1] A.A. Mitsel',[2] and I.G. Okladnikov[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kmy@asd.iao.ru
[2] Tomsk University of Automatic Control Systems and Radioelectronics, Tomsk, Russia

Application of the luck-up-tables of gas coefficient absorption in problems of propagation and gas analysis is considered. Problems connected with the optimum organization of the tables, search and interpolation are resulted arising thus. Specific character of application of the luck-up-tables in depending on a tasks is shown.

A2-14

COMPARISON OF RETRIEVAL METHODS FOR STRATOSPHERIC GASES PROFILE FROM FTIR MEASUREMENTS OF IR DIRECT SOLAR RADIATION

M.Yu. Kataev[1] and H. Nakane[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kmy@asd.iao.ru
[2]National Institute for Environmental Studies, Tsukuba, Japan

Differential retrieval methods (LSQ, NLSQ, Tikhonov, Chahine) comparisons in the task of retrieving gas profile from FTIR measurements of IR direct solar radiation in this report. Shown all studies for solving this task: forward task, search optimal spectral channels, and retrieval methods. Describing problems and errors decision of inverse task for O3 and CO molecules.

A2-15

ABSORPTION OF OPTICAL RADIATION IN THE ATMOSPHERE DURING ANTHROPOGENIC EFFECTS

G.S. Kudryashev, I.R. Abunyayev, and I.N. Lazovik
Irkutsk Military Aviation Engineering Institute, Irkutsk, Russia
avt@iszf.irk.ru

Based on atmospheric research results obtained to date, it was concluded that the ultraviolet (UV) range of radiation includes spectral windows where the absorption factors are small. In the range 190–210 nm, the molecular absorption factor was investigated for the main atmospheric species (O_2, O_3, N_2, CO_2, and H_2O). An analysis was made of the generalized matrix of volumetric attenuation coefficients from the main atmospheric species for the height range 0–40 km, and wavelengths shorter than 300 nm. An area was identified at 19–38 km altitudes (with the maximum at 25 km) with the volumetric attenuation coefficients from 0.06 to 0.16 cm^{-1}, which attenuates the background radiation of the Sun. Anthropogenic impact gives rise to a bright flash effect throughout the range of wavelengths. This paper explores the possibility of recording anthropogenic impacts on the environment at UV wavelengths, at relatively long distances, in the ground air layer. We suggest a system for recording anthropogenic impacts in the atmosphere, and at UV wavelengths, including the dynamics of development of the impact, using the two-channel receiver in the IR and UV radiation ranges.

A2-16

LONG-WAVE RADIATION PROPERTIES OF THE ATMOSPHERE IN DEPENDENCE ON VARIATION OF IT'S GAS COMPOSITION

P.I. Louzan
Institute for Numerical Mathematics RAS, Moscow, Russia
louzan@inm.ras.ru

To estimate how variations of gas composition of the atmosphere effect on the radiation regime of the latter is of great importance for climatic studies and long-range weather forecasts. In particular, much attention is paid to radiation forcing, caused by variations in ozone content.

A mathematical model of long-wave radiative transfer is built, which makes use of two-stream approximation and takes into account absorption by gaseous atmospheric constituents, as well as by clouds of liquid droplets. It is shown through series of test examples that model is in good accordance with line-by-line computations.

Several numerical experiments have been performed for different seasonal and latitudinal conditions to study the effects of variation of the atmospheric composition. Principal attention has been paid to variations in ozone and carbon dioxide concentrations and vertical profiles.

Variability in thermal radiation fluxes in the depth of the atmosphere as well as at the atmospheric boundaries has been studied depending on temperature vertical profiles in the upper layers of the atmosphere as well.

A2-17

EXPERIMENTAL RESEARCHES OF STOCHASTIC GEOMETRY OF CLOUDS

V.P. Savinykh, V.A. Malinnikov, and E.V. Malinnikova
Moscow State University of Geodesy and Cartography, Moscow, Russia
malinnikov@mail.ru

In the report results of research of stochastic geometry of the clouds, executed on are submitted materials of space photographing from a board pilot to orbital station in the period since October, 9 1985 on November, 14, 1985. For reception of pictures camera kate-140 was used. At selection of pictures for processing was emphasized on the form of clouds and their structural features. It was in total allocated 5 groups: cumulus clouds (30 pictures); cumulus clouds located as ridges (28 pictures); cumulus clouds located as cells (29 pictures); continuous overcast (18 pictures); plumose clouds (23 pictures). After selection of negatives they were scanned on the standard scanner with the sanction 600 dpi, that corresponds(meets) to the sanction to districts from height of flight of orbital station approximately 70–100 meters.

Identification of parameters of stochastic geometry of clouds was carried out estimate, independently from each other, its(her) such quantitative characteristics as fractal dimension, parameter hurst, an inclination of a spectrum of capacity, entropy Kolmogorov etc. The analysis of spatial variability of stochastic properties was carried out by calculation and comparison of the given characteristics for one-dimensional transsections a researched cloudy field. For each cloudy field it was considered (examined) 16 angular transsections.

The analysis of the received results allows to draw a conclusion on a stochastic nature and essential anisotropy of spatial parameters of cloudy fields that results in essential horizontal heterogeneity of optical properties of clouds. Anisotropy fractal properties of clouds is full enough described by the rose – diagram of parameter hurst which mathematical models for various types of overcast are given in the report.

A2-18

RESEARCHES OF CHARACTERISTICS OF RADIATIONS OF SMALL-SCALE CLOUDY FORMATIONS IN THE FIELD OF A SPECTRUM: 1.5–1.8 AND 8–13 MICRONS

U. Kozlov, A. Pechenev, and V. Solov'ev
Military University of Army Air Defense, Smolensk, Russia
zav@keytown.com

At research of spatial spectra and correlation communications between fluctuations of brightness of radiation of small-scale cloudy formations, commensurable on the angular sizes from a field of vision of optical systems of vision, the radiometric equipment with the high spatial resolution is required. For this purpose the radiometer is developed and constructed on the basis of a two-mirror objective with diameter of an entrance pupil 300 mm.

The instant field of vision of the device makes about 4 angular minutes. Use of spectral divider on sapphire has allowed to realize the two-channel circuit. In one of channels the signal in a wave band 8–13 microns, and in the

friend – 1.5 – 1.8 microns or 2.1 – 2.4 microns is accepted due to change of filters. Threshold sensitivity a long-wave range makes $1.4 \cdot 10^{-8}$W, in short-wave- $1.8 \cdot 10^{-11}$W. Results of spent measurements are used for construction of models of radiation of the cloudy sky in an infra-red wave band.

A2-19

TRANSMISSION OF FEMTOSECOND TITANIUM-SAPPHIRE LASER'S RADIATION PULSES ON HORIZONTAL AND INCLINED PATHS

Yu.N. Ponomarev, I.A. Bulatova, and K.M. Firsov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
yupon@iao.ru

Femtosecond lasers generate an radiation of regular mode composition, the spectral width of this radiation is compared with the carrier frequency and reaches several hundreds of reciprocal centimeters. Exceptional properties of the multimode radiation of stable femtosecond lasers predestined an interest in them as the sources for solution of the problems to determine the parameters of the atmospheric state.

In the paper the problem of propagation of the femtosecond laser radiation with wide spectrum which overlaps the spectral range 730–980 nm along the horizontal and inclined atmospheric paths allowing for the absorption by molecules of H_2O is considered. Initial shape of radiation pulse had a quasi-Gaussian form.

To calculate the absorption coefficients the method of the direct calculation line-by-line[1,2] has been used with the parameters of lines presented in the data base HITRAN-96.[3,4]

Solving the propagation problem the inhomogeneity of the refractive index of water vapor has been taken into account.[5]

The estimations have been obtained for the atmospheric layer with extent 1 km using the meteomodel of summer of middle latitudes.

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A2-20

EXPERIMENTAL ATMOSPHERIC MODELS DATABASE AND CLOUD DETECTION SCHEME USING HIGH SPECTRAL RESOLUTION IR OBSERVATIONS

A. Rublev,[1] A. Uspensky,[2] A. Trotsenko,[1] E. Zhitnitsky,[1] and A. Kopylov[1]
[1]Russian Research Center "Kurchatov Institute", Moscow, Russia
rublev@imp.kiae.ru
[2]Scientific and Research Center "Planeta", Moscow, Russia
uspensky@planet.iitp.ru

The cloud detection and remote sensing of cloud properties represent one of the primary objectives of the forthcoming advanced IR sounders like IASI. In order to develop the method of remote sensing cloud properties from high spectral resolution radiance measurements the experimental cloud database involving realistic atmosphere cloud condition models has been generated. For this purpose the NOAA-88/89 dataset, including about 8000 over-the-globe radiosonde temperature and humidity soundings, has been utilized. Determination of every cloud model from the database has been performed using corresponding modelling of cloudy parameters with due regard for features of temperature/humidity vertical profiles from the NOAA dataset.

Along with this the following subtasks have been solved:

to generate representative models samples from the database for diverse regions & seasons;

to develop the special 3D radiative transfer Monte Carlo code capable for efficient IASI measurement simulation under different cloudy conditions (including cumulus clouds);

to select the optimal IASI channels in the Bayesian classifier for separation of cloudy scenes into several cloud classes and verification of the decision procedure.

We believe the database can also be used for validations of climate models by benchmark calculations, which can be performed by Monte Carlo method for different types of cloudiness.

A2-21

ACTINIC AND OZONE MEASUREMENTS DURING APE–GAIA CAMPAIGN IN ANTARCTICA

I. Kostadinov,[1] G. Giovanelli,[1] F. Ravegnani,[1] D. Bortoli,[1] A. Petritoli,[1]

V. Rozanov,[2] A.Rozanov,[2] A. Ulanovsky,[3] and V.Yushkov[3]

[1]Institute for Atmospheric and Oceanic Science, ISAO-CNR, Bologna, Italy

I.Kostadinov@isao.bo.cnr.it

[2]Univwersity of Bremen, Institute for remote Sensing, Bremen , Germany

[3]Central Aerological Observatory, Dolgoprudny, Russia

UV/V is upwelling and downwelling irradiation measurements at 20km altitude, carried out by means of GASCOD-A4pi spectroradiometer onboard of Geophysica aircraft during APE-GAIA campaign are presented. The experimental data are used for calculation of rate coefficient of NO_2 photodissociation in the upper troposphere and lower stratosphere along the flight tracks. Obtained field results are compared with a model output. The environmental conditions during the measurements are taking as input for the modelling. A short description of the measurement method, deployed instrumentation and calibration procedures are presented also.

The experimental data show significant variations of the actinic fluxes in the presence of clouds leading to related variations of $J(NO_2)$. Comparison of the obtained results with radiative transfer model demonstrates good agreement for clear sky conditions, while the appearance of the clouds enhances significantly the actinic flux. This enhancement could arrives up to several times, strongly affecting the local photochemistry, and it is very hard to be predicted by the models. The ratio of the outputs from downlooking receiver to the uplooking receiver are used to estimate the albedo under the aircraft in order to account it into the model. The obtained results for $J(NO_2)$ are interpreted together with in-situ O_3 measured by FOZAN instrument onboard of the aircraft. The presented simultaneous measurements, combined with modelling, provide valuable contribution for better understanding of the photochemistry inside and outside of the polar vortex.

A2-22

ASSESSMENT OF THE EXTINCTION OF THE TOTAL SOLAR RADIATION AT PRESENCE OF THE CLOUDLESS ATMOSPHERE

T.K. Sklyadneva and B.D. Belan

Institute of Atmospheric Optics SB RAS, Tomsk, Russia

tatyana@iao.ru

In 1997 the Institute of Atmospheric Optics has started the regular airborne study of the gas and aerosol composition of the atmosphere. Monthly airborne sounding is performed over the region of Zav'yalovo Village (Novosibirsk Region) in the 500 to 7000 m atmosphere layer. For this purpose we use an Antonov-30 aircraft laboratory. The measurements of the radiation parameters (incoming solar radiation $Q\downarrow$ and reflected radiation $Q\uparrow$) of the atmosphere are performed with a couple of pyranometers. One of them is mounted on the top of the aircraft fuselage, and another directly on a photo-port inboard of the aircraft.

In this paper we analyze vertical profiles of $Q_\downarrow$ and $Q_\uparrow$ as well as a gradient of the inlayer extinction of the incoming and reflected radiation fluxes for several seasons. It is shown that about 50 %, on the average, of the incoming and reflected radiation is reduced in the lower 3 km layer, and at higher layers the inlayer extinction of $Q_\downarrow$ and $Q_\uparrow$ is about 12%. At the same time, this behavior differs between seasons. The main extinction during wintertime occurs in the 2 km layer, and in the 1 to 3 km layer during spring. Also we preset some assessments of the $Q_\downarrow$ and $Q_\uparrow$ extinction in the 0 to 7 km layer, in modulus, for several months. Annual mean $\Delta_{700-0}Q_\downarrow$ is about 364 W/m^2.

A2-23

DETERMINATION OF GAS MEDIA TEMPERATURE FROM HEAT RADIATION MEASUREMENTS BY REMOTE SENSING

M.E. Antipin and O.K. Voitsekhovskaya
Siberian Physical-Technical Institute, Tomsk, Russia
vok@elefot.tsu.ru

The purpose of the work is the kinetic temperature determination of gas volume. The data processing of CO and CO_2 spectral emissivity measurements by pyrometer methods are considered. Note that the pyrometer show the temperature of absolutely black body which emission is equal the registered value .

The result of modelling of spectral dependence of above gases emission was calculation by line by line methods. The stratified media model of environment was used and the conditions in layer was varied in wide range.

The simulation outcomes have shown, that the spectral dependence of radiation temperature value is observed and essentially depends on environment model. It illustrates the possibility of using of this spectral dependence for a spatial distribution determination of temperature and concentration of gases forming emanating volume.

The offered scheme bases on the detection of spectral intervals with minimum and maximum temperature dependences of emissivity. It is shown the relative difference of appropriate radiation temperatures is unambiguously concerned with kinetic temperature and saves the behavior in a wide range of optical thickness.

A2-24

ESTIMATION OF INFLUENCE OF WEAK WATER VAPOR ABSORPTION LINES ON THE SOLAR RADIATION TRANSFER IN THE GAS-AEROSOL ATMOSPHERE

B.A. Vorinin, A.B. Serebrennikov, and T.Yu. Chesnokova
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
bor@asd.iao.ru

Contribution of weak absorption lines of water vapor into the solar radiation attenuation in the gas-aerosol atmosphere is presented. This work is a continuation of Ref. 1. This time the new database HITRAN – 2000 and *ab initio* calculation of Partridge and Schwenke (PS)[2] were used that allowed us to get more complete absorption picture. For comparison, the HITRAN - 96 database contains 11940 lines of water vapor in the region from 7600 to 18000 cm^{-1}, the HITRAN – 2000 database has 13575 lines and the PS calculation only for room temperature gives 216670 lines in the same spectral region. Almost all "new" lines that were neglected in the atmospheric HITRAN database appear to be weak ones, but their total contribution into the solar radiation attenuation may become important in the case of long path and multiple scattering of the light quanta.

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A2-25

APPLICATION OF HOLOGRAM LENS IN UV-RADIOMETRY

S.A. Yushkin
Institute of Optical Monitoring SB RAS, Tomsk, Russia
vitaly@iom.tsc.ru

Monitoring solar UV fluxes is among the most important problems within regional environmental-monitoring programs. The significance of research into the Earth's UV climate is due to high activity of solar UV radiation responsible for vital biological and photochemical processes. An optical circuit of a focal monochromator may be the basis of a compact inexpensive instrument for the UV radiometry. A distinction feature of the optical circuit under consideration is a hologram lens used as a dispersing and focusing element. Such a lens is a diffraction grating with variable groove spacing that provides its focussing capabilities. The circuit design includes an off-axis fragment of a uniaxial hologram. As a result, there is no need for a collimator objective, which further simplify the design. The longitudinal chromatic aberration of the hologram lens is defined by the ratio:

$$F(\lambda) = \frac{\lambda 0 \cdot L1 \cdot L2}{k \cdot \lambda \cdot (L1 + L2)}, \qquad (1)$$

where $\lambda 0$, $L1$, and $L2$ are hologram recording parameters of, λ is operating wavelength, and k is the diffraction order.

If follows from Eq. (1) that solar radiation at the radiation at the operating wavelength of interest is focused on a well-defined point on the optical axis. By displacing the output slit along the focal caustic selective monochromatization is realized.

In this design under review, the strongest longitudinal chromatic aberration is typical for short wavelengths. This allows the instrument to be used for measuring the ultraviolet spectral component. A further advantage of the design is the possibility of its operation with a wide slit (~1 mm). This provides a considerable gain in the input energy, since a larger fraction of energy is delivered to the photo-detector, which is of particular importance for solar ultraviolet measurements.

Geometrical and aberration characteristics of the instrument, as well as the experimental evidence for atmospheric ultraviolet are presented.

A2-26

RETRIEVAL OF TRACE SPECIES PROFILES USING BALLON-BORNE OCCULTATION SPECTRA

M.N. Eremenko,[1,2] S. Payan,[2] C. Camy-Peyret,[2] M.Y. Kataev,[1] and A.A. Mitsel[1]
[1]Tomsk University of Automatic Control Systems and Radioelectronics, Tomsk, Russia
kmy@asd.iao.ru
[2]Laboratoire de Physique Moleculaire et Applications, Paris, France
eremenko@lpma.jussieu.fr

Remote sensing of atmospheric state parameters (such as temperature and mixing ratio profiles, trace gas column amounts) requires fast and accurate forward model radiative transfer calculations. The wide spectral regions covered by a number of satellite and balloon instruments need an efficient forward model algorithm.

For the retrieval of a large number of species, a set of micro-windows containing single lines of the target species is generally used. However, spectral signatures of several species like CFCs are often covering more than a small micro-window and a forward calculation in a wide spectral region must be performed to access the concentration of these species in the atmosphere using remote sensing techniques.

A new retrieval algorithm has been developed at LPMA to retrieve vertical profiles in such conditions. In order to decrease the calculation time, pre-calculated absorption cross section look-up tables providing a satisfactory accuracy on an optimised grid of wavenumber, temperature and pressure are used. The simulation of the measurements on wide spectral region is very sensitive to instrumental characteristics like spectral variation of the instrument line shape or accurate calibration of the spectra and the corresponding modelling problems are carefully examined.

A description of the new version of the LPMA atmospheric retrieval algorithm will be presented illustrated by results obtained from balloon solar occultation spectra in the stratosphere.

A2-27

INVESTIGATION OF LASER RADIATION ABSORPTION FOR VARIOUS ATMOSPFERIC PATHS ON THE BASIS OF THE EXPERIMENTAL DATA ON THE SPECTRAL COMPOSITION OF THE SELECTED CHEMICAL LASERS

V.A. Filimonova and M.L. Sentis
Tomsk State University, Tomsk, Russia
Aix-Marseille II University, Marseille, France

The development of chemically pumped lasers and their application in atmospheric optics simulations the progress in study of absorption spectra of atmospheric and pollutant gases, allows to improve the accuracy of laser energy losses along atmospheric paths.[1,2] The dominate components of air that is determined the IR is H_2O. The molecular absorption coefficients explicit selective properties, and thus, depend on the spectral composition of radiation. Estimates of iodine, HF pulsed radiation absorption under their propagation along inclined and vertical atmospheric paths on the basis o the experimental data on the spectral composition of most typical chemical lasers[2,3] were obtained.

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A2-28

EXPERIENCE OF APPLICATION OF SOLAR SPECTROSCOPIC METHOD FOR DETERMINATION OF THE CO TOTAL AMOUNT IN THE ATMOSPHERE OVER THE RURAL AND URBAN ZONE

E.V. Fokeeva,[1] E.I. Grechko,[1] A.V. Dzhola,[1] and L.N. Yurganov[2]
[1]Institute of Atmospheric Physics RAS, Moscow, Russia
fokeeva@omega.ifaran.ru
[2]Department of Physics, University of Toronto, Canada
leonid@atmosp.physics.utoronto.ca

The results of measurements of the total amount of CO using the atmospheric absorption spectra of solar radiation in IR spectral range (2153–2160 cm^{-1}) are presented. A grating spectrometer (resolution 0.2 cm^{-1}) with a solar tracker was used. The CO total amount was determined on absorption in a line R(3) of the CO fundamental band (2158.30 $см^{-1}$). The monthly average means values of the CO total column amount at Zvenigorod scientific station – ZSS (56°N, 38°E; in 60 км in western direction from Moscow) for the period 1970–2000 are presented. A linear positive trend between 1970 and the end of 1984 of 1.7 ppb per year (or 1.6 % per year) was observed.. Between 1984 and the end of 2000 there were no significant trend. It can be explained by OH positive trend (0.6 % per year) and UV increase due to thinning of the ozone layer.

The similar spectroscopic equipment is used for measurements of total column amount of CO at the center of Moscow-city. The value of the CO total column contents over the city essentially change day to day from values close to background amount up to values in 2.5 times greater. Measuring of the CO amount simultaneously in the city and in the ZSS allows to separate the urban part of the CO amount (UPA). The yearly average CO UPA in Moscow for the period 1974–2000 are presented. Are also presented the average and maximal values of UPA in different cities, which reply on CO urban source and meteorological and orographical conditions of carrying-out of pollution.

A2-29

ESTIMATIONS OF LACUNARITY OF OPTICAL SPECTRA

Yu.V. Kistenev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

A specific character of the estimation of atmospheric radiation fluxes consists of that the total molecular absorption is taken into account over a rather large spectral range in these fluxes. Such extended spectrum has a rather complicated form resembling to a certain quasi-random process, and in certain cases supposes an adequate description in terms of the fractal analysis.[1]

A decrease of the spectral resolution inevitably causes the smoothing of "fluctuations" of the spectral dependence of absorption. With the growth of summation interval a moment can set in, when with the given accuracy the spectrum will be translation-invariant. In this case the total absorption in a certain interval can be estimated by a small part of the spectrum.

The translation symmetry of fractal and other sets with a complex structure is characterized by a lacunarity. The paper presents the estimations of the lacunarity of optical spectra of the atmospheric absorption in various spectral ranges and depending on the required spectral resolution.

The work is carried out for a partial financial support of the Russian Foundation of Basic Research.

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B1-01

LASER BEAMS CHARACTERISTICS UNDER THE CONDITIONS OF THE INTERMITTENCE OF SMALL SCALE ATMOSPHERIC TURBULENCE

T.I. Arsenyan, P.V. Korolenko, M.S. Maganova, A.V. Mesniankin, and A.M. Zotov
Moscow State University, Moscow, Russia
arsenit@fluct.phys.msu.su

The evaluations of the influence of instabilities in the fine-scale turbulence development on the structure of laser beams propagating near the ground over the large city terrain were carried out during several years. Theoretical and experimental results of these investigations are presented.

The experiments revealed that the sporadic changes in the state of fine-scale turbulence which usually take place when temperature gradients appear to be rather high effect in the distinctive alternation of two laser beams states. One of them – the quasiregular one – is characterized by the weak distortions of the initial amplitude – phase profile. The second – a stochastic state – is characterized by the stochastic speckle-like structure of the intensity distribution over the beam cross-section. The transition from one state to another occurs by leap. It is of quasiperiodical character. Each state duration may change from seconds to several tens of seconds under different meteorological conditions. More distinctly the alternation of beams structural states manifests itself for the narrow collimated beams with the Fresnel number equal to unity. Even small raising of the beam Fresnel number leads to the situation when the stochastic state of the beam prevails. The theoretical model used for the explanation of the results obtained is based on the suggestion that the changes of the beam structure mentioned above are mainly due to the changes of the turbulence inner scale.

The statistics of the radiation intensity under the conditions of turbulence intermittence was studied. Multiparametric analysis of the experimental data shows, that in spite of the sharp raising of the local intensity variances under the conditions of beam stochastization the intensity fluctuations distributions can be described by the log-normal law. In this case the alternation of the beam state is not accompanied by the distinct changes of the variances of its center of gravity displacements in the vertical as well as in the horizontal direction.

The effects and the dependencies described are to be taken into account when one needs to optimize the characteristics of different metrology devices, systems for the atmosphere remote sensing and optical communication paths.

B1-02

PROPAGATION EXPERIMENTS IN THE NEAR-INFRARED ALONG A 150 KM PATH AND FROM STARS IN THE CANARIAN ARCHIPELAGO

A. Comeron,[1] J.A. Rubio,[1] A. Belmonte,[1] E. Garcнa,[2] T. Prud'homme,[2] and Z. Sodnik[3]
[1]*Polytechnic University of Catalonia, Barcelona, Spain*
[2]*Instituto de Astrofisica de Canarias, La Laguna, Spain*
[3]*European Space Agency, Noordwijk, Netherlands*

Within the framework of the European Space Agency (ESA) SILEX project, aimed at experimentally demonstrating the feasibility of inter-satellite optical communications links, an Optical Ground Station (OGS) has been built by ESA in the premises of the Instituto de Astrofisica de Canarias (IAC, Institute of Astrophysics of the Canary Islands) Observatory of El Teide, in the Tenerife island. The OGS is designed to test the optical communications payload on board the ESA's satellite ARTEMIS, to be launched in June 2001, and to perform ground-satellite optical communications experiments.

As part of the OGS design study, an assessment of the impact of the atmosphere on the ground-satellite links was carried out by the IAC and the Electromagnetic and Photonics Engineering Group of the Universitat Politecnica de Catalunya's Department of Signal Theory and Communications under contract of ESA.

This assessment included experimental characterizations of the atmospheric effects both through measurements from stars in positions close to the ARTEMIS one in bands comprising the SILEX wavelengths, using the IAC's Mons telescope in the Observatory of El Teide, and through measurements on an horizontal link with a transmitter near the IAC's El Roque de los Muchachos Observatory in La Palma island, based on a laser diode similar to those to be used in SILEX, and a receiver in the El Teide Observatory, almost 150 km apart, in the Tenerife island. The 830 nm wavelength horizontal measurements allowed to check the variations in the behavior of the atmospheric turbulence through the diurnal cycle. Besides the information relevant to assess the OGS performance, the horizontal-propagation experiments allowed to gather a considerable amount of propagation data on a very long path most of it 2400 m above the sea.

The experimental methods and the results on collected-power and angle-of-arrival fluctuations, and on the atmosphere-distorted point-spread function of the receivers will be presented and discussed.

B1-03

BASIC RESEARCH ON LASER PROPAGATION THROUGH ATMOSPHERE AND ADAPTIVE OPTICS

Du Xiang Wan
China Academy of Engineering Physics, Beijing, China
jsczs@mail.iapcm.ac.cn

The paper introduces some basic researches on laser propagation through atmosphere and adaptive optics.

1. Measurement of atmosphere parameters and high resolution spectrum of atmospheric absorption of lasers.
2. Statistical characteristics of laser propagation in the turbulent atmosphere and its influence on the laser beam quality: Theoretical research and experiments.
3. Adaptive optics systems with 37 elements and 61 elements and their role for improving the laser beam quality in the turbulent medium.

B1-05

DEVELOPMENT OF TWO INTERFEROMETRIC IMAGING TESTBEDS AT THE MAGDALENA RIDGE OBSERVATORY

G.C. Loos,[1,2] V.L. Gamiz[1]
[1]U.S. Air Force Research Laboratory, Kirtland AFB, NM, USA
[2]New Mexico Institute of Mining and Technology, Socorro, NM, USA

A new observatory planned for the Magdalena Mountains near Socorro in central New Mexico will place a strong emphasis on the development of very high resolution imaging technologies. A university consortium consisting of the New Mexico Institute of Technology, New Mexico State University, New Mexico Highlands University, the University of Puerto Rico, and the University of California is under contract to the United States Army Space and Missile Defense Command to build an astronomical imaging array. The array will consist of 3 2.4 meter telescopes equipped with adaptive optical systems and will be optimized for use at very low light levels. One of the three telescopes will be mobile to allow for increased baseline diversity. A second interferometric imaging system being developed by the Air Force Research Laboratory will be an active system designed to image geostationary satellites using laser illumination. This system will consist of a laser transmitter array that will generate interference patterns on the satellite. Phase modulation of the outgoing laser beams allows the fringe pattern to be scanned across the satellite such that the fringe visibility measurements become temporally encoded and can be read on the ground using simple light collecting optics as a photometric signal.

B1-06

NEW SCINTILLATION AND NEW PROBABILITY DENSITY FUNCTION (PDF) FOR THE IRRADIANCE OF A LASER BEAM PROPAGATING THROUGH ATMOSPHERIC TURBULENCE

A. Al-Habash,[1] L.C. Andrews,[2] and R.L. Phillips[2,3]
[1]Terabeam Redmond, WA, USA
[2]University of Central Florida, Orlando, Florida, USA
Florida Space Institute, Florida, USA

The thermal inhomogeneities (eddies) in the atmosphere lead to irradiance fluctuations of a laser beam as it propagate through atmospheric turbulence. Adopting the idea that large scale eddies modulate the effect of small scale, we have developed an new scintillation model for the laser beam irradiance fluctuations.

The new model takes into consideration the loss of spatial coherence of the beam as it propagates through the atmosphere and eliminates the effects of certain turbulent scale sizes that exist between the scale size of the spatial coherence radius of the beam and that of the scattering disk. The elimination of these sizes is done by the formal introduction of spatial frequency filters that continually adjust spatial cutoff frequencies as a function of the propagation distance.

The resulting scintillation index from this theory has the form $\sigma_I^2 = \sigma_x^2 + \sigma_y^2$, where σ_x^2 denotes the large-scale scintillation and σ_y^2 denotes the small-scale scintillation. By applying a modification of the Rytov method that incorporates an amplitude spatial frequency filter function under strong fluctuation conditions, tractable expressions are developed for the scintillation index of a plane wave, spherical wave and a Gaussian beam. The new model takes into consideration the finite inner and outer scale effects, which are extremely pronounced for horizontal paths near the ground.

Using our scintillation model and the modulation assumption, we have developed a two parameter probability density function (PDF) for the irradiance fluctuations of an optical wave propagating through turbulence. The resulting PDF takes the form of a generalized K distribution function, which we term the gamma-gamma. The gamma-gamma parameters are determined solely based on knowledge of two atmospheric parameters, namely the refractive index structure parameter C_n^2 and the inner scale l_o.

Comparison of the scintillation models with published experimental and simulation data through weak and strong irradiance fluctuations show excellent fit. We also show that the gamma-gamma provide a good fit to simulation data of plane and spherical wave.

B1-07

THEORETICAL ANALYSIS OF FULL APERTURE TILT MEASUREMENT WITH REFLECTED WAVE FROM TARGET

Dong Hang
Institute of Applied Physics and Computational Mathematics, Beijing, China

In this article, the full aperture tilt caused by the incident and returned waves of different paths is studied analytically. It is found that the variance of full aperture tilt of returned beam could be less than 10% of that of transmitting beam under some conditions, and the main reason is the asymmetrical distribution of atmospheric turbulence in different attitude. The effect of coherence of laser beams is also studied.

B1-08

ANGULAR DIVERGENCE OF LASER BEAMS DISTURBED BY A TURBOJET AERO-ENGINE EXHAUST STREAM

V.S. Sirazetdinov,[1] D.I. Dmitriev,[1] I.V. Ivanova,[1] and D.H. Titterton[2]
[1]Research Institute for Complex Testing of Optoelectronic Devices, Sosnovy Bor, Russia
svs@sbor.spb.su
[2]DERA, Farnborough, UK

The results of experimental studies of angular divergence for laser beams intersecting an aero-engine jet stream at different angles to its axis – 90°, 45° and 10°, are presented. The experiments were carried out on the ground with radiation wavelengths of 1.06 and 0.53 microns. The beam diameters were 10 and 30 mm, far-field images of disturbed beams were recorded by a CCD cameras – computer system. Processing of experimental data resulted in obtaining both "long-term" angular distribution of radiation intensity and "short-term" angular distribution of intensity averaged on an experimental series with random beam centroid wonderings disregarded .

Depending on conditions of the experiment the angular divergence of radiation impacted by the jet stream increases 10–30 times as compared to the initial values for undisturbed beams. It has been found that the angular width of the half-micron beam is significantly (two or three times) higher than that of the one-micron beam, which does not fit in with the model of radiation scattered only by random refraction index fluctuations typical of a turbulent medium. Besides, radiation intensity angular distribution demonstrated azimuth asymmetry correlating with physically selected spatial directions – along and across the jet stream.

Based on relevant selection of spectral density for refractive index fluctuations (composition of a "turbulent" spectrum and additional high frequency spectral components, anisotropy in the outer scales of turbulence) analytical relationships for evaluation of the angular distribution of disturbed beams matching experimental data have been obtained.

B1-09

STATISTICAL CHARACTERISTICS OF THE WAVE IN THE CASE OF A STRONG SCATTERING IN THE LAYER WITH RANDOM INHOMOGENEITIES OF DIELECTRIC PERMITTIVITY

S.N. Kolesnik, N.T. Afanasiev, and M.V. Tinin
Irkutsk State University, Irkutsk, Russia
vmt@api.isu.runnet.ru

As is known, within the small-scale approximation, for describing second moments of the radio wave (RW) propagating in a randomly-inhomogeneous medium, it is sufficient to employ the geometrical optics (GO) method by neglecting amplitude fluctuations and calculating the phase fluctuations to a first approximation of perturbation theory. If we leave the framework of the small-angle approximation, then strong deviations of rays are possible in a randomly-inhomogeneous medium, for which it is now necessary to take into account phase variations caused by trajectory variations. This makes the analysis of wave fields in randomly-inhomogeneous media significantly more complicated. On the other hand, these deviations are relatively rare, and do not seem to have a substantial effect on such average characteristics as second moments of the field.

This paper is devoted to verifying these assumptions. For this purpose, we applied a simulation method, on the basis of which we calculated the statistical characteristics of the RW transmitted through the layer with random inhomogeneities of dielectric permittivity.

Numerical calculations were performed by rigorous GO formulas for different intensities and dimensions of the inhomogeneities. The values of the statistical characteristics of the RW, thus calculated, were compared with statistical characteristics inferred from approximate GO formulas obtained on the basis of the perturbation method. On the basis of the comparison, conclusions were drawn about the accuracy of the approximate formulas describing the scattering process of the RW in a randomly-inhomogeneous layer.

This work was done with financial support of the RFBR, Grants 00–02–17780 and 00–15–98509.

B1-10

TIP-TILT IMAGE CORRECTION USING A CORRELATION TRACKER

P.A. Konyaev, V.P. Lukin, N.N. Botugina, and O.N. Emaleev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lukin@iao.ru

The purpose of conducted researches was the creation of an adaptive system prototype for tip-tilt image correction for the solar telescope BSVT.

It is known, that the method of correlation image tracking loses the efficiency with decrease of the image contrast. We create computer model of an adaptive telescope with correlation guide and the numerical experiments on influence of various parameters of an image to correlation algorithms behavior are conducted. The models, synthesized on the computer, of an image of a solar surface and also actual photos from sun rice pattern, obtained on the BSVT were used.

The experimental model of the measurer of displacement of an image ensuring functionality in conditions of small variations of intensity working on a correlation technique is made. As the primary sensor of this measurer the commercial video camera and ASUS AGP-V3800 Pro/TV video adapter is used. The system of input, analysis and image correction on the base of an IBM- compatible workstation with the PENTIUM-III 550 MHz processor with frequency 25 frames per one second is created.

B1-11

DENSITY OF THE OPTICAL VORTICES IN THE TURBULENT ATMOSPHERE

V. P. Aksenov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
avp@iao.ru

To design the adaptive optical systems operating on the long paths in the turbulent atmosphere a necessity appears to estimate the dislocation density as a function of turbulent conditions, laser beam parameters, and parameters of an image forming system. A considerable number of papers are devoted to the statistical description of the dislocations including the average dislocation density. But all of them deal with the dislocation statistics in Gaussian random fields. At the same time, it is known that the optical field statistics in the turbulent atmosphere becomes the Gaussian one in the asymptotic case of the very strong turbulence only, when the scintillation index tends to infinity. In this connection a nongaussian statistics is interesting for practice under the real propagation conditions. There is a single paper only with the estimates of the phase dislocation density for the nongaussian optical fields. But the obtained values of the dislocation density are rather heuristic. Available numerical results are not numerous and differ from each other essentially. Therefore, we propose an approach based on the equation

derived before for the evolution of the phase vortex density, which has been derived earlier. Thus, to calculate the average number of dislocations ⟨ N(z) ⟩ we need to compute the statistical averaged square of the vortex density. The average dislocation density is the average number of dislocations ⟨ N(z) ⟩ normalized by the beam square cross section. So as the value of the phase vortex density is the functional of the random field of the intensity logarithm $\chi = \ln I$, then the value of the statistical characteristics can be calculated using the functional approach by V. Klyatskin. So, if χ is the Gaussian random field, this value can be calculated most easy. In this case the dislocation density corresponds to the lognormal probability distribution law for the intensity fluctuations. This is the widely used law for estimations of the parameters of laser radiation propagating through the turbulent atmosphere. It requires assigning the corresponding correlation functions only.

B1-12
NUMERICAL SIMULATION OF TURBULENCE EFFECT ON GROUND – TO – SATELLITE OPTICAL LINK

V.A. Banakh and A.V. Falits
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
banakh@iao.ru

Numerical simulation of laser beam propagation on space–to–ground and ground–to–space paths is carried out. The simulation is performed for different C_n^2 height profile models in dependence on atmospheric turbulence strength. Atmospheric turbulence severely degrades the performance of ground-to-satellite optical links. Using the wave to be passed from satellite to the optical ground station as the reference wave, it is studied the effectiveness of adaptive correction of laser beam propagating from the ground to satellite. Different schemes of adaptive correction are considered, namely, ideal phase conjugation, correction based on information about reference wave phase restored by mean least square procedure, correction with the use of subapertures. The effectiveness of the correction in case of moving with the wind turbulent inhomogeneities is assessed as well.

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B1-13
SOLUTION OF THE TOMOGRAPHY PROBLEM FOR HETEROGENEOUS ABSORPTING MEDIA

V.P. Yakubov and D.V. Losev
Tomsk State University, Tomsk, Russia
yvlp@ic.tsu.ru

The tomography problem for heterogeneous media with arbitrary constant absorption is discussed in the paper. Up to now this problem first formulated by Cormack in 1963 has not been solved. Well-known solution based on using the Abel transform were restricted limit events with absorption considering for heterogeneities axial symmetry and arbitrary heterogeneity distribution for absorption absence. For decision new integral transform is used which generalizes the existent methods. Applicability of the obtained integral transform to decision of Cormack problem is proved analytically using proof of key identity on the base of complex variable function theory and calculation of residue in infinity point.

Obtained decision is general enough and can be used for increase of reconstruction accuracy in different problems of tomography and therapy when influence of absorption effects is appreciable.

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B1-14
SIMULATION OF GAUSSIAN BEAM OPTICAL SCINTILLATION

A. Belmonte[1] and L.C. Andrews[2]
[1]Polytechnic University of Catalonia, Barcelona, Spain
[2]University of Central Florida, Orlando, USA

The simulation of optical propagation permits to examine the irradiance behavior on the presence of refractive turbulence under general atmospheric conditions and arbitrary beam specifications. Simulations have been shown to be an appropriate and flexible tool to provide accurate Gaussian beam solutions to the higher moments of the field. Beam-wave irradiance fluctuations are due to two relatively distinct processes. The first cause is similar to scintillation for plane and spherical waves, i.e., the generation of a speckle-like pattern superimposed on the beam irradiance profile.

We will refer to on-axis scintillation. The second process, describing an off-axis scintillation, is the effect of beam wander and beam-shape changes upon the received irradiance. This viewpoint provides clearer insights into

beam-wave behavior. In this paper, the normalized irradiance variance of a Gaussian beam is examined numerically with the purpose of showing how intensity fluctuations depend on the assumed shape for the spatial power spectrum and to understand the effects of a finite outer scale in addition to the inner scale cutoff in both on-axis and off-axis irradiance components.

B1-15

ADAPTIVE OPTICAL SYSTEM FOR TURBULENT FLUCTUATIONS OF THE LASER BEAM

A. Rukosuev, A. Aleksandrov, V. Zavalova, V. Samarkin, and A. Kudryashov
Institute on Laser and Information Technologies RAS, Shatura, Russia
kud@laser.ru

The adaptive optical system based on bimorph deformable mirror, Shack-Hartmann wavefront sensor and the control unit was worked out.

Wavefront semipassive bimorph corrector was the key element of the system. The number of the controlled electrodes used in our system was 18. Seventeen electrodes were made as a part of sector and one round electrode to compensate for general defocus of the wavefront.

To measure the wavefront we suggested to use the standard Shack-Hartmann wavefront sensor with the lens to match the sizes of the laser beam and active crystal of the CCD. Worked out software allowed to measure the variation of the wavefront in the real time (25 frames per second). The amplitude (P–V) of the measured low-order aberrations with the help of such sensor was 10 μ. Accuracy of the measurements was better than 0.04 μ.

Control unit allowed to apply the voltages in the range of −300 – +300 V with the frequency up to 100 Hz to all 18 channels of active corrector. The control of this unit was driven through PC.

Two deformable mirrors were used in experimental setup of adaptive optical system – one mirror to introduce various aberrations of the wavefront (that mirror was controlled manually) and second one – to compensate for the aberrations of the wavefront. In order to verify the efficiency of beam correction the laser beam analyzer was introduced into this system. Beam analyzer evaluated the focal spot of the beam.

To control for the wavefront we used the closed-loop software based on phase conjugation algorithm. On the first stage the calibration of the sensor was carried out – the reference picture was stored in computer memory. Then the response functions of the electrodes of bimorph corrector were determined. We applied some arbitrary set of voltages to first deformable mirror to introduce wavefront distortions into the laser beam. This wavefront was measured by wavefront sensor. Then the voltages to be applied to all electrodes of the bimorph mirror were calculated. These voltages were applied to electrodes of our second corrector.

B1-16

ESTIMATE OF WIND VELOCITY FROM MEASUREMENT OF VARIANCE OF VELOCITY OF OBJECT IMAGE CENTROID DISPLACEMENT

A.L. Afanas'ev, V.A. Banakh, and A.P. Rostov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
afanasiev@iao.ru

In the paper the results of theoretical analysis of dependence of velocity of object image centroid displacement on atmospheric wind velocity fluctuations are presented. It is shown, that the variances of first temporal derivatives of components of vector of image centroid displacement are directly related with the effective wind velocity in atmosphere. The possibility of estimate of mean wind velocity and its variance from measurement of variance of velocity of displacement of image centroid of object viewed through a turbulent atmosphere is demonstrated.

B1-17

ITERATIVE ALGORITHMS TO SOLVE PHASE RETRIEVAL PROBLEM BASING ON NONCOHERENT SOURCE IMAGE

S. Chernyavskii, G. Degtyarev, A. Makhan'ko, and A. Chernyavskii
Tupolev State Technical University, Kazan, Russia
chernyavsky@kai.ru

The phase retrieval problem (FRP) is put into discussion. We discern FRP basing on as images of point source (FRP1) as unknown extended source (FRP2) and consider each of these problems separately.

We assume, there is a possibility to introduce a number S of controlled-phase-changes. It allows to get the same number S of images of the same source. For image measurements It also lets us to mitigate a noise influence to the FRP solution, and in the case of FRP2 it let us to eliminate the unknown source from the FRP solution.

It is known that FRP1 can be come to a task of general point finding of two known sets (GPF(2)KS). This task can be solved using an effective iterative Gerhberg – Zaxton algorithm. We show that this theory can be applied to the FRP2-case.

We present a new approach to study of GPF(2)KS, named a Size Extending Method. It is based on an idea of non-negative functional of convergence from the points of known sets that can be equal to zero only in case if these points are coincident.

The method of GPF(2)KS is determined by a choice of the functional of convergence and the method of its optimisation.

One of the possible version methods is the Gerhberg – Zaxton algorithm mentioned above. Here, the functional of convergence is a distance between two points of known sets and a minimisation is realised by the coordinate-by-coordinate descent.

We suppose the iterative algorithms based our Size Extending Method. These algorithms are more effective and efficient than the Gerhberg – Zaxton algorithm and allow to increase the rate of convergence.

B1-18

ACCURACY INCREASING OF CORRELATION MEASUREMENT BY NONLINEAR TRANSFORMATION OF SIGNALS

S.A. Chudinov
Institute for Optical Monitoring SB RAS, Tomsk, Russia
sch@iom.tsc.ru

Correlation methods are broadly used for the speed measurement of moving objects, for positioning the astronomical instruments in the adaptive optics. However, possibility of such measurements is defined significantly of characteristics of signals taken from under investigation objects. For the low-contrast objects, creating signal with the narrow band spectrum, correlation function can have the weakly defined maximum that greatly reduces accuracy of measurements. On it the boundary conditions influence also.

It is known that nonlinear transformations of signal expand its spectrum and consequently narrow its correlation function. However not wholly clear how to choose a type of such transformation, what limits of class of input signals, and what influences upon the end result.

The results of numerical experiments how to sharp the correlation peak of model signals and signals from the natural experiments are demonstrated in the paper. Done findings on comparative features of different nonlinear transformations.

B1-19

VARIABILITY OF COEFFICIENT OF TERRESRIAL REFRACTION IN TRANSBAIKALIAN REGION

N.Ts. Gomboyev
Department of Physical Problems, Buryat Scientific Center SB RAS, Ulan-Ude, Russia
ofp@bsc.buryatia.ru

The paper presents evaluation of climatic variability of the main characteristics of optical refraction, i.e. coefficient of terrestrial refraction K according to aerological sounding data in Transbaikalian region in the lower 900-m atmospheric layer. The daily observation data for two years on continental (Krasny Chikoy) and coastal (Ust-Bargusin) station in winter and summer months have become the initial materials. The vertical gradients of air refraction index of optical g_n range in 2–300 m and 2–900 m layers and their mean square deviations σ_g. The values of terrestrial refraction coefficient $K = -ag_n$ and their mean square deviations σ_K [1].

In settlement Krasny Chikoy the average seasonal values K и σ_K in 2–300 m layer vary: in winter K = = (0,24 – 0,43), σ_K = (0,11 – 0,13); in summer K = (0,14 – 0,24), σ_K = (0,04 – 0,08). These values are considerably larger than generally accepted average value K = 0,16[1].

The analysis of data obtained shows that irrelevantly of the point of measurements and the season of the year maximal values K и σ_K are observed at night, and minimal values – at noon of the diurnal variations. Maximum of K и σ_K is observed in winter and minimum – in summer, if seasons are compared.

Let us compare the results obtained in Krasny Chikoy at day-time of the summer months with Ref. 2 where values K were determined by the method of geodesic leveling at the same hours of the summer days. (Table)

Region of measurements	Thickness of layer, m	$\bar{K}$	σ_K	K_{max}	K_{min}
Transbaikalian	2–300	0.16	0.05	0.33	0.02
Eastern Siberia	200–400	0.157	0.03	0.23	0.10

As we see, statistical characteristics of K, which have been obtained by two different methods are in good agreement, that testifies to the possibility of using aerological data for evaluation of optical refractional climate.

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B1-20

RESEARCH ON REFRACTIONAL INDEX OF ATMOSPHERE IN AN OPTICAL RANGE

N.Ts. Gomboyev
Department of Physical Problems, Buryat Scientific Center SB RAS, Ulan-Ude, Russia
ofp@bsc.buryatia.ru

The paper presents the results of a research of variability of refraction index of the lower 900-m atmospheric layer in optical N wave range basing on two-year aerological data of daily observations on two stations in Transbaikalian region for a winter (January) and three summer (June-August) month. Values N have been determined by a formula[1] $N = 77{,}6 - P/T$ for height 2,300 and 900 m, counted from ground surface for every period of time and season of the year. Then the vertical gradients of refraction index g_n have been determined for layers 2–300 m and 2–900 m and their mean square deviations σ_g (Table)

Table

Seasonal values of g_n

Station	Season	2–300 m		2–900 m	
		g_n $10^8 m^{-1}$	σ_n $10^8 m^{-1}$	g_n $10^8 m^{-1}$	σ_n $10^8 m^{-1}$
Krasny Chikoy	winter	−5.8	2.3	−4.7	1.1
	summer	−3.0	1.1	−2.5	0.4
Ust-Bargusin	winter	−5.4	1.5	−4.1	0.9
	summer	−3.3	0.9	−2.8	0.4

The analysis of tables and plots shows that: 1) on both stations and heights day and night variations of N, $|g_n|$ и σ_g in winter as well as in summer possess one maximal value at night, and one minimal value at noon; 2) in annual variations of N, $|g_n|$ и σ_g a maximal value is observed in winter, and a minimal value – in summer. The Table testifies to a smoothening influence of the Lake Baikal (Ust-Bargusin) on $|g_n|$ and the amplitude of its variations (σ_g).

In the paper curves of diurnal and seasonal variations of N, $|g_n|$ и σ_g; integral curves of g_n distribution will be presented; variability of refraction index for waves of optical and radio ranges.[2]

The results of the research present the opportunity of the wider use of aerological data for evaluation of optical range wave propagation in various physical-geographical regions.

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B1-21

EQUATION FOR AN AVERAGE FIELD OF A WAVE IN STATISTICALLY ANISOTROPIC RANDOM MEDIUM

E.Z. Gribova and A.I. Saichev
Nizhny Novgorod State University, Nizhny Novgorod, Russia
gribova@rf.unn.runnet.ru

To the present time the waves propagation in large-scale randomly inhomogeneous media is investigated full enough. In most of the works on the given subjects the inhomogeneities of medium are assumed statistically isotropic. However one often comes up against scattering of waves by inhomogeneities that are extended along the direction of an incident wave. For example, one can point out the inhomogeneities of ionosphere, random internal waves in the ocean, the molecules of thermotropic liquid crystals, chloroplasts of algae and plants.

It is conveniently to analyze the waves statistics in cases mentioned above on the base of equations for moment functions of wave. However, when the equations are derived, it is necessary, in contrast to the case of statistically isotropic media, to exceed the limits of Markov's approximation, in order to take into account the finite longitudinal correlation scale of the medium inhomogeneities. In the present paper the closed integral-differential equation for the average field in a medium with the spindle-shaped inhomogeneities oriented along an incident wave propagation is

derived with the local Chernov's method. The diffraction on inhomogeneities and the alteration of extinction with small changes of propagation angles are taking into account.

The parameters of the problem under consideration are the transversal correlation scale with respect to the longitudinal one (the angle of anisotropy θ_a) and the angle of diffusion θ_d describing diffraction on the medium inhomogeneities. The analysis of the derived equation is accomplished in the cases of weak ($\theta_a >> \theta_d$) and strong anisotropy. If anisotropy is weak and the wave propagates under small angles to the longitudinal axis the equation becomes the well-known average field equation in the Markov's approximation. And in the case of strong anisotropy the extinction decreases owing to diffraction on the strongly stretched inhomogeneities.

B1-22

RANDOM WANDERINGS OF LASER BEAMS UNDER THE EFFECT OF A TURBULENT JET OF AN AERO-ENGINE

I.V. Ivanova,[1] D.I. Dmitriev,[1] V.S. Sirazetdinov,[1] and D.H. Titterton[2]
[1]Research Institute for Complex Testing of Optoelectronic Devices, Sosnovy Bor, Russia
svs@sbor.spb.su
[2]DERA, Farnborough, UK

The results of experimental measurements of dispersion of a laser beam centroid's random wanderings for beams disturbed by a high-speed turbulent aero-engine jet stream are presented. The duration of light pulses radiated synchronously at wavelengths of λ = 1.06 and 0.53 microns did not exceed 50 ns, which made it possible to record "instantaneous" far-field distributions of radiation intensity.

In each experimental cycle that differed from one another by geometry of experiment (beam diameter of 10 or 30 mm, different angles of beam-jet intersection) not less than 1500 frames were recorded in the computer. The range of measured values for dispersion of the laser beam wanderings depends on conditions of experiment and varies within 60÷180 μrad for λ=1.06 microns and within 110÷240 μrad for λ = 0.53 microns. A certain difference in dispersion of beam wanderings in horizontal and in vertical (orthogonal to jet's axis) directions has been detected.

The results have been analysed and obtained data were interpreted subject to the beam image recording technique.

The analytical model to calculate dispersion of laser beam's wanderings agreeable with experimental data is presented. The results of the experiment have allowed it to estimate the type of a high-frequency component of refraction index fluctuations spectrum in the jet, which supplements von Karman's spectrum for a turbulent medium.

B1-23

FLUCTUATIONS OF INTENSITY OF A LASER BEACON REGISTERED SIGNAL

G.A. Kaloshin and V.V. Nosov
Institute of Atmospheric Optics SB RAS, Tomsk
gkaloshin@iao.ru

The operation characteristics of a laser beacon assume the formation of orientation sectors by a scanning laser beam. In this case the frequencies of horizontal and vertical scans differ by several hundreds Hz. As a result, the registered signal consists of a packet of pulses, which resulting (generating) line repeats the laser beam intensity distribution. The quantity of pulses of the packet at a level of threshold detection for a fixed receiver varies in the course of time.

The paper present the results of examinations of a combined effect in a registered signal of scanning peculiarities of laser beams and intensity fluctuations in the turbulent atmosphere for horizontal paths. The schematic of the experimental set up for measuring the shape and duration of registered pulses of a laser beacon is given on the basis of a laser dosimeter ILD-II. The estimates of relative RMS of intensity fluctuations using a receiver with the aperture of radius 1÷4; $50 \cdot 10^{-3}$ m for different turbulent conditions of propagation and for paths, reaching values from units up to ten kilometres, are compared to measured a signal fluctuations due to scanning. The range of variation of a registered signal is estimated at combined effect of both factors; the corresponding variations of luminosity are also estimated at visual recording.

The taking account of a combined effect of the turbulent atmosphere and the character of scanning is important both for obtaining quantitative information of signal fluctuations and for the development of engineering solutions on the decrease of this effect.

B1-24

INFLUENCE OF THE TURBULENT ATMOSPHERE ON RANGE OF MEASURING OF DIRECTIONS BY AN OPTICO-ACOUSTIC INTERFEROMETRIC METHOD

G.A. Kaloshin and I.P. Lukin
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
gkaloshin@iao.ru

In the last few years the optico-acoustic methods are widely used both when analysing the amplitude and phase structure of the optical images and a realisation of scanning of laser beams in space. At synchronous scanning of two laser beams in the field of their superposition the waves interference is formed. The intensity of a result oscillation is uniquely linked with a direction to a source. These are two advantages of optico-acoustic methods, namely, a possibility of laser beam scanning with high resolution and quick operation a simultaneous possibility of setting directions and stipulate their use in the problems of laser navigation.

It is known that the possibility of recording of contrast of an interference pattern is determined by the value of a degree of coherence. Therefore of interest is the estimate of the range of transmission of the method depending on the turbulence intensity on the route and geometry of the scheme.

For estimates the solution of the equation for the function of mutual coherence of the second order is used.

The estimates are made for quantities of contrast, being equal to 0,1 and 0,5; structural parameters of the atmospheric turbulence, being equal to $10^{-16}.10^{-13}$ $m^{-2/3}$; for distances between centres of the radiating apertures, being equal to 1, 2, 3, 5, 10, $15 \cdot 10^{-2}$ m and for the wavelength of 0.63 μm. The effect of geometry of the scheme and the radiation wavelength on the limiting detection range are analysed. It is shown that at quantity of contrast, being equal to 0,1 and at average values of the turbulence intensity the limiting visibility range varies from hundreds of meters up to 10 and more km, and the increase of the wavelength essentially extends the range of operation of the method.

B1-25

METHODS OF REGISTRATION AND STATISTICS OF DISLOCATIONS ON THE PATH OF GAUSSIAN BEAM PROPAGATION

F. Yu. Kanev, V.P. Lukin, and L.N. Lavrinova
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kanev@iao.ru

The code is developed that simulates the propagation of a laser beam in a turbulent atmosphere. The application includes several algorithms of dislocation detection, graphical interface of the program allows one to see in great details the close vicinity of dislocation point, and in this manner to asses the precision of algorithms.

Two algorithms of registration were analyzed. According to the first algorithm the dislocation is detected as a point of local minimum, an integral on the close loop around this point is approximately equal to 2π. It was shown that precision of this algorithm is unsatisfying. Due to discrete representation of functions and interaction of the beam with grid edges, amplitude distribution is discontinuous, and under this conditions is practically impossible to account for local minimums. Their appearance can be caused by phase singularities or by imperfections of numerical model. According to the second algorithm the integral is taken around every point of the phase surface and the result of integration is compared with 2π.

The development of dislocations in the beam propagating along atmospheric paths is considered in the report. Dislocations were detected according to the first algorithm as well as to the second one. In both cases the statistics of dislocations is represented. Numerical experiments were performed on the path of 0.5 of diffraction radius (Z_d). With the first algorithm the distribution of dislocations has a well pronounced maximum in the middle of the path ($Z = Z_d$), in the second case the number of dislocation increase almost in direct proportion to the length. The analyses performed explains in both cases the peculiarities of dislocation distribution.

B1-26

PECULIARITIES OF PHASE CONJUGATION WITH DIFFERENT WAVE LENGTHS OF SOURCE AND BEACON RADIATION

F.Yu. Kanev,[1] V.P. Lukin,[1] and N.A. Makienova[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kanev@iao.ru
[2]Tomsk Polytechnic University, Tomsk, Russia
kft@ce.cctpu.edu.ru

Efficiency of adaptive correction for turbulent distortions of laser beams was considered in the report on the base of phase conjugation algorithm with different ratios between wave lengths of incident and beacon radiation and different parameters of the atmosphere. As a figure of merit was taken a parameter proportional to the total beam

power registered in an aperture of given radius. It was shown that efficiency of control decreases then wave length of incident beam differs from a beacon source. This decrease could be less pronounced if an algorithm of phase scaling for a beacon radiation is implied.

Efficiency of control decreases more sharply with increase of turbulent aberration intensity, especially under conditions of phase dislocation development in the beacon radiation. In this case even with scaling of phase surface the efficiency of control is low.

B1-27

ADAPTIVE FOCUSING OF RADIATION PROPAGATING THROUGH PHASE SCREEN FORMING A SINGLE DISLOCATION IN REFERENCE WAVE

V.V. Kolosov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kvv@iao.ru

It is well-known that during the propagation of the wave field in a turbulent medium it acquires a speckle-structure, and an appearance of dislocations in a reference wave essentially tells on the conditions of the adaptive focusing of radiation[1,2]. In the paper the test problem is considered to reveal a role of a single dislocation. For this case the phase correction of Gaussian beam propagating into the receiving plane through a single phase screen is considered. The phase screen satisfies the following conditions. On the one hand, during the propagation through the given screen a single dislocation is formed in a reference wave. On the other hand, a form of the screen allows an analytical solution for a field distribution behind the screen to be obtained. Analytical solution has been used as a test to control an accuracy of the numerical calculations performed on the base of the parabolic equation. To solve the equation the method of splitting by physical factors and the method of fast Fourier transform[2] have been used. As a reference source the narrow Gaussian beam has been used. Geometry of the problem has been selected thus that a reference beam can be considered as pointwise. Location of the screen between the receiving and radiating planes has been varied. The Strehl ratio has been used as a performance criterion of phase correction. Calculations have shown that even for the ideal phase correction a presence of a single dislocation in a reference wave can cause an essential decrease of the effectiveness of focusing of radiation. The Strehl ration had the values that were lesser then 0.75.

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B1-28

PIEZOCERAMIC DRIVER FOR TWO-COORDINATE CONTROLLING OF MIRROR ANGLE

N.N. Botugina, O.N. Emaleev, P.A. Konyaev, V.P. Lukin, L.V. Antoshkin, and A.P. Yankov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lukin@iao.ru

Applications of adaptive optical systems are giving possibilities for essential improving images quality in astronomical and solar telescopes under the compensation of distortions of wave front due to atmospheric turbulence. Adaptive optical systems of first order are doing of compensation tilts of wave front for receiving irradiance to stabilize spatial position of image of object. As for correction element in similar systems is used two-angles controlling mirror. We are creating similar mirror for stabilization of fragment of image of solar disk on entrance of specrograph of Big Solar Vacuum Telescope of Institute of solar-terrestrial physics of RAS.

Technical performance of controlling mirror

Maximum of turning angle, rad	$\pm 2 \cdot 10^{-4}$
Resonance frequency, кHz	2
Working diameter of mirror, мм	76
Thickness of mirror, мм	10
Mass of mirror, g	150
Capacity of actuator, мF	0.5

Piezoceramic driver for two-coordinate controlling of angle mirror position is containing electronic box and executive mean, creating on the base miltielemental piezoceramic discs for piezoceramic kinds CTC-19.

For controlling of piezoceramic actuators are developing amplifier with capacity C_H = 0,5 мF, voltage ± 300 V in frequencies range 0–180 Hz.

B1-29

IN THE MATTER OF INTERRELATIONSHIP OF OPTICAL, ELECTRIC, AND METEOROLOGICAL PARAMETERS OF THE ATMOSPHERE

E.V. Ovcharenko,[1] V.F. Donchenko,[1] and V.T.Kalayda[2]
[1]Siberian Physical-Technical Institute, Tomsk, Russia
[2]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
jhon@elefot.tsu.ru

The study of optical radiation propagation in random inhomogeneous media requires to take into account a set of the processes effecting on a propagation medium. For example, the meteorological and electric processes relate to such ones. In one's turn, the afore-mentioned processes have interrelationship. To determine a contribution of a set of meteorological parameters into the electric field strength the synchronous measurement of the electric and meteorological parameters has been carried out. Based on these measurements the regression model of their interrelationship has been constructed. Basic parameters effecting on the twenty-four-hour dynamics of the electric field strength are the temperature and atmospheric humidity.

B1-30

HOW TO PHASE AN INVERSE LIGHT WAVE IN THE STRONG FLUCTUATION CONDITION

V.A. Sennikov,[1] P.A.Konjaev,[1] V.P. Lukin,[1] and V.A. Tartakovsky[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
wsen@iao.ru
[2]Institute for Optical Monitoring SB RAS, Tomsk, Russia

In adaptive optics an inverse wave is formed, illuminating the adaptive mirror by a wave of the simple form, for example, with the constant amplitude and phase. This mirror reproduces the phase, which ceases to be a continuous function of two variables, when strong fluctuations are realized or at appearance of optical vortices, localized around the light intensity zeroes in the measured aperture plane. The phase of the optical vortex is not defined in the zero points, screwed in its neighborhood, but the wave amplitude is small there, therefore the zero neighborhoods cannot essentially influence on the wave as a whole. However the wave at inversion has the same amplitude for all portions of the adaptive mirror, and this fact disproportionately raises the vortex influence and contributes errors into the adaptive system operations.

To eliminate these difficulties it would be possible to use a shutter for the zero neighborhood or to apply two adaptive mirrors, phasing them in this region distinguished on Pi/2 and then superposing two waves from these mirrors at the output of the system. In any case it is inexpedient to measure the phase in the neighborhood of probable optical vortices, where intensity is small; it is enough to locate these areas into the aperture.

As a result of numerical experiments we have known how to operate there. Our methods to measure the phase and to phase of adaptive mirror, which may be useful for adaptive optics in conditions of the strong fluctuations, are considered in the paper.

B1-31

BEHAVIOR FEATURES OF RADIATION INTENSITY FLUCTUATIONS IN A SATURATION RANGE AT PROPAGATION IN AN ABSORBING TURBULENT ATMOSPHERE

A.A. Suvorov[1] and R.Kh. Almaev[2]
[1]RSSC Institute of Physics and Power Engineering, Obninsk, Kaluga region, Russia
suvorov@ippe.rssi.ru
[2]Institute of Experimental Meteorology, Obninsk, Kaluga region, Russia
skr@iem.obninsk.ru

Electromagnetic wave propagation along prolonged paths in a turbulent atmosphere is accompanied by the occurrence of strong intensity fluctuations saturated with an increasing path length. The classical wave theory in random media explains the saturation phenomenon on the basis of an assumption that the formation of radiation statistical characteristics occurs only due to turbulent pulsations of the real component of the atmospheric permittivity. Such an approach does not given satisfactory agreement of the theory and experiment when comparing the higher statistical moments of radiation intensity.

The paper gives the investigation results of radiation statistical features behavior along prolonged paths in a turbulent atmosphere with the account for not only the effect on the wave of the real but also of the imaginary parts

of the medium permittivity along with their correlations. It is shown that the account for the effect of the permittivity imaginary part random fluctuations is of most importance for the saturation range because the radiation fluctuations in this range are rather sensitive even to relatively small pulsations of the absorption factor.

The expressions for the radiation intensity statistical moments are obtained in the paper. A detailed investigation of a relative variance of the intensity fluctuations was made. It is shown that the range where the saturation are realized and the saturation rate are governed by the effect of absorption pulsations on the wave and the transition to the saturation range is accompanied by extremely nonmonotonous behavior of intensity fluctuation variance depending on the length of the path. Over the intensity statistical moments the intensity probability distribution function was retrieved. A comparison of the distribution function with the functions obtained experimentally was made. An effect of additional mechanisms of radiation stochastization on the behavior of the distribution function in the region of fading is discussed.

B1-32

ALGORITHM FOR THE PHASE RECONSTRUCTION FROM THE DATA OF COMBINED WAVEFRONT SENSOR UNDER CONDITIONS OF STRONG SCINTILLATION

V.P. Aksenov and O.P. Tikhomirova
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
tov@iao.ru

The combined computational algorithm is proposed for retrieving the optical wave singular phase under conditions of the strong turbulence. The input data for the phase reconstruction are the measurements of wavefront slopes and longitudinal intensity gradient (curvature sensing). The algorithm is based on the phase reconstruction theory proposed by the authors before. This theory allows for the vortical and potential properties of the wavefront slope vector field and uses strict integral expressions relating the slopes to the divergence and curl of the slope vector together with the differential form of the low of energy conservation. The algorithm takes into account that a real wavefront sensor measures the Poynting vector values average-weighted over a subaperture. These values coincide with the phase partial derivatives for the pointwise subaperture. Numerical simulation shows a reliable operation of the developed algorithm even in the case of comparatively small number of the subapertures and essential reduction of random error of the slope measurements.

B1-33

PROPAGATION OF A LASER BEAM THROUGH A CONVECTIVE COLUMN OF A FIRE

V. M. Sazanovich, A.L. Afanas'ev, A.P. Rostov, and R.Sh. Tsvyk
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
tsvyk@iao.ru

In this paper the outcomes of experimental researches of fluctuations of intensity and displacement of the image of a laser beam, past through a layer of a convective column above a zone of a fire are considered. The measurements of fluctuations of parameters of a beam were accompanied by measurements of fluctuations of temperature and wind speed, lapse rates of temperature. In experiment the conditions of local forest fire are implemented at combustion of fallen of needles of a cedar. The spectra of fluctuations, correlation functions and dispersions of processes are analyzed.

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B1-34

PHYSICAL MODELING OF WAVE PROPAGATION IN INCIDENTALLY HETEROGENEOUS MEDIA

I.L. Volkhin and N.N. Korotaev
Perm State University, Perm, Russia
volkhin@psu.ru

The wave propagation in incidentally heterogeneous media formed by dielectric particles is studied by method of physical modeling. The point of modeling is increasing incident radiation wavelength in comparison to the wavelength of visible light, approximately by 10^5. The dimensions of particles were also increased by 10^5 times. Thus, the model radiation wavelength was $\lambda \approx 3.2$ cm, and the sizes of model particles were within the limits

between 1 and 30 cm. The microwave refractive index for the model particles substance was equal to that of the actual particles for visible light. The model particles were made of paraffin wax with magnetic permeability $\mu = 1$, refractive index $n = 1.5$ and dielectric loss tangent $\tan\delta \approx 10^{-4}$ for the wavelength $\lambda \sim 3$ cm. In order to model absorption, paraffin for the particles was filled with a carbon powder.

Incidentally heterogeneous media contained cubic particles with rib dimension a being smaller, larger, or comparable with λ. Propagation and reflection of radiation by single-row and multiple-row ensembles were studied. The relations of directional transmission factor T and reflection R on diffraction parameter $\rho = \pi a/\lambda$ for ensembles with various overlapping and absorption factors, are obtained. Enlightenment effect in single-row layer with increase of particles packing density, is discovered. The conditions are retrieved at which T vanishes. In multiple-row layers with weak absorption, the effect of repeated radiation scattering is found.

The relation of particle attenuation factor Q on parameter ρ is computed.

B1-35

PECULIARITIES LASER RADIATION FLUCTUATIONS IN PRECIPITATION

N.A. Vostretsov and A.F. Zhukov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

In report, describes peculiarity fluctuation in direct and scattered radiation in precipitation was determined in experiment, obtained as compared with to fluctuation in atmosphere without precipitation. Experiments was made in snowfall, rain, fog and in turbulent atmosphere. In report we analyzed of level fluctuation, autocorrelation function , temporal frequency spectrum and probability density fluctuations.

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B1-36

PROBABILITY DISTRIBUTION OF FLUCTUATIONS OF LASER SIGNAL IN SNOWFALL

N.A. Vostretsov and A F. Zhukov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

In report, results of the analysis of the probability distribution of fluctuations of laser signal in snowfall in the direct and scattered radiation are presented.

Selection of model distributions for approximating experimental distributions were made different methods. We used: method of straightened diagrams for the probability density and the probability integral; method of least squares; method of higher-order moments; method of maximum likelihood; by χ^2 – criterion and the Kolmogorov criterion, also the method joint consideration two different distributions taking into account fluctuations spectrum.

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B1-37

MICROWAVE TOMOGRAPHY – EXPERIMENTAL MODEL

V.P. Yakubov and S.A. Slavgorodsky
Tomsk State University, Tomsk, Russia
yvlp@ic.tsu.ru

One of basic problems originating at implementation microwave tomography of inhomogeneous mediums, consists in necessity of the registration of effects of multiple interaction. The development of these effects does not allow transferring known methods x-ray tomography on a radio range. The solution of a problem is represented and the experimental model of radio tomography of a centimeter wave band grounded on usage of effect of a double focusing is described. For creation of this effect two lenses, manufactured of plasters having a diameter 32 cm are used. Placed on distance 90 cm these lenses have allowed creating in space between them the localized wave channel as a region of length 30 cm and diameter 3 cm. The measurement of amplitude-phase perturbations of a field was carried by a meter of complex transmission factors P4-34.

With the help of created device is carried out tomography scanning of a series of test inhomogeneous plants manufactured from plastics. The level-by-level scanning was carried out by means of linear shifts and rotation of investigated plants. For automation of measurements and handling the system LabVIEW5 is used. Is shown that the adequate exposition of diffraction effects in this channel is given within the framework of a phase approximation of Huygens-Kirchhoff method. The deriving tomography is reduced to sequential usage of operations: deconvolution,

nonlinear restoring of a complex phase on an axes of a beam, method the Fourier of synthesis. The reached exactitude of restoring of structure of plants has the order 1/3 from a working wavelength.

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B1-38

REPRESENTATION OF RANDOM OPTICAL WAVE PHASE IN THE BASIS OF EIGENFUNCTIONS OF PHASE CORRELATION FUNCTION

E.V. Zakharova, Yu.N. Isaev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
zev@iao.ru

Optical wave is distorted passing through the turbulent atmosphere. In adaptive optics during the compensation of these distortions a phase of optical wave is often represented as an expansion with random coefficients. The specific character of a problem determines a choice of the orthogonal functions for this expansion.

The most often Zernike polynomials are used for representation of distorted phase because they have a simple analytical expression and their first modes coincide with the classical aberrations. However, the best basis is the eigenfunctions of the Fredholm integral equation which kernel is a phase correlation function (in adaptive optics it is named often as Karhunen-Loeve-Obukhov (KLO) equation) give us independent expansion coefficients and minimal expansion error for fixed number of expansion terms.

A process to obtain the KLO functions is not a simple mathematical procedure, moreover the KLO basis is changed when a state of the atmosphere is changed. Therefore authors have derived the KLO functions represented in terms of Zernike polynomials[1] and then developed the effective method to represent a random phase using the matrix relations between the phase expansion coefficients in different bases: Zernike, KLO, Walsh, and Haar.[2] The method has been obtained for the Kolmogorov model of turbulence which is valid only within the inertial range of turbulence. Authors have developed the algorithm to obtain the KLO functions allowing for the outer scale of turbulence (von Karman model).[3]

Authors investigate in numerical experiment the representation of random wave phase in terms of the KLO functions obtained with the use of the phase correlation function calculated from experimental data, and also the algorithm to represent the phase correlation function with the Zernike expansion coefficients of distorted wave phase.

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B1-39

EFFECT OF UNDERLYING RELIEF ON ASTRONOMICAL IMAGE TREMOR

V.V. Nosov, V.P. Lukin, and E.V. Nosov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
lukin@iao.ru

In the publication in Ref. 1 the theory of registration of underlying surface relief effect on the image tremor in ground astronomical telescopes has been developed. It has been proposed to select the location of astronomical telescopes so that in a sector of observations the steepness of a slope of underlying surface near a telescope was sufficiently high. In this case the standard deviation of the image tremor can be decreased by an order.

In the present paper we compare the theory[1] and experimental results obtained to the present time (see, for example, Ref. 2) for the variance of astronomical image tremor in dependence on the zenith angle (zenith distance) of observed astronomical object and the steepness of slopes of underlying surface near a telescope. The comparison is carried out for various types of a surface including a mountain relief.

Satisfactory agreement of the experimental data with the theory (including the data deviating essentially from the secant law) is shown if to take into account a type of a underlying relief in the location of an astronomical observation station.

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B1-40

PROPAGATION OF THE PARTIALLY COHERENT GAUSSIAN BEAM IN A TURBULENT REFRACTIVE MEDIUM

V.V. Kolosov,[1] O.A. Kolosova,[2] V.V. Dudorov[1]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
dvv@iao.ru, kvv@iao.ru
[2]Tomsk State University, Tomsk, Russia

The propagation of a partially coherent wave field in inhomogeneous media is investigated. The influence of refraction, inhomogeneity of gain (absorbing) medium properties and refraction parameter fluctuations on target characteristics of radiation are taken into consideration. Such problems arise in the study of power and coherence target properties of a single-pass laser, which resonator had the volume of a turbulent medium, inside structure of strongly absorbing inhomogeneous media, acoustic propagation in strong absorption conditions or optical propagation in clearing channels.

The exact solution reduced to quadrature is obtained for the partially coherent radiation propagating through a turbulent medium with the Kolmogorov spectrum of fluctuations and a inhomogeneous distribution of the mean refractive index. On the basis of this solution the accuracy of calculations is investigated for the approached solution of the equation for a coherence function of the second order obtained by the effective ray-tracing technique[1] corrected a turbulence and a inhomogeneity of a gain medium in the result of a propagation of a radiation with an arbitrary initial coherence. Numerical solutions obtained by the ray-tracing technique are adduced for the problem with an asymmetrical structure of a perturbation of the dielectric constant.

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Session B2. NONLINEAR EFFECTS AT RADIATION PROPAGATION IN ATMOSPHERE AND WATER MEDIA

B2-01

LASER ACCELERATION OF SUSPENDED MICROPARTICLES

S.E. Skipetrov[1] and M.A. Kazaryan[2]
[1]Moscow State University, Moscow, Russia
skipetrov@mail.ru
[2]Lebedev Institute of Physics RAS, Moscow, Russia
kazar@sci.lebedev.ru

Laser radiation can accelerate the particles suspended in a liquid or gas up to considerable speeds. The effect can be observed both in the laboratory conditions (for example, in suspension of polystyrene balls of micron dimension) and for the propagation of laser radiation in natural media (for example, in the atmosphere). In the last case the drops of aerosols and particles of dust are as such particles, and the effect of radiation consists not only of the acceleration of particles, but of the modification of their dimension, form etc. Thus, the scattering radiation modifies both the dynamics of scattering medium and the its microstructure that, in one's turn, changes a behavior of propagation of radiation itself etc. The problem becomes especially interesting for the large concentrations of particles when the scattering acquires the essentially multiple character.

B2-02

PHOTOLYSIS OF AQUEOUS SOLUTIONS OF PHENOLS UNDER POWERFUL UV EXCITATION

V.A. Svetlitchnyi, I.V. Sokolova, T.N. Kopylova, R.T. Kuznetsova, O.N. Tchaikovskaya and E.N. Telminov
Siberian Physical-Technical Institute, Tomsk, Russia
kopylova@phys.tsu.ru

The relation of a photolysis of organic and inorganic connections to conditions of excitation is widely known.[1-3] Changing a spectral distribution, the intensity and temporary characteristics of exciting radiation is possible to activate various mechanisms of photodegradation of a concrete molecule.

The process of a photolysis even of simple molecules consists of large number of elementary photochemical reactions in which one take part not only molecules of researched compounds, but also the solvent, products of primary photoreactions etc. In case of complex organic compounds number of probable photoreactions is considerably increased, that makes difficult the analysis of a photolysis. However for comparison a photolysis under various conditions of excitation it happens enough to determine predominant path of photodegradation and to estimate a general efficiency of a photolysis in each case.

In presented paper the photolysis of aqueous solutions two widely spread in atmosphere and hydrosphere organic ecotoxicants- phenol and parachlorophenol is studied at excitation UV by radiation of the exiplex KrCl laser (E_{pump} = 7 mJ, t = 7 ns, l = 222 nm, $\Delta l < 1$ nm, f = 1÷2 Hz) and high-frequency exilamp of a glow discharge on same molecules (W = 5 W, t = 10 mcs, Δl = 222 nm, l = 1 nm, f = 100 kHz). At a laser photolysis the power density of exciting radiation reached 50 MW/sm^2, that produced non-linear absorption of solutions. A power density of radiation at lamp excitation $<<$ 1MW/sm^2. The efficiency of a photolysis by spectroscopic methods estimated. Comparison of lamp and laser photolysis is held.

The researches are made with the purpose of development of highly sensitive methods of optical diagnostic of ecotoxicants, and so methods of their destruction.

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B2-03

FORMATION OF A SECONDARY AEROSOL FROM PLASMA WITH A DISPERSE PHASE

V.I. Bykaty and O.V. Gas'kova
Altay State University, Barnaul, Russia
perfilev@phys.dcn-asu.ru

The problem on frame of a secondary aerosol resulting intensive vaporization of carbonic particles and further process recondence is investigated at an optical discharge in a field of a laser radiation, and also research of main specifications of generatrix plasma and attendant effects. At effect on a carbonic particle the size about 500 mkm of a impulse radiation of the neodymium laser with a wavelength 1.06 μm and energy ~500 Дж descends processes of vaporization and recondence to formation of small-sized fragments, which one deposited on a substrate from an electrosheet copper. The microphotographs of fragments obtained with the help of a supermicroscope are adduced. The particle-size distribution is retrieved, and the sizes of fragments make from 0.01mkm up to 1,2mkm, if there is a minor lobe of fragments of larger sizes. At usage as a seeding agent of fragments of graphite by the size about 200 mkm, splitting last it was revealed not. It is possible to explain it to that during inertial holding of fragments of graphite in focal area there is their full vaporization. The fragmentation of sootflakes is explained to that owing to a high porosity the fragment has not time completely to get warm and is disintegrated on small-sized debris. The relation of speed of front formation of a secondary aerosol from plasma with a disperse phase is retrieved At measurement of speed of front the spectral method was used. The registration of front of plasma was made with the help of a photomultiplier with registration of glow on a line of oxygen with a wavelength l = 394 нм. The speed of front was determined on a signal delay given on a storage-type oscilloscope from a photomultiplier, concerning a driving pulse of the laser. The observed data have shown, that the relation of a square of speed to impulse energy is approximated by a symmetric function V^2 (E) = 3.69E− 746.

B2-04

EFFECT OF VAPOR CONDENSATION ON THE PARAMETERS OF STEAM-GASEOUS CLOUD WHEN IT IS EXTENDING FROM THE SURFACE OF HIGH-MELTING PARTICLE UNDER THE LASER ACTION

V.I. Bykaty and K.V. Solomatin
Altay State University, Barnaul, Russia
solomatin@phys.dcn-asu.ru

The effect of a potent laser radiation on a high-melting aerosol fragment can be accompanied by vaporization. The vaporized matter, scattering with high speed about a local velocity of a note in a vapor, creates around of a fragment a steam-gaseous halation. As one of basic practices resulting in to change of a structure of an extending steam-gaseous cloud, it is necessary to consider condensation of vaporized matter arising owing to cooling a vapor at its almost adiabatic dilating.

The formation of a secondary aerosol can be esteemed in two directions. At first, as a way of creation of aerosols with a very mesh size of fragments. Secondly, as the gear resulting in to padding power easing of a laser beam owing to an attenuation of radiation by secondary fragments.

The solution of this problem was earlier conducted in a thermodynamic approaching, which one is rough enough for fragments, components actual atmospheric aerosols, that is at the sizes up to 50 microns.

However it can be executed for a number of more applicable particular cases. The problem about pseudo-steady retraction of vaporized matter in vacuum with allowance for alteration of speeds of condensation appearing owing to reduction of vapor density at dilating, when on some spacing interval from a surface of a fragment process of condensation in general ceases.

The numerical calculations demonstrate, that in a gas current extending from exhaling primary fragments by the size less of 50 microns, condensation practically does not go, and the value of a degree of condensation at a great distance from a fragment is little bit more than the initial value for a surface, that is the flow is practically single-phase.

For large fragments by the size more than 250 microns, both calculations, and the experiments demonstrate, that the degree of condensation reaches 30 %, and vapors on considerable spacing interval has time "to monitor" a supersaturation.

B2-05

SIMULATION OF PROCESSES OF COMBUSTION AND VAPORIZATION OF FRAGMENTS IN A LASER FIELD

V.I. Bucaty, A.A. Popov, and A.M. Sajduk
Altay State University, Barnaul, Russia
ic564aap@ic.dcn-asu.ru.

The spherical fragment millimeter of the size, fluidized in air and located in a field of a potent laser radiation is reviewed. As initial parameters are taken irradiance, radius and temperature of a fragment. Dynamics of parameters of this fragment in a diffusive approaching of retraction of a steam cloud, is described by a system of non-linear differential equations. The software product permitting to conduct calculations of main specifications of a fragment in a field of a potent laser radiation is built. Dynamics from time is concretely calculated: radius, surface temperature, burning rate and the vaporizations etc. Also are under construction the charts of indispensable relations on miscellaneous time periods. The process of vaporization in vacuum is modeled and the calculations for fragments from different stuffs are carried out.

At heats of a surface of a fragment the speed of retraction of material comes nearer to sound, in this case diffusive approaching is inapplicable. Is designed gas dynamics model of vaporization of a fragment with allowance for quasi-steady of process, spherical symmetry in a case small of diffusion of an oxidant. During activity is established, that the bicomponent approach to the solution of a problem is inapplicable. The obtained system of non-linear differential equations without violation(disturbance) of a commonality describes vaporization on medium consisting of steams(vapors) of material(matter) of a fragment. The main effect arising in a steam cloud of a fragment at high intensities of an incident radiation – originating of a shockwave is shown in a simple form.

B2-06

PECULIARITIES OF RESONANCE EXCITATIONS INSIDE TRANSPARENT SPHERICAL PARTICLES BY FEMTOSECOND LASER RADIATION

A.A. Zemlyanov and Yu.E. Geints
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
zemla@iao.ru

The application of a ultrashort laser radiation for the purposes of atmospheric sounding puts on the foreground the research problem of interaction of such radiation with an aerosol component of the atmosphere. It concerns as a linear problem of a diffraction of spectral bounded laser pulses on particles and the problem of study of different nonlinear effects in aerosols (SRS, higher optical harmonics excitation, optical breakdown) under the action of ultrashort light pulses also. The peculiarities of the realization of these effects in microparticles is that their existence is closely connected with the presence in a particle of high quality resonant oscillatory modes of internal electromagnetic field which multiply increase the length of nonlinear wave coupling. From this point of view the main goal of nonlinear effects study in microparticles is gained by the examinations such structures of the internal optical field.

In the present report the results of numerical calculations of temporal-spatial structure of internal optical field in micron-sized transparent spherical particles under the action of femtosecond laser pulses with Gaussian spatial profile are submitted. The main attention we put to the study of the opportunity of internal field resonant configurations excitation by ultrashort radiation, as well as the estimation of efficiency of SRS and the third harmonic generation in atmospheric aerosol during a given time scale. The calculations have shown, that as a whole the formation of field resonant structure in a case, when spatial length of a light pulse is compared and less with the geometrical size of a particle, is originated differently, than in a case of a CW irradiation, especially at side particle illumination.

The work was supported by SB RAS complex integration project № 8.

B2-07

NONSTATIONARY SCATTERING OF ULTRA SHORT LASER PULSES ON ISOLATED AEROSOL PARTICLES

A.A. Zemlyanov and Yu.E. Geints
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
zemla@iao.ru

The report is dedicated to a problem of a diffraction of ultrashort laser radiation on transparent spherical particles. The given problem has gained a urgency specially in the last years in connection with the use in atmospheric examinations of high intensive laser systems with pulses of pica- and femtosecond duration. For the study of a linear scattering, as is known, the Lorentz-Mie theory is widely utilized which enables to calculate all most relevant optical parameters of an ensemble of microparticles in monochromatic radiation field. However, due to high frequency selectivity of Lorentz-Mie theory, the direct its application to essential restricted on a time scale light pulses is strictly speaking noncorrect. The non-stationary Lorentz-Mie theory developed in the past decade is a combination of the linear theory and Fourier-analysis and operates not with monochromatic radiation, but with the set of light frequencies filling the spectrum of the pulse being diffracted on a particle. Let's note, that such approach is similar to transition from a scattering on a particle of one size to a scattering on an ensemble of polydisperse particles.

On the basis of the non-stationary Lorentz-Mie theory we carried out calculations of the major integral optical parameters of spherical particles with different radii. First of all the scattering efficiency factors and lidar coefficient being of great importance to the problems of laser sounding of atmospheric aerosols were studied. The calculations have shown the difference in frequency behavior of the data of the scattering efficiencies for monochromatic radiation (plane wave) and spectral bounded pulses expressed, mainly, in the effect of their smoothing. This effect is a direct consequence of laser pulse spectrum spreading at its temporal shortening.

The work was supported by SB RAS complex integration project № 8.

B2-08

STIMULATED RAMAN SCATTERING IN MICROPARTICLES UNDER THE CONDITIONS OF FIELDS DOUBLE RESONANCE

A.A. Zemlyanov, Yu.E. Geints, and E.K. Panina
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

One of peculiarities of stimulated light scattering in Raman-active transparent microparticles (SRS) is the effect of a "double" resonance, at which one of the internal optical field on a primary frequency (pumping field) and frequency shifted radiation on Stokes frequency simultaneously are in resonance with any MDR's of a particle. In this case there is an effective nonlinear interaction between the indicated fields. Such interaction lets to a considerable lowering of a threshold of SRS generation, that is of interest, first of all, from the practical point of view, as the expedient of essential depression of a threshold of SRS effects in particles and in particular allows to carry out the examinations of SRS in microparticles by the use of CW laser radiation.

In the report the results of analytical investigations of optimum requirements for development of "double" resonance SRS in spherical microparticles are presented. The expression for a threshold intensity of pumping field is obtained in the case when regenerative gain condition of Stokes noise realizes in a particle at the conditions of "double" resonance SRS. Normalized coefficient of spatial overlapping of optical fields $\overline{B}_c$ in a particle reflecting efficiency of their interaction is ad-hoc entered. We show that the coefficient $\overline{B}_c$ at "double" resonance conditions is much higher when the orders of MDR's of a particle are equal, than in the case of a MDR's coupling with the different resonance orders. The main factor which is determining the size of the overlapping coefficient, is the half-width of MDR's in excited modes.

B2-09

HIGHT STIMULATED COMBINATIVE SCATTERING INFLUENCE ON LASER BEAM PROPAGATION IN THE ATMOSPHERE

A.B. Ignatyev and V.V. Morozov
Joint Stock Company ALMAZ Central Design Bureau, Moscow, Russia
almaz@mbt.ru

At propagation powerful of laser radiation in an atmosphere there can be effects of a stimulated scattering caused by a swing of inoculation thermal oscillations owing to action on them of laser and scattering waves. So the swing of intramolecular oscillations gives in a stimulated Raman effect (SRS). For last years many experimental

examinations on definition of sections of a spontaneous Raman effect for various molecules of air, his(its) frequency profile were executed which allow more full to estimate influence of a SRS on propagation of a bull laser bundle in an atmosphere for a various optical paths.

In operation the intensities of laser radiation of various lengths of waves and breadths of a spectrum of oscillation are spotted, at which the SRS on molecules N_2 and O_2 should be observed at a radiative transfer in requirements of a meteorological atmosphere of air in zenith from height of 10 km and on horizontal paths a major lengths.

B2-10

DYNAMICS OF POWER AND COHERENCE CHARACTERISTICS OF PARTIALLY COHERENT BEAMS IN A NON-LINEAR MEDIUM

V.V. Kolosov,[1] O.A. Kolosova,[2] and V.V. Dudorov[1]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
dvv@iao.ru, kvv@iao.ru
[2]Tomsk State University

The beam dynamics for equal power ray tubes and equal coherence ray tubes is investigated for the partially coherent radiation propagating in non-linear media. The Gaussian beam propagation through media with Kerr non-linearity and thermal blooming is considered on the basis of the solution of the equation for coherence function of the second order. Calculations are adduced for the two-dimensional beam. The dimension of a coherence function decreases from five down to three for this case. Consequently, the numerical solution of this equation is possible by means of the method of a separation on physical factors, widely using for a solution of the parabolic wave equation, with using the algorithm of fast Fourier transform.

The comparable analysis of the equal power and equal coherence ray tubes behavior is carried out. The same analysis is carried out for solutions of the equation for coherence function obtaining by the ray-tracing technique[1] allowing to create effective numerical algorithms for the three dimensional problem. The technique is asymptotically exact since it gives exact solutions at limiting cases when the coherence length tends to zero or when the distribution of complex dielectric constant of medium has the parabolic form.

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B2-11

LASER SPARK IN THE PROBLEM OF OUTFLOW OF LIGHTNING DISCHARGES

A.A. Zemlyanov, N.N. Bochkarev, A.M. Kabanov, and V.A. Pogodaev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
zemla@iao.ru

The problem of the effect of optical-meteorological state (OMS) of the atmosphere on the conditions of propagation of power laser radiation (PLR) can be considered from several, sometimes almost diametrically opposed, points of view. For example, the problem of transfer of PLR energy through the depth of the atmosphere means a simulation of radiation parameters conformably to an atmospheric situation thus in order to avoid the losses of energy blocked by the centers of optical breakdown in the propagation channel. Hence, the generation of plasma centers in the propagation channel is "parasitic" effect in the given case. In the problem to use a laser radiation for the pilotage of lightning discharge the formation of extended laser spark on the peak of lightning tower in the given direction is the "useful" effect. Of course, we ought not to consider the second problem as an inversion of the first. In the paper we consider a possibility to use the results of nature experiments which are obtained solving the propagation problem for the prediction problem of the effectiveness of long laser spark creation in different OMS of the atmosphere. Results of the processing of an acoustic response from the centers of optical breakdown in the atmosphere are presented. Obtained dependences of the characteristics of acoustic signals (amplitude, duration) on the parameters of PLR OMS are considered from the point of view of their accordance with the available models of acoustic pulse formation. Prospects to use the super-short laser pulses in the problem of lightning protection are discussed.

Session C1. MULTIPLE SCATTERING IN OPTICAL REMOTE SENSING. IMAGE TRANSFER AND PROCESSING

C1-01
REMOTE SENSING OF CLOUDS BY A LIDAR WITH VARIABLE FIELD-OF-VIEW ANGLES

V.V. Veretennikov,[1] A.I. Abramotchkin,[2] and S.A. Abramotchkin[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
vvv@iao.ru
[2]Institute for Optical Monitoring SB RAS, Tomsk, Russia
asa@iom.tsc.ru

The experimental data on lidar sensing of clouds above Tomsk city and their interpretation results are presented in the report. The purpose of work was to study the multiple scattering influences on lidar signals behavior experimentally and analyze the practical possibility of using the measurable information for data acquisition by solving relevant inverse problems. The sounding was performed at 0.532 mkm by a lidar with changeable field-of-view (FOV) in the receiver. The receiver's FOV angle range was from 0.67 to 13.3 mrad. Other lidar parameters are detailed in Ref. 1. The experimental research results of lidar signal transform depending on the receiver's FOV at various signal penetration depths into the cloud layer are presented. The comparison of experimental data with the results of return power calculation in the limits of small-angle approximation[2] in terms of the lidar transceiver system objective parameters is performed. Iteration algorithm developed in terms of multiple scattering in the small-angle approximation for lidar equation solution was used to restore the extinction coefficient profiles from the signals measured.

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C1-02
ANALYTICAL MODELING OF THE RAMAN LIDAR RETURN WITH MULTIPLE SCATTERING

A. Malinka and E. Zege
Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus
mal@zege.bas-net.by

In this work the Raman lidar return from geophysical media is investigated. An analytical approach for modeling Raman lidar return with multiple scattering is presented. The approach is based on the small-angle quasi-single scattering approximation developed earlier for the case of elastic scattering. An approximation of isotropic backscattering for the Raman scattering case is proposed and tested. The computation results are presented and compared with known data. The approximation is found to be quite simple and to provide high accuracy of Raman lidar return calculation.

C1-03
SPATIAL-ANGULAR STRUCTURE OF THE SCATTERED RADIATION AT THE BOUNDARIES AND INSIDE THE OPTICALLY DENSE MEDIA

V.V. Belov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
belov@iao.ru

The results of theoretical investigation of the spatial-angular structure of the light fluxes of scattered radiation at the boundaries and inside the scattering and absorbing medium are presented and discussed in the paper.

The classic statement of the problem of characteristics of the light field appearing in the limited (in the direction of propagation of the incident radiation) homogeneous layer at its illumination of infinitely wide light beam is considered.

Investigations are carried out for the model media formed by an ensemble of hard spherical particles characterized by different degree of asymmetry of the scattering phase function, optical thickness and single scattering albedo. The optical thickness was selected in the range that does not overlap the boundaries of applicability of the approximation of low multiplicities of scattering to solving the radiation transfer and depth regime equations.

Different from the basic solutions of the radiation transfer equation presented, for example[1], the discussed results were obtained by the Monte-Carlo method.

The purpose of investigations was in the study of the effect of the layer boundary distant from the source on the spatial-angular characteristics of diffuse light fluxes propagating in the medium and on the distribution of the absorbed energy along the direction of incident radiation.

The non-monotonic dependence of the depth of penetration of the absorbed energy, as well as the light fluxes scattered into both hemisphere, into the medium was revealed in statistical experiments. The response of these characteristics and angular distributions of the scattered radiation inside the medium on the change of the position of its boundary distant from the source is investigated.

Interpretation of the obtained dependencies is presented.

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C1-04
CONSIDERATION OF THE DISTORTING EFFECT OF THE ATMOSPHERE IN THE PROBLEM OF SATELLITE MONITORING OF SMALL-SIZED HIGH-TEMPEATURE ANOMALIES

V.V. Belov and S.V. Afonin
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
belov@iao.ru

The most important problem of satellite monitoring of the Earth's underlying surface from satellite images is automatic recognition of high-temperature anomalies (seats of the fire) whose dimensions are much less than the spatial resolution of the radiometer. To maximize the accuracy, we must correct the satellite images recorded, first of all, in the 3.5–4 μm spectral channel (the third channel of the AVHRR/NOAA device), which is the basic one for detection of seats of the fire, for the distorting effect of the atmosphere. Of special importance in this case is estimation of the contribution of J_S – the solar radiation intensity scattered by the atmosphere and reflected from the underlying surface – to a measurable signal. An analysis of the available literature data demonstrates that the procedure of correction for the distorting effect of the atmosphere was not implemented for satellite monitoring of seats of the fire. For example, to take into account the solar additive J_S in the third AVHRR channel, a fixed threshold value (disregarding even the position of the Sun) or the quantity $J_S(Z) \sim J_S(0)/\cos(Z)$, which depends only on the solar zenith angle **Z** (or the solar elevation angle $H = 90° - Z$), was considered.

Disregarding the obvious dependence of the quantity J_S on the atmospheric turbidity, we only illustrate here a noticeable azimuth dependence of the solar additive on the radiative temperature in the third channel.

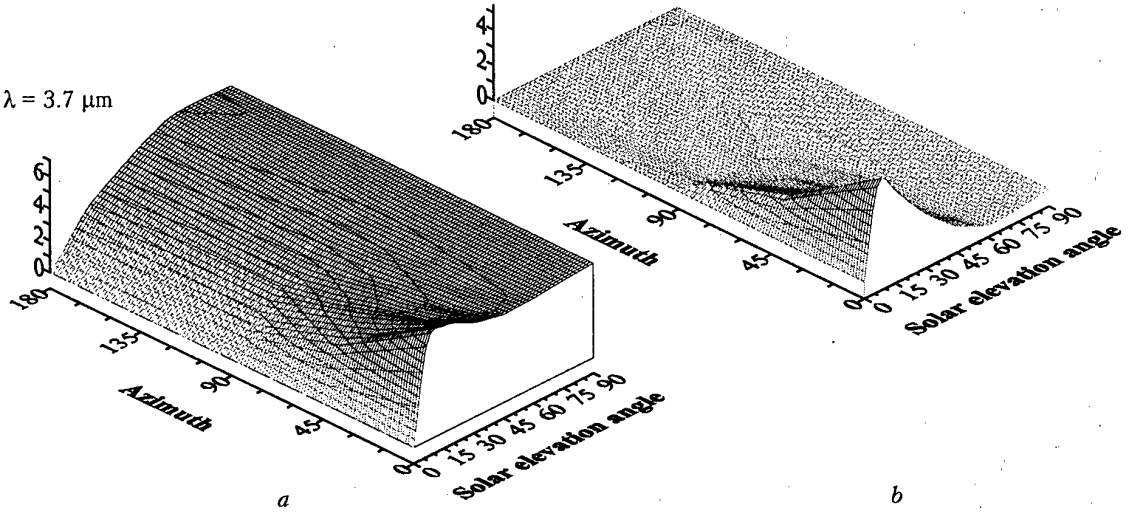

Figure shows the results of statistical simulation of absolute values of the thermal solar additive (a) and the amplitudes of its azimuth differences (b) calculated for an optically dense aerosol model (the meteorological visibility range was MVR = 2 km) of the surface atmospheric layer and an angle of 45° between the nadir and the axis of the AHVRR device as functions of the solar elevation angles (the underlying surface albedo was 0,04). The results obtained demonstrate that the azimuth differences of the measured temperatures may be comparable to the solar additive itself.

The results presented in this report confirm the importance of consideration of the optical-geometric conditions of observations for solving the problem of satellite monitoring of small-sized high-temperature anomalies on the Earth's underlying surface.

C1-05

METHODS OF MAPPING AND MEDIUM-TERM PREDICTION OF FIRE DANGER BY WEATHER CONDITIONS

A.I. Sukhinin and E.I. Ponomarev
Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russia
boss@ksc.krasn.ru

The problem of medium-term prediction of fire danger (FD) appears to be one of the key tasks pertaining to forest fire monitoring. Methods of mapping and medium-term prediction of fire danger by weather conditions using remote sensing data from NOAA series satellites are being developed in V.N. Sukachev Institute of Forest. Estimation of fire danger by weather condition is carried out according to an expression analogous to the one suggested by G.N. Nesterov:

$$\Gamma_{ij} = \xi \sum_i \sum_j t_{ij}(t_{ij} - \tau_{ij}), \quad (1)$$

where Γ_{ij} – index of fire danger; τ – temperature of dew point, °C; t – radiometric temperature of surface, °C; ξ – coefficient of precipitation compensation. Summation is calculated for every pixel (i) of the given region from the first through the last day of fire dangerous season (j).

Analysis, made during fire dangerous periods of 1996–2000, revealed close correlation between Russian ($r \approx 0,9$) and foreign ($r \approx 0,8$) indices of fire danger.

Temperature of every image pixel is restored with the help of data from the 5-th (thermal IR) channel of AVHRR. Combination of visible (1st) and near IR (2nd) channels of AVHRR allows to detect and exclude areas covered by clouds and water surfaces from calculations. Data from weather stations and from instruments of TOVS/NOAA provide lacking information necessary for FD calculations (precipitation, temperature of dew point). Using formula (1), one can calculate FD for every image pixel and thus generate a map of current fire danger for N-day period of observation.

Meteorological prognoses of near surface pressure and air temperature are used on the stage of fire danger prediction. In accordance with the prognoses one can restore temperature field and calculate fire danger index. The result is represented in the form of prognosis fire danger map for 1 through 7 days ahead. Nevertheless, the solution of the medium-term fire danger prediction problem is impeded by the absence of methods of probable watery precipitation fields mapping, as well as by the absence of methods of their quantitative estimation. Solving this problem we use iterative method of every-day correction of prognosis fire danger map. Taking into consideration data about fallen out precipitation for every day of predictable period we get adjusted prognosis fire danger map according to weather conditions.

C1-06

COMPUTER SIMULATION AND EXPERIMENTAL RESULTS FOR OCEANIC LIDAR RETURN

I.L. Katsev[1], E.P. Zege[1], A.S. Prikhach[1], B.I. Stepanov[1], D. Allocca[2], M. Contarino[2], L. Mullen[2], and G. Ludbrook[3]
[1]*Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus*
eleonor@zege.bas-net.by
[2]*NAVAIR, Patuxent River, MD, USA*
[3]*DERA Malvern, UK*

During the last few years, DERA (Malvern, UK) and NAVAIR (Maryland, USA) performed experiments with two oceanic lidar systems: the K-meter Survey System (KSS) and the Australian LADS system. LADS system was primarily developed for seabed mapping. The MALVERN group expanded the application area and used LADS for seawater optical characteristics monitoring.

The development of computer modeling of oceanic lidar performance has begun in the Institute of Physics (Belarus). This modeling provides:

- lidar return profiles from ocean with different stratification;
- the components of the lidar return due to seawater, atmosphere-ocean interface, atmosphere, and sea bottom;
- the efficient coefficient of laser beam attenuation as a function of depth and its average value.

The real shape of a laser pulse and an amplifier bandwidth of a receiver in a lidar system are regarded. The simulation includes the realistic models of seawater optical properties. All specific features of a real hydrosol phase function including those of the back scattering are allowed for.

The coupling of the specific backscattering technique and the multi-component method to solve the radiative transfer equation provide accurate and extremely fast lidar return simulations.

We present experimental results, outline the simulation algorithm, and present the very first comparison of experimental data and the results of computer simulations.

C1-07

SIMULATING TRANSFER OF THE OCEAN BOTTOM IMAGE IN VIEW OF THE RADIATION INTERCHANGE BETWEEN THE ATMOSPHERE AND OCEAN

T.A. Sushkevich, A.K. Kulikov, S.V. Maksakova
Keldysh Institute of Applied Mathematics RAS, Moscow, Russia
tamaras@spp.keldysh.ru

The original mathematical means is recommended to simulate the transfer of the image of the orthotropic or nonorthotropic horizontally homogeneous or inhomogeneous ocean (reservoir) bottom in the millimeter and short-wave range of the radiation spectrum.

The basic for this theory are the influence functions and spatial frequency characteristics method, the theory of the regular perturbations, the linearly-system approach, the optical transfer operator. The methods makes possible taking into account of the radiation multiple scattering in the atmosphere and ocean as well as the structural determinations of the radiation interchange between the media. As this takes place, the radiation transfer in the atmosphere and ocean is calculated by the different methods to the different approximations of the kinetic equation solution.

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C1-08

ANALYSIS OF LIDAR SIGNAL SPATIAL PERFORMANCES WHEN SOUNDING THE OPTICALLY DENSE AEROSOL OBJECTS

S.A. Abramotchkin, A.I. Abramotchkin, and A.A. Tikhomirov
Institute for Optical Monitoring SB RAS, Tomsk, Russia
tikhomirov@iom.tsc.ru

The application of elastic scattering lidars for aerosol object examinations in the atmosphere is based on the use of a lidar equation. In the classical view it describes the power of a singly scattered signal component. In optically dense objects, such as clouds, the probability of repeated scattering acts is great. Their energy contribution to the return signal increases together with the optical density of the medium sounded. The repeated scattering acts occur both inside the sounding beam and on the outside of it. Therefore, the angular size of double scattering volume exceeds the angular size of single scattering volume on a viewed distance in quantity. This circumstance is used to separate the singly and multiply scattered components in a lidar signal by means of the spatial filtration of the flux returned.

The results of experimental examination of a possibility to analyze the lidar signal spatial performances for the purpose to estimate the multiple scattering energy contribution when sounding the optically dense aerosol objects are presented herein. The parameters of lidar, spatial filter and recording system being used are presented. The algorithms of receiving and processing the returned signals and some features of experiment implementation with the use of an adjustable spatial filter are discussed. The submitted results allow one to make up a conclusion that the spatial filtration of the elastic scattering lidar signals enables to increase the lidar measurement information density essentially and therefore it is a perspective direction in elastic scattering lidars technical developing.

C1-09

ANALYSIS OF THE EFFICIENCY OF SATELLITE MONITORING OF FOREST FIRES BY THE AVHRR/NOAA DEVICE (TOMSK REGION)

V.V. Belov and S.V. Afonin
Institute of Atmospheric Optics SB RAS, Tomsk
belov@iao.ru

In 1998–2000, 1185 forest fires were recorded in the Tomsk Region Their total area was more than 60 thousand hectares. Conventional use of aircrafts for monitoring of fire-hazardous regions requires considerable expenses, which explains an increasing role of satellite systems of remote sensing of the Earth's underlying surface. At present the AVHRR/NOAA satellite system is commonly used for satellite monitoring of seats of the fire.

In the Tomsk Region, real-time monitoring of forest fires has been carried out since 1998 by the Institute of Atmospheric Optics as a leading institution by the order of the Tomsk Department of Forest Management (nowadays the Forest Service) and the Tomsk Aviation Center of Forest Protection. This work is described in detail in Ref. 1.

The efficiency of satellite fire monitoring was analyzed by the following main criteria: (*a*) dependence of the fire detection probability on its area, (*b*) dependence of the efficiency of detecting seats of the fire on the time of a day; and c) efficiency of early detection of seats of the fire compared to the ground-based and airborne methods of fire detection.

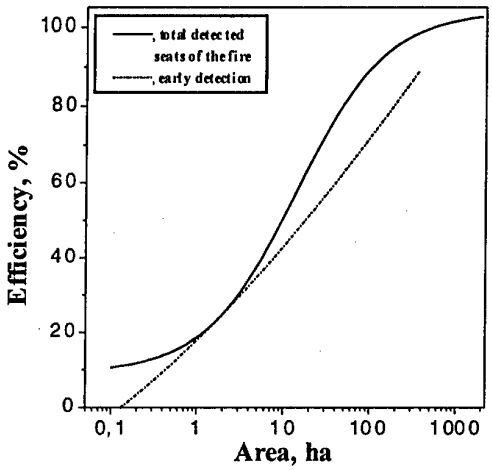

Figure shows the estimated efficiency of satellite fire monitoring in 1998-2000 as a function of the forest fire area (including the data on early detection of fires). The number of fires detected from the satellite is about 29–47% of their total number, and the efficiency of their early detection (compared to the results of ground-based and aviation services of fire protection) is 13–21%. The spread of the data for different years is primarily determined by the amount of clouds above the territory of the Region in the period of the maximum probability of fire occurrence.

The results obtained of forest fire monitoring obtained at the IAO SB RAS were approved by the Aviation Center of Forest Protection, the International Institute of Forest Sciences of the RANS, V. N. Sukachev Institute of Forest Sciences of the SB RAS, and the Institute of Solar-Terrestrial Physics of the SB RAS.

They were also discussed in seven scientific seminars held in Novosibirsk, Krasnoyarsk, Barnaul, and Tomsk in 1999-2000.

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C1-10

ON THE APPLICABILITY LIMITS OF THE SMALL-ANGLE SCATTERING APPROXIMATION FOR A DESCRIPTION OF THE BEAM SPREAD FUNCTION WITH ALLOWANCE FOR THE DISPERSE COMPOSITION OF A SCATTERING MEDIUM

V.V. Belov, V.V. Veretennikov, and R.V. Vil'danov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
vvv@iao.ru

A broad class of problems connected with the study of the optical radiation propagation through the atmosphere can be solved within the framework of the small-angle scattering approximation (SASA). As is well known, the SASA applicability limits are specified by the requirements of pronounced scattering anisotropy, not too large optical thickness of the medium, and the presence of light absorption in the medium.

The SASA application calls for the separation of the forward-peaked small-angle component of the scattering phase function. To do this, it is most natural from the physical viewpoint to use the diffraction component of the scattering phase function. This approach allows an explicit relationship between the light field structure in the SASA and the geometric parameters of scatterers, defined by the correlation function of particle shadows, to be derived.

The characteristics of multiply scattered radiation in the SASA contain information on the dispersion composition of the medium, which can be extracted by solving the corresponding inverse problem. In practice, a solution of

the problem on the diagnostics of the microstructure of media calls for a reliable quantitative assessment of the SASA applicability limits for polydisperse scattering phase functions in the approximation of the Fraunhofer diffraction.

In the present report, the results of solving the radiative transfer problem for one of the basic optical characteristics – the light beam spread function – and for the light flux passing through a circle area of finite radius, are compared with the data of statistical simulation of radiative transfer by the Monte Carlo method. Among the variable parameters of the problem are the modal radius of the particle size distribution described by a modified gamma-function and the geometric and optical thickness of the layer. Based on the results of statistical simulation, recommendations for the SASA applicability are developed.

C1-11

VARIATIONS OF THE IMAGE CONTRAST AT OBSERVATION THROUGH A DISPERSE LAYER

B.D. Borisov

Institute of Atmospheric Optics SB RAS, Tomsk, Russia

Much attention was paid last decade for calculations and experiments on solving the partial problem of the vision theory devoted to the image transfer through a geometrically thin but optically dense scattering layer. In spite of the fact that such variant of stratification of a medium is simplest, it makes it possible to more deep understand the processes of the image transfer through disperse media.

The purpose of this paper is the attempt of quantitative estimation of the passive vision system image quality at observation of a complex large-size object with the change of position of the plane disperse layer along the line of vision by means of the methods of laboratory modeling.

The experimental setup consisted of the plane round diffusely radiating object of 900 mm diameter. The radial test pattern of 50 mm diameter and angular size of the sector 10° was placed at the center of the object. The pattern of observation was constructed so that only the image of the central part of the object limited by the radial test pattern size was formed on the sensitive element of the TV ПЗС-camera through the plane chamber.

Measurements were performed at optical thickness $\tau = 0$ (distilled water) and $\tau = 1.16–4.74$ (milk solution). The layer position relatively to the object was changed $l = 22–522$ mm at the distance between the object and the receiver of $L = 2894$ mm.

Analysis of the experimental data has shown that the test pattern image contrast determined for three spatial frequencies changes non-monotonically as the layer moves, and has the stable maximum at the distance of $l \sim 150$ mm. The contrast value at the greatest τ can vary from 0.07 to 0.01 as l increases.

C1-12

PROBLEM OF INCLUSION OF REFRACTION IN THE RADIATIVE TRANSFER EQUATION FOR THE ATMOSPHERE-OCEAN SPHERICAL SYSTEM

A.B. Gavrilovich

Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus

gavril@dragon.bas-net.by

The theoretical modeling of the field of optical radiation scattered by the air and water envelopes of the atmosphere – ocean system (AOS) is based on the solution of a boundary problem for the radiative transfer equation (RTE). The setting of the problem on the optical-radiation transfer in the AOS requires a consideration of a great number of parameters determining the character of interaction of light with a medium inside it as well as at the boundaries including the boundary between the media air – water. Because of this, approximate methods based on the introduction of different simplified suppositions, such as a plane geometry of the system, a single-interaction of light with the Fresnel boundary between the media air – water, and the absence of the refraction of light rays, are widely used. The multiparametrisity of the problem and the impossibility of the obtaining of simple solutions generate a need for the search of new methodical approaches taking into account the spherical geometry of the system, the singularities of boundary conditions, the real profile of the refractive index and the refraction effect determining the deviation and refraction of light beams.

The refraction theory is based on the differential equation of refraction describing the change in the direction of a beam propagating in a medium with a varying refractive index. The inclusion of it in the problem on the scattering of light in the AOS leads to a change in the RTE and in the boundary conditions, which complicates the problem. Because of this the practically important question arises: if the boundary problem on the radiation transfer in the AOS can be reduced to a more simple form that not explicitly involve the refraction effect. The work provides the positive answer to this question and gives a mathematical substantiation of this possibility.

C1-13

ESTIMATION OF THE BURNED AREAS BY USING AVHRR/NOAA DATA

N.P. Minko, V.V. Koshelev, N.A. Abushenko, D.A. Altyntsev, S.A. Naschilin, and A.V. Tatarnikov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
nick@iszf.irk.ru

The large forest fires that occurred in 1998 in Khabarovsk krai, are of paramount interest in such branches of knowledge as silviculture, ecology and atmospheric chemistry, and the burnt area is a key fire parameter.

Monitoring surveys of forest fires based on multichannel satellite information received at the Space Monitoring Center (SMC) of the Institute of Solar-Terrestrial Physics SD RAS, Irkutsk, furnish an opportunity to obtained several estimates of burnt areas which can be successfully used in determining the areas of large forest fires.

Estimations of burnt areas are based on using satellite data in the middle infrared spectral region (3.5–3.9 μm), i.e. on the basis of identifying hot spots detected by a threshold algorithm[2] in AVHRR/NOAA images in 1998.

The territory, for which an analysis of the burnt areas is made, occupies the longitude and latitude ranges 110–155°E and 46–49°N, respectively. The time interval is from March 26 to October 26, 1998. The accuracy of geographic referencing made visually from reference points averages 2 pixels.

Thus the result derived from the superposition of fires obtained by three methods from hot spots, on the contours of burn-out areas shows a good agreement with the mean estimate of the burn-out areas made from the initial hot spots.

A total of 229398 hot spots was found. The entire set of hot spots is broken up into fires. A group of hot spots closely spaced in space and time is considered to be a fire. Than we calculated burned areas. The results are presented in the table.

Fire area, km^2	Number of fires of this area	Percentage of the number of fires of a total number of fires	Total area of fires of this area	Percentage of a total area of a total area
1	3682	55.5	3682	4.2
2	780	11.8	1560	1.8
3	441	6.7	1323	1.5
4–10	943	14.2	5616	6.4
11–100	655	9.9	20325	23.0
101–300	88	1.3	15236	17.3
301–1000	37	0.5	19716	22.3
1001–2000	8	0.1	10488	11.9
2001–3000	1	0.015	2172	2.5
3001–4209	2	0.03	8165	9.2

It is evident from the table that more than a half of the fires occupy an area of 1 km^2; however, a total area of these fires makes up only 4% of a total burn-out area.

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C1-14

USE OF INFORMATION TECHNOLOGIES IN SYSTEMS OF SATELLITE MONITORING OF FOREST FIRES

S.A. Bartalev, D.V. Ershov, E.A. Lupyan, A.A. Mazurov, N.P. Min'ko, A.A. Proshin, and E.V. Flitman
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
nick@iszf.irk.ru

To solve a set of the problems connected with the operational monitoring of forest fires and their consequences the data of various satellite systems operating in standard mode are used today. Therefore a rather large number of publications has been devoted to the problems of detection of forest fires by satellite data.

However, to solve the specific operational problems it is required to have not only the appropriate algorithms of processing and analysis for satellite data, but also the technology allowing us operatively to give an information obtained as a result of processing of satellite data for the forest protection service. This technology should provide an integration of this information into the systems for a decision making of corresponding services. With it the following problems should be solved first of all:

- obtaining of satellite data;
- operational data processing;
- integration of results of satellite data processing with an information obtained from other sources;
- operational representation of data to the users.

The fast growth during the last years of various information systems has allowed such technology to be created. The present paper is devoted to description of its basic possibilities. We consider both the possibilities to automate the processes of reception and processing of satellite data and the organization of automatic delivery to the users of results of processing and their integration into geoinformation systems for the fire-protection services for forests. The technology described in the paper is used to provide the works of the Air forest protection service of Russia the last five years.[1] It has been created jointly by the experts of International Institute of Forest (IIF), Institute of Solar-Terrestrial Physics of SB RAS (ISTP of SB RAS), and Institute of Space Researches of RAS (ISR RAS).

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C1-15

IMPROVEMENT OF SPATIAL RESOLUTION OF IMAGES RECORDED WITH THE AVHRR/NOAA DEVICE AND INTENDED FOR SOLVING PROBLEMS OF RESOURCE-ECOLOGICAL MONITORING

E.S. Artamonov and K.T. Protasov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
prot@iao.ru

Recently increasing attention is given to the videodata recorded with the AVHRR/NOAA device and intended for solving both the meteorological and resource-ecological monitoring problems. Unfortunately, poor spatial resolution and significant geometric and radiobrightness distortions of these images make their direct use difficult. The procedure of complex correction suggested by us includes normalization of illumination of the Earth's underlying surface images recorded in the daytime with allowance made for the solar zenith angle. The procedure of correction of geometric distortions considers changes in projections of the AVHRR scanning spot onto the cylinder and includes recalculations of the radiobrightness values for a fixed diameter. The next step of image correction is the improvement of the spatial resolution of NOAA images. In the first stage, an image fragment is subjected to a magnification of the carrier by the adjustment of lines and columns. This yields the image with omitted pixels. In the second stage, the omitted pixels are restored with the use of the two-dimensional interpolation procedure. In so doing, contour brightness gradients are retained. The last stage includes deconvolution of the recorded smoothed image by inversion of the equation of convolution of the desired sharp magnified image of the underlying surface with the point spread function (PSF). We used the modified Yakubov function with variances changing along the lines and columns of the image as the instrumental function. The convolution equation was solved based on the representation of the PSF as a singular SVD expansion and subsequent pseudo-inversion of the spread function. Some examples of the complex correction of model and actual images recorded with the AVHRR device are presented. Magnified and normalized images intended to solve the problem of monitoring of the Earth's underlying surface demonstrate significant advantage of the corrected data compared to conventional images.

C1-16

IDENTIFICATION OF CLOUD FIELDS BY THE NONPARAMETRIC ALGORITHM OF PATTERN RECOGNITION FROM THE AVHRR/NOAA DATA

T.G. Pushkareva and K.T. Protasov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
prot@iao.ru

The problem of cloud field recognition from the NOAA satellite data is urgent for solving not only meteorological problems but also for resource-ecological monitoring of the Earth's underlying surface associated with the detection of thunderstorm clouds, estimation of the liquid water content of clouds and the moisture of the soil, the degree of fire hazard, etc. To solve these problems, we used the AVHRR/NOAA videodata that regularly displayed the situation in the territory. The complexity and extremely nonstationary character of problems to be solved call for the use of information of all spectral channels, mathematical apparatus of testing statistical hypotheses, and methods of pattern recognition and identification of the informative parameters. For a class of detection and pattern recognition problems, the average risk functional is a natural criterion for the quality and the information content of the synthesized decision rules. In this case, to solve efficiently the problem of identifying cloud field types, the informative

parameters must be determined by minimization of this functional. Since the conditional probability density functions, representing mathematical models of stochastic patterns, are unknown, the problem of nonparametric reconstruction of distributions from the leaning samples arises. To this end, we used nonparametric estimates of distributions with the modified Epanechnikov kernel. The unknown parameters of these distributions were determined by minimization of the risk functional, which for the learning sample was substituted by the empirical risk. After the conditional probability density functions had been reconstructed for the examined hypotheses, a cloudiness type was identified using the Bayes decision rule. To estimate the efficiency of our algorithm, we used the AVHRR data for the Tomsk Region recorded in 2000 when the cloud amount was high. A comparison of the results of algorithmic implementation with the data obtained by the operator has demonstrated high efficiency of the algorithm of detecting cloud types and estimating their parameters.

C1-17

SOFTWARE COMPLEX FOR SOLVING THE DIRECT PROBLEMS OF ATMOSPHERIC OPTICS

A.B. Serebrennikov and V.V. Belov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
belov@iao.ru

A great number of software products for solving various research and applied problems of atmospheric optics are developed and available to date for scientists, engineers, constructors, post-graduate students and students. Among them one can note the programs MODTRAN, FASCODE, MOSART, HitranPC, and LidarPC, developed by Air Force Phillips Laboratory and Ontar Corp (see www-vsbm.plh.af.mil и www.ontar.com). estimation of characteristics of the radiation undergone interaction with a medium is performed in the majority of these software products based on the methods for solving the radiation transfer equation (for example, Ref. 1). As a rule, in this connection, the question remains open on the accuracy of the obtained solutions.

The "Photon" information-retrieval system is created in the Institute of Calculation Mathematics and Mathematical Geophysics SB RAS for automatization of statistical modeling of the radiation field of the atmosphere.[2] It is capable of solving the stochastic radiation transfer equation, estimating the brightness fields and optical transmission functions in the atmosphere–underlying surface and atmosphere–ocean systems by means of the Monte-Carlo method.

The set of methods for solving the non-stationary (laser sounding, location, range finding, communication) and stationary (navigation, transfer and formation of images in scattering media, radiation regime of the atmosphere, illumination of the ground surface) problems of atmospheric optics, including the asymptotically precise (Monte-Carlo) method for solving the transfer equation in addition to the approximate methods.

When developing the new software, especial attention is paid for creation of the friendly interface for work with a user and reaching quite flexibility of the program at setting the initial conditions of the modeled experiment.

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C1-18

SIMULATING TRANSFER OF THE NONORTHOTROPIC SURFACE IMAGE IN THE POLARIZED LIGHT

T.A. Sushkevich and S.A. Strelkov
Keldysh Institute of Applied Mathematics RAS, Moscow, Russia
tamaras@spp.keldysh.ru

In the problems of the radiation correction at the remote sensing of the objects and Earth surface, in the processing of the optical information, in the theories of vision and image transferring through the muddy media, in the theoretically computational bases of the designing of the optical-electronic observation systems the widespread occurrence has received an approximation of the linear systems. The linear systems are responded to the first boundary value problems (BVP) of the transfer theory (with "vacuum" boundaries).

In the present work the Stokes vector of the non-coherent multiply scattering light beam of rays in an approximation of a non-linear system as the solution of the general vectorial BVP of the polarized radiation transfer theory in a planar layer with a reflecting underlying surface or inner dividing border of two media. The nonlinearity is stipulated by the non-linear dependence of the solution from the characteristics of the law circumscribing of the radiation interaction with the boundaries.

From the unified methodical positions the four classes of the problems are considered: with horizontally homogeneous and inhomogeneous lambertian and anisotropic boundary conditions. Instead of the initial model – general BVP is proposed the new model, asymptotically exact and adequately describing of the physical process.

The constructed base mathematical models of the vectorial IF and the vectorial OTO allow to devise the new algorithms of a numerical modeling of the polarized optical and millimeter (in a quasi-optical approximation) radiative transfer in the systems "atmosphere – land", "atmosphere – ocean", "atmosphere – cloud", "atmosphere – hydrometeors", "atmosphere – vegetative cover", and also the radiation correction in the methods of the remote sensing, theory of the vision and the transfer theory of the image through the muddy polarizing media.

The work was supported in part by The Russian Foundation for Basic Research (Project 99-01-00170).

C1-19

SIMULATING TRANSFER OF THE TERRESTRIAL SURFACE IMAGE TAKING INTO ACCOUNT OF EARTH SPHERICITY

T.A. Sushkevich and E.V. Vladimirova
Keldysh Institute of Applied Mathematics RAS, Moscow, Russia
tamaras@spp.keldysh.ru

In the last few years the active evolution and application of the adjoint equations method is observed in problems of the mathematical physics and in problems of environment global and climatic changes as well as in the global and local monitoring and the pollution transport.

Since 70th years in a parallel way the theory of the transfer operator and the method of the influence functions and spatial-frequency characteristics are developed to solve the problems of the atmosphere and surface remote sensing and the space information radiation correction.

In the present work the analysis have been carried out to compare two methods based on use of the influence functions and of the value functions as well as the linear functionals to solve the earth surface image transport problem taking into account of the multiple scattering and of Earth sphericity. The optical transfer operator of the spherical atmosphere-Earth system is stated. The models of the influence functions for the transfer theory spherical problem are formulated.

The work was supported in part by The Russian Foundation for Basic Research (Project 01–01–00298).

C1-20

ANALYSIS OF DYNAMICAL IMAGES OF GAS-AEROSOL PLUMES AS A RESULT OF EXPLOSION OF MINE LAUNCHING INSTALLATION

B.N. Dmitriev and I.A. Sutorikhin
Institute for Water and Environmental Problems SB RAS, Barnaul, Russia
sia@iwep.secna.ru

In November-December, 2001 the Laboratory of Ecology of Atmosphere, Institute for Water and Environmental Problems, carried out investigations on dissipation aerosol-gas emission in atmosphere resulted form the explosion of six mine launching installations (MLI) of RS-20 type ballistic rockets. The work was done by the use of movable laboratory for atmosphere ecological monitoring was located at 1.5 km from the explosion site in the point of expected gas-aerosol plumes pass.

Measurements were made using aerosol- and gas- measuring equipment as well as means of visual recording (theodolite, camera, videocamera). Besides, the telephotometric monitoring used previously for monitoring of emissions from local pointer sources, i.e. chimneys in industrial areas, was done.[1,2] This method is based on statistical image analysis of distribution of the fields of bright contrast of dynamic synthesized images containing information on aerosol plumes dissipation in atmosphere. Dynamic synthesized images have been obtained by transformation of analogue videosequences into digital ones with subsequent statistic image processing and make it possible to decrease information stored on physical carriers.[3]

The report presents the results of statistic processing and analysis of dynamic images of gas-aerosol plumes dissipation in the site of mine launching installation explosion. The comparison of the data obtained with the results of measurement of countable and mass concentration in atmosphere ground layer as well as with numerical experiments is performed.

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C1-21

LIDAR EQUATION IN THE SECOND ORDER APPROXIMATION FOR MEDIA WITH A STRONGLY EXTENDED PHASE FUNCTION

V.V. Veretennikov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
vvv@iao.ru

It is known that the analytical description of a lidar signal in a dense medium can be reduced to the solution of the problem of direct radiance propagation from a stationary source in a fictitious medium where the extinction and scattering coefficients are twice exceeded their true values. The specified relation of two problems takes place when considering a multiple scattering in the small-angle approximation. The optical transfer function (OTF) of the fictitious medium plays a fundamental role in this description. An expansion of the OTF in the Taylor series results in the separation of the radiation on scattering orders in the fictitious medium. In the report a case is in detail analyzed, when the first two members of this series (i.e. the approximation of the second order) are only taken into account.

The simple analytical dependence of a lidar signal on the small-angle phase function is derived in an obvious form. The phase function is presented in the lidar equation in the form of linear integrated transformation, the kernel of which depends on geometrical parameters of the lidar receiving and transmitting system. Relations obtained in the paper allow us to lower considerably the requirements to computing resources when solving direct and inverse problems of lidar sensing taking into account the multiple scattering. In the report the estimations of the applicability limits of the considered approximation are presented depending on the dispersed structure and density of the sounded medium. Methods of the solution of inverse problems on restoration of the extinction coefficient profiles and parameters of microstructure with the variable receiving field-of-view angle lidar are discussed.

C1-22

POLARIZATION ESTIMATION IN THE PROPAGATION OF A NARROW POLARIZED BEAM THROUGH A MULTIPLY SCATTERING MEDIUM

L.I. Chaikovskaja
Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus
lch@zege.bas-net.by

For solution of the laser sounding problems applying to clouds and sea water one should be able to calculate parameters of polarization of a narrow polarized beam propagating through a multiply scattering medium. Development of polarization calculation techniques encounters difficulties of solving the multi-parametric transfer equations, such as the vector equations for the four Stokes parameters, or ones for the elements of the four by four Green's matrix, depending on angular and spatial coordinates. In recent works by Zege and Chaikovskaja the vector equations were simplified. To calculate the near-forward polarization of a linearly polarized beam, there was offered an approximate semi – analytical technique, alternative to the numerical method Monte-Carlo usually used in this case. The semi – analytical technique is distinctive by being very fast.

The purposes of the present work are to improve and to make more precise the fast computation technique for the near-forward radiation linear polarization (Zege and Chaikovskaja, 2000); to investigate features of transformation of the beam near-forward linear polarization.

The improvement concerns in the first turn solution for the linearly polarized radiance. This is built with using the small – angle and small – angle diffusion approximations and multi component approach, generalized to the case of description of the polarized portion of radiation. In the work, illustrations showing technique accuracy are given. Results of calculations for angular patterns of the near-forward linear polarization degree are compared with experimental data available in literature.

C1-23

RESULTS OF SATELLITE MONITORING OF FOREST FIRES IN TERRITORY OF YAKUTIYA

V.S. Solov'ev and E.K. Vasil'ev

Institute of Cosmic-Physical Researches and Aeronomy SB RAS, Yakutsk, Russia

solo@ikfia.ysn.ru

The operational detection and monitoring of the centers of fires in the territory of Russia is the important nature-protection problem, especially, it concerns the extensive forest arrays in scanty populated regions of Siberia and Far East. In particular, in 1998 in the territory of Yakutiya only as a result of forest fires more than 2.1 millions of cubic meters of wood had been destroyed and damaged, the total loss had amounted 108.2 millions of rubles. Forest canopy of the territory of Sakha Republic (Yakutiya) is more than 125 millions of hectares, about a half of this area concerns to a category of regions unprotected by the Yakutiya air base of forest protection. To provide the operational forest-fire monitoring in such extensive space with the traditional resources: the air patrolling and net of ground posts, under the conditions of insufficient financial support of forest protection services it is not possible practically.

As the practice shows, the most promising method of monitoring of a forest-fire situation, especially for the extensive scanty populated territories, is the method of satellite sounding from the point of view of both the efficiency of obtaining of information and the large saving of material and human resources. At the station of satellite data receipt from NOAA satellites installed in Institute of Cosmic-Physical Researches and Aeronomy SB RAS (Yakutsk) from 1998 the satellite monitoring of forest fires in the territory of Yakutiya is carried out jointly with the Yakutiya air forest protection. To estimate the effectiveness of detection of the centers of forest fires by the data of NOAA satellites using the threshold algorithm developed in Institute of Solar and Terrestrial Physics SB RAS the comparison with the official data on forest fires registered by the Yakutiya air base of forest protection has been carried out.

The results of comparison with the reports of fire situation of the Air forest protection in June and beginning of August 1998 have shown that under the conditions of actual receipt by the satellite photographs the fires with area 10–100 ha are detected for more than 80% from the number of considered cases, the centers with the area more than 100 ha are detected practically everyone. The centers of smaller dimensions are detected with smaller probability: with the area less than 1 ha (in 20% of cases), with the area 1–10 ha (in 40% of cases). The main reason, on which it fails to detect the forest fires by satellite data, is the powerful cloudiness; the remaining reasons are caused by flight time that is not optimum to detect the centers of fires and the orbit parameters of a satellite.

Session C2. LASER AND ACOUSTIC SOUNDING OF ATMOSPHERE AND OCEAN

C2-01

NUMERICAL MODELS OF LASER RADIATION PROPAGATION IN RANDOM INHOMOGENEOUS MEDIA

B.A. Kargin
Institute of Computational Mathematics and Mathematical Geophysic SB RAS, Novosibirsk, Russia
bkargin@osmf.sscc.ru

Effective weight algorithms of Monte Carlo method for solving non-stationary stochastic transfer equation which models laser impulses propagation in random scattering media are considered. The algorithms of statistical modeling have been elaborated mainly as applied to direct and inverse problems of laser sensing of aerosol atmosphere, continuous and broken cloudiness as well as the ocean-atmosphere system. In order to simulate the stochastic structure of cloudiness and ruffled ocean surface the spectral models of random fields were used. The algorithms have been realized in a set of computer programs. Wide series of numerical experiments, allowing the investigation of effectiveness of space lidars for remote sensing of the optical characteristics of cloudiness and upper layer of the ocean has been carried out.

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C2-02

LIDAR OBSERVATION OF SAHARAN DUST INJECTIONS IN THE EAST EUROPE REGION

A.P. Chaikovsky,[1] A.P. Ivanov,[1] F.P. Osipenko,[1] M.M. Korol,[1] A.C. Slesar,[1] I.S. Hutko,[1] S.Puchalski,[2] and P.Sobolewski[2]
[1]*Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus*
chaikov@dragon.bas-net.by
[2]*Institute of Geophysics Polish Academy of Sciences, Warsaw, Poland*

Regular measurements of profiles of aerosol parameters by lidars have being conducted on the 22d Lidar Stations of the 11the European countries in the framework of the Observation Program of the European Lidar Net (EARLINET). With using results of the measurements by lidars jointly with data of observations from the satellites, penetration zones of the Sahara dust in Europe have been discovered and determined.

On the lidar station of Institute of Physics of National Academy of Science of Belarus (Minsk, 53.85° N, 27.5° E) and also on the lidar station of Institute of Geophysics of Polish Academy of Science (Belsk, 51.83° N, 20.78° E), the dust layers for the East Europe region have been found and then investigated. The atmosphere was sounded at the wavelengths 532 and 694 nm, the backscatter signal depolarization being measured. Dust layers were found to be on the heights from 3 to 8 km. An aerosol backscatter ratio measured at 532 and 694 nm inside of the dust layer was close to unity. The aerosol backscatter depolarization values between 0.07 and 0.1. Note that continuance of a particular observation of the dust layers was from 1 to 4 days.

In the work, we compare data of measurements on the two lidar stations. We also estimate optical parameters of the aerosol layers. With analysis of trajectories of air mass movement, we can interpret features of transformation of the aerosol layers.

C2-03

LIDAR INVESTIGATIONS OF THE DYNAMICS OF AEROSOL FIELDS OF THE BOUNDARY LAYER OF THE ATMOSPHERE

Yu.S. Balin, A.D. Ershov, and S.V. Samoilova
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
balin@iao.ru

The results are presented of investigation of the spatial-temporal structure of the aerosol fields in micrometeorological, mesometeorological and synoptic spectral ranges of oscillations of the fields as a complete physical object. Stabilization of the solution is reached at data processing simultaneously on two coordinates (distance–distance, distance–time). The patterns of formation of the structure of the aerosol fields of the boundary layer under conditions of West Siberia (the city of Tomsk) and the mountain depression contour of lake Baikal are shown at the beginning.

The work was supported in part by Russian Foundation for Basic Research (Grant No. 00–05–81164 and No. 00–05–97240).

C2-04

OPTIMAL REGRESSIONS TO ESTIMATE AEROSOL PARAMETERS BY DATA OF TWO- AND THREE-WAVELENGTH LASER SOUNDING

V.V. Barun, A.I. Bryl, V.P. Kabashnikov, V.M. Popov, and A.P. Chaikovsky
Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus
barun@dragon.bas-net.by

A problem on introduction of additional a prior assumptions to construct a closed set of lidar equations and on their solutions to estimate microphysical parameters of atmospheric aerosols by two- or three-wavelength laser sounding data is discussed. Some regression relations between spectral values of aerosol backscatter and extinction coefficients are used as the assumptions. The regressions are constructed on the base of model considerations. The model of "Continental" aerosols of the World Meteorological Organization is taken as a basic one. The constructed regressions have enabled one to evaluate the solvability of, generally, ill-conditioned lidar equations, the errors in the solutions as well as errors in determined mass concentrations and effective radii of aerosols. This work has been directed towards the design of procedures and algorithms to process laser sounding data gathered routinely by lidar setups of the Institute of Physics, Belarus National Academy of Sciences, Minsk, Republic of Belarus within the frame of a number of International and National research and development

C2-05

OPTICAL SENSING OF THE MIDDLE ATMOSPHERE AT SIBERIAN LIDAR STATION

V.D. Burlakov, S.L. Bondarenko, M.V. Grishaev, S.I. Dolgii, A.V. Elnikov, V.V. Zuev, A.V. Nevzorov, and S.V. Smirnov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
dolgii@iao.ru

Presently, the methods of remote optical sensing, utilizing lidar and spectrophotometric techniques, have been widely and efficiently used for atmospheric research and high-speed monitoring of atmospheric state. The observations are made routinely at many tens of lidar observatories from the Arctic to Antarctic, and at network of lidar stations such as NDSC, the widest network for determining stratospheric changes. At the same time, throughout the great Asian part of the Russia, the only operating is the Siberian Lidar Station (SLS) at the Institute of Atmospheric Optics SB RAS, Tomsk (56.5°N, 85.0°E), performing atmospheric measurements primarily aimed to study the mechanisms of ozone layer transformation. The study at SLS is made using integrated approach, by monitoring a few key parameters of ozonosphere determining its state: aerosol (since 1986), ozone (since 1989), and the gas components of ozone cycle and temperature (since 1995). The report describes the methods and techniques of lidar and spectrophotometric measurements at the Station, and presents some general obtained results.

Based on experience of creation and exploitation of SLS, it is suggested to discuss the possibility of creating the first series of lidar network stations in Siberian region for high speed monitoring of regional and global changes of the key parameters of the middle atmosphere (ozone, aerosol, and temperature). The simultaneous data analysis at all observation points will make it possible (*a*) to obtain information on dynamics of ozonosphere and predict its

changes for almost all the territory of Russia; (*b*) monitor the processes of meridional and zonal aerosol transport in the upper troposphere and stratosphere; and (*c*) overall, obtain important information for better understanding of atmospheric physics.

The work is performed at the Siberian Lidar Station (reg. No. 01–64) under support of the Ministry of Science of the Russian Federation.

C2-06

GAS RECONSTRUCTION IN MULTICOMPONENT MEDIA USING GENETIC ALGORITHMS

Yu.V. Fedotov, M.L. Belov, V.A. Gorodnichev, and V.I. Kozintsev
Bauman Moscow State Technical University, Moscow, Russia
ekomonit@mx.bmstu.ru

Application of lasers for gas-analysis requires using special algorithms for solving the corresponding inverse problem, namely restoration of quantitative information about gas component concentrations on the basis of measurements.

The paper describes gas reconstruction from multispectral laser measurements using genetic algorithms (GA).

The results of mathematical modeling using the developed algorithm have been compared with the direct solution of sets of linear equations and with the regularization procedures for sets of linear algebraic equations with ill-posed right part. Use of genetic algorithms for gas reconstruction has been shown to result in substantially lower errors than the direct solution of sets of linear equations. The method errors are comparable to regularization procedures ones.

Effectiveness of using GA for solution of sets of linear integral equations is shown for situations when the source bandwidth is comparable or more than the absorption bandwidth of the analyzed gas components.

C2-07

OZONE MEASUREMENTS BY UV-DIAL LIDAR AT HEFEI, CHINA

Shunxing Hu, Huanling Hu, Yonghua Wu, and Jun Zhou
Anhui Institute of Optics and Fine Mechanics, Hefei, China
sxhu@naol.hfcas.ac.cn

A four-wavelength lidar system based on the differential absorption method is described for measurements of ozone concentration profiles in troposphere and stratosphere. It contains two wavelength-pairs(308 nm (on-line) and 355 nm (off-line), 289 nm (on-line) and 308 nm (off-line)). An additional wavelength 532 nm is provided for ozone measurement correction due to aerosol loading. Wavelength 308 nm is generated by the XeCl excimer laser. Wavelengths 355 nm and 532 nm are produced by the second and third harmonic of Nd:YAG laser, respectively. Wavelength 289 nm is provided by Raman shift output of D_2 gas pumped by quadric-harmonic frequency (λ = 266 nm) of YAG.

Long-term stratospheric ozone measurements are regularly conducted at cloudless night since the lidar system was constructed in 1993. In this paper some tropospheric ozone concentration profiles and seasonal variation of stratospheric ozone at different altitude during 1996–2000 will be presented. Measurement results show that the peak of ozone layer over Hefei is near 25 km altitude, higher in autumn, and lower in spring. Ozone concentration at altitude 30 and 35 km is higher in summer and autumn than that in winter and spring. Contrarily the concentration of ozone at 20 km is lower in summer and autumn than that in winter and spring.

C2-08

A MOBILE LIDAR SYSTEM FOR AIR POLLUTION MEASUREMENTS

Zhang Yinchao, Hu Huanlin, Tan Kun, Yang Gaochao, Liu Xiaoqin, Shao Shisheng, Deng Min, and Zhang Gaoyong
Anhui Institute of Optics and Fine Mechanics, Hefei, China
yczhang@aiofm.ac.cn

A differential absorption lidar system for pollution monitoring for daytime and nighttime operation is described. It allows 3D-measurements by using a steering unit. This system was developed at the Anhui Institute of Optics and Fine Mechanics, the academy of Sciences of China. A few examples of measured O_3, SO_2, and aerosols distributions are presented.

C2-09

A NEW METHOD OF THE MIXING DETERMINATION IN ATMOSPHERE

M.A. Lokoshchenko
Moscow State University, Moscow, Russia
loko@geogr.msu.su

Both traditional values of mixing heights by radiosonde data, and sodar estimations of the ones are presented. The main features of annual and daily courses of mixing heights by sodar data, as well as their relations with a type of air mass, are discussed for results of long-term sodar sounding at Moscow University during 10 years.

A new proposal is using of instability energy for a mixing determination as an integral parameter instead of traditional heights. Three methods of mixing determination (traditional heights, energetic estimations by radiosonde data and heights by sodar data) are compared each to other. The result of theoretic calculations of the veritable mixing height is more as comparable as their traditional determination following Holzworth due to account of inertial lifting above intersection point between temperature profile and dry-adiabatic line.

C2-10

DIAGNOSTICS OF INTENSE ATMOSPHERIC VORTICES OVER THE SATELLITE MICROWAVE RADIOMETRIC SOUNDING DATA

A.F. Nerushev,[1] H.K. Kramchaninova,[1] and B.Z. Petrenko[2]
[1]*Institute of Experimental Meteorology, Russian Federal Service for Hydrometeorology and Environmental Monitoring, Obninsk, Kaluga region, Russia*
nerushev@obninsk.org
[2]*Institute of Radio Engineering and Electronics RAS, Frayzino, Moscow region, Russia*
petrenko@ire.rssi.ru

The microwave radiometric sounding is an effective means of studying the ocean-atmosphere system in a wide range of varying geophysical parameters. But in the central regions of intense atmospheric vortices, in particular of tropical cyclones (TC), the radiation-geophysical models developed for standard meteorological conditions are inapplicable. We have developed an approximation semi-empirical method to determine most important TC characteristics on the basis of satellite microwave soundings of the ocean-atmosphere system.

The data of tropical cyclone soundings in the Atlantic and Pacific made in 1998–1999 by the radiometer SSM/I (Special Sensor Microwave/Imager) from board the American satellites of the DMSP (Defense Meteorological Satellite Program) series and the data of independent assessment of tropical cyclone parameters from storm warnings are the basis of the experimental studies. The method is based on the revealed link of the peculiarities of the TC central zone brightness image in the spectrum high-frequency range with the parameters characterizing the TC structure and power. It allows one according to the data of soundings at several wave lengths to determine the tropical cyclone eye sizes, the eye cloud wall thickness, maximum wind velocity (TC intensity), effective dimensions and configuration of the hurricane wind zone. With the method developed and with the radiation-geophysical models constructed for standard meteorological conditions a spatial distribution of sea surface wind velocity in the whole range occupied by a mature tropical cyclone including its central part can be obtained.

The work was carried out under the financial support of the Russian Foundation for Basic Research (Grant No. 99–05–64040).

C2-11

ANALYSIS OF THE DATA OF ACOUSTIC SOUNDING IN CONDITIONS OF STABLE STRATIFICATION OF THE BOUNDARY LAYER OF THE ATMOSPHERE

S.L. Odintsov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
odintsov@iao.ru

The results are discussed of the analysis of experimental data of remote acoustic sounding of the atmospheric boundary layer in conditions of many-day keeping the thermodynamically stable stratification, that is characteristics of winter anticyclones. The intensity of temperature turbulence is estimated for both principal (near-ground) scattering layer and the higher layers usually present under these conditions by means of reconstruction (from the amplitude of the reflected acoustic signals) of the structural characteristic of the temperature field. The cases and peculiarities of manifestation of the inner gravitational waves in vertical-temporal distribution of temperature inhomogeneities are considered.

C2-12
CONTINUOUS OBSERVATIONS OF BAROCLINIC DISTURBANCES IN LAKE BAIKAL WATER

S.V. Lovtsov,[1] N.M. Budnev,[1] Yu.V. Parfenov,[1] V.Yu. Rubtzov,[1]
M. Schurter,[2] M. Sturm,[2] and A. Wuest[2]
[1]Applied Physics Institute of Irkutsk State University, Irkutsk, Russia
par@api.isu.runnet.ru
[2]Swiss Federal Institute for Environmental Science and Technology, Dubendorf, Switzerland
sturm@eawag.ch

Results of all-the-year-round observations of temperature variations, collected in different depths from the surface down to the bottom in Lake Baikal, are presented. Experiments were conducted in South Baikal, in the vicinities of the Baikal Deep Underwater Neutrino Telescope (51.46 02'N, 104.25 02'E). In 1999-2000 a set of five sensors TR-1000 registered the temperature to a resolution of 1 mil degree. Three of them were located at the hydrological string of the Neutrino Telescope NT-200 (at depths of 20, 270, 550 m), and two other sensors inhered on another string were situated parallel to the coast 120 m to the west of the other two (on depths: 90, 1363 m).

We can divide the entire vertical water column of Lake Baikal into three depth ranges. The top 0–300 m is subjected to a strong exposure to wind. Influence of the external factors reveals itself in near bottom area also. The bottom layers see also a baroclinic distortion if the disturbance of the surface layers is large. This confirms the phenomena of penetration of surface waters to the deep bottom reaches that was registered by hydrologic system of Neutrino Telescope.[1]

The water body between 300 and 800 m depth is the mostly stable one. In this section the Fourier components with periods 6, 2, and 1 months are the most dominant.

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C2-13
LIDAR SIGNAL FLUCTUATIONS AT THE SEA SOUNDING THROUGH THE ROUGH SURFACE

W.L. Weber
Institute of Applied Physics RAS, Nizhny Novgorod, Russia
weber@hydro.appl.sci-nnov.ru

At remote laser sounding of the sea depth through the rough surface some specific effects caused by correlation of light beams incoming in and outcoming from the water are appeared. At present the influence of these effects on the mean value of backscattered signal (BSS) is well known. But the problems of determination of the second moments of the signal (the dispersion of the fluctuation and the correlation functions of BSS) are now investigated not so well.

In this work on the basis of the photometric approach the sufficiently rigorous procedure of the calculation of the lidar signal fluctuation characteristics at the sounding of the upper sea layer through the one-dimensional rough sea surface is worked out. The dependence of mean value, dispersion and variation coefficient of the signal of monostatic lidar having the identical source and receiver parameters on the sounding depth, the wind speed and the lidar beam width is investigated. The analysis of the dependence of the lidar signal correlation coefficient on the sounding depth is carried out.

The received results are compared with results of the calculations carried out in the frameworks of the known approaches; first of those is based on "one-lens" model of the sea surface, and the second (which strictly takes into account the statistical nature of waves) is based on the approximation which is linear in relation to the surface slopes. It is shown, in particular, that the most used linear model gives essentially underestimated values of the signal variation coefficient in comparison with the strict model, and "one-lens" model gives the overestimated ones. The main qualitative features of dependence of lidar signal on a depth of sounding, wind speed, and lidar parameters are described by the linear and the "one-lens" models well enough.

C2-14
ACTIVE-PASSIVE REMOTE SENSING OF THE BIOOPTICAL FEATURES OF THE SEA WATER

O.A. Bukin and M.I. Permyakov
Ilyichev Pacific Oceanological Institute RAS, Vladivostok, Russia
o_bukin@mail.ru

Active-passive remote sensing methods are widely used for investigation of the ocean. The optical active-passive remote sensing methods are more advanced among them and allow to measure the biooptical sea water features: spectral

distribution of the upwelling radiation, the laser radiation attenuation coefficient, the spectra of the laser fluorescence and so on.

The results of the using ship's active-passive remote sensing methods for measuring of the biooptical features of the sea water are presented in this work. The data measured during some research vessels cruises in 1992–2000 years in Pacific, sea of Japan and sea of Okhotsk are analyzed.

C2-15

LASER SPECTROGRAPH FOR INVESTIGATION OF UNSTEADY PROCESSES IN ATMOSPHERE

V.P. Fokeev,[1] Yu.A. Akimov,[2] Yu.I. Grin,[2] V.A. Levin,[1] S.Yu. Mitichkin,[1] and V.G. Testov[1]

[1]Institute of Mechanics, Moscow State University, Moscow, Russia

vfokeev@imec.msu.ru

[2]GUP "NPO – Astrophisika", Moscow, Russia

In case of natural or casual industry explosions there may be in the atmosphere components having short life time and for their definition usual scanning narrowband lidars are impossible to use because of time deficiency. Using method of nonlinear optics it is possible to get instant spectra. It is described IR transmitter emitting wideband signal which after passing trace absorption is converted into visual region for next analysis with help of optical multichannel analyzer. For methane it was got the spectrum in the region 3.25–3.42 micron for time interval 15–20 ns.

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C2-16

LIDAR AND SATELLITE MEASUREMENTS DETERMINATION OF HIGH CLOUDS PROPERTIES

Olga Lado-Bordowsky

ENSSAT – Universite de Rennes, France

Olga.Lado-Bordowsky@enssat.fr

High clouds participate, through their radiative impact, to meteorological and climatic processes and act as disturbing factors when satellite surface remote sensing or atmospheric profiles retrieval is carried out. This paper deals with high clouds remote sensing, from the ground with a lidar device and from space using polar orbiting satellite data.

Measurements are performed with the ENSSAT lidar which is described with two-fields-of-view detection apparatus designed to evaluate multiple scattering contribution.

From satellite data, an experimental study of the relationship between high clouds visible reflectance and infrared emissivity is presented. A thin-clouds reflectance retrieval method is achieved, using two AVHRR channels located in the visible and the near-infrared spectrum. Clouds mid-infrared emissivity is derived from a third channel, which data are collocated with ground-based lidar measurements.

An emissivity-versus-reflectance domain is then delimited from 13 cirrus cases and interpreted in terms of cloud microphysics; a thin high clouds detection scheme is derived and tested over a satellite data set.

C2-17

TEMPORAL ASPECTS OF FLUORESCENCE – IN-SITU ANALYSIS WITH A BISTATIC SUBMARINE LIDAR

U. Stute,[1] M. Lehaitre,[1] and O. Lado-Bordowsky[2]

[1]TMSI/ME Ifremer, Plouzane, France

uwstute@compuserve.de

[2]ENSSAT – Universite de Rennes, France

For a long time fluorescence techniques have provided interesting information in oceanography. Lidar are generally used fast profiling tools over several meters especially in high dynamic water masses. While fluorosensors provide the broadband spectroscopic response of a small water volume, remote sensing operates over several meters and the excitation power at a range R depends on optical properties of the medium during the light propagation. As the fluorescence response of marine environment is on one hand related to the fluorophore at the distance R from the source, it is also linked to the excitation photon density available at the same distance which means that fluorescence spectra are widely influenced by the propagation properties of the aquatic medium.

The presented study is focused on the bistatic design of LIDAR combined with a spectral analysis of the backscattered signal for tomoscopic application. The data were obtained with a frequency doubled Nd:YAG (λ = 532 nm) and a gated angular resolved detection. While the time base of the system can be used similarly to other on-axis LIDAR ranging, the signal brings also complementary spatial information by the light flux distribution which is function of the angle of incidence. The bistatic configuration of this LIDAR gives geometrical ranging by a set of detection channels, detecting simultaneously the spectrum (532 nm–720 nm) with the same time base system.

The analysis of fluorescence from the bistatic angular resolved detection is focussed on the temporal aspects of fluorescence in near field data. The fluorescence signal can be extracted from the spectra and be compared to the Raman standard to perform an analysis of the temporal behaviour of fluorescence.

As fluorescence relaxation time may be in the same order of magnitude as the time base of LIDARs, the relaxation process may have a significant impact on LIDAR measurements and can *in-situ,* only be investigated with a detection using simultaneously spatial and temporal ranging facilities, as it will be presented in this paper.

First sea trials with this LIDAR have shown the potentialities of investigation in the fluorescence profiles even in very turbid estuaries. A large area could be covered, once the system is settled on a towed platform. This initial option could be realised with minor changes, as the concept of the platform has already taken into account the operational aspects.

C2-18

CW–DL–DR–LIDAR FOR REMOTE DETECTION OF GASES: MATHEMATICAL DESCRIPTION AND COMPARISON WITH OTHER METHODS

R.R. Agishev and R.K. Sagdiev
Tupolev Kazan State Technical University, Kazan, Russia
agishev@kai.ru

One of the limitations of laser diodes for their wide application for remote measurement of a gas escape with spatial resolution (depth resolution, DR) is their limited power. The use of continuous (continuous wave, CW) methods of range finding in combination with the modern methods of laser modulation spectroscopy allows one to obtain the acceptable sensitivities of detection of a gas and the range of operation of the lidar at the limited power of the laser. One can state that the development of such systems is limited, in particular, by insufficient elaboration of the methods and their theoretical description.

New approaches are discussed, as well as the technique for detecting the gases with spatial resolution based on tuned laser diodes.

We have developed a mathematical model of the continuous lidar based on the laser diode (LD). The elements of the theory of continuous range finding and the theory of the laser modulation spectroscopy were used when constructing the model. The formulas were obtained relating the parameters of the signal received by the lidar to the distance to the path part under investigation, spatial resolution, the gas absorption line width and the frequency deviation of the sounding signal. The model developed made it possible to reveal the relationships between the value of the frequency deviation and the spatial resolution of measurements of the continuous lidar, the depth of modulation of the laser wavelength and the absorption line width of the gas under study.

The results are presented of the numerical modeling of the continuous lidar. The calibration functions of absorption are constructed based on the model obtained for calculation of the gas concentration from the results of data processing and measurement of the return signal. The upper limits are determined of the concentration sensitivity of the LD–WM–CW–lidar. The issues are discussed of the effect of the interfering neighbor absorption lines of the gases on the accuracy of determination of the concentration of the principal gas.

The comparative analysis is carried out of the lidar under investigation with continuous aerosol lidars and gas detectors based on the modulation methods of spectroscopy. The advantages and drawbacks of the approach under discussion in comparison with that known earlier are shown.

C2-19

LIDAR COMPLEX SOUNDING LASERS WITH RESONANCE PUMPINTG SYSTEMS

L.R. Aibatov
Tupolev Kazan State Technical University, Kazan, Russia
vvi@karlson.kai.ru

Working out of the compact and economical lasers for CW lidar complexes requires to solve a number of tasks such as pumping system power losses minimization and supporting of homogeneous gas discharge in chambers with great volume and cross-section. Well-known resistance ballast circuits employing for discharge stabilization essentially reduce the laser efficiency.

At this work the results of the resonance pumping systems operation analysis for gas discharge lasers has been represented. Gas laser is pumped here with midfrequency discharge (tens kHz – several Mhz) and it is fed by series resonance LC-circuit connected with the AC voltage generator.

It has been shown that chambers with lengthy electrodes and small gas gap should be connected in series with resonance LC-circuit wave impedance of which have to be made much more than discharge plasma resistance to excite the transverse low-resistance discharges. With respect to discharge plasma resistance AC voltage generator and resonance ballast circuit operate as EMF source in stationary regime and they act as current generator during the fault transients. Such the pumping systems combines as rather high frequency of the exciting voltage as balast reactive discharge loop great inertness preventing discharge current sharp inrease and providing the laser operation considerable reliability. Chabmers for longitudinal gas discharges which are characterized with large resistance and high voltage supply required should be paralleled to one of the reactive ballast elements (practically – to ballast capacitor) and ballast circuit wave impedance have to be choosen much smaller than plasma resistance. In this case series resonance LC-circuit operates as voltage transformer and simultaneously it is a high effective ballast element because it behaves as current generator.

Such the pumping systems features discussed significantly simplify the scheme technique and design of the gas laser active medium excitation devices. The resonance ballast circuits are characterized by minimal power losses providing essential sounding lasers efficiency increase.

C2-20

LFM-CW LIDARS WITH RECTANGULAR PULSED SOUNDING SIGNALS

L.R. Aibatov
Tupolev Kazan State Technical University, Kazan, Russia
vvi@karlson.kai.ru

LFM-CW lidars operation analysis[1,2] has been made for sinusoidal law of beam intensity modulation. But this law practical realization with low harmonic distortions level is rather difficult task as in case of external light modulators as in case of internal laser modulation, for diode lasers, in particular, which have essentially nonlinear dependence the power output on pumping current.

The CW lidars operation analysis results has been represented at this work in case of sounding emission intensity modulation by symmetrical pulsed signals with a linear law of repetition rate change. Here optical signal to be received was transformed to the electric one by photodetector and it was applied to the mixer input. The receiver mixer was fed with heterodyne sinusoidal signal with the same frequency modulation law as the sounding optical rectangular pulsed signal repetition rate change law. It has been shown that mixer output beat signals for such mode contain independent on time spectrum components only for the first harmonic of the optical rectangular pulsed sounding signal. By analogy with Ref. 1, 2, the mixer output signals frequencies are directly proportional to double sounding beam propagation time providing the proper range resolution of the method discussed.

The described sounding method naturally combines as CW lidars features as pulsed lidars peculiarities and it can provide simultaneous realization in practice of the both mentioned systems advantages. Correspondingly, the employment of the pulsed sounding signals in LFM-CW lidars makes it possible to eliminate the influence of optical modulators and laser emitters characteristics nonlinearities upon lidar parameters and facilities the electric modulator operation because its active elements may be moved to the key regime. It could be mentioned that represented sounding method may lead to increase of energy characteristics for whole lidar system because the first spectral component corresponding to symmetrical pulsed signal has amplitude which is 1.27 times greater than the pulsed signal amplitude.

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C2-21

DETERMINATION ACCURACY OF ATMOSPHERIC GAS COMPONENT CONTENT WITH DIAL SYSTEMS

Y.M. Andreev and P.P. Geiko
Institute for Optical Monitoring SB RAS, Tomsk, Russia
andreev@iom.tomsk.ru

The results are presented on post-experimental analysis of atmospheric gas component determination accuracy with differential absorption Lidar Complex. The Lidar Complex consist of trace gas analyzer supplied with mirror

retrorefrector and working with full beam uptake, and also of two mode operation (trace mode operation with using of topographical targets as retroreflectors and range resolved (DAS) mode operation) Lidar.

In the first case main factor, limiting accuracy at the 1–10 ppb level when using 2 km measuring trace, are mechanical interferences caused by nearby going transport and wind. In the second case, at 10–20 ppb accuracy, its are spectral dependence and nonuniformity of topographical target reflection coefficients, nonuniformity of photodetector zone sensitivity. In the last case (30–50 ppb) main factor is preamplifier noise and nonuniformity of intensity distribution in laser output beam cross section and also nonuniformity photodetector zone sensitivity.

In every case contributions of different interference sources in forming of measurement accuracy are determined that are including photodetector and background noises, nonstability of other laser output beam parameters, meteorological parameters variations, atmospheric turbulence, spectroscopic data bank incorrectness, statistical and systematic measurement mistakes, electromagnetic field interferences and other factors.

C2-22

MATHEMATICAL SIMULATION OF OPERATION OF THE OPTICAL CORRELATION GAS ANALYZER

S.F. Balandin, Yu.D. Kopytin, and V.I. Kokhanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kyud@iao.ru

Numerical simulation and analysis of the correlation technique for gas analyzing measurements in the atmosphere were carried out based on the passive location using the daylight sky illumination (sky–regime) and on the measurement on a path with recording the re-reflection of the solar or mini-projector radiation from remote topographic objects (TT-regime).

The principal used approximations of the method are the following:

– correlation "gas" filters are the replaceable chambers with optical thickness of the gas in each spectral window for recording significantly less than 1;

– additive contribution of technogenic and geophysical fields of anomaly of trace gases in the atmosphere is considered; the background geophysical fields are taken into account on the basis of the standard models of the atmosphere in different geographic regions, seasons and time of day;

– the effect of single scattering on the aerosol component is taken into account at joint taking into account the radiation fluxes both passing through the plume of an industrial object emission and formed by scattering in the direction to the receiver at the adjacent effect of solar radiation on the plume. Panoramic measurements of the angular distribution of the incident light flux be means of a video-camera with the objective of the type "fish eye" were used for correct taking into account of the total adjacent effect.

In order to reach the acceptable accuracy of observations, the system of equations according to the number of the fixed spectral ranges (windows) is solved. The equation is formulated for each of the windows, which determines the corresponding coefficient of the total transmission of the atmosphere taking into account the terms responsible for the absorption by the principal and interfering gases.

C2-23

SOUNDING OF DENSE GAS PLUMES ON THE BASIS OF THE USE OF THE OPTICAL CORRELATION ANALYZER

S.F. Balandin, V.I. Kokhavov, and S.A. Shishigin
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

The effect of passive location of trace gases in the atmosphere on the basis of optical correlation spectrometry attracts the attention or researchers last years, that is connected, first of all, with the absence of high-cost powerful laser sources in the instrumentation. However, actual application of this method met some difficulties connected, first of all, with the optical non-transparence of the majority of smoke plumes, that made their direct sounding impossible. The new technique for sounding of the dense smoke plumes using the mean weighted correlation function of fluctuations of the received signal is examined for the first time in this paper. The optimal geometry of sounding was chosen relatively to the source of radiation (Sun, projector or lamp). Investigations are carried out based on the analysis of NO_2 concentration in the plumes of the electric power station of the city of Tomsk under different meteorological conditions (Sun without clouds, clouds, and continuous cloudiness).

C2-24

REMOTE CONTROL OF OIL FILM THICKNESS ON WATER SURFACE USING LASER

S.V. Berezin, M.L. Belov, V.A. Gorodnichev, and V.I. Kozintsev
Bauman Moscow State Technical University, Moscow, Russia
ekomonit@mx.bmstu.ru

Physical basis of laser remote control of oil films on water surfaces is the dependence of reflection coefficient of "air–oil film" mixture on film thickness and wavelength.

Laser with tunable wavelength is the most preferable for oil film thickness measurement. The film thickness can be defined by means of laser wavelength tuning in a spectral interval and registration of the reflected signal.

Usually film thickness calculation procedure requires more than two interferential extremum and this condition is violated in case of thin films. A film thickness determination technique has been introduced that is on approximation of measured dependency of the reflected signal on the wavelength by a certain function and finding best approximation coefficients to fit measured data. The fitting parameters have been obtained using non-conditional minimization of the root-mean square in the multidimensional space.

Mathematical modeling has shown a small error of film thickness restoration on water surface.

C2-25

FLUORESCENT DIAGNOSTICS OF DISSOLVED ORGANIC MATTER IN NATURAL WATER

V.I. Yuzhakov, K.G. Blinova, L.V. Levshin, and S.V. Patsayeva
Moscow State University, Moscow, Russia
blinova@genphys.phys.msu.su

Luminescence spectra of natural water under UV excitation typically contain two overlapping emission bands with maxima located at 300...350 nm and 420...450 nm. These bands are usually considered as ones caused by emission of protein-like substances (the UV band) and humic substances (blue emission). Proteins containing aromatic amino acids tryptophan, tyrosyne, and phenylalanine luminesce in the UV region under excitation by radiation with wavelength shorter than 290 nm. However some other natural compounds like phenols and polyphenolic compounds – tannin and lignin – can also contribute in the UV fluorescence of natural water. Therefore it is necessary to know spectral-luminescent properties of natural organic compounds for development. of luminescent diagnostics techniques.

The purpose of the investigation is an elaboration of methods for luminescent diagnostics of natural organic compounds. Contributions of several compounds to the UV band of natural water luminescence and its relation with blue luminescence of dissolved organic matter are studied. Aqueous solutions of aromatic amino acids, phenol compounds (pyrogallol, pyrocatechol, hydroquinone, and gallic acid), as well as lignin, tannin, humic acid are investigated. Emission spectra obtained with both lamp and laser excitation and absorption spectra are compared with ones of natural water of different origin.

C2-26

METEOROLOGICAL COMPLEXES AMK–01 AND BMK–01

A.Ya. Bogushevich, A.A. Azbukin, V.V. Burkov,
V.V. Zanin, V.S. Ilichevskii, and V.A. Korolkov
Institute for Optical Monitoring SB RAS, Tomsk, Russia
bay@iom.tsc.ru

The description of meteorological complexes AMK–01 and BMK–01, designed in laboratory of ecological instrument making IOM SB RAS is resulted. The data complexes are intended for measurement of the basic meteorological parameters of atmosphere: speeds and wind directions, temperature of air, relative and absolute humidity of air, atmospheric pressure. Extremely short-term lag of measurements and computer processing of their primary data allow also to calculated parameters of atmospheric turbulence.

The complexes are produced in two design versions:

– as a fixed station (AMK–01) of an automatic control of the indicated parameters of air environment with transmission of the primary data of measurements on the remote computer through cable and/or phone lines of communication;

– as an onboard movable meteorological station (BMK–01), placed on land and water means of transport.

For measurement of meteorological parameters in AMK–01 and BMK–01 the non-traditional ultrasonic and optical methods are applied permitted it is essential to increase selfdescriptiveness of measurements, their accuracy and sensitivity, and also reliability of obtaining of the information in conditions of effect of unfavorable external factors.

AMK–01 and BMK–01 can execute measurements at temperatures of air from –50 up to +50 °C and wind speeds up to 30 m/s, are protected from effect of rainfall. They are capable to register turbulent fluctuations of temperature and wind speed in 0.01 °C and 0.009 m×s, accordingly. The output data is given by the way of digital code in the standard RS–232 with a recurrence rate up to 20 Hz. The devices can be hooked up to the specialized calculator of average values of meteorological parameters (on the basis of microprocessor) or to the standard computer through one of its serial ports (COM1, COM2 etc.).

C2-27

SOFTWARE FOR ULTRASONIC ANEMOMETERS-THERMOMETERS

A.Ya. Bogushevich
Institute for Optical Monitoring SB RAS, Tomsk, Russia
bay@iom.tsc.ru

In the report the description again of designed software for ultrasonic anemometers – thermometers is given, which one practically does not depend on hardware implementation last and requires only capability of their connection to the computer through one of serial ports COM1 – COM4. It represents the 32-bit Windows – application named «METEO–2M», which one can operate in different versions of an operating system Windows, since Windows 95. The given application completely supports multitasking work in Windows. A data acquisition of the anemometer – thermometer through COM port and their current mathematical processing implement in an asynchronous mode on hardware interrupts of the adapter of COM-port. Thus the measurements run in a background, allowing the operator in the same time to work on by other problems and with other programs, not losing any byte of the information from the device. Except for maintenance of primary goal of measurement of meteorological parameters and saving of outcomes of work on a hard disk the application «METEO–2M» allows:

– to execute real time calculations of a number of the secondary characteristics of meteorological fields having large value at the solution of many particular problems (connected with physics of an atmospheric ground layer, connected to physics of distribution of contamination of free air etc.);

– to provide operation of padding operational modes of anemometers – thermometers (execution of measurements in an automatic day-night mode without participation of the operator, conversational operation, mode of self-test of a functional condition of the device, mode of the automated graduation);

– to create and to provide management of the local database of values of the main meteorological parameters for a durable span with automatic accumulation of the new data;

– to organize remote access to the primary data of the anemometer – thermometer on isolated or switched (standard) phone line of communication.

C2-28

EXPERIMENTAL RESEARCH OF THE METROLOGICAL CHARACTERISTICS OF A ULTRASONIC ANEMOMETER IN A WIND TUNNEL

A.Ya. Bogushevich, A.A. Azbukin, V.V.Burkov, V.S.Ilichevskii, and V.A.Korolkov
Institute for Optical Monitoring SB RAS, Tomsk, Russia
bay@iom.tsc.ru

In the report the outcomes of experimental researches of errors of measurements of wind speed in a ultrasonic meteorological complex AMK-01 are represented. The researches were conducted in the certificated wind tunnel T-324 of Institute theoretical and applied mechanics SB RAS (Novosibirsk). The basic characteristics of a wind tunnel T-324: maximum speed of a created airflow – up to 100 m/s; a turbulence factor of a created airflow – no more than 0.1 of %; a coefficient of irregularity of flow velocity of air on cross-section – no more than 0.1 of %. During experience the flow velocity of air in a wind tunnel changed by switching of revolutions per minute of its ventilator, and value of speed was separately controlled on value of dynamic pressure of a airflow on the calibrated nozzle of a micromanometer H-1000.

It was revealed, that at a direction of flow of air concerning a ultrasonic anemometer under angles, aliquot 90°, (i.e. in planes of two orthogonal rings, on which one the ultrasonic probes AMK-01 are fixed) the inhibition of flow velocity is watched. This blanketing effect by design elements AMK-01 is watched only in narrow sector of angles of a direction of flow, approximately equal ± 5° concerning a plane of rings. He results in underestimation of wind speeds measured AMK-01, concerning speed of a free stream of air. The maximum rating of the indicated underestimation of measured flow velocity in relative values reached 17 of %. For other orientations of a ultrasonic anemometer concerning a direction of flow was established, that AMK-01 in a range of measurement of wind speed from 0 up to 30 m/s have a limiting error ± (0.1 + 0.02V) m/s, where V – measured value of wind speed.

The error of measurements of a ultrasonic anemometer stipulated by blanketing effect, falls into systematic and consequently should be eliminated by introduction of the appropriate corrections at calculation of wind speed. The data of research have allowed to establish values of these corrections for AMK-01.

C2-29
RELIABILITY OF RECOVERY OF A PROFILE OF WIND SPEED IN GROUND ATMOSPHERE FROM THE SINGLELEVEL DATA THE ULTRASONIC ANEMOMETER – THERMOMETER

A.Ya. Bogushevich,[1] V.A. Gladkih,[2] A.E. Makienko,[1] and V.A. Fedorov[2]
[1]Institute for Optical Monitoring SB RAS, Tomsk, Russia
bay@iom.tsc.ru
[2]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
andy@iao.ru

In theory of atmospheric turbulence universal functions of a similarity for a long time will be used. One of their remarkable properties is that they allow to model high-altitude profiles of the whole group of parameters of atmospheric turbulence, and also profiles of average values of temperature and wind speed. Thus it is enough to know at any one altitude above a surface of value of a scale Monin-Obuhov, flows of heat and impulse, and also value of modeled parameters. All this information can be successfully obtained from the data of measurements of the ultrasonic anemometer – thermometer. Therefore in the literature the attempts of recovery from the data of the ultrasonic anemometer – thermometer of profiles of different atmospheric parameters were repeatedly described. In the report the outcomes of the comparative analysis of values of wind speed repaired for altitudes 50–200 m from the data of the anemometer – thermometer and measured at the same altitudes with the help Doppler sodar are resulted. The indicated analysis was conducted from experimental data obtained in steppe region in different time of day and for different types of stratification of an atmospheric boundary layer. The special attention was given to estimations of errors of recovery of wind speeds from the data of the anemometer – thermometer and probability that last do not exceed prescribed value.

C2-30
INVESTIGATION OF THE ORGANIC MATTER LASER FLUORESCENCE SPECTRA FOR CLASSIFICATION OF THE SEA WATER CASES

V.V. Tchekunkova, O.A. Bukin, and M.S. Permyakov
Pacific Oceanology Institute FEB RAS, Vladivostok, Russia
o_bukin@mail.ru

The question of the classification of sea water by biooptical parameters is very important for the solution of a lot of problems. Such as selection of the optimum restoring algorithms of chlorophyll "A" concentration from the upwelling radiance spectra, investigations of the organic matter sources etc. There are some approaches to the sea water types classification[1–2], however all of them demand holding complex measuring of biooptical parameters of seawater. In the present operation the results of the elaborating of a procedure of the sea water classification by spectra laser fluorescence are presented. These results were obtained in a series of cruises during 1993 year in the sea of Okhotsk on the research vessel "Academician Lavrentiev", in 1997–1998 years in Pacific, in 2000 year in coastal waters sea of Japan and sea of Okhotsk on the sailboard "Nadezhda". The obtained correlation ratio between moments of fluorescence spectra both dissolved, suspended organic matter and fluorescence spectra of chlorophyll "A" allow as a first approximation to distinguish pure oceanic waters of the first case from coastal waters of the second case.

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C2-31
SOME RESULTS OF THE COMPARISON ANALYSIS OF THE SHIP AND SATELLITE CHLOROPHYLL A DATA

D.V. Burov, O.A. Bukin, M.S. Permyakov, and V.A. Khovanets
Nevel'skoy Far East State Marine Academy, Vladivostok, Russia
o_bukin@mail.ru

It is necessary to provide under satellite validate ship's measurements for correct estimation of the chlorophyll A concentration measured by remote sensing methods.

The results of the comparison analysis of the chlorophyll A concentrations measured by the SeaWiFS scanner and ship's laser fluorometer are presented. These results were obtained during the training sailboard "Nadezhda" cruise in 2000 year in coastal zone of the sea of Okhotsk. The statistical parameters of the chlorophyll A concentration fields (histograms, correlation function, and so on) were calculated. Characteristic scales of the chlorophyll A fields structure were selected. The possibilities of the regional correction of the algorithms for processing Sea WiFS data are discussed.

C2-32

OPERATIONAL MEASUREMENT OF AIR POLLUTION CONCENTRATIONS IN THE CZECH REPUBLIC BY COMBINED LIDAR/SODAR TECHNIQUES

J. Keder,[1] P. Berger,[2] A. Cerny,[2] P. Engst,[2] F. Folttiny,[2] and M. Strizik[2]

[1]Czech Hydrometeorological Institute, Praha, Czech Republic
keder@chmi.cz
[2]LIDAR s.r.o., Praha, Czech Republic
office@lidar.cz

The air pollution problematic in the Czech Republic is very complex due to large number of factors forming the concentration fields: the diversity of emission sources (traffic, industry, heating, etc.), the meteorological and the geographical conditions. Conventional monitoring devices cover an important part of the monitoring tasks, but still there remain many questions that cannot be answered by them, particularly the vertical distribution of air pollutants

Lidar and sodar technologies have become still more popular in the field of air pollution monitoring thanks to the extensive complementary data both systems can deliver:

- the capability of remote sensing,
- a spatial resolution down to a meters and
- the possibility to make 2D and even 3D measurements.

To determine the spatial distribution of a gaseous pollutant, the **DI**fferential **A**bsorption **L**idar technique (DIAL) has been applied in CZ since 1999. A commercially produced LIDAR system manufactured by Elight Laser Systems Ltd is operated in combination with the REMTECH Doppler sodar.

After brief explanation of principles of both monitoring techniques, their proposed application fields in Czech are summarised. Examples of encouraging results obtained during extensive field measurement campaigns provided in the Czech Republic are presented in graphical form and compared with the conventional monitoring data.

C2-33

PECULIARITIES OF RECONSTRUCTION OF THE AEROSOL SCATTERING COEFFICIENT TAKING INTO ACCOUNT MOLECULAR SCATTERING AND VARIATIONS OF THE LIDAR RATIO UNDER CONDITIONS OF THE WEAKLY TURBID ATMOSPHERE

A.D. Ershov, Yu.S. Balin, and S.V. Samoilova
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
ead@iao.ru

Numerical simulation of the lidar signals is carried out for the conditions of clear and weakly turbid atmosphere with subsequent inversion relatively to the optical parameters by means of the methods for solution of the laser sounding equation. The errors in reconstruction appearing due to not taking into account the contribution of molecular scattering and variations of the setting the lidar ratio are determined. The results of numerical simulation are illustrated by examples of processing the data of field experiments carried out in conditions of the enhanced transparency of the atmosphere (meteorological range of ~ 60–70 km) in summer in the mountain depression contour of lake Baikal.

It is shown that ignoring the molecular component of the atmosphere leads to the significant underestimating the reconstructing aerosol scattering coefficient, and the error in setting the vertical profile of the lidar ratio leads to the distortion of the profile of the sought characteristic.

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C2-34

MULTICOMPONENT ANALYSIS OF THE UNSYMMETRICAL DIMETHYLHYDRAZINE AND ITS DEGRADATION PRODUCTS BY THE LASER PHOTOACOUSTIC SPECTROSCOPY

Yu.V. Fedotov, M.L. Belov, V.A. Gorodnichev, A.N. Gitov, V.I.Kozintsev, A.A. Kormakov, and I.P. Suprun
Bauman Moscow State Technical University, Moscow, Russia
ekomonit@mx.bmstu.ru

The problems of atmosphere pollution monitoring in the rocket and space machinery's utilization areas are actual at the present time. Quantitative analyze of gas mixture, which includes traces of rocket fuel and its degradation products, is one of the most important problems. Differential absorption (DA) laser photoacoustic gas analyzer (LPAGA) allows rapid and precise quantitative estimation of multicomponent gas mixture.

An estimation of quantitative analyzes possibility by DA LPAGA with tunable CO_2 laser was made for 6-component mixture (unsymmetrical dimethylhydrazine and its degradation products – nitrosodimethylamine, methylendimethylhydrazine, dimethylamine, ammonia, and methanol).

Analytical wavelengths have been selected for described mixture in spectral region of CO_2 laser. Mathematical modeling has been made in closed cycle. Signal values at selected analytical wavelengths were calculated for given mixture concentrations. Noise with determined RMS was added to calculated signal. Then concentrations of mixture components were recovered by the search of quasi solution method. Acceptable recovering errors (< 20%) were determined for typical levels of noise measurements.

C2-35

SELECTION OF ANALYTICAL WAVELENGTHS FOR MULTICOMPONENT ANALYSIS OF GAS MIXTURE BY THE LASER PHOTOACOUSTIC METHOD

Yu.V. Fedotov, M.L. Belov, V.A. Gorodnichev, and V.I. Kozintsev
Bauman Moscow State Technical University, Moscow, Russia
ekomonit@mx.bmstu.ru

Set of analytical wavelengths is one of the most important factors, which define precision, sensitivity and selectivity of laser photoacoustic multicomponent gas analysis.

Different criteria of selection of analytical wavelengths (maximization of determinant module of the absorption coefficient matrix, minimization of sum of variance-covariance matrix diagonal elements, maximization of information distance, minimization of condition number of the absorption coefficient matrix) are compared by the physical correction, consideration of all basic factors and rapidity. The capability of analytical wavelengths criteria for laser differential absorption photoacoustic gas analyzer is examined. The significant lack of most selection algorithms is the long-lasting calculations. The ways of increasing of rapidity are described.

Original engineering algorithm of selection of analytical wavelengths is represented. The algorithm is physical correct, considers all basic factors and very rapid.

C2-36

MODELLING SOFTWARE MOLSA FOR UV-V LIDAR SOUNDINGS OF ATMOSPHERE PARAMETERS

I.V. Boichenko, M.Yu. Kataev, D.R. Kulakhmetov, A.A. Mitsel', and A.Ya. Sukhanov
Tomsk University of Automatic Control System and Radioelectronics, Tomsk, Russia
kmy@asd.iao.ru

Software package for modeling of lidar sounding of atmosphere in UV-V spectral region is demonstrated. The package is developed on the basis of modern methods designing of object-oriented systems. A convenient interface and various databases enabling to simulate known prototypes of lidars, as well as to create and to investigate new lidar variants.

C2-37

INVESTIGATION OF A CLOUD COVER WITH USE OF SPECTRAL MEASUREMENTS AND BI-STATIC TOMOGRAPHIC SENSING

D.M. Onoshko and M.M. Kugeiko
Belarussian State University, Minsk, Belarus
kugeiko@rfe.bsu.unibel.by

For a research of optical (optical thickness) and microphysical characteristics (effective size of particles) of cloud cover the spectral passive method is used.[1] An essential shortage of a method is the difficulty in establishment of area of physical interpretation of measurement results.

Tomographic system of laser sensing includes all components (receiving devices, recording and processing equipment), permitting to carry out passive measurements. The realization of tomographic and passive methods can be combined in one measuring system. Therefore the statement of a problem of the analysis of an opportunity and effectiveness of complex use of tomographic and passive measurements results for the determination of optical and microphysical characteristics of a cloud cover is fair. Such statement of a question is especially urgent for bi-static tomographic method[2], appreciably reducing a methodical error inherent in known tomographic methods.

In the report the influence of an inhomogeneous structure of a cloud cover on registered value of an albedo and, as a consequence, the possibility of the unambiguous interpretation of spectral measurements data relative to optical thickness of a cloud and effective size of particles is investigated. The area of unambiguous interpretation of results is established within the framework of homogeneous, regular and fractal models of an optical thickness distribution. It is shown by a numerical mathematical simulation that for extension of the area of unambiguous interpretation of spectral measurements data the development of more adequate models of a cloud cover for each concrete meteorological situation is required, that causes necessity to perform the additional measurements of a cloud cover optical thickness. The use of bi-static tomographic sensing corresponds to realization of such additional measurements in a sense of efficiency, possibility of investigation of horizontal and vertical stratification, study of a temporal variability of a medium.

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C2-38

REMOTE SENSING OF COMPLICATED STRATIFIED INHOMOGENEOUS DISPERSING MEDIA (CONCEPT OF MINIMIZING OF A PRIORI DATA)

M.M. Kugeiko
Belarussian State University, Minsk, Belarus
kugeiko@rfe.bsu.unibel.by

The problem of deriving and processing of an information in remote sensing of inhomogeneous dispersing media requires a measurement of a back scattering signal depending on many parameters and reversion it relative to the determined characteristics. Owing to a multiparametrical dependence the interpretation of registered signals requires use of a priori information or assumptions about a medium under investigation, that results in large errors in the determination of characteristics. The essence of the concept of minimizing of a priori data, developed by us, consists in minimal use of a priori information about a medium, maximal exception of influence of the equipment and used physical processes on measurement results. The base values of determined parameters are derived without additional independent measurements.

In the report the technique of the determination of optical characteristics of complicated stratified inhomogeneous dispersing media with the diffused boundaries between the layers (such as "atmosphere–cloud", "atmosphere–industrial emission – atmosphere", "atmosphere–water medium", multilayer cloud cover etc.), developed on the basis of the concept of minimizing of a priori data, is considered. The technique includes:

- analysis of a profile of back scattering signal (for allocation of the boundaries of layers);
- deriving of base values of the determined characteristics from measured signals;
- the definition of a transparency of transitional layer of mediums;
- correction of measured back scattering signals on a variation in scattering indicatrix in back direction (on a degree of variation in a qualitative structure of a medium) and on attenuation value in a transitional layer;
- the interpretation of a back scattering signal in transitional layer;

Recovery of attenuation factor along the whole route of sensing.

C2-39

MEASUREMENTS OF THE ABSOLUTE QUANTITIES OF THE CHLOROPHYLL A CONCENTRATION BY LASER FLUOROMETER

E.A. Lipilina, O.A. Bukin, M.S. Permyakov, and A.Yu. Major
Pacific Oceanology Institute FEB RAS, Vladivostok, Russia
o_bukin@mail.ru

The values of the calibration coefficients for measurement of absolute quantities of chlorophyll A concentrations by laser fluorometer are presented.. It is shown that these values are equal in the limits of the experimental errors for different regions of the Pacific, sea of Japan and sea of Okhotsk. Except for the regions where the intensive temperature fronts were observed. In such situation the calibration coefficients significantly distinguished.

C2-40

DOPPLER SODAR OBSERVATIONS OF VERTICAL COMPONENT OF A WIND SPEED IN MOSCOW

M.A. Lokoshchenko, V.G. Perepyolkin, and N.V. Semenova
Moscow State University, Moscow, Russia
loko@geogr.msu.su

The vertical SODAR «ECHO-1», produced in the Eastern Germany, is in operate at Moscow State University since 1988. In 1999–2000 it has been modernized. Sodar records, as well as profiles of C_t^2, were transformed in digital view on PC. An original Doppler arrangement was made for monitoring of a wind speed vertical component. Average profiles of this parameter for every hour during one month (October 2000) are presented. Important physical features were noted, such as: connecting with a free convection maximum of rising movements on the 100–150 m height at 12 a.m. – 4 p.m.; clear subsidence, i.e. at nocturnal time on middle heights, decreasing up to zero in the ground layer.

C2-41

STUDYING OF AEROSOL CONCENTRATIONS AND THERMAL STRUCTURE OF THE LOWER ATMOSPHERE ABOVE MOSCOW BY MEANS OF SODAR AND LIDAR

M.A. Lokoshchenko, G.I. Gorchakov, and P.O. Shishkov
Moscow State University, Moscow, Russia
loko@geogr.msu.su

The results of scientific experiment, which was conducted in Meteorological Observatory of Moscow State University during July–August of 1998, are presented. In this period sodar «ECHO-1» and aerosol ecological lidar were operated here simultaneously and continuously during some weeks. The range of sodar is 800 m; lidar data are reliable up to nearly 500 m height. The purpose of experiment was to investigate particularities of aerosol concentrations and their relations with thermal stratification on various heights of the atmospheric boundary layer in conditions of big city like Moscow. Some common features of daily course of aerosol concentration are eliminated. For instance, a strong increasing of aerosol concentrations near ground level on evening time, when daily convection and intense vertical mixing by sodar data usually decay, is evident. During morning hours a top of layer of high aerosol concentrations usually coincides with bottom of elevated inversion by sodar data.

Besides common analysis, lidar and sodar data were compared in terms of synoptic processes, i.e. separately for periods of various air mass dominating, passing of different atmospheric fronts, etc. As a result, some typical ranges of aerosol concentrations in a lower atmosphere were determined for different air mass conditions in summer in Moscow.

C2-42

SPEED OF LARGE SCALE DISTURBANCES IN THE LAKE BAIKAL WATER

Yu.V. Parfenov, A.G. Chensky, S.V. Lovtsov, A.E. Rastegin, and V.Yu. Rubtzov
Applied Physics Institute of Irkutsk State University, Irkutsk, Russia
par@api.isu.runnet.ru

At a winter period 1991–2001 were studied large-scale disturbances of a Baikal water in upper layer (0–150 m). Region of observing situated near Baikal Neutrino Telescope. Here coastal declivity has a slope about 40 degrees and length of order 2.5 km. A flat bottom with depths near 1370 m spreads hereinafter. In the kilometer to sea apart

from of coastal declivity measurements of temperature were taken as on the fixed depth with the time so and changing a temperature with the depth. In all experiments 1991–2001 were observed disturbances of water temperature with different amplitudes and duration. In 1999–2001 measurements was conducted on network of sensors with the spatial scale in several kilometers. The disturbances come to the observing area from south-east direction. The horizontal component of velocity is of order 1–10 cm/sec. Spatial size of disturbances lies in the interval from several kilometers to several of ten kilometers.

C2-43

ESTIMATION OF THE STATISTICAL PARAMETERS OF OPTICAL AND GEOMETRICAL SPATIAL STRUCTURE OF CLOUDINESS

I.E. Penner, G.P. Kokhanenko, and V.S. Shamanaev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kokh@iao.ru

Solving the problems of modeling the processes of radiation transfer, turbulent exchange and the structure of the boundary layer of the atmosphere requires investigation of not only the vertical aerosol structure but also the characteristics of cloudiness. The majority of available data of laser sounding of cloud fields obtained in the experiments with both ground-based and airborne lidars allow one to extract the data on simultaneously measured geometrical and optical characteristics of cloudiness. The mean weighted coefficient of scattering of the laser radiation in the cloud layer selected upon the criteria for determining the cloud boundaries, the same for all data, is considered as an optical characteristic of the cloudy substance. Apart from statistical estimates of geometric characteristics of cloudiness, such consideration essentially extends possibilities of the model description of the spatial structure of the boundary layer of the atmosphere at presence of the lower-layer cloudiness. Then, the simultaneously measured height of the lower boundary of cloudiness, scattering coefficient and the gradient of the scattering coefficient are analyzed on the basis of the lidar data obtained on meso-scale of the spatial length of the front boundary of the stratocumulus cloudiness of lower level. The spatial-temporal spectra of fluctuations of these characteristics are analyzed. It is shown that one can select the characteristic spatial scales of optical inhomogeneities of the cloud field under study with greater contrast in the spectrum of the gradient of the scattering coefficient.

C2-44

MULTIWAVE TRACE GAS ANALYZER BASED ON WAVEGUIDE TUNABLE CO_2-LASER

A.I. Karapuzikov,[1] G.G. Matvienko,[2] Yu.N. Ponomarev,[2] I.V. Sherstov,[1] A.I. Grishin,[2] A.I. Petrov,[2] and I.V. Ptashnik[2]
[1]*Institute of Laser Physics SB RAS, Novosibirsk, Russia*
[2]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
yupon@iao.ru

The construction and characteristics of the trace gas analyzer with the distance of visibility up to 1 km based on the compact fast-tunable continuous waveguide CO_2-laser with RF excitation is described. The laser is provided with the changeable active elements filled up by gas mixtures with various isotopes of CO_2 molecule that essentially increases an amount of laser radiation lines and number of gas impurities that are found under monitoring of a similar lidar.

The sensitivity of the gas analyzer to determine the concentration of small molecules (C_2H_4, NH_3, O_3 etc.) and polyatomic organic compounds with unsolved spectra is calculated.

The results of bench tests by a corner reflector and top-target are presented.

C2-45

SIMULATION OF LIDAR SOUNDING OF METEOPARAMETERS OF THE ATMOSPHERE IN THE SPECTRAL WINDOW 2–2.4 μM

P.P. Geiko,[1] G.G. Matvienko,[2] O.A. Romanovskii,[2] and O.V. Kharchenko[2]
[1]*Institute of Optical Monitoring SB RAS, Tomsk, Russia*
[2]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
roa@iao.ru

The results of numerical simulation for the lidar sounding of meteoparameters of the atmosphere by the method of differential absorption in the spectral window 2–2.4 μm are presented. It is proposed to use as radiation sources

the solid-state Ho^{2+} and Er^{3+} ion lasers and the radiation obtained by the mixing of radiation of CO_2 laser and Er^{3+} laser which completely overlaps the range 2–2.4 μm. The selection of absorption lines of a water vapor which are suitable for the sounding of profiles of temperature and humidity in the lower troposphere is carried out. The systematic errors of reconstruction of temperature profiles are analyzed. Ii is shown that the reconstruction errors for temperature and humidity profiles have admissible values in the lower troposphere.

C2-46

OPTOACOUSTIC SOUNDING OF THE ATMOSPHERIC PARAMETERS AND THE CHANNEL OF HIGH-POWER PULSED LASER RADIATION PROPAGATION IN THE ATMOSPHERE

L.G. Shamanaeva
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

Experimental investigations of the effect of sound pulse generation accompanying the propagation of high-power pulsed laser radiation in the atmosphere were started at the IAO SB RAS in 1986. Based on these investigations, optoacoustic methods of sounding of the atmospheric temperature, the wind velocity, the relative humidity, and the number density of micron fraction of the atmospheric aerosol were suggested. A source of the acoustic signal in an optoacoustic sounding system is a discrete laser spark made by focusing of a CO_2 laser beam into the atmosphere at distances of up to 500 m. The number density of coarsely dispersed aerosols was determined from the number of pulses in the laser spark acoustic signal whose amplitudes exceed the threshold noise level. The results of optoacoustic sounding agree well with the microphysical model of the aerosol atmosphere for Western Siberia.

When the laser energy density is below the threshold level of laser spark formation, the acoustic radiation is due to laser-induced thermal expansion of the propagation medium. Measurable parameters in this case are the effective laser beam radius, the coefficient of laser radiation absorption, and the total laser radiation energy.

An analysis of the characteristics of a laser-induced acoustic signal allows also the breakdown and underbreakdown regimes of laser radiation propagation to be detected.

An additional advantage of the optoacoustic sounding system is its capability to operate simultaneously with a spectrochemical lidar which analyzes the chemical aerosol composition by the optical emission spectrum of the laser spark. This allows one to obtain qualitatively new information about the atmosphere with minimum additional expenses.

C2-47

DOPPLER MEASUREMENT ACCURACY OF THE WIND PROFILE IN THE NONSTATIONARY SIGNAL REGIME

A.P. Shelekhov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
ash@iao.ru

In this paper the theoretical approach to the statistical analysis of the nonstationary signal of the pulsed Doppler lidar is proposed. The equation for the Doppler shift estimate as the sum of the regular component, the non-Gaussian and Gaussian fluctuating components is obtained. It shows that such definition of the Doppler shift estimate corresponds to the time average of the instantaneous signal frequency. The problem of the measurement of the average and true profiles of the wind velocity is discussed for the different stratification of the atmospheric turbulence.

C2-48

VOLUME ACOUSTIC SCATTERING IN THE OCEAN

V.E. Sklyarov and A.V. Berezutskii
Shirshov Institute of Oceanology RAS, Moscow, Russia
vsklyarov@aport.ru

The analyses of the hydro physical and acoustic researches, which have been carried out in the different regions of the northern Atlantic, are resulted. The main particulars of hydro physical structure and dynamic formations (currents jet, fronts and eddies) were well traced on the acoustic sounding on frequencies 12 and 24 kHz. At works in the Barents Sea, greatest value of the contrasts in a field of volume acoustic scattering were watched in area of the Polar front. It reached maximum ratings 15–20 dB on horizons of 90–200 m. Reference width of the meander gradient zone constitute 10–15 km, which corresponded to force dissipation spatial gradients, is about 1–1.6 dB/km.

C2-49

COMPARISON ANALYSIS OF THE STATISTICAL FEATURES OF THE BIOOPTICAL AND HYDROLOGICAL SEAWATER PARAMETERS

G.V. Skorokhod, O.A. Bukin, M.S. Permyakov, A.Yu. Major, and T.I. Tarkhova
Nevel'skoy Far East State Marine Academy, Vladivostok, Russia
o_bukin@mail.ru

The results of the experimental measuring of the biooptical and hydrological parameters space-time distribution of the sea water in the upper ocean layer are presented. The comparison analysis of the statistical features of the sea water temperature and salinity distribution and chlorophyll A fluorescence induced by laser radiation are described. The data were obtained in some scientific trip around Pacific, sea of Japan and sea of Okhotsk during 1992–1993, 1998–2000 years. The temperature, salinity and the laser induced fluorescence spectra of the sea water were simultaneously measured on moving ship by spipborne laser fluorometer.

C2-50

EXPERIENCE ON LASER SENSING OF THE BAIKAL WATER FROM THE ICE COVER

G.P. Kokhanenko,[1] I.E. Penner,[1] V.S. Shamanaev,[1]
N.P. Budnev,[2] B.A. Tarashchanskii,[2] and P.P. Sherstyankin[3]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
kokh@iao.ru
[2]*Scientific-Research Institute of Applied Physics at Irkutsk State University, Irkutsk, Russia*
[3]*Limnological Institute SB RAS, Irkutsk, Russia*

An experiment on laser sensing of the subsurface layer of Baikal water has been carried out under stationary conditions. To this end, the lidar developed at the Institute of Atmospheric Optics of the SB RAS was mounted on the ice cover of lake Baikal in the vicinity of the deep-water neutrino telescope of the Scientific-Research Institute of Applied Physics at Irkutsk State University. Sensing was performed through the hole of required size hacked through ice. The optical water parameters were simultaneously measured with the submerged transparency meter developed at the Limnological Institute. The experiment was aimed at further refinement of the laser sensing method and investigations of the applicability limits of the laser sensing equation under conditions of strong multiple scattering and the motion of hydrosols under the ice cover.

Session C3. AIRBORNE AND SPACEBORNE LIDARS AND THEIR APPLICATIONS. MODELS OF THE ATMOSPHERE. LASER BEAMS ON HIGH-ALTITUDE PATHS IN THE ATMOSPHERE AND SPACE

C3-01

HOW PRECISELY AN EQUATION MUST DESCRIBE THE RETURN SIGNAL OF A SPACE-BORNE LIDAR SYSTEM TO ALLOW FOR THE RETRIEVAL OF CLOUD PARAMETERS?

A. Borovoi,[1] G. Czerwinski,[2] J. Ding,[3] U. Oppel,[2] and L. Xu[3]
[1]Institute of Atmospheric Optics, SB RAS, Tomsk, Russia
borovoi@iao.ru
[2]Institute of Mathematics, L-M-University of Munich, Munich, Germany
[3]Satellite Remote Sensing Laboratory, Chengdu College of Information Engineering, Chengdu, China

The return of a space-borne lidar system contains essential contributions of high orders of multiple scattering. Hence, methods for the retrieval of cloud parameters from such returns must be based on equations which take into account such higher orders of multiple scattering. The more precisely this is done the more complicated these equations will be and the less chances are to be able to retrieve the parameters. At least this is true for retrieval procedures which are based on solving integro-differential equations. Hence, in such a case it is necessary to use simplified equations to describe such returns. Such simplified equations may be equations which introduce a correction term into the classical (single scattering) lidar equation or which take into account one or two orders of multiple scattering only or which have the form of some sophisticated exponential series including knowledge on depolarization for example. Of course, it is necessary to check the validity of such approximative multiple scattering lidar equations. This is done by comparing results of simulations based on these equations with simulations based on exact multiple scattering lidar equations. We shall do this for a variety of stratified clouds consisting of various scatterers and mixtures of scatterers such as models of cirrus clouds (hexagonal prisms, dendrites, bullet rosettes), aerosol clouds (oblate and prolate spheroids), water clouds (haze, C1), and molecules. The results of this comparison shows that the contributions of multiple scattering are underestimated in many situations. Hence, the range of validity of such usually ill-posed retrieval procedures has to be examined with care.

C3-02

EYE-SAFE LASER TRANSMITTER FOR ATMOSPHERIC REMOTE SENSING APPLICATIONS

U.N. Singh
NASA Langley Research Center, USA
u.n.singh@larc.nasa.gov

Space-based lidar remote sensing measurements of water vapor, carbon dioxide, and wind needs the laser transmitters to be highly efficient and reliable, conductively cooled, compact, and long operating lifetime. Recent advancement in CW and Quasi-CW laser diodes technologies has led to the development of high-energy diode-pumped solid-state lasers, which have the potential to be deployed in space for extended period. A strong effort is underway to develop eye-safe solid-state laser for multiple lidar applications. The concern of eye-safety is promoting the development of solid-state eye-safe laser transmitters in mid-IR. Using the non-linear optical devices, such as optical parametric oscillator (OPO), optical parametric amplifier (OPA) and wave mixing technologies, the wavelength coverage can be extended and can be tuned to target the different atmospheric constituents. This paper will review the current developments and the future technology challenges in the eye-safe solid-state lasers.

C3-03

PROJECT OF LIDAR INVESTIGATION OF THE EARTH FROM ONBOARD THE SMALL SPACE PLATFORMS

G.G. Matvienko
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
mgg@iao.ru

Rich experience of the first lidar space experiments performed in the Russian Federation and the U.S. has supported the utility of the use of space lidars for monitoring of the atmosphere. Automated artificial Earth satellites with the rigid program of observations can be mainly used for monitoring of the atmosphere. At the present time in the Rosaviakosmos there are some draft projects intended for tracking the aerosol and gas anomalies in the lower atmosphere from onboard the small space apparatus (SSA). As a rule, the SSA platforms are put into orbit at a height of 600 km and more. Therefore the effective power of the created space lidars should be high.

This paper describes the two projects of lidars for SSA–200. One of the projects is intended for monitoring of aerosols of natural and technogenic disasters.[1] The second project realizes the differential absorption methods for determining the excess of hydrocarbon contaminations over the background ones. The paper analyzes the other aspects of laser space sensing of atmospheric anomalies.

1. G. Matvienko, G. Kokhanenko, V. Shamanaev, V. Alekseev, Proc. SPIE, **3494**, 206–210 (1998).

C3-04

METHOD FOR RECONSTRUCTION OF THE HEIGHT WIND PROFILES FROM THE DATA OF SPACE DOPPLER LIDAR

V.A. Banakh,[1] Ch. Werner,[2] N.P. Krivolutskii,[1] I. Leike,[2] I.N. Smalikho,[1] and J. Streicher[2]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
banakh@iao.ru
[2]*DLR Institute of Atmospheric Physics, Wessling, Germany*
Christian.Werner@dlr.de

New method has been proposed for reconstruction of height profiles of wind velocity and wind direction from the data of space scanning coherent Doppler lidar. The approaches used before are based on the following procedure. The height profile of the radial component of wind velocity vector is obtained from the temporal series of echo-signal samples. Then the height profiles of wind velocity and wind direction are reconstructed from the data for the various azimuth angles of scanning. As the results of numerical simulation show, such an approach gives large error at low signal-to-noise ratio and allows the wind profiles to be reconstructed with required accuracy to the height of 2–3 km only.

Our method is based on accumulation of the echo-signal Doppler power spectra measured under various azimuth angles of scanning and subsequent use of the variation principle to estimate. The Doppler spectra for given height are summed with allowance for sounding geometry. Then the estimated velocity and direction values are determined from the obtained two-dimensional (velocity-direction) distribution of accumulated spectra as coordinates of maximum. Numerical simulation shows that the use of this technique allows the height wind profiles to be reconstructed up to the height of ~ 20 km with acceptable accuracy even for SNR = 10^{-3}.

The research was supported by the Russian Foundation for Basic Research Grant 05–00–64033.

C3-05

USING SATELLITE DATA FOR ESTIMATE TEMPERATURE CHARACTERISTICS OF AIR ON THE GROUND LEVEL

S.A. Tashchilin and N. A. Abushenko
Institute of Solar–Terrestrial Physics SB RAS, Irkutsk, Russia
koshelev@iszf.irk.ru

The definition of the temperature characteristics in a ground stratum of air is of interest within the framework of the forecast of designated fire conditions in territory of the large-scale wood arrays of territory of Siberia and Far East. The existing network of meteorological stations in territory of East Siberia and Far East and especially in

northern areas, is rather unloaded, and consequently the rating of temperature parameters of a surface of a land and ground stratum of air in enough extensive territory is made approximately. Usage of satellite methods of observation, on the basis of the data optical, microwave and. ranges of lengths of waves can appreciably increase efficiency of solution of the given task.

In this studying the daily satellite data of instruments AVHRR and TOVS (NOAA) obtained in the Center of Remote Sensing were used. The statistical analysis of accuracy of restoring of temperature of air and temperature of dew point under the information of the data of instruments in matching with outcomes of ground observations on 30 meteorological stations for spring – summer period of 1998 in limits of territory of Irkutsk area is carried out.

As a result of researches is shown, that for ideal meteorologic conditions of observations (absence of a cloud cover) the standard deviation (SD) of temperature, restored on the satellite information, has made under the data AVHRR 0.7 K, under the data TOVS 1.0 to accordingly. In case of an overcast the analysis only under the data of instrumentation TOVS/NOAA was conducted. Thus SD has made about 3.5 K.

As a result of operation the output about a feasibility of the satellite information for operational use is made at the prognosis of fire danger of woods on the basis of a meteorologic Nesterov index

C3-06

LIDAR SIGNAL IN THE DOUBLE SCATTERING APPROXIMATION AT PARAMETRIC SETTING OF THE SCATTERING PHASE FUNCTION

V.V. Bryukhanova and I.V. Samokhvalov
Tomsk State University, Tomsk, Russia
leo@elefot.tsu.ru

The analytical formulas for the lidar signal from far cloud formations in the double scattering approximation are presented. It is shown that the contribution of the intensity of doubly scattered radiation significantly depends on the used model of the scattering phase function for the same class of atmospheric aerosols.

C3-07

NUMERICAL SIMULATION OF DOPPLER LIDAR DETECTION OF CLEAR AIR TURBULENCE

V.A. Banakh,[1] Ch. Werner,[2] and I.N. Smalikho[1]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
banakh@iao.ru
[2]DLR Institute of Atmospheric Physics, Wessling, Germany
Christian.Werner@dlr.de

There is a need for airline industry to create new tools for forecasting, detecting and avoiding turbulence in order to increase safety of flights, since turbulence remains the leading cause of flight attendant injuries. Now pilots have no defense against turbulence – especially the most treacherous type: clear air turbulence. It is necessary to collect volumes of quantitative data on the size and magnitude of turbulence field in atmosphere, to use these databases for validating the modeling and improved the forecasting of the heights of aircraft cruises which are dangerous for flights, to elaborate the criteria of false alarm algorithm, which can be used in airborne warning systems. The promising tool for detection of wind fields is Doppler lidar. Installed on aircraft it can in principle measure wind velocity, wind shear; obtained Doppler lidar data permit to estimate the turbulence strength, the length of small-scale turbulent phenomena.

In the paper the possibility of detection of clear air turbulence by airborne laser Doppler system is under study by means of numerical simulation. Simulation of lidar signals is carried out for different signal-to-noise ratio and turbulence strength realized in a free atmosphere. Information about the turbulent dissipation rate characterizing the strength of clear air turbulence we obtained from Doppler spectrum width. The simulation shows that this approach is sufficiently effective for detection the turbulent area which are dangerous for flights.

The research was supported by Russian Foundation for Basic Research Grant 00–05–64033.

C3-08

COMPARATIVE ANALYSIS OF POLARIZATION CHARACTERISTICS OF SCANNERS FOR AIRBORNE LIDARS

A.V. Beresnev and A.A. Tikhomirov
Institute of Optical Monitoring SB RAS, Tomsk, Russia
tikhomirov@iom.tsc.ru

Different types of the scanning systems applied in the airborne lidars (optical wedges, rotating diffraction grids, rocking and rotating mirrors) introduce a distortion into the polarization state of the transferred radiation fluxes at the change of the angles of incidence on the active element.

The paper presents the results of theoretical estimations of the polarization state of radiation for the scanners of the available lidar systems: MAKREL-2 (optical wedges), LASAL (rocking mirror) and HARLIE (rotating diffraction grid). The estimates were performed for the characteristic ranges of variation of the angles of incidence and reflection of the optical radiation. The results have shown that the principal depolarizing element in the LASAL system are two mirrors; the depolarization effect appears in the HARLIE system on the mirror and diffraction grid; and the double optical cline in the depolarizing element in the MAKREL system. From the standpoint of optimality of the polarization characteristics, the MAKREL–2 lidar based on two optical clines has the best polarization characteristics.

C3-09

LIDAR MEASURMENTS OF TIME VARIATIONS OF THE VOLUMETRIC BACKSCATTERING COEFFICIENT

B.T. Tashenov, V.A. Filippov, and R.V. Filippov
Fesenkov Astrophysical Institute, Almaty, Kazakhstan
filippov_romanv@mail.ru

In solving problems connected with the usage of the systems of distance optical sensing working through the atmosphere it is necessary to determine the influence of change of optical properties of the atmosphere.

In this matter the investigations of the variations of the volumetric backscattering coefficient on fixed altitudes were continued.

For the realization of the measurements we used a lidar with wavelength 532 nm. As a receiving antenna of the lidar a telescope-reflector with efficient mirror surface 1.2 m in diameter was used.

The aim of the present work was to analyze more in detail the oscillations of the volumetric backscattering coefficient in laser sensing of the atmosphere that were discovered earlier on the altitudes 10–80 km. For the analysis were taken the layers with thickness from 0.9 to 70km. The period of the revealed perturbations was 2.5–3.0 hours and was seen better when the thickness of the investigated layer was higher. For the thick layers these periods are seen relatively clear.

The possible causes of the revealed oscillations are discussed.

C3-10

POLARIZING CHARACTERISTICS OF DOUBLE SCATTERING RADIATION FROM DROP AND CRYSTAL CLOUDS

I.V. Samokhvalov, V.V. Bryukhanova, and P.V. Kryganov
Tomsk State University, Tomsk, Russia
leo@elefot.tsu.ru

The results of account of the Stocks vector of the double scattering radiation for water clouds of various phase structures are given. As the basis is taken the equation of laser sensing in double scattering approach consider polarization.

C3-11

EMPIRICAL MODEL OF THE SPECTRAL BEHAVIOR OF THE AEROSOL OPTICAL THICKNESS OF THE ATMOSPHERE IN THE WAVELENGTH RANGE 0.44 TO 12 μM

N.N. Shchelkanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
snn@iao.ru

When solving the problems of propagation of the optical radiation on horizontal and slant path, it is necessary to have the data on the value of the aerosol optical thickness of the atmosphere and its spectral behavior. Calculations of the aerosol optical thickness of the atmosphere in visible and IR wavelength ranges are carried out, as a rule, using the regional one-parameter models, where the input parameter usually is the aerosol optical thickness of the atmosphere at one wavelength in visible range. The first two-parameter model of aerosol extinction in atmospheric hazes was proposed in Ref. 1, where the input parameters are the aerosol extinction coefficients at the wavelengths of 0.48 and 0.69 μm.

The model providing for calculation of the aerosol optical thickness of the atmosphere in the wavelength range 0.44 to 12 μm is proposed in the paper. The input parameters of the model are the measured or set values of the aerosol optical thickness in the wavelength range 0.4 to 1 μm. The proposed model is universal, i.e. applicable for all types of the optical weather and different climatic zones.

1. N.N. Shchelkanov and Yu.A. Pkhalagov, Atmos. Oceanic Optics **12**, № 12, 1089–1092 (1999).

Session C4. OPTICAL AND MICROPHYSICAL PROPERTIES OF ATMOSPHERIC AEROSOL AND SUSPENSION IN WATER MEDIA

C4-01

ASSESSMENT OF OPTICAL CHARACTERISTICS OF ATMOSPHERE AND OCEAN BY DATA FROM SATELLITE OCEAN COLOR SENSORS

O.V. Kopelevich
Shirshov Institute of Oceanology RAS, Moscow, Russia
oleg@sio.rssi.ru

At present there are half a score of satellite ocean color sensors being in operation or prepared for launch; they offer strong possibilities of providing data on spatial and temporal variability of various characteristics of atmosphere and ocean, primarily of the optical ones. As of now, data from the satellite scanner SeaWiFS (Sea-viewing Wide Field-of-view Sensor) are in most common use; they have been available since September 1997. The possibilities and problems of retrieval of optical characteristics of atmospheric aerosol, cloudiness, and sea water from SeaWiFS data are considered. The algorithms developed in the P.P.Shirshov Institute of Oceanology Russian Academy of Sciences are presented as well as some results of their validation by data of field measurements. The examples of spatial distributions and seasonal changeability of aerosol optical thickness and seawater optical characteristics derived from SeaWiFS data are given.

C4-02

ABOUT OPTICAL, THERMAL AND DYNAMIC STRUCTURE OF COASTAL WATERS OF LAKE BAIKAL (DATA 1994, 1999)

P.P. Sherstyankin, M.N. Shimaraev, V.V. Khokhlov, V.N. Sergeeva, and V.N. Drozdov
Limnological Institute SB RAS, Irkutsk, Russia
ppsherst@lin.irk.ru

On optical and thermal structures of coastal waters made on solve of front to a grid of stations, as show observation, for example, on a section Maritui – Solzan on October 21, 1994 (Sherstyankin, Shimaraev, Khokhlov et al., 1998), show a close vicinity of areas of upwelling and downwelling. For an explanation of such phenomenon on the same temperature data the currents were designed by a dynamic method Zubov, Mamaev (1956) under the program prepared for the personal computer. The analysis of currents has shown, that waters located from the coastal party of front, have anticyclonic vortices, and from the lake party have cyclonic vortices. Taking into account, that anticyclonic vortices cause on periphery upwellings, and cyclonic vortices – downwelings, in places them convergence upwellings and downwellings are in the vicinity, that corresponds as theoretical performances (Sherstyankin, Kuimova, Minenko, 1995), and observations (Sherstyankin, Shimaraev, Khokhlov et al., 1998).

Anticyclonic vortices of coastal area is kept as well in winter time under ice, as it is shown by accounts of currents by a dynamic method in March, 1999 at cape Ivanovsky in Southern Baikal.

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C4-03

INFORMATION CONTENT OF SPECTRA OF FACTORS OF BRIGHTNESS FOR WATER ECOSYSTEMS

B.L.Sukhorukov and I.V.Novikov
Institute of Water Problems RAS, Rostov-na-Donu, Russia
bml@icomm.ru

The optical spectra of radiation rising from water are determined by the optically active components (OAC) which are present in water. The components changing the complex refractive index, its real and (or) imaginary parts relate to such components. A difficulty to obtain an information on the concentrations of all OAC consists of that the partial contributions of OAC in the spectrum intensity are non-comparable by their magnitude. The OAC concentrations appreciably determining a state of ecosystem make the very small contribution into the total spectrum intensity and are disguised by such OAC as the mineral suspended substances and organic solutes, and chlorophyll of phytoplankton. The method to solve this situation by the introduction of a concept of the space of optical conditions (SOC) and a change to magnitudes describing an optical condition of water ecosystems[1] (OCWS) is proposed.

The problems connected with the topology of three-dimensional SOC constructed by the data of model calculations are considered in the paper. The investigations connected with its completeness and stability have been carried out. For the graduation of SOC the families of isopleths in two-dimensional projections have been constructed. The analysis of experimental OCWS of certain water objects of the surface waters, and also of artificial water ecosystems in this space has been carried out. It is shown that the information content of the factors of brightness of water objects is determined by an integrated condition of ecosystem. Concentrations of separate OAC can be determined with the adequate accuracy in particular cases only.

1. B.L. Sukhorukov, G.P. Garbuzov, and A.M. Nikanorov. Vodnye resursy **27**, № 5, 579–588 (2000).

C4-04

INFLUENCE OF HEAVY METALS ON OPTICAL CHARACTERISTICS OF AQUEOUS MEDIA

A.Ya. Khairullina and V.A. Lapina
Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus
alphiya@dragon.bas-net.by

Conservation of biological and mineral resources oceans, lakes and rivers, their protection from man-made injection of pollutants as well as contamination control came for the humanity one of the important tasks today. In spite of numerous investigations some of the aspects of this problem remain underdeveloped. It is the determination of the contribution of potential dangerous chemical pollutants as metals and their oxides in the optical characteristics of aqueous media and the search of natural indicators (algae, animals, plants) of optical properties sensitive to the presence of heavy metals.

Analysis of references of phytoindication of heavy metals contamination[1] evidences to the availability of 435-670 nm spectral region for heavy metal identification (copper, zinc, iron, manganese) . Use of see water optical properties models in this spectral range, taking into account the absorption of pure water, chlorophyll and yellow substance say about the possibility to measure copper volume concentration down to 10 μg per m^3 (λ = 570 nm). Use of natural indicators will allow one to increase the sensitivity of the method. To analyze optical characteristics of aqueous media and natural indicators should take into account that heavy metals are luminescence killers (iron, copper) to be used for their identification.

The approach under review can be widely adopted for remote monitoring of the aqueous media and assessment of purification systems working efficiency.

1. A.A. Buznikov, N.V. Alekseeva-Popova et al, Journ. Optical Tech. **66**, № 8, 19–23 (1999).

C4-05

METHOD AND SOME RESULTS OF MEASUREMENT OF LIGHT ABSORPTION, DIRECT AND BACKSCATTERING SPECTRUMS IN LAKE BAIKAL WATER

B.A. Tarashansky, N.M. Budnev, and R.R. Mirgasov
Applied Physics Institute of Irkutsk State University, Irkutsk, Russia
tarash@api.isu.runnet.ru

New methods of a remote control of natural waters chemical and biological composition become more and more actual. Size of an information obtained using instruments situated on satellites and aircrafts increase con-

stantly. Nevertheless, high-quality interpretation of such data is difficult without measurements of inherent optical properties (IOP) *in situ*.

For analysis of data coming from deep underwater Neutrino Telescope NT-200 situated on South Baikal one have to have information about IOP as well. We have designed a new method and have constructed an instrument for measurement of light absorption, direct and backscattering spectrums in water. The device have been installed at mooring at 1000 m depth, it calibration is made *in situ* without any preliminary precise tuning. A methodical error of absorption and direct scattering factors measurements does not exceed 1% for wide range of parameters.

The method allows to estimate concentrations of dissolved and suspended fractions of organic mater and to observe processes of their mutual transformations and sedimentation. Our preliminary data shows on a high spatial and temporal variability of direct and back light scattering spectrum of Baikal water. It concerns both absolute values of IOP and spectrum shape.

C4-06

INFLUENCE OF CLOUD MICROPHYSICAL CHARACTERISTICS ON SOLAR RADIATION TRANSFER IN THE ATMOSPHERE

M.V. Shatunova
Hydrometeorological Research Center of Russia, Moscow, Russia
ldmitr@mecom.ru

Algorithm for calculation optical properties of water and ice clouds is developed.

Cloud absorption and scattering coefficients were calculated in dependence of cloud water content values and particle effective radius, taking into account evolution of cloud particle size distribution function. Extinction and absorption efficiency factors were calculated using approximate formula of K.S. Shifrin and G. Van de Hulst. Cloud extinction and absorption coefficients were compared with results based upon Mie theory.

For cloud particles size distribution function the gamma-function was used with parameters depended upon the cloud phase. These parameters are determined by changes in radius of particles due to coagulation and sublimation processes.

Dependence of cloud absorption values upon cloud microphysical parameters is investigated. Maximum absorption and minimum albedo values appear under the definite combination of cloud water content, particle concentration and radii interval.

Numerical experiments showed that variation of liquid cloud optical depth within the limit of 20–30 leads to decrease of the surface radiation budget up to 50% and to increase of the whole atmosphere flux divergence up to 40%.

The influence of cloud microphysical and optical properties on the radiation characteristics of the atmosphere is investigated.

C4-07

AEROSOL RETRIEVAL FROM COMBINED SPECTRAL EXTINCTION AND AUREOLE MEASUREMENTS

M.A. Sviridenkov
Obukhov Institute of Atmospheric Physics RAS, Moscow, Russia
misv@mail.ru

One of the main difficulties in interpreting of the clear sky radiance measurements is deriving the aerosol phase function from the measured sky brightness. Correct retrieval of the single scattering needs knowledge of the sky radiance in the whole range of the scattering angles. This is impossible for small solar zenith angles. In the present work, the ways to solve (or avoid) this problem for aureole measurements using spectral aerosol extinction data.

Aerosol optical thickness (AOT) in visible and near-IR is determined mostly by submicron aerosol fraction (except for the situations with extremely high coarse aerosol loading like a dust storm). This fraction is also predominant in the side scattering. So, the single scattering phase function can be derived from the spectral AOT by means of inversion and following Mie calculations for retrieved submicron aerosol. For rough estimations, it is sufficient to calculate the Angstrom exponent and take the phase function for the corresponding power law distribution. Analysis of the model and derived from the experimental data size spectra showed that inversion of the spectral extinction allows to recover the phase function in the angular range 30–150 deg. with accuracy, comparable with the measurement accuracy. The phase function obtained, gives the information needed for the account of the multiple scattering in the aureole region. The asymmetry of clear sky radiance due to multiple scattering is much less than for single scattering. Numerical simulations showed that aerosol size spectra retrieved from measured and single scattered aure-

ole radiance differ only in the region of small particles (less than wavelength). Thus, the aerosol size distribution can be obtained as a combination of the results of the inversion of AOT (submicron fraction) and aureole brightness (coarse fraction). The limits of applicability of the approaches proposed are discussed. The examples of the results obtained for different model and experimental size distributions are given.

C4-08

CARBONACEOUS PARTICLES IN THE URBAN ATMOSPHERE

Wang Gengchen,[1] Kong Qinxin,[1] Gu Zhifang,[1] Wan Xiaowei,[1] and A.S. Emilenko[2]

[1]Institute of Atmospheric Physics CAS, Beijing, China

wanggc@mimi.cnc.ac.cn

[2]Obukhov Institute of Atmospheric Physics RAS, Moscow, Russia

Presence of carbonaceous particles in the atmosphere not only strongly pollutes the air quality but also affects some important physical, chemical and photochemical processes in the atmosphere, in particular, affects the optical properties of aerosol in the atmosphere. Carbon particles have a larger imaginary part of the particle refractive indexes, and as a result, variation of the imaginary part of particles may affect directly on the single scattering albedo, on the asymmetrical scattering factor and other scattering parameters.

Concentration of carbon particles in the urban atmosphere in Beijing was measured during period of 1990–2000. Results show that concentration of carbonaceous particles in the urban atmosphere varies in quite large range. According to measured data obtained during 1996–2000, daily average concentration of carbon particles in atmosphere in Beijing is ranging from about 2.0 to 72.0 $\mu g/m^3$, maximum instantaneous value of the carbon particle concentration of 135 $\mu g/m^3$ was observed during the observation period, while minimum carbon particle concentration of about 0.2 $\mu g/m^3$ which was observed under favorable meteorological conditions can be considered as a background concentration of carbonaceous particles in atmosphere in Beijing. Moreover, results also demonstrate that, on an average, carbon particles are accounted for 10–15% to total aerosol in the atmosphere showing necessity to take carbon particles into account in lidar monitoring the urban atmosphere.

C4-09

ANALYSIS OF DAY SKY SPECTRAL BRIGHTNESS IN NEPHELOMETRIC ANGLES OF SCATTERING

V.N Korovchenko,[1] V.K. Oshlakov,[2] V.E. Pavlov,[3] and A.S. Shestukhin[4]

[1]Abai Kazakh State Pedagogical University, Alma-Ata, Kazakhstan

[2]Institute of Atmospheric Optics SB RAS, Tomsk, Russia

[3]Institute for Water and Environmental Problems SB RAS, Barnaul, Russia

pavlov@iwep.secna

[4]Polzunov Altai State Technical University, Barnaul, Russia

Regional optic atmosphere models are widely used in climatology, environmental sciences, remote sensing, etc. In case of considering optic properties of atmosphere on the whole, its parameters can be defined due to observations of atmosphere spectral transparency and the sky brightness in daytime. Among these are aerosol optic depth of scattering and light absorption as well as scattering indicatrices. Tools of conception on radiation transport used for experimental data analysis make possible to solve inverse problems. The most advanced and promising methods are iteration ones developed by the Computer Center Academy of Sciences (Novosibirsk). Inverse problem solving can be augmented by including empiric regularities obtained under the sky brightness observations. Probably, empiric regularities have their own regional characteristics.

With this in mind experimental sets of absolute brightness indicatrices $f(\varphi)$ in Solar almucantar within the wave length range from 332 up to 1100 nm obtained in south-east Kazakhstan were analyzed. Substitution of $2\pi \int f(\varphi) \sin\varphi \, d\varphi$ (integration within 0–180°) applied to solve inverse problem for $kf(\varphi_i)$ values for nephelometric angles φ_i = 30, 40 end 60° has been studied. The possibility of substitution is of fundamental importance for small Solar zenith distances Z, since maximum angle of scattering φ_{max} is restricted to $\varphi_{max} = 2Z$ and some uncertainties under integral calculation occur. Substitution errors, when one, two or tree angles φ_i are in use, have been estimated. The results obtained allow to extend the procedure of inverse problem solving to small $Z \geq 45°$ (previously Z was commonly restricted to 75–80°).

C4-10

SEASONAL DYNAMICS OF THE AEROSOL EXTINCTION COEFFICIENTS IN THE HAZES OVER WEST SIBERIA

V.N. Uzhegov and Yu.A. Pkhalagov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
pkhalagov@iao ru

Three arrays of the aerosol extinction coefficients $\alpha(\lambda)$ in the wavelength range $\lambda = 0.44 - 12$ μm obtained in round-the-clock measurements on the long near-ground path in the region of Tomsk in spring-summer, summer and autumn of 1998 are analyzed in this paper. The arrays included 115, 290, and 311 spectra $\alpha(\lambda)$, respectively. The analysis of mean spectra $\alpha(\lambda)$ and eigenvectors of autocorrelation matrices for these arrays was carried out. It is shown that there is the pronounced seasonal dynamics of the value and spectral structure of the aerosol extinction coefficients in hazes. It is the most well seen when passing from summer to autumn. The maximum variations of the coefficients $\alpha(\lambda)$ are observed in IR range, while in visible wavelength range they are very close to each other. The spectral dependencies of the aerosol extinction coefficients in spring-summer (June) and summer (July - first half of August) hazes are practically similar are differ only in the level of extinction that is formed by coarse particles.

Analysis of the spectral structure of the first eigenvector of the autocorrelation matrix of the coefficients $\alpha(\lambda)$ in the hazes of the selected seasons also shows the significant difference of autumn hazes from two other seasons.

C4-11

ADVANTAGES OF USING CIRCULAR POLARIZED LIGHT IN LASER SENSING OF CRYSTAL CLOUDS

B.V. Kaul,[1] D.N. Romashov,[1] and I.V. Samokhvalov[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
kaul@iao.ru
[2]Tomsk State University, Tomsk, Russia
leo@elefot.tsu.ru

We analyze the results of lidar measurements of the backscattering phase matrices (BSPM) of crystal clouds and theoretically calculated BSPMs of ensembles of hexagonal plates and columns of water ice. Our analysis shows that in sensing crystal clouds when only light with one polarization state is available the circularly polarized light ought to be preferred.

C4-12

LIGHT SCATTERING ON ICE CRYSTALS OF CIRRUS CLOUDS: JONES MATRIX

A.G. Borovoi,[1] I.A. Grishin,[1] and U.G Oppel[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
borovoi@iao.ru
[2]Institute of Mathematics, L-M-University, Munich, Germany

Light scattering on crystal particles of cirrus clouds is described with good accuracy by geometric optics equations. In numerical calculations it is realized by the ray tracing method. However, the majority of authors apply the ray tracing method not to the electromagnetic field, but to its squared values, for example, to the Stokes parameters. Such an approach significantly simplifies the algorithms for calculation, but the obtained Muller matrix does not takes into account such wave effects as diffraction and interference. The ray tracing method is applied in this paper directly to the electromagnetic field, that gives the Jones matrix for the scattered field. As result, two scattering phase matrices (Muller matrices) are obtained, called the pure and mixed matrix, respectively, where the pure Muller matrix is obtained from summing the squared values of the field. The question is posed: what of the matrices is measured at laser sounding of cirrus clouds?

C4-13

ABOUT MODELING THE EFFECT OF HUMIDITY ON THE AEROSOL OPTICAL CHARACTERISTICS USING WIDE LOGNORMAL PARTICLE SIZE DISTRIBUTIONS

M.V. Panchenko, V.V. Pol'kin, and S.A. Terpugova
Institute of Atmospheric Optics SB RAS, Tomsk
pmv@iao.ru

Submicron particles play principal role in formation of the atmospheric aerosol optical properties in the visible wavelength range, the particles of other fractions make the smaller contribution. So, when reconstructing the microphysical characteristics from the data of optical measurements in the visible wavelength range, one often have to describe the particle size distribution function in the form of wide lognormal distribution of submicron particles, the boundaries of which cover the part of microdisperse and coarse fractions. Indeed, such a distribution well describes a certain image of the really observed aerosol microstructure, if the data have been averaged over a large set of various atmospheric situations. At the same time, physics of the processes occurring in the atmosphere far from the sources of aerosol and aerosol–forming substances, as a rule, does not permit simultaneous long–term existence of great quantity of submicron and microdisperse particles. Hence it follows that it is less probable to observe the situation in the local volume of the real «background» atmosphere, which were corresponding to the model image of microphysical characteristics in the particle size range intermediate between microdisperse and submicron fractions. The defect of such a representation of the microstructure is less noticeable when describing the energetic parameters of the scattered radiation in the visible wavelength range. Another matter is when the microphysical model supposes to describe the change of the optical characteristics, for example, under the effect of relative humidity of air, the increase of which can displace the small particles, earlier weakly noticeable, to the range of the optically active ones. In this case all errors in approximation of the size distribution function in this size range can seriously damage the pattern of transformation of the angular polarization characteristics.

When introducing the block of the effect of humidity into the model, we have developed some methods for decreasing the effect of these errors. They are described in the paper.

C4-14

LIGHT SCATTERING BY MIXED CLOUDS

A.G. Petrushin
Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia
las@iem.obninsk.ru

The phase scattering functions $P(\theta)/4\pi$ by mixed clouds were investigated. A model of a mixed cloud microstructure under its spatial homogeneity is presented. For the mixed cloud microstructure model the expressions were used that connect the ratio of droplets liquid water content to the crystals ice content (t) with the ratio of scattering efficiencies for these fractions (q) for mixed clouds. The $P(\theta)/4\pi$ calculations for the crystalline fraction of a mixed cloud for the microstructure model were made with the calculation methods of Ref. 1, and for the $P(\theta)/4\pi$ calculations for the droplet fraction the method based on the well-known Mie-Lorentz theory was used.[2] Using the suggested expressions and Sundqvist's approximation for the calculation of t for the mixed cloud depending on the cloud temperature within the cloud layer T[3], $P(\theta)/4\pi$ for different values of T were obtained. This work was supported by the Russian Foundation for Basic Research (grant No. 00–05–64571a).

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C4-15

COMBINED (SPECTRAL AND LANGMUIR) METHOD FOR DETECTION OF WATER BASINS CONTAMINATED BY OIL PRODUCTS

M.I. Allenov, V.G. Biryukov, N.D. Tretiakov, and S.G. Yudin
Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia
post@typhoon.obninsk.org
Plant "Volkovsky" Morshansk District, Tambov Region, Russia
Institute of Crystallography RAS, Moscow, Russia

Fast-response spectroradiometers and multichannel radiometers for different spectral ranges from 0.4 to 13 mcm were designed at SPA "Typhoon" (Obninsk). With the help of these instruments on the basis of correlation between the fluctuations of absorbed and reflected radiation one can detect water basins contaminated by oil products at perturbed water surface.

Along with the optical and highly-sensitive Langmuir methods such combined methods allow one to create online means for water basin snap analysis, basins mudded by different particles in their number.

The paper gives the results of field and laboratory studies of contaminated water basins obtained with the use of the spectral and Langmuir methods for determining optical and physical properties of mono- and multimolecular layers. Oil concentrations detected in water were up to $10^{-9} - 10^{-11}$%v.

C4-16

DETERMINATION OF WATER BASINS MUDDINESS CREATED BY MINERAL PARTICLES CARRIED-OVER BY RIVERS

M.I. Allenov, N.P. Ivanova, V.V. Ovchinnikov, and N.D. Tretiakov
Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia
post@typhoon.obninsk.org

Based on the studies of spectral reflectance of the Kairakkum water storage basin surface a possibility is shown of determining water basin contamination by mineral particles. The studies were made from the helicopter by a fast-response spectrometer designed on the basis of a wedge circular interference light filter.

The spectrometer has the following parameters: speed of response is 20 spectra per s; threshold sensitivity is up to 10^{-8} W cm^{-2} sr^{-1} mcm^{-1}; spatial resolution is about 20 minutes of arc. The contrasts of water surface spectral brightness vary by almost five times, that corresponds to volume concentrations of particles suspended in water from 0.8 to 27 g/m^3 (the concentrations were determined by the specialists of the water storage basin hydrological post).

The results are presented in the paper in the form of isophotes corresponding to different levels of muddiness of the water storage basin from the dam to the Syrdaria estuary. On the basis of the experimental data obtained the wavelength intervals are recommended for the registration of solar radiation reflected from the mudded water surface.

C4-17

HOLOGRAPHIC DIAGNOSTICS OF BIOLOGICAL MICROPARTICLES IN LIQUID MEDIA

V.V. Dyomin, V.A. Mazur, A.V. Makarov, N.G.Melnik, and O.A. Timoshkin
Tomsk State University, Tomsk, Russia
dyomin@ic.tsu.ru
Institute for Optical Monitoring SB RAS, Tomsk, Russia
Limnological Institute SB RAS, Irkutsk, Russia
info@lin.irk.ru

Further progress in plankton ecology is connected with the development of methods for organisms observation in their natural habitats. Investigation of processes and phenomena taking place in microvolumes of the water environment is becoming more and more topical.

Possibilities, advantages and limitations of holography applied to zooplanktonic studies in Lake Baikal are estimated in the paper. Peculiarities of the Lake Baikal zooplankters holographing are studied in laboratory experiments. The endemic pelagic crustacean Macrohectopus branickii (Amphipoda) was one of the objects studied. Images of the crustacean body fragments (5-40 μm and more) allowed us to estimate the resolution of holographic methods for different distances from the hologram plane. The resulting holograms reveal the interior of hard chitin structures

ferent distances from the hologram plane. The resulting holograms reveal the interior of hard chitin structures (spines and other body parts). It is possible to count and to size the less hard structures (e.g., setae).

A lot of biological particles are transparent or semitransparent and holographic image of such particle differs from the opaque particle image. Peculiarities of holographic images of these particles are discussed in the paper. As a result, we proposed method for evaluation of the particle optical features (refractive index and absorption factor), in addition to its geometrical parameters. The additional information can provide more precise identification of particle type. Method is based on analysis of intensity distributions in various cross-sections of holographic image.

The above technique has been applied to experimental measurements of the refractive index of water drops in the air, latex spheres in various liquids, air bubbles in water. The accuracy of measurements was about 10% for the particles of 100 micrometers in diameter. Results of holographing of biological microparticles are presented as well.

C4-18

ELECTRICAL AND AEROSOL ATMOSPHERIC CHARACTERISTICS FLUCTUATION IN TECTONIC ACTIVITY REGION

G.G. Matvienko,[1] A.I. Grishin,[1] and V.A.Alekseev[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
aig@iao.ru
[2]Institute of Innovation and Thermonuclear Investigation, Troitsk, Russia

Known methods to present time of a prediction of earthquakes do not provide the reliable forecast. This circumstance stimulates search new predictors which are capable to provide more reliable forecasting of time and a place of spontaneous cataclysm.

As such predictor the set of aerosol characteristics of a ground layer of an atmosphere which essentially change some hours prior to the moment of earthquake may act. Changes of concentration, a spectrum of the sizes, and also a chemical compound of aerosol particles are observed. however, it is necessary to note, that similar variability is not unequivocally connected with tectonic processes. Similar fluctuations of physical and chemical properties may be caused by of other reasons (for example, change of wind characteristics, change of air medium, variations of physical characteristics of a gas component of an atmosphere etc.). This circumstance essentially increases risk of the announcement of a false alarm. Therefore it is meaningful search additional predictors, not associated with aerosols on a physical nature. As such object the electric field of the Earth which also actively reacts to variability tensometric characteristics of an earth's crust may act. Especially brightly it is shown in zones of tectonic breaks of an earth's crust.

In the given report results of experimental supervision of factor of aerosol scattering and intensity of the electric field, in November, 1999 on Tamanskii peninsula in zone Budasskii of a cross fault are submitted. The basic statistical characteristics of observably objects are investigated. Presence of mutual correlation between variability aerosol both electric characteristic – on the one hand, and tectonic activity of an earth's crust – with another is shown.

C4-19

OPTICAL PROPERTIES OF SALT PARTICLES OF A SEA AEROSOL (LABORATORY EXPERIMENT)

T.V. Gubareva
Bratsk State Technical University, Bratsk, Russia
tvgbratsk@mail.ru

The strips of fundamental uptake of halogenides of alkali metals lay in the field of lengths of waves less than 259 nm. They are transparent in wide spectral area. Therefore contribution of a sea aerosol at the analysis of optical properties of an atmosphere, as a rule, is not taken into account. However dimensional – time variability of the performances of an aerosol is great. Sectional full-scale of observations thus are fragmentary and do not allow full to study properties of particles. The similar situation determines small reliability sectional concerning transmutations of a natural sea aerosol. Are extremely complex and are for the present badly investigated radiochemical, photochemical and chemical reactions, which are responsible for transformation a builder of an aerosol.

Idiosyncrasy of these crystals is the opportunity of making in them of dot flaws termed as centers of colorings. It is known, that the centers of colorings can supply catalytic activity of these linkings at lengths of waves up to 800 nm. In requirements of an atmosphere containing sea aerosol, there are physicochemical factors, which can give in formation of F-centers by various trajectories. It results in pinch of reactivity of crystals. The laboratory experi-

ments with use of high-energy activation of system "air–microcrystal" testify to it. All obtained sectional are compounded with results showing that at high-energy actions there is an effective entrapment by a surface of microcrystals gaseous making of air. Is shown, that the interaction on a surface is composite multiphase process including interaction with NO_X; CO_2; H_2O; O_3. Thus the dot flaws in volume of crystals are created, are formed and the new phases crystallize on a surface. The specified processes results are found out on change of optical properties of crystals. In ultraviolet, visual and infrared fields of a spectrum there are considerable changes.

C4-20

EXAMINATIONS OF STRUCTURE OF SALT PARTICLES OF A SEA AEROSOL (LABORATORY EXPERIMENT)

T.V. Gubareva
Bratsk State Technical University, Bratsk, Russia
tvgbratsk@mail.ru

In the present operation some results of study of a microstructure of salt particles are submitted. The purpose of experiments – examination of physicochemical transmutations in disperse systems, namely particles of salts of alkali-halides in contact to free air. The experiments on examination of physicochemical transmutations on a surface of alkali-halides crystals included: 1) irradiation of a disperse system scale, X-ray or ultraviolet radiation in various requirements; 2) X-ray diffraction and electronic – microscopic analysis. As solid particles the finely divided powders and crystals in the filamentary shape were utilized. The sizes of particles were in limits 1–10 microns. It corresponds to the sizes of a coarse-dispersion fraction of a sea aerosol. Thus the interaction was initiated by various views of high-energy actions in view of their potential importance in heterogeneous chemistry of a Earth's atmosphere (sea aerosol and radioactive factor).

All obtained sectional are compounded with results showing that at all utilized views of high-energy actions there is an effective entrapment by a surface of microcrystals gaseous making of air. During experiments the new substances that have appeared in particles as a result of action identified. Is shown, that the interaction on a surface is composite multiphase process. As have shown electronic – microscopic examinations on a surface of starting microcrystals there are formations, which with magnification of time of processing form a continuous surface film. The X-ray diffraction examinations have shown, that the surface layer usually includes such linkings as $MeNO_3$, $MeNO_2$, $MeCO_3$, $MeXO_3$, $MeXO_4$, where Me – alkali metal, X – halogen.

C4-21

TRANSFORMATION OF THE SMOKE AEROSOL MICROSTRUCTURE AT THE AFTER – PYROLYSIS STAGE

R.F. Rakhimov and V.S. Kozlov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
temur@iao.ru

The dynamics of the microstructural variations of smokes of pyrolysis origin at their settling in a close volume is considered on the basis of diagram comparison of the results of polarization measurements with the data of the model estimates. The revealed dynamics of the size spectrum of dense smokes shows that the selected fraction with the modal radius r_m ~ 0.25–0.30 μm is formed during the process of development of the smoke microstructure. Numerical modeling of the kinetics of coagulation development of the smoke particle size spectrum indicates two possible reasons.

First, the particle size spectrum of the microdisperse fraction of pyrolysis origin undergoes essential dynamics due to the very high number density, and finally it is transformed to the fraction with r_m ~ 0.17–0.20 μm. Second, the dynamics of the change of microstructure of the coarse fraction show significant decrease of both number and volume densities due to the intensive sedimentation of this fractions on the chamber walls. Besides, the one should consider the displacement of the mode of the volume distribution of this fraction from 1.19 to 0.80 μm together with relative narrowing of the size spectrum as indicator of the increase of compactness of the morphological structure of fractal particles. Thus, the process of coagulation of the moderately dispersed particles with the radius of about 0.3–0.5 μm replenishes the content of particles of the selected coagulation mode from right, that finally determines the aforementioned characteristic size.

Other peculiarities of transformation of the disperse structure of smokes are discussed.

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C4-22

CORRELATION OF AEROSOL CHARACTERISTICS, SOOT AND METEOROLOGICAL PARAMETERS IN THE NEAR-GROUND AIR LAYER

V.S. Kozlov, M.V. Panchenko, V.V. Polkin, S.A. Terpugova, and E.P. Yausheva
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
pmv@iao.ru

The results are considered of synchronic measurements of the scattering coefficient of the dry matter of aerosol particles, at the wavelength of 0.52 μm, mass concentration of soot, number density and size distribution function of aerosol particles of the size d = 0.4–10 μm, parameter of condensation activity of aerosol particles, thermooptical parameters and the standard meteorological parameters carried out at the Aerosol Station of IAO SB RAS in 1998–2000. Analysis has been carried out of correlation between the aerosol parameters, temperature, relative and absolute humidity of air.

High correlation is observed between the aerosol content (scattering coefficient), soot concentration and the total number density of particles. The monthly correlation coefficients are 0.65 to 0.98, maximum of correlation is observed in winter and minimum is in summer. Correlation of daily mean data is greater than that of hourly data. High correlation of the aerosol parameters can be explained by the dominating role of finely dispersed aerosol fraction in variation of each of them. For example, the correlation coefficients of the soot concentration and scattering coefficient with the number density of particles d = 0.4 μm are approximately 0.2 greater than that with the number density of particles d = 1 μm.

The statistically significant correlation is obtained of the aerosol and soot contents with air temperature in winter, and positive – in summer (correlation coefficients are 0.35–0.66).

The significant negative correlation is observed in winter, spring and summer between the parameter of condensation activity and the soot concentration, as well as between the parameter of condensation activity and the scattering coefficient. Correlation between the noted parameters in autumn is absent.

Small positive correlation is observed in warm seasons (spring and summer) between the unburned residue ($S = \sigma(250°C)/\sigma(25°C)$), where σ is the scattering coefficient at respective temperature) and the relative content of soot in aerosol particles. The correlation in autumn and winter is absent.

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C4-23

SIMULTANEOUS MEASUREMENTS OF AEROSOL ABSORPTION COEFFICIENT AND SOOT CONCENTRATION IN THE NEAR-GROUND AIR LAYER BY METHODS OF OPTICAL–ACOUSTICAL SPECTROMETRY AND DIFFUSE EXTINCTION

V.S. Kozlov, M.V. Panchenko, A.B. Tikhomirov, and B.A. Tikhomirov
Institute of Atmospheric Optics SB RAS, Tomsk
pmv@iao.ru, boris@ra9hai.tomsk.ru

When solving some radiative and climatic problems, it is urgent to obtain the precise and real-time data on the aerosol absorption coefficient (or the content of soot in air) determining the non-selective extinction of radiation in the visible wavelength range.

The results of simultaneous measurements of the aerosol absorption coefficient and the mass concentration of soot in the near-ground air layer in winter and spring 2001 are analyzed. The aerosol absorption coefficient was measured by means of the optical-acoustic spectrometer with mono-pulse transformable ruby laser and with the photoacoustic cell with about 10 liters of volume, in which the technique for spatial-temporal resolution of the optical-acoustic signals is realized, providing for reliable selection of aerosol absorption. The device was calibrated by the resonance absorption by water vapor and provided for sensitivity of about 10^{-3} km^{-1} that is sufficient for measuring the low levels of aerosol extinction in the atmosphere. The mass concentration of soot was measured by the aethalometer (method of diffuse extinction) used at the Aerosol Station of the Institute for round-the-clock every-hour measurements. The device was calibrated by means for the pyrolysis generator of soot based on comparison with gravimetric measurements and provided for sensitivity of about 0.1 $\mu g/m^3$ (absorption coefficient of about 10^{-3} km^{-1}) at pumping of 20–30 liters of air.

The results of simultaneous measurements have shown that, in general, the data of two devices are in good agreement between each other. Good correspondence is observed in simultaneous following the characteristic peculi-

arities of the diurnal dynamics of the aerosol absorption and the content of soot during the period of measurements. Good correlation between the data also exists. The estimates are evidence of correctness and consistency of the data and make it possible to perform the intercalibration of the devices. The results obtained significantly extend the capabilities of organizing the regular complex measurements of the aerosol extinction coefficient and the concentration of soot in monitoring regime.

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C4-24

POLARIZATION STRUCTURE OF THE MULTIPLE SCATTERING BACKGROUND OF THE SIGNAL REFLECTED BY CLOUD ICE CRYSTALS

G.M. Krekov, M.M. Krekova, and D.M. Romashov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
gm@iao.ru

The polarized radiation carrying the additional information on the medium is the most often used for sounding of the upper level clouds. The distance of clouds from ground-based or satellite-based lidar systems predetermines the presence of the multiple scattering background in the location signal, in spite of the low optical density of clouds. It depends both on the scattering volume determined by the vision cone and on the degree of asymmetry of the scattering phase function. It can be very high for the large ice crystals.

The necessity of investigation of the polarization structure of the multiple scattering background is connected with the use of approximate methods for solving the inverse problems of different level. Till now it was very difficult to carry out the detailed analysis, because the data on the scattering phase functions available in literature is graphic, and obtaining the numerical data causes large errors in the directions close to 0 and 180°. Now the data are available on the scattering phase matrices of the crystals of hexagonal shape obtained by one of the authors by means of the beam division method. The brief, comparative with other authors, analysis of these results is presented in the paper. Then the location signal is calculated by means of the Monte-Carlo method for the initially linearly polarized radiation. Calculations are performed for the medium consisting of the monodisperse crystals, the shape and size of which varied. The polarization state of radiation of different order of multiplicity is analyzed depending on the geometry of experiment.

C4-25

EFFECT OF AIR BUBBLES IN SEA WATER ON THE FORMATION OF LIDAR SIGNAL

M.M. Krekova, G.M. Krekov, and V.S. Shamanaev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
mmk@iao.ru

Formation of the lidar signal reflected from sea water occurs due to several mechanisms: scattering and absorption by suspended hydrosol particles, absorption by chlorophyll and yellow substance, as well as scattering on the air bubbles in water.

There are several sources of air bubbles generation in water. First of all, it is aeration of air when falling down the waves under conditions of strong wind roughness and photosynthesis due to the marine biomass. It is known from literature that the bubble size reaches 15–200 μm, they are concentrated in the near-surface water layer down to 10–15 m, and their number density can vary within the limits 10^4–10^8 cm^{-3}. There are the data on the optical properties of air bubble in sea water, from which it follows that their extinction coefficient in visible wavelength range can reach the value of 10^{-4}–10^{-2} m^{-1}. Besides, air bubble scatter light in the directions close to 180° by tens of order greater than hydrosol particles. Big size of bubbles predetermine the high degree of asymmetry of the scattering phase function. Taking into account all aforementioned, the necessity is obvious of investigation of their role in formation of the lidar signal.

Calculation of the lidar signal is performed by means of the Monte-Carlo method for waters of different productivity, geometric conditions of observation have been also varied. The results obtained allow one to determine the necessity of taking into account the presence of air bubble in water when extracting information from the lidar signal.

C4-26

NUMERICAL SIMULATION OF SAMPLING AEROSOL PARTICLES FROM A HIGH-SPEED AIR FLOW

A.A. Medvedev, V.S. Toporkov, S.G. Chernyi, S.V. Sharov, and D.V. Chirkov
Scientific-research institute of Aerobiology,
State Research Center of Virology "Vector", Koltsovo, Novosibirsk region, Russia
Institute of Computation Technologies SB RAS, Novosibirsk, Russia
medvedev@vector.nsc.ru

Investigation of atmospheric aerosols is often started from the fact that air containing particles is collected to the sampling tube. Then it is important to minimize or take into account distortions of the aerosol disperse composition appearing because of inertia of particles as well as fluctuations of speed and direction of the external flow. The aforementioned distortions are especially great when the samples have been collected from onboard the aircraft. The purpose of this paper is numerical investigation of the aerosol aspiration from flow, the velocity of which is much greater than the rate of air sampling into the tube. Air motion is simulated by means of solution of the Navier–Stokes equations. The trajectories of aerosol particles and the efficiency of aspiration are calculated by means of integrating of the equations of particle movement in the obtained fields of air velocity. Different variants of air samplers are considered, in which the tube is equipped with special screen for braking and equalizing the external flow. The dependencies are presented of the efficiency of aspiration on the velocity of external flow, particle size and the sampler parameters. The diagram of the device for aerosol particle sample collection and dividing them into two fractions of different size is developed based on the results of calculations. The results can be used for selection of the design and regimes of operation of sample collectors, as well as for taking into account the distortions of the disperse composition of aerosol particles.

C4-27

DAY SKY POLARIMETER FOR A SHORT-WAVE REGION OF THE SPECTRUM

P.M. Zatsepin,[1] A.S. Istomin,[2] V.E. Pavlov,[2] V.V. Pashnev,[1]
P.V. Semenko,[2] D.N. Troshkin,[2] E.A. Tuterev[2]
[1]Altai State University, Barnaul, Russia
[2]Institute for Water and Environmental Problems SB RAS, Barnaul, Russia
pavlov@iwep.secna.ru

The spectral day sky polarimeter was designed and made on the base of dual quartz monochromator. The polarimeter is intended to measure the following atmosphere optical characteristics:

- atmosphere spectral transparency including ozone total content in atmosphere,
- day sky brightness at different angular solar distances,
- degree of linear polarization of the sky light,
- polarization plane orientation,
- spectral fluxes of short-wave radiation on horizontal and vertical sites,
- albedo of underlying surface.

Small angle of polarimeter entry is defined by focus distance of quartz lens, width and height of monochromator entry slit. The photomultiplier serves as the light detector in polarimeter and the Glan prism as the analyzer. Standardization of data sky brightness measurement is performed with a magnesium oxide screen placed into special packing and exposed to perpendicular solar beams. The recording and signal computer processing are controlled automatically. The control of equipment sensitivity during observation is provided.

Polarimeter is designed to study urban pollution influence on atmosphere optical characteristics.

C4-28

DIURNAL DYNAMICS OF THE AEROSOL EXTINCTION COEFFICIENTS IN THE HAZES OVER WEST SIBERIA

Yu.A. Pkhalagov and V.N. Uzhegov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
pkhalagov@iao ru

The data on the diurnal variability of the aerosol extinction coefficients $\alpha(\lambda)$ in the near-ground layer of the atmosphere in different seasons are interesting for the study of the processes of aerosol accumulation and its temporal

dynamics. The analysis of the mean spectra of the coefficients $\alpha(\lambda)$ obtained in daytime and nighttime in the hazes of spring–summer, summer and autumn of 1998 is presented in this paper. Measurements were carried out in the wavelength range $\lambda = 0.44–12$ μm on the long near-ground path in the region of Tomsk. The arrays included 115, 290 and 311 spectra $\alpha(\lambda)$, respectively. The spectra obtained at 2 and 5 p.m. were used as daytime data, and the spectra obtained at 2 and 5 a.m. were considered as nighttime data.

The data were statistically processed. It is revealed that the well-pronouced diurnal dynamics of the value and spectral structure of the aerosol extinction coefficient is observed in spring–summer and summer. It is apparent in the fact that the level of aerosol extinction in the IR wavelength range significantly increases in the daytime due to the convective emission of coarse particles. The diurnal behavior of the aerosol extinction in the IR range in autumn is pronounced worse.

It is also revealed that the stable maximum near $\lambda = 1.06$ μm is observed in the daytime spectra of the aerosol extinction coefficients in spring–summer and summer hazes. This maximum disappears in the nighttime spectra.

C4-29

DIURNAL DYNAMICS OF THE ATMOSPHERIC HAZE MICROSTRUCTURE UNDER CONDITIONS OF ANOMALOUS AND USUAL TRANSPARENCY

E.V. Makienko, R.F. Rakhimov, S.M. Sakerin, and D.M. Kabanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
andy@iao.ru

The data on the diurnal dynamics of the size spectrum of atmospheric haze particles were obtained from the results of spectrophotometric measurements of the aerosol optical thickness (AOT). It is shown that the optical contribution of the moderately dispersed particles (0.4–0.7 μm) into the spectral dependence of AOT is significant not only in the episode of anomalous spectral transparency of the atmosphere, but also under usual conditions.

The data on accumulation of AOT at $\lambda = 0.55$ μm and the volume aerosol concentration show that the content of accumulative fraction under conditions of anomalous transparency steadily increases during a day till 8 p.m. The decrease of the content of accumulative fraction from morning till noon is observed under usual conditions.

Optical contribution of the moderately dispersed particles increases up to 25% till noon while in the morning it does not exceed 10%. The decrease of their content down to the morning level and the displacement of the modal radius to the smaller size range is observed in the evening. The half-width and the modal radius of the moderately dispersed particle size spectrum in the morning almost always exceed the analogous parameters of the size spectrum observed overnight. This provides for the reason to suppose that the volume of this fraction increases in the night at the increase of relative humidity due to absorption of the atmospheric moisture.

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C4-30

LIGHT SCATTERING BY HEXAGONAL ICE CRYSTALS

D.N. Romashov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
rdn@iao.ru

Most of the currently available calculations of the optical characteristics of light scattering by hexagonal ice crystals employ the. geometrical optic approximation. This approximation uses the generalized Snell's and Fresnel's laws to analyze the geometry and physics of the light's passage inside polyhedrons. The principal shortcoming of this approach is the assumption that the emergent rays contribute to the field in the far zone only along their exit directions. Most researchers that use this approximation confine their calculations to the scattering indicatix and the degree of polarization of the randomly orientated ensemble of hexagonal ice crystals.

In the present paper, we discuss the Beam Splitting Method (BSM) which is used to obtain the characteristics of polarization for the case of scattering by randomly oriented hexagonal ice crystals, and compare the BSM with the Ray Tracing Method (RTM). The BSM is applied to compute and the scattering matrix of monodisperse ensemble of randomly orientated hexagonal ice crystals. We discuss the dependence of the scattering matrix elements on the size and shape of hexagonal ice crystals for the incident light with the wavelengths of 0.55–0.67 μm.

C4-31

VARIATIONS OF THE ATMOSPHERIC TRANSPARENCY CHARACTERISTICS OF DIFFERENT SCALES (TOMSK, 1992–2000)

S.M. Sakerin and D.M. Kabanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
sms@iao.ru

Aerosol optical depth τ and columnar water vapor W play special role among the characteristics determining the atmospheric transparency. They are characterized by not only big amplitude but also by the wide spectrum of oscillations which complicatedly depend on the dynamics of other physical fields (insolation, turbulence, wind, etc.).

The characteristics of variability of τ and W over West Siberia are discussed in this paper for the following types of oscillations: regular components of mean diurnal and seasonal behaviors, synoptic and mesometeorological variations, year-to-year changes. The results of measurements of the spectral transparency of the atmosphere (0.37 to 1.06 μm) in the region of Tomsk since 1992 till 2000 were analyzed. The principal portion of the data were obtained in warm seasons, so the results obtained by other authors were attracted for estimating the seasonal variability.

Mean values of the Angstrom parameter α for the regional background, volcanic eruption, forest fires and anomalous transparency are presented for characterizing the selectivity of the spectral dependence $\tau(\lambda)$. A new problem is considered in detail – mesometeorological variations of τ and W. One can ignore the noted variations in applied problems (because of their small amplitude) but they are of interest for revealing the properties of aerosol and atmospheric processes.

The uniform techniques for measuring and data processing make it possible to compare different scales of variability of the total content of aerosol and water vapor in the atmosphere. The quantitative estimates of relative contribution of different variations are presented in the form of the variation coefficients.

C4-32

ANALYTICAL APPROXIMATION OF RAINDROP SIZE DISTRIBUTION FUNCTIONS

S.V. Shamanaev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
shaman@iao.ru

Sodar measurements of raindrop size distribution function have shown that its analytical approximation by the Marshall-Palmer formula describes satisfactorily only a narrow segment of its exponential decay, when the raindrop sizes $d \geq 0.4$ mm. In the present report, a polynomial approximation is suggested, which allows the raindrop size distribution function (RSDF) to be satisfactorily described in a wider range of raindrop diameters. By adjusting the coefficients of the polynomial of the fourth power, the RSDF can be approximated with an error of 23–27% for raindrop diameters $d \geq 0.02$ mm. The corresponding coefficients are given for a light rain with the intensity $I \sim 0.1$ mm/h for which the RSDF was retrieved from the spectra of acoustic signals measured with the KIRE (Ukraine) cw bistatic Doppler sodar having a working frequency of 5 kHz and a scattering angle of 132° as well as for rains with intensities $I \sim 5$–6 mm/h for which the RSDFs were retrieved from the spectra of signals measured with the Auckland University (New Zealand) cw bistatic Doppler minisodar having a working frequency of 40 kHz and a scattering angle of 90°.

C4-33

RESULTS OF TESTS OF A SPECTRAL INTEGRATING NEPHELOMETER FOR ATMOSPHERIC INVESTIGATIONS

I.A. Razenkov, A.P. Rostov, and N.A. Shefer
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
rostov@iao.ru

The integrating nephelometer for measurement of a scattering coefficient in a visible range of a spectrum is developed. The integration for an angle was made between the limits from 5 to 175° that provides 10% accuracy of measurements. The use of a diffraction grid allows to sequentially carry out recording of scattering coefficient spectrum with the resolution of 14 nm. The receiver was the photoelectron multiplier working in the count of photons. The absolute calibration of the nephelometer is made on molecular scattering of the air, cleared from aerosol particles, and on carbon dioxide.

The results of tests of the device are presented: spectral and absolute calibrations, the results of continuous extended observations of scattering coefficient spectrum of an atmospheric air.

C4-34

NUMERICAL INVESTIGATION OF CHARACTERISTICS OF REFLECTED RADIATION GENERATED THE LIGTH PILLARS IN ATMOSPHERE

O.V. Shefer
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
Tomsk State University, Tomsk, Russia
shefer@elefot.tsu.ru

At present there is a major preoccupation to studying of crystal clouds by investigation of atmosphere. Researchers have a special interest to atmospheric optical phenomena, which are generated, when a light has been interacting with ice crystals. This work is dedicated to theoretical investigation of such atmospheric phenomenon as a light pillars. The reflected optical radiation from oriented crystals, having extended shape, generates a light pillars. A comparative analysis of energy characteristics of the light pillars are due to reflection of optical radiation from plates and hexagonal columns in view of flutter is represented.

This report represents the results of numerical investigation of energy parameters and polarization characteristics of space distribution of reflected radiation from oriented plate. There are illustrated a well formed variations of amplitude of reflected radiation and its polarized properties as a functions of plate orientation, the refractive index, the plate sizes also the wavelength of incident radiation. Results of investigation can be used to estimate microphysical, optical, orientation properties of plates of crystal cloud for solving of inversion problem as applied to bistatic polarization laser sensing and passive sensing.

C4-35

ABOUT OPTICAL, THERMAL AND DYNAMIC STRUCTURES SELENGA SHALLOW WATERS OF LAKE BAIKAL

P.P. Sherstyankin, L.N. Kuimova, and I.V. Ivanovskaya
Limnological Institute SB RAS, Irkutsk, Russia
ppsherst@lin.irk.ru

The first optical and thermal observations on Selenga shallow waters in May–June, 1960 have shown on their high connection with dynamic (current) by the characteristics of waters (Sherstyankin, 1964). The large contribution to formation of structures of shallow waters is given by topography of depth. The basic mixing of waters occurs on avant-delta of Selenga River, outside which begins break (fast growth) depths. On avant-delta of river waters act as though by two-layer flow: the top layer more transparent, and bottom – less transparent also contains a lot of suspensions. At once after an output from delta there is an enlightenment of river waters at the expense of reduction of speed of movement of water and, accordingly, mitigation of carrying power of a flow. Outside of avant-delta, as show numerous observations, there is a distribution of the mixing waters to the party of lake in subbottom, surface layers and intermediate and sometimes as lenses.

The large role in effective mixing Selenga and Baikal waters is played by thermal barriers: spring and autumn thermobar, from which is most investigated spring (Sherstyankin, 1964; Shimaraev et al., 1993; Sherstyankin, Potemkin, 1997 and etc).

Selenga shallow has the large economic meaning, as is rich by biological, fish and other resources.

The special anxiety causes the sanction of Government and Committee of natural resources of Republic Buryatiya on production in region of delta Selenga River of petroleum and gas till 2025.

C4-36

USE OF THE METHOD BY X-RAY SPECTROMETRY TO ANALYZE ATMOSPHERIC AEROSOLS

A.N. Smagunova, O.M. Karpukova, E.N. Korjova, and V.A. Kozlov
Irkutsk State University, Irkutsk, Russia
smagunova@mail.ru, rfa@chem.isu.ru

The effectiveness of the use of the analysis by X-ray spectrometry (AXS) to determine an element composition of atmospheric aerosols is briefly shown on the example of foreign experience. We present the results of our own investigations to determine the metals in atmospheric aerosols that are collected on a filter.

The quality of the domestic (AFA-HA and FPP) and foreign (Vatman-41) filters used for a selection of aerosol tests is compared. It is founded that the FPP filters have the poorest quality (the unstable surface density and the presence of Fe in variable amounts); the quality of AFA-HA and Vatman-41 filters is approximately identical. The errors of a selection of tests of atmospheric aerosols are estimated. It is founded that their magnitude (relative standard deviation (RSD)) changes from 0.08 up to 0.5. The recommendations to select the tests of atmospheric aerosols for their subsequent analysis by the AXS method are given.

The graduation of AXS techniques and the control of correctness of results are difficult due to a lack of domestic standard samples of a composition of aerosols. We see a solution of this problem in a creation of synthetic samples for comparison (SC) which imitate the aerosols collected on a filter, and the research of methods to take into account a distinction of their physical-chemical properties and actual tests. We propose 3 techniques to prepare SC: application of a solution on a filter, sedimentation of a powder preparation on a filter, and injection of a powder in a solution of polymer and deriving from the mixture of a thin film. As the carrier of aerosol particles the material of GSO soils and ash of coals with the additives of compounds of heavy metals is used. RSD characterizing the error of manufacture of various types of SC does not exceed 0.10. The recommendations to select the optimal conditions of graduation of AXS techniques for urban and industrial aerosols with the synthetic SC are given.

Allowing for the given recommendations the techniques of the X-ray spectrometric fluorescent determination of V, Mn, Fe, Ni, Zn, and Pb in aerosols collected on a filter are developed and metrology investigated. The limits of a detection of elements are 0.02–0.09 $\mu g/cm^2$. The reproducibility of the analysis results is characterized by RSD varying in the limits from 0.02 up to 0.5 in the dependence on a content of element on a filter. The results of the X-ray spectrometric determination of elements in atmospheric aerosols with the developed techniques are conformed to the data of Scientific-Production Association "Taifun" (Obninsk). The AXS techniques are used to analyze the urban and industrial aerosols.

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C4-37

STUDY OF AEROSOL CONDENSATION ACTIVITY IN DIFFERENT AIR MASSES

S.A. Terpugova, M.V. Panchenko, and E.P. Yausheva
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
swet@iao.ru

Principal factors essentially affecting the variability of aerosol characteristics in each season are the processes of synoptic scale, the main of which is the change of air masses in the site of observation.

The parameter of condensation activity γ (involving in the known Hanel formula) depends on the microstructure and chemical composition of aerosol particles, mainly on the ratio of soluble and insoluble species. It is clear that, as air masses differ in the principal meteorological (temperature and relative humidity of air) and aerosol parameters, then the differences should exist in such important characteristic of aerosol particles as their condensation activity.

Regular every–day measurements of the aerosol scattering coefficient as function of relative humidity of air are carried out in the Institute of Atmospheric Optics starting from 1998 by means of nephelometric setup equipped with the tools for artificial moistening of aerosol to be investigated. The data were analyzed separately in each season for two principal types of air mass determining the weather in West Siberia, namely, continental Arctic and continental mid–latitude ones.

It is revealed that the aerosol condensation activity in winter is greater in the mid–latitude air mass than in Arctic (reliability of the difference in mean values in 99%). In spring the character of the difference reverses. In summer and autumn mean value γ are indistinguishable. Obviously, it is related to the difference prehistory of air masses coming to West Siberia in different seasons.

C4-38

MODEL ESTIMATES OF REGULARITIES IN FORMATION OF NEAR-HORIZON SKY BRIGHTNESS IN THE VISIBLE AND THERMAL SPECTRAL RANGE

S.M. Sakerin, T.B. Zhuravleva, and I.M. Nasretdinov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
sms@iao.ru

A key topic of radiative transfer through the cloudless atmosphere is the development of new methods of determining aerosol single scattering albedo in different spectral regions. Preliminary estimates showed that near-horizon

region is an informative object for which relatively simple expressions relating optical characteristics of near-ground aerosol with incoming radiation can readily be obtained. Numerical study of regularities in formation of near-horizon sky brightness, which is of concern in the present work, is a necessary step toward development of this parameterization.

Since the role of factors influencing the formation of brightness fields is different in the visible and longwave spectral regions, to solve the problem we will use different approaches and approximations.

The brightness fields of visible and infrared radiation have different features, which necessitates the use of different approaches and approximations to solve the problem.

1. In the region of thermal radiation, the solution of radiative transfer equation for horizontal direction is considered assuming axial symmetry (nighttime, clear-sky conditions). Results calculated for some model conditions and algorithm for determining single scattering albedo are analyzed. The simulated results provide an explanation for the "cold horizon" effect, manifested in the fact that the radiation temperature of near-horizon sky differs by a few degrees from air temperature in the near-ground layer.

2. The brightness fields of visible radiation are calculated by the method of statistical simulation (method of adjoint walks) for standard models of the cloudless, plane-stratified atmosphere. The calculation technique includes the Rayleigh scattering, scattering and absorption by aerosol particles, and reflection from the underlying surface. We studied the effects of atmospheric optical characteristics (single scattering albedo, scattering phase function of aerosol particles, and optical depth), surface albedo, and geometry of experiment on angular structure of incoming radiation (with account of separate contributions of single- and multiple-scattering effects).

C4-39

VAPORIZATION OF THE AEROSOL PARTICLES BY TEA CO_2 LASER INSIDE SINGLE PARTICLE MASS SPECTROMETER

N.N. Belov,[1] N.G. Belova,[2] and T. Baer[1]
[1]University of North Carolina at Chapel Hill, USA
Baer@unc.edu
[2]ATECH KFT, Budapest, Hungary
nick.belov@usa.net

The completed PC modeling of vaporization of the aerosol particle in single particle mass spectrometer is demonstrated. This calculation reduces estimation of the probability of vaporization of different particles – transparent/absorbing, with low/high boiling temperatures, with high/low velocity – to simple criteria for large size diapason of particles – 0.1–30 micrometers.

The laser radiation density along particle trajectory is introduced and computed as function of particle velocity in high vacuum chamber and pulse parameters (start, duration).

It is shown that the ratio of enthalpy [J/mol] of particle vaporization to boiling temperature [K] is equal to 100 for great quantity of different substances. The absorbed radiation is function of the value of optical field within particle. It is shown that using of optical field at particle center gives good estimation for absorbed energy for particle with different optical parameters. New data about intensity in the main maximum of optical field of different particles (nitromethane, methanol, NaCl, Al_2O_3, SiO_2, AsGa, KCl, CCl_4, H_2O, BeO, $BaTiO_3$, Y_2O_3, CaF_4) are presented.

Simple formula for optical field at particle center is founded. Two good approximations of optical field in the center of droplet, for small and large particles, are represented.

C4-40

DIFFERENT REMOTE SENSING METHODS FOR MEASURING BIOOPTICAL PARAMETERS OF THE SEA WATER

O.S. Tsareva,[1] and A.N. Pavlov[2]
[1]Far Eastern State University, Vladivostok, Russia
tsarevao@mail.ru
[2]Pacific Oceanological Institute RAS, Vladivostok, Russia
o_bukin@mail.ru

Remote sensing methods permit to measure optical parameters of the sea water. Stokes vectors and matrixes are using to analyze polarization state of light beam. Stokes parameters determine intensity I and polarization state P of light wave. Matrixes and vectors are coefficients. Stokes vectors and matrixes make up basic equation of radiation. We can found intensity-angle relation. This method are employing for experiment data processing. Obtained data consist with data obtained by different methods.

C4-41

SP–4M SOLAR PHOTOMETER FOR SCIENTIFIC MONITORING OF THE ATMOSPHERIC TRANSPARENCY CHARACTERISTICS

S.M. Sakerin, D.M.Kabanov, and S.A. Turchinovich
Institute of Atmospheric Optics SB RAS, Tomsk
sms@iao.ru

Method of solar photometry is the information–capacious instrument for investigation of aerosol and gas composition of the atmosphere, but it is possible to realize it only in the periods when the Sun is not covered by clouds. This disadvantage limits the more wide use of the method and the possibilities of automation of the experiment (especially at all-the-year-round monitoring). It is easy to technically realize the principal functions – guidance to the Sun, change of filters, recording, but for decision to measure, usually the presence of operator is necessary.

The description of the instrumentation complex and the principles of organizing the automated observations are presented in the paper. The complex includes the SP–4M solar photometer with actinometer, pyranometer, sensors of Sun (SS) and illumination. The following elements of the algorithm can be selected:

– at the sunrise, the illumination sensor "opens" the protecting box of the pyranometer and "starts" the program of measuring the total radiation;

– in the case of the "open" Sun, the SS sensor starts the program of search for the Sun, and after guidance (capture) the program of measuring the spectral transparency and the direct radiation (in addition to the total one) starts;

– when the cloudiness have appeared, the SS sensor stops operation of the photometer;

– at the sunset the illumination sensor switches all measurers to the "night" state and stops the program of measuring.

Principal specifications of the SP–4M photometer:

wavelength range	0.308 to 4 μm (16 interference filters)
angle of the field of view of the measurement channels	1.2° (1.5°)
error in Sun tracking	no more than 0.2°
duration of one cycle	4 sec (1 turn of the filter drum)
error of photometric measurement	no more than 0.3% (0.7%)

C4-42

NUMERICAL ANALYSIS OF THE INSTRUMENTATION MATRIX OF THE POLARIZATION MEASURER

V.G. Oshlakov and Yu.G. Borkov
Institute of Atmospheric Optics SB RAS, Tomsk
geo@lts.iao.ru

The instrumentation matrix M of the size [4×4] is used in the measurer of the Stokes parameters and the optimal measurer of the scattering phase matrix. The effect is studies of the position of the transmission plane of the polarizer, for positions of the fast axis of the phase element and the phase displacement of the orthogonal components performed by it on the conditionality value of the matrix M. Their value are determined providing minimum of the conditionality value of the matrix M for the phase displacement of 90. The sensitivity is studied of the conditionality value of the matrix M to deviations of these parameters from the optimal ones.

Session C5. TRANSPORT AND TRANSFORMATION OF AEROSOL AND GAS COMPONENTS IN THE ATMOSPHERE

C5-01
PRELIMINARY RESULTS OF INVESTIGATION OF THE AEROSOL OPTICAL DEPTH AND COLUMNAR WATER VAPOR OF THE ATMOSPHERE IN THE IRKUTSK REGION

S.M. Sakerin,[1] D.M. Kabanov,[1] V.V. Koshelev,[2] and A.Yu. Shalin[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
sms@iao.ru
[2]Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
koshelev@iszf.irk.ru

Both global processes and peculiarities of the specific regions and areas are apparent in variations of the components of atmospheric transparency (aerosol optical depth, columnar water vapor). The necessity of monitoring investigations in several sites of the region is doubtless for revealing the features of the transparency variations over Siberia. For this purpose, in addition to Tomsk, all-the-year-round observation of the transparency by means of the SP–3I multiwave sunphotometer (wavelength range 0.37 to 1.06 μm) were started in November 2000 in the Irkutsk.

Brief descriptions of the modernized SP–3I photometer, software, and techniques for determining the sought characteristics - aerosol optical depth τ and the columnar water vapor W are presented in this paper. The importance of similarity of the technical specifications of two photometers (Tomsk and Irkutsk) and techniques for calculation of τ and W for subsequent joint analysis is noted.

Principal attention is paid for the discussion of the results of calibration and preliminary analysis of the variations of τ (in different wavelength ranges) and W in winter and spring 2000–2001. Selectivity of the spectral behavior of τ under different atmospheric conditions (season, synoptic conditions) is estimated by means of the Angstrom parameter α. Statistical characteristics of τ, W and α are presented in comparison with the analogous results obtained in Tomsk and with the long–term data obtained by other authors. The necessity of performing observations in the region free of industrial impact in order to exclude the urban effect is noted.

C5-02
OBSERVATIONS ON LOCATION OF THE DYNAMICS OF OROGRAPHIC WAVE CLOUDS OVER THE BAIKAL LAKE

T.N. Bibikova and E.V. Jurba
Moscow State University, Moskow, Russia
jurba@phys.msu.su

Effects of orography on the dynamics of cloud fields over the Baikal Lake were studded in the summer 1986 during the research expedition organized by the of Moscow University department of physics of atmosphere. The measurement technique was based on using of the cloud stereophotogrammetry approach including the processing by the high-precision stereocomparator "Stecometer". Geometrical sizes of separate clouds, positions of clouds on the locality and information about cloud structures were received as results of the measurements. The effect of orography was found to differ significantly for the different directions of airflow. The orographic effect on cloud structures was selected on the lee side of the Primorsky mountain range under the northwestern airflow. Two-level wave cloud structure was observed over the Bolshoi Sea. The wavelength was 4.5 km at the low 3.2 km level ant it was 5.5 km at the high 4.7 km. The orographic cumulus clouds over the Olhon Ireland were also analyzed.

A climatological analysis of airflows leading to the formation of the wave orographic Ac Lent clouds was performed on the basis of 20-year radiosonde data and cloud observations received from the Irkutsk Hydrometbureau.

C5-03

ESTIMATION OFANTROPOGENEOUS LOAD ON PROTECTED REGION USING THE CLIMATIC INFORMATION

G.S. Rivin and P.V. Voronina
Institute of Computational Technologies SB RAS, Novosibirsk, Russia
rivin@ict.nsc.ru, voronina@ict.nsc.ru

To define the antropogeneous load on protected region it is possible with following ways: solving the basic transport problem or with the help of appropriate adjoint equation. The second way is based on application of G.I. Marchuk[1] and theory of adjoint operators. In this case we need to decide the adjoint transport and diffusion equation of impurities only once, and further with the help of non time-taking calculations it is possible to define a quantity of the impurities which have come in atmosphere of protected territory from a prospective source. The used technique is described in Ref. 2. We chose four protected regions of the Western and East Siberia and for all months the areas of influence using the climatic meteorological information were found. The information is obtained from archive "Reanalysis" NCEP/NCAR.[3]

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C5-04

MODEL OF LOCAL DYNAMIC INTERACTION OF A WATER RESERVOIR AND THE ATMOSPHERE AT SURFACE ROUGHNESS

V.A. Shlychkov
Institute of Water and Ecological Problems SB RAS, Novosibirsk, Russia
slav@ad-sbras.nsc.ru

Mathematical statement is presented of the problem of description of the small-scale interaction of a water reservoir and the atmosphere at moderate wind with working out in detail of the vertical turbulent exchange near the division boundary. The 1D hydrothermodynamical equations, in which the terms of the shape resistance, proportional to the square of the relative velocity, are introduced, are used as initial equations. Calculation of the surface exchange is carried out taking into account the viscous buffer films in both natural media. Description of the wind roughness is based on solving the spectral density transfer equation which is key for completion of the problem in the space of parameters.

The b–e equations of semi-empiric theory of turbulence are used for modeling the turbulent regimes of water and air. The problem is considered of statement of the boundary conditions for the kinetic energy of turbulence at the division boundary. The analysis is carried out of the numerical solution with sub-millimeter resolution in the water medium. It is shown that the energy flux into water caused by falling down waves forms the inner boundary layer of thin structure near the surface, which provides for transfer of turbulent energy into the depth.

The energy cycle of the processes on interaction is constructed, and fulfillment of the conservation law both in the components of the model and the system as whole is shown. The calculated values of energy fluxes to waves, rate of dissipation in the near-surface layers and in the depth are in agreement with the data of observations.

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C5-05

GENERATION OF SULFATE AEROSOL BY A SURFACE OF DRIED UP LAKE

I.A. Sutorikhin[1] and A.E. Kaplinsky[2]
[1]Institute for Water and Environmental Problems SB RAS, Barnaul, Russia
sia@iwep.secna.ru
[2]University of Antwerp, Antwerpen, Belgium
kaplinsk@uia.ua.ac.be

In the western part of the Altai Region, that is situated on the territory of Kulunda lowland, there is a great number of salty lakes. Among them due to their size one may point out lakes Kulunda and Kuchuk occupying areas

690 and 172 km^2 accordingly. The degree of water mineralization in them is very high and reaches even 400 g/l in summer time in Lake Kuchuk.

Besides, the "Kuchuksulfate" chemical plant, located close to Lake Kuchuk, is using a natural depression of neighbouring small lake Selitrennoe as a reservoir for accumulation of crystalline sodium sulfate in dry condition. The periodicity of its filling from Lake Kuchuk by a channel – once per 4 years. After the winter crystallization of sodium sulfate at the lake bottom, the remainders of salt solution are pumped back to Lake Kuchuk. From this moment Lake Selitrennoe represents an open storage of crystalline sodium sulfate with the area about 6 km^2. At the technological processes and due to activity of wind and convective flows, a considerable part of sulfate particles 0.05–10 mkm in size is transported to a boundary atmospheric layer. According to our estimations, it gives a noticeable contribution to the regional aerosol background. The presence of a fine disperse aerosol above Lake Selitrennoe is well noticeable at visual observation in summer time at low standing of the Sun above horizon.

In the report the results of summer field-trip studies which have been carried out in recent years at this object are considered. Two basic mechanisms of sulfate aerosol generation are pointed out. First one is realized at wind speed more than 10–12 m/s and is characterized by saltation, or directional transport of substance from the lake surface. Such mechanism has the highest productivity of the aerosol generation process. At wind speed less than 5–10 m/s the saltation weakens essentially. The second mechanism – the birth of vertical vortexes, similar to tornados, in this case can be exhibited. They are generated on a border of white surface of sodium sulfate and dark surface of coastal soil even at meteorological conditions close to calm. The heights of vortexes are reaching values about 70–100 m. During the existence period of one medium-sized vortex, by previous estimations, about 5–10 kg of substance is risen to the air. The number of vortexes generated for 10 minutes can vary from 1 to 5.

This study was carried out at financial support of the RFBR Grant № 99-05-64735, integration Project SB RAS № 64 and Grant of supporting field-trip researches of SB RAS.

C5-06
FEATURES OF DISTRIBUTION OF GROUND LEVEL CONCENTRATIONS OF OZONE AND NITROGEN OXIDES UNDER PHOTOCHEMICAL PROCESSES IN THE BAIKAL REGION

V.P. Butukahnov, G.S. Zhamsueva, A.S. Zayakhanov, Yu.L. Lomukhin, and B.Z. Tzydypov
Buryat Science Center SB RAS, Ulan-Ude, Russia
lrf@pres.bsc.buryatia.ru

Since 1998 the laboratory of radiophysics conducts a regular observations of ground level concentration of ozone, nitric oxide, nitrogen dioxide, carbon monoxide, sulfur dioxide and weighted particles (aerosols) in atmosphere of Ulan-Ude and coastal zone of Lake Baikal (Boyarsk station). Daily and seasonal variation of near-ground ozone concentration are revealed in Ulan-Ude city. The ratios of nitric oxide and nitrogen dioxide concentrations under photochemical equilibrium, intensity of solar radiation, air temperature influence on a formation ozone speed as have shown measurements in station Boyarsk in summer period 1998–2000. Is determined that under photochemical equilibrium NO_2, NO and O_3 the speed of ozone formation is equal 7 ppb/h.

In the given report the calculating degree of photolysis NO_2 and calculating degree of transformation NO to NO_2 by data of concentration NO_2, NO, O_3 in the coastal zone of Lake Baikal in summer 2000 are resulted.

Date	t, (hh.mm)	$[O_3]$, ppm	$\frac{[NO]}{[NO_2]}$	t, °C	Calculating degree of photolysis NO_2	$\frac{[NO_2]}{[NO_x]}$	Calculating degree of transformation NO in NO_2
25.07	15.00	0.014	0.8	23	0.258	0.55	0.52
26.07	14.00	0.012	1.05	22	0.290	0.486	0.45
30.07	15.00	0.016	0.27	21	0.099	0.78	0.5
01.08	14.00	0.008	1.22	18	0.244	0.499	0.46
02.08	13.00	0.015	1.52	24	0.524	0.4	0.455
03.08	13.00	0.007	0.737	18	0.118	0.585	0.46
04.08	17.00	0.01	0.38	20	0.076	0.72	0.52
05.08	14.00	0.008	0.96	20	0.081	0.7	0.49
07.08	13.00	0.02	1.1	20	0.484	0.47	0.488
09.08	15.00	0.012	0.75	23	0.207	0.567	0.55
10.08	16.00	0.011	1.2	25	0.304	0.45	0.52

During measurements the atmospheric instability with an often change of air masses, cloud and precipitation was observed. In clear solar days the photochemical equilibrium or cases near to this condition was determined.

The processes of formation NO_2 predominate above photolysis processes NO_2. The low concentration of ozone in summer of 2000 are obviously explained by these conditions.

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C5-07

TRANSFORMATION OF A SEA AEROSOL UNDER ACTIVITY OF THE RADIOACTIVE FACTOR

T.V. Gubareva
Bratsk State Technical University, Bratsk, Russia
tvgbratsk@mail.ru

It is known, that the particles of halogenides of alkali metals contain in huge amounts above a surface of World Ocean, forming a sea aerosol. The examinations executed for last years, have shown, that interesting response is the formation of nitrate in sea salt particles, when they are exposed to action NO_2. The observations specify voiding Cl from sea salt particles. Thus the properties of particles and influence on the mechanism of this process both chemical, and physical factors are not investigated. The experiments on examination of physicochemical transmutations on a surface of alkali-halides crystals included: 1) irradiation of a disperse system scale, X-ray or ultraviolet radiations in contact to free air under various requirements; 2) X-ray diffraction and electronic microscopic analysis of microcrystals of salt; 3) study of optical properties of particles.

It is necessary to note, that in a meteorological atmosphere, as well as in our laboratory examinations, there are all requirements necessary for transmutations of salt particles in sea aerosols.

The complex laboratory examinations of microcrystals of alkali-halides enable to receive the experimental data, which the structures and optical properties of natural sea aerosols can be utilized for an explanation of composite processes, bound with change of composition. It can be by a radiant of reception of models, sectional for build-up, of a climate in view of the contribution of a sea aerosol, and also material for study of processes in clouds. Linking's, which are formed as a result of hydrogenation, oxidizing and the nitrations of microcrystals of salt intensively change properties of an aerosol. Radiation boosts heterogeneous processes and crystallization of new linking's (nitrates, nitrites, carbonates, oxy-halogenides). The special interest is caused with stabilization on a surface of salt particles of linking's such as $HalNO_X$ and accumulation U-centers. The specified processes are significant changed optical properties of particles in ultraviolet, visual and infrared areas of a spectrum.

C5-08

PROPAGATION OF IMPURITY FROM PULSE SOURCE IN TURBULENT ATMOSPHERE: REMOTE SENSING AND MATHEMATICAL SIMULATION

Yu.S. Balin,[1] A.D. Yershov,[1] A.I. Bril,[2] V.P. Kabashnikov,[2] V.M. Popov,[2] and A.P. Chaikovskiy[2]
[1]*Institute of Atmospheric Optics SB RAS, Tomsk, Russia*
balin@iao.ru
[2]*Stepanov Institute of Physics, National Academy of Sciences, Minsk, Belarus*
chaikov@dragon.bas-net.by

The experiment was carried out in a steppe region with low hills; underlying surface was covered by sparse vegetation. The charge exploded at a altitude of 10 m was used as a source of impurity. Tracking of the produced cloud of condensed explosion products was performed with lidar, 770 meters distant from source. Observations were conducted within 6 minutes. During this period the cloud removed by approximately 2 kilometers and raised above 200 meters. Relative backscattering signal values at different times along with coordinates of signal generation points were recorded. Ultrasonic meteorological station and sodar were 25–30 meters distant from explosion location. This equipment was used to measure air temperature, vertical and horizontal wind velocity components, wind direction, total energy of turbulent motions, tangential strain value and vertical heat flux. The measured data allowed one to estimate Monin–Obukhov scale, structure constant values for temperature and velocity fluctuations and turbulent exchange coefficients of heat and momentum.

Experimental data obtained with lidar were compared with results of numerical simulation of impurity spatial distribution that was performed on the basis of statistical Gaussian model developed by Institute of Experimental Meteorology. The requirements to input parameters definition, lidar experiment technique and simulation algorithms that ensure adequate experiment description are discussed.

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C5-09

BUOYANT PLUME RISE IN TURBULENT ATMOSPHERE

V.D. Perminov
Central Aerohydrodynamic Institute, Zhukovsky, Moscow region, Russia
valery.perminov@mtu-net.ru

At the moment there are a lot of theoretical approaches to an investigation of the plume rise problem in turbulent atmosphere (solution of Navier-Stokes equations with the help of large eddy simulation, solution of transport equation for the probability density function, Lagrangian models constructed in accordance to Reynolds averaged Navier-Stokes equations, numerous semi-empirical models and etc.). Only simplest test problems were solved so far. Successful application of the transport equation for probability density function[1] and Lagrangian models[2] recently and an appearance of massive parallel computers give us a hope to solve the plume rise problems in more complex and more real formulation.

In this paper a stochactic numerical method for solution of such problems on the basis of the Lagrangian model[2] is proposed. The algorithm was adapted to massive parallel computers and was realised within the framework of the MPI system. A verification of the model and numerical method efficiency has been carried out for the turbulent dispersion problem that has been investigated experimentally by M.R. Raupach and B.J. Legg.[3] The results obtained for several 2D problems of stack plume dispersion for different atmosphere conditions are also presented.

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C5-10

DISTRIBUTION OF KINETIC ENERGY OF TURBULENCE AND OPTICAL INSTABILITY OF A TERRESTRIAL ATMOSPHERE ABOVE TERRITORY OF THE CIS

P.G. Kovadlo
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
kovadlo@iszf.irk.ru

Turbulence in an atmosphere is determined by kinetic energy of processes of the general carry of air. By results of the analysis of distribution of kinetic energy of turbulent movement above territory of the CIS, us it is shown that turbulent processes in troposphere have local and seasonal attributes. To these attributes it is possible to allocate points with the lowered and increased turbulence, both in the certain seasons of year, and within all year.

Thus, there is an opportunity with these results to compare distribution of optical instability of an atmosphere above territory of the CIS. Optical instability of air here is understood, how a degree of development inhomogeneities a parameter of refraction of air on a beam of sight. Dimensionless deviations of a parameter of refraction are designed at 15 levels from a surface up to 30.5 kms, according to 50 aerologic stations located in territory of the CIS, for the 10-years period. For the characteristic of kinetic energy of turbulent movement of a free atmosphere we have taken advantage of the aerologic data of 108 stations also for 10 years about an average quadratic deviation of a vector of a wind concerning average value at three levels 1, 5 and 10 kms. This layer of troposphere energetically most we mean for large-scale heat exchange between oceans and continents as contains more than half of weight of air of all atmospheres.

Kinetic energy of turbulence of an atmosphere has stationary zones within one year of the increased and lowered values. They should be designated. Two zones with the minimal turbulent energy: the first – above Southern Kazakhstan, Central Asia and Caucasus; the second – above Yakutia, Khabarovsk territory and the western part of the Amur area. Three zones with the increased turbulent energy: 1 – above the western part the European territory of the CIS, including Baltic; 2 – the Far East (Primorski Krai) and adjoining islands, including peninsula Kamchatka; 3 – above all Western Siberia. It is necessary to tell, that kinetic energy of turbulent movement in the third zone (above Western Siberia) on 10 – is lower than 15%, than in first two. To maxima of kinetic energy of turbulence for all territory of the CIS there correspond minima of values of optical instability of an atmosphere and on the contrary, the factor of conformity is equal – 0.58.

C5-11

CERTAIN RESULTS OF COMPARISON FOR DATA OF SIMULATION OF ACID AEROSOL AND SATELLITE MONITORING OF RADIATION CHARACTERISTICS OF THE CLOUDY/CLOUDLESS ATMOSPHERE

V.V. Kozoderov and V.D. Egorov
Institute of Computational Mathematics RAS, Moscow, Russia
vkozod@inm.ras.ru

Using the ground-based information of the existing European network of observations for polluting impurities of the atmosphere (data on the pollution sources, wind fields, temperature, pressure etc.) for cloudless conditions the formation of an acid aerosol (on the example of effluents of a sulfur dioxide) in the boundary layer of the atmosphere and the turbulent transfer of arising impurities with transformation of a spectrum of dimensions of aerosol particles in time is simulated. For typical model of the stratus-wise cloudiness under winter conditions in the given territory the changes of the distribution functions of cloudy drops by dimensions and the acid aerosol in a cloudy medium which comes at corresponding altitude levels of the atmosphere are considered also. Simulation results for cloudless and cloudy situations are correlated with the average values of radiation characteristics and forcing action "cloudiness-radiation" for investigated territory which are systematized within the International project by satellite climatology of cloudiness (ISCCP – International Satellite Cloud Climatology Project). As the comparative analysis of results we selected January 1986. Proceeding from the quantitative characteristics of the indicated action during the selected month of observations and their comparison with the results of performed simulation the power characteristics of antropogeneous effect of sulphate compounds in the given territory which betoken a rise of acid precipitation are revised.

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C5-12

MATHEMATICAL MODEL OF AEROSOL CLOUD FORMATION

I.R. Abunyayev, I.N. Lazovik, and G.S. Kudryashev
Irkutsk Military Aviation Engineering Institute, Irkutsk, Russia
avt@iszf.irk.ru

Formation of aerosol clouds in the ground layer is properly the fragmentation of jets and droplets of liquid in a turbulent air flow. On other words, it implies the fragmentation of jets and droplets under the effect of aerodynamic forces. This study is based on using mathematical models which make it possible to calculate - with a high degree of reliability – the characteristics of liquid spraying. Liquid spraying in a drifting turbulent air flow should be treated in two stages. Initially, the jet decays into separate droplets, which is followed by the fragmentation of single droplets. In this paper, an analysis is made of the decay of the jet and of the fragmentation of droplets in a turbulent atmosphere, which permits a determination of the formation parameters of the aerosol cloud.

C5-13

THERMODYNAMIC MODELING OF ANTHROPOGENIC IMPACT ON CHEMICAL COMPOSITION OF PRECIPITATION

Ye.V. Kuchmenko, B.M. Kaganovich, and Ye.V. Molozhnikova
Institute for Power Engineering Systems SB RAS, Irkutsk, Russia
kuch@isem.sei.irk.ru

As is known anthropogenic impact leads to an increase in precipitation acidity, i.e. in the general case to a change in their chemical composition due to change in the composition of condensation nuclei (CN) and absorption of gaseous admixtures, for instance, SO_2 and NO_2 at formation and falling of rain droplets.

A new approach to studying the condensation processes in the polluted atmosphere using thermodynamic models is developed in ESI SB RAS. The thermodynamic models of extreme intermediate states (MEIS) enable analysis the states of the system relaxing toward the final equilibrium. Rain droplets are represented in the model by a diluted electrolyte solution, using Debye-Hueckel statistical theory.

The ways to describe surface effects in the model are detailed in the presentation. Equilibrium chemical composition of droplets of different radius has been compared and correlated with the results of the other researchers. The peculiarities of condensation processes in different layers of the troposphere and stratosphere are simulated by setting different initial conditions (temperature and pressure).

Besides the results of mathematical modeling are compared with the observed data on precipitation composition in different areas of Eastern Siberia. The theoretical and experimental estimations of the relationship between ionic composition of droplets in the atmosphere and concentrations of SO_2 and NO_2 in gaseous phase are presented.

C5-14

RESEARCH OF A TURBULENT STATE OF THE LOWER ATMOSPHERE

P.G. Stafeev, G.V. Buhlova, and N.P. Krasnenko
Institute for Optical Monitoring SB RAS, Tomsk, Russia
krasnenko@iom.tsc.ru

For a long time, the study of the spatio-temporal variability of meteorological and turbulent parameters takes a central place in an analysis of climatic factors. When this the lower atmospheric layer is characterized by the greatest variability of it's state. In the present work the outcomes of such researches conducted in Tomsk, in Academgorodok, on territory of a climatic-ecological observatory of the Institute during of several months on different seasons are summerized. Ultrasonic meteorological complexes placed at different heights were used as meters. In addition to standard meteorological parameters, such turbulence parameters as full energy of turbulent movements, pulse and heat fluxes, wind, temperature and Monin–Obukhov scales, etc., so as their statistical performances and stability classes of the atmosphere were determined. Measurement data were compared with the data of acoustic sounding and of standard measurements of meteorological station. The behaviour of the measured parameters with a general state of atmosphere was evaluated.

C5-16

DEVICE FOR INVESTIGATION OF HEAT, HUMIDITY, AND AEROSOL PARTICLES GROUND FLOWS

A.P. Rostov, A.L. Afanasiev, and A.P. Ivanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
rostov@iao.ru

For experimental researches of turbulent flows of heat, and aerosol particles the automatic device is developed. It's measuring fluctuation of temperature, three-dimensional speeds of a wind, absolute humidity of air and coefficient of directional scattering of an atmospheric aerosols. The device contains the spatially located paths: the modernised version three-dimensional ultrasonic anemometer – thermometer, spectroscopic sensor of absolute humidity of air and nephelometer of an opened type. It's also has the sensors of kinetic temperature, relative humidity of air and sensors coming and leaving radiation of the sun. The distance between all sensors does not exceed 500 mm. They are supervised in real time the many processor system, built-in in to the device. The frequency of synchronous sounding of this parameters is equal 4Hz. Only the two-wire line cable used the power supply and controls our device. It's has long not more then 500 meters. This property enables to use this device in naturally conditions.

The any personal computer may be used to control of device. Needs only the cable modem. It is built – in to the power supply of the device.

C5-17

OPTICAL AND MICROPHYSICAL URBAN AEROSOLS MODELS

L.S. Ivlev[1] and A.V. Vasilyev,[1] B.D. Belan,[2] M.V. Panchenko,[2] and S.A. Terpugova[2]
[1]Scientific Reaserch Institute of Physics of St. Peterburg State University, St. Peterburg, Russia
vsa@lich.phys.spbu.ru
[2]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
bbd@iao.ru

The optical and microphysical urban aerosols model, based on proposed by authors towns classification[1] according to population quantity and industrial development, climatic region and season (winter, summer) is worked out. The optical and microphysical models of some large cities: Moscow, S-Peterburg, Mexico City, Peking are considered. Some models of numerical concentration vertical profiles, size distribution functions, volume aerosol extinction coefficients in visible spectral region are presented. It was shown, that the main factor in aerosol structure forming in large cities is the value of total solar radiation. The comparison with aerosols model for Siberian large cities was carried out.

1. A.V. Vasilyev, L.S. Ivlev, B.D. Belan, M.V. Panchenko, S.A. Terpugova, In Aerosols of Siberia, Tomsk, 17 (2000).

C5-18

MEASUREMENTS OF METHANE CONTENT IN THE ATMOSPHERIC BOUNDARY LAYER AND IN THE ATMOSPHERIC DEPTH

V.N. Aref'ev, Yu.I. Baranov, E.L. Baranova, G.I. Bougrim, N.Ye. Kamenogradsky, and F.V. Kashin
Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia
las@iem.obninsk.ru

The results are given of triennial (1998–2000) continuous spectroscopic measurements of methane (CH_4) content in the air samples taken near the ground and in the atmospheric depth in Obninsk. Also presented are the CH_4 contents measured in air samples taken at heights up to 300 m from the High Meteorological Mast in 2000. The air samples were taken near the ground in the urban conditions. The CH_4 measured concentrations were affected by not only natural but its anthropogenic sources as well. Under an anticyclone (the absence of clouds and wind) and a temperature inversion in the atmospheric boundary layer increased concentrations of CH_4 significantly exceeding its typical variations were registered. This was caused by anthropogenic CH_4 accumulation air near the ground due to the absence of vertical mixing at a temperature inversion. The amplitudes and phases of CH_4 concentration seasonal variations near the ground were determined (only natural ground-based sources were accounted for). The measurements have shown the concentration of CH_4 in the morning remains constant to the height of 300 m; in the evening it decreases with an increasing height. The concentrations of CH_4 near the ground are more frequently higher by evening. The amplitudes and phases of CH_4 content seasonal variations in the atmospheric depth have been determined. It has been stated in view of small variations of its average annual contents that the CH_4 content remains constant in the atmospheric depth for the past three years. The studies were carried out under the financial support of the Russian Foundation for Basic Research (Grants Nos. 99–05–64275 and 00–07–90092).

C5-19

CARBON DIOXIDE IN THE CONTINENTAL ATMOSPHERE

V.N. Aref'ev,[1] N.Ye. Kamenogradsky,[1] F.V. Kashin,[1] V.K. Semyonov,[2] V.P. Sinyakov,[2] and L.I. Sorokina[2]
[1]*Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia*
las@iem.obninsk.ru
[2]*Kyrgyz State National University, Bishkek, Kyrgyzstan*
svk@it.kg

The data of long-term (1980–2000) continuous spectroscopic measurements of a height-averaged carbon dioxide (CO_2) concentration in the continental atmosphere (the Issyk Kul station, the central part of Eurasia) are given. The amplitudes and phases of CO_2 concentration seasonal variations and their changes are determined. The amplitudes of seasonal variations are typical of the latitude zone where the Issyk Kul station is located. An exception is 1987, when the amplitude of seasonal variations at this station increased up to 24 ppm and a phase shift of these variations occurred. On the average, during the observation period a maximum in CO_2 seasonal variations is registered in June, minimum – in October. A year-to-year variation of CO_2 concentration presented in a linear approximation corresponds to its annual increase in the atmosphere of 2.2 ppm. With the help of the spectroscopic analysis of the data obtained basic periodic components of CO_2 concentration variability were found, the periods of 12 and 51 months in their number. Their connection with the seasonal variations of CO_2 exchange between the biota and atmosphere (the period of 12 months) and with the global consequences of the El Nino phenomenon (a 51 month period) was noted. An empirical statistical model for the atmospheric CO_2 variability over the continent was constructed, that describes its mean monthly and average annual concentrations with the deviations equal to ± 1 and ± 0.5%, correspondingly. The studies were carried out under the financial support of the Russian Foundation for Basic Research (Grants Nos. 99–05–64275 and 00–07–90092) and International Science and Technology Center (Grant ISTC KR–157–98).

C5-20

ATMOSPHERIC SPECTRAL TRANSPARENCY IN THE ISSYK KUL LAKE REGION

V.N. Aref'ev,[1] K.N. Visheratin,[1] F.V. Kashin,[1]
S.S. Khmelevtsov,[1] V.K. Semyonov,[2] and L.I. Sorokina[2]
[1]Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia
las@iem.obninsk.ru
[2]Kyrgyz State National University, Bishkek, Kyrgyzstan
svk@it.kg

The results of analysis of the data obtained during the measurements of the atmospheric vertical depth spectral transparency (ATS) made by a filter photometer in the solar spectrum visible range at the wavelength of (519 ± 5) nm. The measurements were carried out on the northern shore of Issyk Kul Lake since 1982 to 2000. During this period two powerful eruptions of the El Chichon (1982) and Pinatubo (1991) volcanoes occured. The products released during the eruptions penetrated into the stratosphere and were transported all over the world. Self-cleansing of the atmosphere from the volcanic aerosol takes on the whole about 2-3 years. A positive linear trend was registered during the whole observation period (0.55 ± 0.06)% per year; when the effect of the volcanic eruptions was excluded, i.e. the data of 1982–1984 and of 1991–1994, it was (0.36 ± 0.03)% per year. The basic oscillations that revealed themselves as the variations in the AST mean monthly values had the periods: 6 and 12 months connected with the AST seasonal variations; 35 months (a quasibiennial harmonic of a vague nature); 54 months close to the appearance of the El Nino phenomenon and 106 months that is most probably controlled by the volcanic eruptions. The statistical model proposed with the empirical parameters obtained on the basis of the experimental data describes the AST mean monthly and average values with the deviations of ± 4.5 and ± 1.2% , respectively. The studies were carried out under the financial support of the Russian Foundation for Basic Research (Grant No. 00–07–90092) and International Science and Technology Center (Grant ISTC KR–157–98).

C5-21

WATER VAPOR IN THE CONTINENTAL ATMOSPHERE

V.N. Aref'ev,[1] N.Ye. Kamenogradsky,[1] F.V. Kashin,[1] V.P. Ustinov,[1]
V.K. Semyonov,[2] V.P. Sinyakov,[2] and L.I. Sorokina[2]
[1]Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Kaluga region, Russia
las@iem.obninsk.ru
[2]Kyrgyz State National University, Bishkek, Kyrgyzstan
svk@it.kg

The data of long-term (1980-2000) continuous spectroscopic measurements of water vapor cjntenh in the depth of the continental atmosphere (the Issyk Kul station, the center of Eurasia) are given. The amplitudes and phases of water vapor content seasonal variations have been defined, their long-term values and seasonal differences of the gas content variability are given for the observation site depending on the atmospheric temperature. Minimum contents of 0.3–0.6 g/cm^2 are observed in winter (December-January) and maximum ones (2.0–2.9 g/cm^2) are registered in summer (July). A mean for the whole observation period amplitude of seasonal variations is 2 g/cm^2 . A year-to year variability of atmospheric water vapor content is stated under a linear approximation that corresponds to an annual increase of its concentration by 0.015 g/cm^2 . With the help of the spectral analysis of the data the main periodic components of water vapor variability were revealed with the periods of 6, 12, 35, 51 and 110 months. Their connection is shown with the temperature seasonal variations (periods of 6 and 12 months), with the El Nino phenomenon global consequences (a 51 month period) and with powerful volcanic eruptions (periods of 35, 51 and 110 months). An empirical statistical model was constructed for the atmospheric water vapor variability, that describes its mean monthly and average annual contents with the deviations of ± 13 and ± 3.2%, correspondingly. The studies were carried out under the financial support of the Russian Foundation for Basic Research (Grants Nos. 99–05–64275 and 00–07–90092) and International Science and Technology Center (Grant ISTC KR–157–98).

C5-22

INVESTIGATION OF PROCESSES OF TRANSPORTATION, DIFFUSION AND TRANSFORMATION OF SULPHUR AND NITROGEN COMPOUNDS ALONG THE ATMOSPHERE LAYER ADJACENT TO THE LAKE BAIKAL SURFACE BY MEANS OF THE NUMERICAL MODEL

V.L. Makukhin[1] and B.K. Arguchintsev[2]
[1]Limnological Institute SB RAS, Irkutsk, Russia
aerosol@lin.irk.ru
[2]Irkutsk State University, Irkutsk, Russia
arg@math.igu.ru

Studying processes of diffusion and transformation of sulphur and nitrogen compounds is one of the most important tasks within the care of the atmosphere physics and the environment protection. Solution of this problem would improve the monitoring of basic characteristics of acid rains exhibiting as well known the negative influence to the soil, vegetation and health of people.

The present work continues the investigation begun in Ref. 1 on pollution of the South Baikal area with sulphates and nitrates and on the processes of diffusion and chemical transformation of other few-content gases by the means of the non-stationary space Euler's model. Sources emitted sulphur and nitrogen dioxides have been the enterprises located at the lake shore. The meteorological information used in our calculations has been obtained from statistical processing of the data taken from the hydro-meteorological stations.

Our numerical experiments carried out have resulted in that how amount of sulphates and nitrates fall down to the lake area in total and separately to the basins surface of the lake. Concentration fields of sulphur and nitrogen compounds and other few-content gases along the atmosphere layer adjacent to the Lake Baikal area have been found for different seasons of year. The obtained results are illustrated with the maps showing the concentration distribution of primary and secondary admixtures.

1. V.K. Arguchintsev and V.L. Makukhin, Proc. SPIE **4341**, 593–599 (2000).

C5-23

QUANTITATIVE ESTIMATION OF THE VALUE OF SEDIMENTATION OF SOME HEAVY METALS ON THE SURFACE OF SOUTHERN BAIKAL AND ADJACENT SPECIALLY PROTECED TERRITORIES IN DIFFERENT SEASONS

V.L. Makukhin and V.L. Potemkin
Limnological Institute SB RAS, Irkutsk, Russia
aerosol@lin.irk.ru, klimat@lin.irk.ru

The problem of pollution of environment by heavy metals is urgent both in Russia and abroad. Many of heavy metals, accumulating in organs and muscles of people and animals, cause serous illnesses, and sometimes lead to death. In order to determine the mass of these toxic substances coming to a living organism, it is necessary to estimate the rate of the mass flux of heavy metals to the underlying surface of the region under investigation.

Investigations of the processes of spread and sedimentation of some the most toxic heavy metals in the Southern Baikal region in different seasons are performed in this paper by means of the non-stationary Euler model taking into account the effect of the relief. The sources of emission were industrial enterprises and industrial complexes situated in the valleys of rivers Angara and Selenga, at the coats of Southern Baikal and in the region of lake Gusinoe. The characteristics of the sources of emission were set based on the inventory data.[1] The meteorological data were obtained by means of statistical processing the data of hydrometeorological stations.[2, 3]

Calculations are carried out of the mass of each toxicant settling on the surface of lake Baikal in different seasons, the load is estimated of these substances on the specially protected territories of Southern Baikal region. The contribution is determined of large industrial complexes situated on the territory into the pollution of Southern Baikal by heavy metals. The results obtained are illustrated by maps and diagrams.

1. Protection of atmospheric air. Statistical bulletin (Oblkomstat, Irkutsk, 2000) 165 pp.
2. Monthly meteorological magazines. Issue 22. Part 2. Novosibirsk, 1985–1994.
3. Monthly meteorological magazines. Issue 23. Part 2. Chita, 1985–1994.

C5-24

ATMOSPHERIC CONVECTION AND ITS ROLE IN THE VERTICAL TRANSPORT OF AEROSOLS: MODELS AND ESTIMATES

V.M. Mal'bakhov,[1] P.Yu. Pushistov,[2] and B.A. Shlychkov[2]
[1]Institute of Computational Mathematics and Mathematical Geophysic SB RAS, Novosibirsk, Russia
mvm@climate.sscc.ru
[2]Institute for Water and Environmental Problems SB RAS, Novosibirsk, Russia
slav@ad-sbras.nsc.ru

The results of a theoretical investigation of vertical transport of aerosols in the conditions of developed turbulent convection and during convective eddies, such as spouts or tornadoes are presented. The velocities of aerosols transported from the Earth's surface are determined by using a semi-empirical model of wind-sand flow. Thermodynamic models of different complexity are used to describe motions in the atmosphere. These are 2D and 3D LES, a model in the gradient-diffusion approximation for the calculation of the kinetic energy of turbulence and its dissipation rate, axially symmetric models for mesoscale eddies with a vertical axis of rotation. The processes of diffusion, sedimentation, deflation, and exchange of droplet moisture at the breaking of wind waves are taken into account. Estimates of the height of ascent and the mass of liquid and solid aerosols coming into the atmosphere as functions of the sizes of particles and the intensity of convection have been obtained. The results of the investigation can be used in models of climate to calculate integral characteristics of turbidity of lower atmospheric levels, volumes of the condensation nuclei entering cloud layers. They can also be used in investigations of the entrainment effect of aerosols into long-distance transfer, as well as in estimation of the ecological risk at the transfer of toxic aerosols. An example of ecological catastrophe of such type is the transfer of a salt impurity from the drying bed of the Aral Sea.

C5-25

SURFACE OZONE MEASUREMENTS IN THE TRANSCONTINENTAL EXPERIMENTS "TROICA"

T.A. Markova, N.F. Elansky, N.P. Shakina, and A.P. Ivanova
Oboukhov Institute of Atmospheric Physics RAS, Moscow, Russia
markova@omega.ifaran.ru

Results of analyzing of the surface ozone concentration ($[O_3]$) over continental Russia along the Trans-Siberian railway Moscow–Khabarovsk-Moscow measured on the basis of a carriage-laboratory are presented. The relation between the $[O_3]$ variations and different-scaled air-transfer is considered. Under the inversion layer, a nighttime $[O_3]$ dramatic decrease is found. The mean rates of the ozone dry deposition on the underlying snow-covered and snow-free surfaces are estimated as 0.08 and 0.64 cm/s, respectively. The $[O_3]$ level measured over towns and industrial localities is significantly lower than that over rural areas polluted moderately. In the Primorski Territory, the TROICA-5 expedition registered a surprisingly high $[O_3]$ level caused by photochemical processes. Somewhat enhanced $[O_3]$ levels are observed under conditions of the incoming of air masses from China and from zones of forest fires. A parallel-directed gradient in the O_3 concentration is detected. It is caused by the air masses incoming from polluted territories in the Central Europe.

Episodically, enhanced surface $[O_3]$ values caused by intrusions of stratospheric air masses are detected. Different mechanisms of such intrusions causing the local (several kilometers) and prolonged (several hundreds of kilometers) areas of enhanced $[O_3]$ are proposed.

C5-26

OPTOACOUSTIC GAS-ANALYZER FOR THE MEASUREMENTS OF CARBON MONOXIDE CONCENTRATION IN THE FIRE AREA

V.S. Safonov and V.A. Kapitanov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
svs@ iao.ru

Atmospheric pollutants (such as CO, CH_4, etc.) are a reason of respiratory diseases, forest decline, acid rain and photochemical smog. CO monitoring is of interest for climatology. The prognosis of state of biocenosis under different concentrations of CO and its influence on gaseous exchange between atmosphere and biosphere are actual difficult task in environmental protection.

The industrial centers and the undertakings are CO sources. The forest fires are not less important carbon monoxide source. The increase of a load of biocenosis to lead to the increase of the forest fires. The fire emission (the process is conditioned by direct combustion of forest combustibles (FC)) and the afterfire emission (the process of decay of crushed plants) are responsible for carbohydrogens and carbons emission. For example, wood to evolve 15.3% CO during its thermodecay process.

The main purpose of this work is the design of the equipment, is based on optoacoustic detector (OAD) with gas pumping and IR sources of a light, for the measurement of CO concentration, also the work out of a technique of the measurements of CO in combustion products of the forest combustibles with following calculation of coefficient of CO emission for various FC is based on experimental results.

The above mentioned OAD is Helmholtz resonator, which contains two identical cells is connected by means of the capillaries with mounted microphones. IR sources of a light of coaxial construction with heating (about 600–700°C) filament used in GIAM gas-analyzers will be using as a source of light. Coaxial construction of the sources of a light to secure high temporal stabilization of the measurements of IR energy within spectral range from 2 to 13 μm. The selection of spectral range, in which the absorption band of CO is not overlapped by disturb components bands, will be performing by optical filter with 4.7 μm on admission maximum.

1. A.A. Dolgov and V.S. Safonov, Bulletin of TSU, Tomsk, 2000.

C5-27

RESULTS OF USE OF PARAMETRIC SPECTRAL ESTIMATION METHOD FOR PROCESSING OF METEOROLOGICAL DATA

N.A. Shefer, I.A. Razenkov, and A.P. Rostov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
shefer@iao.ru

It is proposed to use parametric method of "autoregressive-moving average" (ARMA) for calculations of the spectral statistical characteristics and parameters of an atmospheric turbulence. The Nuttal-Strand algorithm was applied to time realizations with duration of 1 min and more. The order of ARMA model was varied parameter and it was allowed to control a "smoothness" of spectral estimations.

The comparison with the conventional, classical approach based on fast Fourier transform (FFT) is carried out. The obtained results of a comparison and recommendations are presented.

C5-28

MORE ACCURATE DEFINITIION OF TECTONIC FAULTS LOCATION BY *IN SITU* MEASUREMENTS OF CLOUDINESS

T.N. Bibikova,[1] T.A. Proskurjakova,[1] E.V. Jurba,[1] and V.A. Alekseev[2]
[1]*Moscow State Unoversity, Moskow, Russia*
ann@geoc34.phys.msu.ru
[2]*TRINITI, Troitsk, Moskow region, Russia*

There are a lot of papers where the correspondence between the processes in the Earth's interior and troposphere are shown. But it is a very complex and unsimple. The attempt of investigation the connection between the location and character of cloudiness and fault's zones in Crimea and Baykal lake. The region located in the coordinates $\lambda = 33.5–34.5°$ E and $\varphi = 44.0–45.0°$ N was chosen, because we have the observation data for this region for 45 years.

The presence of fault's zones creates the conditions for earthquakes origin. The data of Yalta, Alushta and Ai-Petri meteostations about the number and form of cloudiness for 1936-1981 years were used.

We found out that cloudiness range 6–8 appears in 3–5 days before the earthquakes. In Crimea the earthquakes happen with north-west streams, which are perpendicular to main direction of Crimea mountains in 80% cases. The wave orographic cloud of *Ac-lenticularis* type appaer with north-west streams in 90% of cases. The location of cloudiness was obtained with accuracy about 2–3% because of stereo survey of these clouds and subsequent stereogrammetric working up by higly precise equipment. The comparison of the faults lines and clouds location showed that clouds draw up along the fault's lines, which are parallel to sea cost and the main line of mountain ridge. We also used data of satellite's observation.

C5-29

MEASUREMENT OF TURBULENT FLUXES OF SCALARS IN THE SURFACE LAYER OF THE ATMOSPHERE

A.L. Afanas'ev, V.A. Banakh, and A.P. Rostov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
afanasiev@iao.ru

Study of dynamics of convective fluxes in the atmospheric surface layer is a complex problem by a reason of necessity of the simultaneous use of various primary sensors and handling of large volume of sampling data in order to estimate turbulent fluxes. The fluctuation measurements of meteorological parameters should be conducted synchronously, in small space volume, with high accuracy.

To solve this problem the complex meter of turbulent micropulsation of meteorological parameters is developed and tested in atmosphere. The meter is a compact automatic device joining the acoustic meter of wind velocity components and virtual temperature, optical infra-red meter of micropulsation of absolute humidity, temperature, pressure, and relative humidity sensors, and also two-angle nephelometer of an open type, for measurements of aerosol scattering coefficient fluctuation and evaluation of pulsations of atmospheric aerosol concentration. The device also has sensors of coming and leaving radiation permitting to evaluate radiation balance during measurements.

With the use of this device the set of experiments in the surface layer of the atmosphere was carried out. The continuous daily time series of data of micropulsiations of absolute humidity, temperature, wind velocity components and aerosol scattering coefficient together with synchronously measured relative humidity, pressure and coming and leaving radiation were accumulated.

On the base of obtained experimental data the evaluations of daily behaviour for vertical turbulent fluxes of sensible and latent heat, moisture, aerosol and momentum fluxes were obtained.

The mutual correlation of measured parameters at various thermal conditions and time of day are investigated.

C5-30

CONNECTION BETWEEN TEMPERATURE VARIATIONS AND SEISMICITY IN CRIMEA REGION

T.N. Bibikova,[1] E.S. Rembovskaya,[2] T.A. Proskurjakova,[1] E.V. Jurba,[1] and V.A. Alekseev[3]
[1]*Moscow State University, Moscow, Russia*
[2]*Institute of Earth Puhysics RAS, Moscow, Russia*
badgers_hole@mtu-net.ru
[3]*TRINITI, Troitsk, Moscow Region, Russia*

We have made an attempt to find connection between temperature variations in winter months (december-january) and earthquakes during the same period in Yalta region, Crimea. As the result, it was obtained that there is dependence of temperature on seismic processes. Also, it seems us interesting the fact of temperature increasing on 3 and 7–8 days before earthquake. Statistical analysis of these data also marks some peculiarity in temperature row in 3 days before earthquake.

Session C6. DIAGNOSTICS OF STATE AND FUNCTIONING OF PLANTS' BIO SYSTEMS

C6-01

PHYSICAL AND BIOLOGICAL ASPECTS OF TRANSFORMATION OF SOLAR RADIATION IN THE "SNOW–ICE–WATER–AQUATIC PLANT SUSPENSION" SYSTEM AT THE DEVELOPMENT OF THE SPRING PENETRATING CONVECTION IN LAKES OF POLAR AND MID–LATITUDES

P.Yu. Pushistov, V.K. Ievlev, and V.A. Shlychkov
Institute for Water and Enviranmental Problems SB RAS, Novosibirsk, Russia
push@ad-sbras.nsc.ru

The review is presented of experimental and theoretical investigations devoted to the aspects of transformation of the net flux of solar radiation at the development of turbulent penetrating convection in water reservoirs of polar and mid–latitudes covered with snow in the period of spring heating, and the role of convection and radiation in the development of diatomic aquatic plants. The complex is constructed of mathematical hydrothermodynamic models capable of describing the diurnal and synoptic variations of energy and mass exchange in the geobiosystem: snow and ice cover, under-ice water layer, and hydrobiological community of diatomic aquatic plants.

The methodology of vortex-resolution modeling is applied for description of the penetrating turbulent convection. The modeling is based on representation of the possibility of selection of three principal processes in the under-ice water layer, which are significantly different in their spatial and temporal scales: regular principal state, coherent structures ("large vortices" with characteristic vertical scales of order of the thickness of the photo-zone) and chaotic small-scale (under-grid) turbulence generated by the action of flotation forces and the shift of the flow velocity. The cycle is described of transformation of the solar radiation energy in the modeled system. The analysis is carried out of the results of numerical experiments both with the complex as whole and its separate functionally oriented subsystems, including comparison of the results of calculations with the known data of field measurements.

The work was supported in part by Russian Foundation for Basic Research (Grant No. 99–05–64735).

C6-02

ESTIMATION OF THE ADDITIONAL EMISSION OF CO_2 BY FOREST AREAS AT ANTHROPOGENIC POLLUTION OF AIR

B.G. Ageev, Yu.N. Ponomarev, V.A. Sapozhnikova, and K.M. Firsov
Institute of Atmospheric Optics, SB RAS, Tomsk, Russia
ageev@iao.ru

The problem of determination of the possible sources and sinks of CO_2 and estimation of their productivity becomes one of the most urgent problems last years because of the increase of the content of atmospheric CO_2. Biological processes, breath of soils and vegetation, are the powerful providers of CO_2 into the atmosphere, and their sources become more and more intensive with time. For example, the data are available, that the increase of June and July average maximums of CO_2 at the level of the middle of the tree crown under the curtain of pine forest is 54% during 14 years (from 350 to 540 ppm), it was shown in our experiments that the effect of gaseous pollution (C_2H_4, CO, O_3) on grass and trees leads to the change of the "dark" breath (to its intensification in the majority of events) that causes the increase of CO_2 breathed out by vegetation. Thus, one can suppose that pollution of air, including the results of anthropogenic activity, can stimulate the additional emission of CO_2 resulting from the vital activity of the polluted vegetation.

The estimates of the possible increase of the concentration of atmospheric CO_2 by vegetation areas at their anthropogenic pollution are presented in this paper. The estimates are carried out by means of the numerical modeling using the data of original measurements. It is shown that the content of CO_2 under the forest curtain can exceed its background concentration by 200%, and this exceeding reach 14% in the 3-m high level over the curtain.

C6-03

MEASUREMENT OF CHLOROPHYLL "A" CONCENTRATION ON THE SEA SURFACE WITH THE HELP OF SEAWIFS

E.A. Shtraikhert and S.P. Zakharkov
Pacific Oceanology Institute FEB RAS, Vladivostok, Russia
zakharkov@ocean.poi.dvo.ru

At present, for obtaining global chlorophyll "a" distribution in the ocean and for research of its dynamics, the method of passive remote sensing of the ocean is used. The method requires calibration, especially, in coastal regions where the waters are attributed to the second type. Adaptation of present algorithms to local conditions is realized by means of conducting joint remote and contact measurements of chlorophyll "a" concentration.

In the paper the fields of chlorophyll "a" concentration in Peter the Great Bay (42.3–43.3N; 130.7–133W) were obtained from 23.11.99. to 03.12.99. both by the contact method of shipborne probing and by remote sensing method with the help of the SeaWiFS color sensor. At observation of chlorophyll "a" concentration by contact method, the standard extractive spectrometric method was used. For observing the satellite color maps(data of level 2) the requirements are made in DAAC. To read the maps the software JHV 2.3. was used. Fields of chlorophyll "a" concentration in Peter the Great Bay were received for all cloudless days. For compilation of the total picture of distribution of chlorophyll "a" from every field of distribution, the individual sites of the region were taken, where the shipborne stations in the same day with the satellite picture or, as a last resort, over 1–2 days were made. From the sites the total picture of satellite data for chlorophyll "a" concentration was composed. On account of the composed map, 4 sites characterized by different mean content of chlorophyll "a" concentration in water and their individual coefficients of relationship between the satellite and shipborne data were marked.

C6-04

CALIBRATION OF THE SEAWIFS DATA BY SHIPBORNE MEASUREMENTS

E.A. Shtraikhert and S.P. Zakharkov
Pacific Oceanology Institute FEB RAS, Vladivostok, Russia
zakharkov@ocean.poi.dvo.ru

The calibration by the data of the shipborne measurements is necessary for verification and binding to local conditions of existing algorithms for finding of the chlorophyll "a" concentration on the sea surface of sea by method of remote sensing. It has been carried out study.

The shipborne probing of water for determination of chlorophyll "a" concentration was executed from 14.04.99. to 23.04.99. in the north-western part of the Sea of Japan (39°50′ – 43°00′ N and 130°30′ – 134°30′ E, 32-th Cruise of the R/V "P. Gordienko"). For determination of phytoplankton pigment in samples of water the standard extractive spectrometric method was used. The analysis of probes was conducted in land laboratory using spectra of absorption of 90% acetone.

Values of chlorophyll "a" concentration from specialized satellite NASA- "OrbView-2" with SeaWiFS (Seaviewing Wide Field-of-view Sensor) on board were received parallel to the ship data. For this purpose in DAAC (Distributed Active Achieve Center) over INTERNET the color maps (data of level 2) stored in files of HDF (Hierarchical Data Format) format were ordered. To read these maps, i.e. to translate pixels color magnitude in numerical values of chlorophyll "a" concentration with binding to geographical coordinate the software JHV 2.3.(Java HDF Viewer) was used. As far as possible, for the calibration of satellite data the measurements were taken relatively synchronized among oneselves (taken in the same day or every other one). The satellite data for the sea sites of sea closed by cloudiness, where it was possible, were taken from the color images removed in time from basic image for 2 days. But in this case, the calibration error probability was increasing. In whole, the exceeding of satellite values of chlorophyll "a" concentration above the shipborne ones was marked. It is obvious from the coefficients of the relationship between the satellite and ship data that the satellite values of chlorophyll "a" concentration for the stations located closer to coast more exceed the ship ones (coefficients of relationship (cr) = 1.75; 3.29) than for the stations located nearer to the sea.(cr = 1.64). It is caused by larger soiling of coast waters, which are rich in the dissolved organic matter of terrigenous origin carried from the coast. Due to the mean values of chlorophyll "a" concentration in water and coefficients of relationship between the ship and satellite values, three districts characterized by the definite waters subtypes were singled out. For each of them its the calibration equation was brought out.

C6-05

THE CONTENT OF CHLOROPHYLL IN TREES RESEARCH BY SPECTROPHOTOMETRIC AND LIDAR METHODS

N.L. Fateeva,[1] G.G. Matvienko,[1] A.I. Grishin,[1] O.A. Romanovskii,[1] O.V. Kharchenko,[1] N.A. Vorob'eva,[2] and A.P. Zotikova[2]

[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
roa@iao.ru
[2]Forestry Institute SB RAS, Tomsk, Russia.

The comparative experimental content of chlorophyll in number of trees by traditional spectrophotometric and florescence laser methods research was made. Season changes of chlorophyll concentrations in number of needle and leaf trees during spring-summer period were analyzed. Observations of chlorophyll content changes as a result of leaf and needle fading were made with the help of fluorescence lidar. Received experimental results allow us to identity specific kind of the plant. Combined analysis showed similarity of results received with the help of completely different methods.

C6-06

VEGETATIVE COVER BY OBSERVATIONS FROM THE SPACE: ACCURACY CHARACTERISTICS FOR ESTIMATION OF PARAMETERS OF ITS CONDITION

V.V. Kozoderov and V.S. Kosolapov

Institute of Computational Mathematics RAS, Moscow, Russia
vkozod@inm.ras.ru

The direct problem to determine the remotely measured functional of brightness of a vegetative cover that is inhomogeneous by space in the limits of a field of view of the equipment of multispectral satellite sounding at the given altitude of the Sun in dependence on the density of green (deciduous, coniferous) phytomass of forest ecosystems is reduced to use the appropriate concepts on a typical spectral variation for the reflecting power of researched vegetation classes allowing for the areas occupied by the crown region and inter-crown grass/shrubbery region, and also the shading and multiple scattering of radiation in a presence of intra-crown clearances. Introduction of the concepts of a forest canopy density (average statistic distance between trees) and open-work of crowns (transparency of a medium for passing of solar radiation photons) allows us to calculate magnitudes of the indicated functional in terms of the given two-parameter family which uniquely characterizes a required magnitude of the green phytomass volume.

The inverse problem to determine this magnitude from the space consists of the finding of pair-wise intersections for data of measurement channels of the remote sensing of forest ecosystems using the square-law measures of minimization such as the Euclidean distance which are known in the problems of a pattern recognition of natural objects by their multispectral images. It is shown that for the given accuracy of remote measurements the effect of partition levels of grid values for the given family is essential to obtain the estimation accuracy which is admissible for a practice for the indicated magnitude. Proposed new statement of the problems for the quantitative estimation of parameters of the forest ecosystem state conduces to optimize the conditions for realization of practical techniques for the solution of considered problems by the number of channels of the remote video spectrometry and the reconstruction accuracy for the volume of green phytomass of vegetation comparing with an actual accuracy of the measurement equipment.

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C6-07

RS DIAGNOSTICS OF FOREST ECOLOGICAL AND RESOURCE POTENTIAL IN BAIKAL BASIN

N.V. Malysheva, O.L. Orlova, I.A. Voukolova, S.V. Knjazeva, and T.A. Zolina

All-Russian Scientific Research & Information Centre for Forest Resources, Moscow, Russia
nataliam@himky.comcor.ru

The maintenance of forest ecological and resource potential into the Baikal region is the obligatory condition of preserving the unique lake. Baikal watershed basin area (Russian part) is equal to 24 mln. ha, and 18 mln. ha of this area is occupied by forests.

Strategy of monitoring system and the set of data collection methods for evaluation of forest ecological and resource potential were developed. System have been oriented on application of satellite images, selective airborne photo- or video survey in combination with field data.

The establishment of the monitoring system includes the following:

– design of observation network - selection of long-term observation units;

– data collection- obtaining the generalized indices by interpreting the satellite images; detection of the ecological risk zones; conducting the detail observation by selective airborne photo- or video survey;

– storage of the primary data in database, registration of the current changes, updating the primary data;

– analysis and visualization of indices; compiling the maps in GIS environment.

Data describing the ecological and resource potential of forests for river basins, hydrological regions, forest enterprises and Baikal basin on the whole were obtained. 3 river basins with heavy disturbed forest ecosystems and 25 river basins with unsustainable forest ecosystems were detected into the Baikal lake basin.

C6-08

GEOINFORMATION ANALYSIS OF THE EFFECT OF ATMOSPHERIC POLLUTION ON VEGETATION BIOSYSTEMS USING PICTURES MADE FROM SPACE

Yu.M. Polischuk, V.V. Ryukhko,
O.S. Tokareva, and M.N. Alekseeva
Institute of Oil Chemistry SB RAS, Tomsk, Russia
yuri@ipc.tsc.ru

The purpose of this paper is presentation of the results of analysis of ecological effect of atmospheric pollution on forest-wetland complexes of taiga zone of West Siberia on the example of emissions of ecologically dangerous chemical substances at burning the accompanying gas at the plumes situated on the areas of oil depositions, depending on the oil extraction level. The essence of the applied methodical approach to the analysis of the effect of atmospheric air pollution is reduced to combination of sanitary-hygienic and landscape-geophysical approaches to estimation of technogenic effects of atmospheric pollution on the environment. However, we suppose to use the structural map of natural area obtained by decoding and vectorization of a picture of the territory under investigation made from space, instead of the landscape map. The zones of pollution are determined by means of simulation of spread of polluting substances in the atmosphere using the spread models standard for Russian practice of nature preservation.

Investigations were carried out using the data on air pollution obtained based on ecological certificates of oil deposited in the area of oil extraction, where the following natural complexes are selected: wetlands of different type, coniferous-deciduous forest and pine forest. The areas of polluted landscapes related to the total area of the corresponding type of natural complexes were determined by means of overlap of the modeled polluted zones on the structure map of the landscape выделов by means of geoinfomation systems.

The work was supported in part by Russian Foundation for Basic Research (Grant R98Siberia No. 98–05–03174).

C6-09

USING THE SATELLITE DATA NOAA/AVHRR FOR MONITORING OF DYNAMIC VEGETATION COVER IN SIBERIA

S.A. Tashchilin and N.A. Abushenko
Institute of Solar – Terrestrial Physics SB RAS, Irkutsk, Russia
koshelev@iszf.irk.ru

The scheme and results of processing of the multispectral information from satellites NOAA of the instrument AVHRR for monitoring speakers of a vegetative cover have been represented. As a mark of a status of vegetation the normalized index (NDVI) is applied. The application of various types of the composite images constructed on a principle of a method of maximum values for research of seasonal changes of vegetation is considered. By outcome of the fulfilled operations was the archive of the satellite data for period 1997–2000 with space resolution of 1 km on territory of Irkutsk region. The influence of wood fires on a status of vegetation is retraced on the basis of the created archive.

C6-10

IDENTIFICATION OF THE SPECIES COMPOSITION AND EVALUATION OF THE PRODUCTIVITY OF FOREST TERRITORIES FROM SATELLITE VIDEODATA

K.G. Kolodnikov and K.T. Protasov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
prot@iao.ru

Recently a demand arose for real-time monitoring of forest ecosystems in vast territories of the Siberian region with simultaneous evaluation of the species composition, phytomass, and other characteristics of forest complexes. Aerial photographs and high-resolution satellite images were used as input data. The use of high-resolution images changes significantly the algorithms of thematic image interpretation, because distributed objects, such as stand tops, rides, roads, buildings, and other objects of the Earth's surface are seen in these images. Hence, the problem of recognition of main spatially distributed objects of the Earth's underlying surface arises. A solution of this problem calls for the development of optical models of the hierarchy of classes being recognized and for the determination of a class of transformations by which a current observation will differ from the stochastic standards of the learning material. It should be noted that physically informative and simple mathematical models that describe the objects and processes in terms of their radiobrightness properties considered as functions of the physical characteristics are required to improve the efficiency of satellite image interpretation algorithms. To describe the stand classes, we took advantage of the linear models in the adaptive Karhunen-Loĭve bases. These bases are formed for the leaning samples constructed by the teacher for each class. In addition, to describe variations of brightness portraits of images being constructed, a class of parametric transformations was chosen. In the pre-recognition stage, the problem of matching of the observations and models was solved by variations of the transformation parameters, and the confidence level was estimated against the χ^2 criterion or the criterion of the conditional empirical likelihood. If the confidence level was achieved, the Bayes decision rule was used to specify a class. The results of algorithmic implementation agree well with the results of image interpretation by the operator.

C6-11

NONPARAMETRIC CLASSIFICATION ALGORITHM OF CLUSTER ANALYSIS OF THE LARGE VASYUGAN BOG FROM THE DATA OF THE AVHRR/NOAA DEVICE

N.V. Tkalicheva and K.T. Protasov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
prot@iao.ru

The important problem of thematic interpretation of space images of the Large Vasyugan Bog is taxation of landscape and photocenosis variety of this largest system of bogs. We used the data of the AVHRR/NOAA device whose resolution in the nadir was only 1×1 km^2; however, this allowed us to fix the entire bog with its neighborhood and to perform its practically continuous observations 4 times a day. This creates essential prerequisites to an analysis of time variations in the seasonal character and transformation of the phenophase of the examined landscape formation. To solve this problem, we have developed some taxonomy (cluster analysis) algorithms. The first algorithm represents a hierarchic procedure of successive cluster extension against the criterion of the degree of proximity of the vectors observed based on nonparametric estimation of the density function for the sample of the cluster. This algorithm is cumbersome due to the necessity of examination of every possible pair of intersample distances. It includes the exhaustive search of these distances. The second algorithm is based on the search of modes of the multidimensional density function reconstructed *a priori* for the entire sampled data array of the recorded image with the use of nonparametric estimation of the unknown density function. To solve the problem of an optimum search for local extremes, we used an adaptive searching algorithm. Despite cumbersome calculations connected with the search of local extremes, the problem simplifies, because starting directions for searching local extremes are the sample vectors themselves. As a result of algorithmic implementation, stable classes of typological variety of the vegetative cover of the system of the Vasyugan Bog have been identified.

Session D1. MAGNETOSPHERE-IONOSPHERE INTERACTIONS

D1-01

GEOMAGNETIC CONTROL OF THE SPECTRUM OF TRAVELING IONOSPHERIC DISTURBANCES BASED ON DATA FROM A GLOBAL GPS NETWORK

E.L. Afraimovich,[1] E.A. Kosogorov,[1] O.S. Lesyuta,[1] I.I. Ushakov,[1] and A.F. Yakovets[2]
[1]Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
afra@iszf.irk.ru
[2]Institute of Ionosphere, Almaty, Kazakhstan

In this paper an attempt is made to verify the hypothesis on the role of geomagnetic disturbances as a factor determining the intensity of traveling ionospheric disturbances (TIDs). To improve the statistical validity of the data, we have used the based on the new GLOBDET technology method involving a global spatial averaging of disturbance spectra of the total electron content (TEC). To characterize the TID intensity quantitatively, we suggest that a new global index of the degree of disturbance should be used, which is equal to the mean value of the rms variations in TEC within the selected range of spectral periods (of 20–60 min in the present case). The analysis has been made for a set of 100 to 300 GPS stations and for 10 days with a different level of geomagnetic activity (Dst from −13 to −321 nT; the Kp index from 3 to 9). It was found that an increase in the level of geomagnetic activity is accompanied by an increase in total intensity of TEC; however, it correlates not with the absolute level of Dst, but with the value of the time derivative of Dst (a maximum correlation coefficient reaches −0.94). The delay of the TID response of the order of 2 hours is consistent with the view that TIDs are generated in auroral regions, and propagate equatorward with the velocity of about 300–400 m/s.

D1-02

VARIATIONS OF EMISSION BRIGHTNESS OF 557.7 nm MORE EQUATORIAL THEN LOW-LATITUDE BOUNDARY OF AURORAL BACKGROUND GLOW BEFORE BREAKUP START

V.A. Velichko, R.N. Boroev, G.V. Borisov, and D.G. Baishev
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
laex@ikfia.ysn.ru

The data of photometry observations in 1991 and 1996 which have been obtained at the stations Stolb and Tiksi have allowed us to reveal the peculiarities of variations of the emission brightness 557.7 nm and to measure the speeds of drift of subvisual optical inhomogeneities more equatorial then low-latitude boundary of the auroral background glow before a breakup starts.

During a several tens minutes before a start of explosion phase of substorm the brightness of auroral background glow in the center of future explosion seat, and also in the area that is more equatorial then low-latitude boundary of background varies otherwise then at the boundary itself and around the explosion seat.

Obtained values of the speed of optical inhomogeneity drift have allowed us to estimate a value of the electric field penetrating into the inner magnetosphere at different phases of substorm. The value of electric field on the meridian of formation of sustorm seat before the start of explosion phase has amounted to 9–11 mV/m, and at the phase of restoration with epicenter in other longitude sector the electric field has changed in the interval from 1 mV/m to 4 mV/m.

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D1-03

RELATIONSHIP OF PCA EVENTS AND ENERGETIC ELECTRON PRECIPITATIONS WITH FLUXES OF PROTONS AND RELATIVISTIC ELECTRONS ON THE GEOSTATIONARY ORBIT

V.A. Kuzmin
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
v.a.kuzmin@ikfia.ysn.ru

The comparison of annual average values of PCA events appearance frequency (Fpca) and the precipitation frequency of energetic electrons (F), registered with the Tixi riometer (L = 5.6),[1] with the fluxes of protons and relativistic electrons on the geostationary orbit (GOES) during the 22 nd solar activity cycle is presented. A high correlation relation of the PCA event frequency with Jp proton fluxes is found. The highest correlation R(Fpca, Jp) > 0.97 has been obtained for energy intervals of 5–10 and 10–30 MeV. It is in good agreement with the known dependence of the riometer absorption amplitude versus the proton energy in the PCA events and points to the true character of the PCA event frequency distribution during the 22 nd solar cycle. The distribution F during the solar cycle has a maximum on the decay phase (1994) associated with the activity of the coronal holes and high-speed solar wind streams.[1] The analogous but more sharp maximum is observed in relativistic electron fluxes by geostationary satellite data.[2] The highest non-linear correlation between the annual average values F and relativistic electron fluxes R[F, Je(>2MeV)] = 0.83 is shown. It allows us to consider the energetic electrons as the initial population for the formation of relativistic electrons.[2]

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D1-04

IONOSPHERIC MANIFESTATIONS OF GEOMAGNETIC PULSATIONS IN HIGH LATITUDES

Yu.V. Lipko, R.A. Rakhmatulin, and A.Yu. Pashinin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
lipko@iszf.irk.ru

During 1995–1998, observations of variations of high-latitude ionospheric parameters during the passage of geomagnetic pulsations were carried out at the Norilsk station (geomagnetic latitude and longitude 64.2 and 160.4, and L = 5.3). The ionospheric facility made it possible to carry out Doppler and amplitude measurements, and to obtain small- and medium-scale structures of the ionosphere. Geomagnetic pulsations were recorded with the induction magnetometer on a 24-hour basis.

Thirty cases of a simultaneous recording of duration from 10 min to one hour were obtained. The observations showed the presence of a good correlation between regular geomagnetic Pc5 pulsations and frequency Doppler shift (FDS) variations of the radio signal reflected from the ionospheric F2 layer. During the passage of regular pulsations, the following features were also noticed: a broadening of the Doppler spectrum, and changes in the propagation velocity and direction of ionospheric irregularities.

An interrelation between ionospheric parameter variations and irregular geomagnetic pulsations is not traceable in such a clear manner. For instance, a comparison of irregular Pi2 pulsations and frequency Doppler shift variations shows: a) an almost total absence of a correlation between time series; and b) an enhancement of short-period components of the FDS variation spectrum, and the coincidence of the main maxima on spectral density plots of FDS and Pi2 variations.

The observations that have been carried out suggest the existence of a clear interrelationship between variations of the inhomogeneous ionospheric structure parameters and geomagnetic pulsations. Some possible mechanisms for such a coupling are considered.

D1-05

SOME OBSERVATIONAL FEATURES OF MID-LATITUDE AURORAS AND EMISSION PERTURBATIONS IN THE UPPER ATMOSPHERE DURING MAGNETIC STORMS OVER THE REGION OF EAST SIBERIA

A.V. Mikhalev
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
mikhalev@iszf.irk.ru

Using experimental observations of the airglow in the upper atmosphere over East Siberia (52N, 104E), an analysis is made of the properties of mid-latitude auroras and emission perturbations in the upper atmosphere at the

time of magnetic storms during high solar activity periods of 1989–1993 and 1997–2000. It is pointed out that mid-latitude auroras and 630 nm emission perturbations during severe magnetic storms in the above-indicated longitudinal sector are mostly observed in the second half of night, and in the dawn hours. Considering that the mid-latitudes are characterized by a large correlation between Dst-indices of magnetic disturbance and the 630 nm emission intensity during geomagnetic-disturbed periods, a comparative analysis is made of the daily mean distributions of the values of the Dst-indices (for the years 1957–2000) as a function of the universal time UT at different levels of geomagnetic disturbances, and the time of observed mid-latitude auroras over East Siberia. Time intervals in the longitudinal zone under consideration that are accessible for night-time optical observations coincide with those of minimum values of the Dst-indices (maximum levels of geomagnetic disturbance) on the daily mean dependences of the Dst-indices in coordinates of the universal time UT. Minimum and extreme values of the Dst-indices correspond, respectively, to the second half of night, and to the dawn hours of the local time LT. Two severe magnetic storms of March 24–25, 1991 ($Dst^{max} = -298$ nT) and of April 6–7, 2000 ($Dst^{max} = -321$ nT) show a high similarity in the dynamics of the night-time behavior of 630 nm emission and in the character of the 557.7 nm emission perturbation. We discuss the dynamics of the main structural elements of the ionosphere during major magnetic storms which leads to the observed disturbances of emissions of the a upper atmosphere in mid-latitudes. It is suggested that the region of East Siberia refers to favorable areas for a monitoring and investigation of mid-latitude auroras during geomagnetic disturbances.

D1-06

NON THERMAL PROFILE OF THE 557.7 NM [OI] IN AURORA

V.M. Ignat'ev and S.V. Nickolashkin
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
nikolashkin@ikfia.ysn.ru

The rare case of the 557.7 nm [OI] auroral emission non thermal profile appearance during interferometric observations at January 2000 at Maimaga optic station (63N, 129.7E) is considered. The Fabry-Perot interferometer had an aperture 140 mm, free spectral range $\delta\sigma = 0.333$ cm^{-1} ($\delta\sigma = 0.0108$ nm) and instrumental width – $\delta\sigma = 0.041$ cm^{-1} ($\delta\lambda = 0.0015$ nm).

On base of analysis of shape and half-width of the non-thermal profile of the 557.7 nm [OI] auroral emission made conclusion that their appearance caused by a short time sporadic intensification of the dissociative recombination process of molecular oxygen ion in the limited region of the F2 ionospheric layer.

D1-07

SOLAR ACTIVITY EFFECTS ON STORM VARIATION OF FO F2 AT MIDDLE LATITUDES

N.M. Polekh, O.M. Pirog, and L.V. Chistyakova
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
polekh@iszf.irk.ru

The experimental and theoretical researches of an ionosphere during the geomagnetic storms which have been carried out per last decades, have allowed to make up a common picture of ionospheric storms and to reveal common regularities of their development.[1] Using the statistical research of the ionospheric data the diurnal and seasonal variations of critical frequencies during the main phase storm were separated[2] and the defining role of neutral composition and winds on the variations of ionospheric parameters during a magnetic storm is shown. The neutral composition and wind speed vary in a cycle of solar activity. So it is possible to assume, that the storm-time variations foF2 also depend on a level of solar activity. For examination of this supposition the diurnal variations of critical frequencies of layer F2 during geomagnetic disturbances for different seasons for a maxima and minimum of a solar activity obtained at middle latitude stations Magadan, Irkutsk and Khabarovsk were analyzed. The parameter $\ln (N_c/N_{co})$ is considered as a index ionospheric disturbances, where N_c is value of an electron concentration in the maxima of layer F2 for disturbed conditions, and N_{co} – for quiet ones[1]. Two levels of magnetic activity are analyzed. It is shown that the daily negative ionospheric disturbances are observed on these stations for all seasons. They are more expressed in the minimum of solar activity. In winter time the positive variations of $\ln (N_c/N_{co})$ are observed in evening and night hours.

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D1-08

USE OF INCOHERENT SCATTER DATA FOR THE ESTIMATION OF THE THERMOSPHERE GAS COMPOSITION

L.A. Shchepkin, G.P. Kushnarenko, and G.M. Kuznetsova
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
chepk@iszf.irk.ru

A major portion of exposure of the magnetosphere to the ionosphere has come through the thermosphere. Thus the task of the thermosphere state evaluation for the specific conditions with using the experimental ionospheric data is the actual one.

This paper deals with the proposed combined approach to this task solution on the base of incoherent scattering (IS) data. It consistent of the traditional methods of the oxygen density definition at heights 400–450 km and of the new method of gas composition evaluation at heights 120 or 180–200 km. The last has been proposed by the authors. It was based on the analytical model describing the connection of electron density with the thermospheric characteristics. As a result it is possible to receive the changes of atomic and molecular gas components at the same time if conditions are favorable.

First of all the possibility of IS-data using for the model generalization was investigated. It was showed that IS-data can be used for the solution of the formulated task. It is necessary the using of the enough large amount of the initial data with a possible large diapason of the solar activity levels.

D1-09

IONOSPHERIC OBSERVATION DURING JULY 15–16, 2000 MAJOR GEOMAGNETIC STORM

B.G. Shpynev, A.V. Medvedev, V.E. Nosov, G.A. Zherebtsov, A.P. Potekhin, and A.V. Zavorin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

High Solar activity was observed at July 2000. Sequences of X-ray flares and proton flare were registered during July 12–14. Radar groups of Millstone-Hill and Irkutsk carried out coordinated observations in this period for investigation ionosphere response to these flares. As a result, strong disturbances ionosphere parameters were observed. Largest disturbance appears on July 15–16 as most power magnetic storm over last 20 years. At this period, measurements of electron density, electron and ion temperatures plasma drift velocity are carried out by Irkutsk Incoherent Scatter Radar. Additionally, it were made measurements of powerful coherent echoes which appear due to two-stream plasma instability in E layer of ionosphere. Disturbances of ionospheric structure was so large, that polar oval was to the south of Irkutsk. Electron density profiles had the shape, usually observed in polar ionosphere. Ionospheric F-layer was almost depressed. During some hours E-layer density exceed one in F-region. Electron temperature in some moments exceed 5000°K, ion temperature was more then 2000 °K. High speed plasma drift observed at thee 300–600 km altitudes. Powerful coherent echoes from E-layer irregularities observed for long period of time. In the paper we also analyze how different flare in the set affect on magnetosphere-ionosphere processes.

D1-10

MODEL STUDY OF THE RESPONSE OF THE MID-LATITUDE IONOSPHERE TO A GREAT GEOMAGNETIC STORM OF SEPTEMBER 25, 1998

A.V. Tashchilin, E.B. Romanova, and B.G. Shpynev
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
avt@iszf.irk.ru

A great geomagnetic storm occurred during September 25–27, 1998, during which the planetary index of geomagnetic activity Kp was as high as ~ 9, and Dst was ~ 230 nT. Observations of the state of the ionosphere using the incoherent scatter radar were made during the storm. The observations with the IS radar made it possible to record height-time changes in electron density, electron and ion temperature, and in line-of-sight velocities of the plasma drift both during the storm and on preceding quiet days.

To study the mechanism of the observed response of the mid-latitude ionosphere to the geomagnetic disturbance, we carried out numerical calculations of the variations in ionospheric F-region characteristics on the basis of a mathematical model of ionosphere-plasmasphere coupling. According to the currently generally accepted view, the initial stage of the ionospheric storm (positive phase) is controlled by the effect of electric fields and winds propagating equatorward from the auroral zone, while the second stage (negative phase) represents ionospheric

consequences of changes in the composition of the neutral atmosphere. For this reason, in this paper an attempt is made to interpret the observational data on the September 25, 1998 storm in terms of the operation of two factors only: an enhancement of the meridian wind velocity, and the subsequent change in number density of atomic and molecular components in the thermosphere.

D1-11

LOCAL INCREASE OF FIELD-ALIGNED CURRENT INTENSITY BEFORE A SUBSTORM ONSET

V.A. Velichko, R.N. Boroyev, and D.G. Baishev
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
laex@ikfia.ysn.ru

By using data treatment results of mid-latitude geomagnetic variations, the significant increase of the local current system intensity with the eastern direction current system, arising near the meridian of expected substorm center ~ 15–30 min before the break-up onset, has been found. A comparison of longitudinal sizes of two current systems, forming the substorm disturbance before and after the onset, of the substorm expansion phase, has been carried out. The longitudinal size of the current loop of the substorm growth phase is nearly twice as small as azimuth scale of the substorm current wedge, and the current strength is as weak as 5 times.

D1-12

SIGNATURES OF MAGNETIC FIELD LINE RECONNECTION

H.K. Biernat,[1,2,3] V.S. Semenov,[4] N.V. Erkaev,[5] S. M'uhlbachler,[1,2] and C.J. Farrugia[6]
[1]Space Research Institute AAS, Graz, Austria
[2]Institute for Geophysics, Astrophysics, and Meteorology, University of Graz, Austria
[3]Institute for Theoretical Physics, University of Graz, Austria
[4]Institute of Physics, University of St. Petersburg, Russia
[5]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
[6]Institute for Study of Earth, Oceans, and Space, University of New Hampshire, Durham, USA

Reconnection of magnetic field lines is a very important coupling mechanism in space for configurations with considerable skew in the magnetic field. In a magnetospheric context such configurations take place at the dayside magnetopause but also in the magnetotail. Thus, reconnection couples phenomena prevailing in the solar wind with ionospheric phenomena. We report on the most important signatures of reconnection. Recent developments of reconnection theory are presented. Phenomena in the tail, showing the evidence of reconnection, are discussed.

D1-13

GENERATION OF ELECTRIC POTENTIAL DIFFERENCE DUE TO MHD SLOW SHOCKS PROPAGATING ALONG THE IO FLUX TUBE

D. Langmayr,[1,2] N.V. Erkaev,[3] V.S. Semenov,[4] V.A. Shaidurov,[3,5] H.K. Biernat,[1,2,6] H.O. Rucker,[1,2] D.F. Vogl,[1] and S. M'uhlbachler[1,2]
[1]Space Research Institute AAS, Graz, Austria
[2]Institute for Geophysics, Astrophysics, and Meteorology, University of Graz, Austria
[3]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
[4]Institute of Physics, State University of St. Petersburg, Russia
[5]State University of Krasnoyarsk, Russia
[6]Institute for Theoretical Physics, University of Graz, Austria

Many ionospheric and magnetospheric phenomena, e.g., the northern lights, require the existence of accelerated particle populations. One possible explanation for the development of such particles is an electric field directed along magnetic field lines. The main aim of this paper is to investigate the physical mechanisms leading to an electric potential difference along the Io flux tube with special emphasis on the processes acting in the outer ionosphere of Jupiter. As a starting point, we assume a pressure perturbation at the position of Io and follow the evolution of this pressure perturbation from Io towards Jupiter. Initially, the pressure pulse produces two slow mode waves propagating along the Io flux tube. These slow mode waves are converted into slow shocks traveling towards Jupiter, and are accompanied by a supersonic flow behind the shock front. The crucial point is now that due to the propagation into a

more narrow flux tube, the flow velocity behind the shock increases, in particular fast near the surface of Jupiter. Such a strong plasma flow generates an electric potential difference along the magnetic field. We estimate this potential difference using well-known techniques of kinetic theory. The main result is that the strength of the potential drop is directly proportional to the flow energy of ions. Thus, the very heavy ion populations in the Io torus plasma provide an appropriate environment in order to generate an electric potential difference of the order of 1 kV.

D1-14

ANALYSIS OF THE INCLINED FAST SHOCK INCLUDING PRESSURE ANISOTROPY

D.F. Vogl,[1] N.V. Erkaev,[2] H.K. Biernat,[1,3,4] H.O. Rucker,[1,3] S. M'uhlbachler,[1,3] and D. Langmayr[1,3]
[1]Space Research Institute AAS, Graz, Austria
[2]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
[3]Institute for Geophysics, Astrophysics, and Meteorology, University of Graz, Austria
[4]Institute for Theoretical Physics, University of Graz, Austria

To study magnetosphere-ionosphere interactions, appropriate considerations on the solar wind, the bow shock, the magnetosheath, and the outer ionosphere are of importance. In this study, we concentrate on the analysis of an inclined fast shock including upstream and downstream pressure anisotropy, and apply it to conditions at the Earth's bow shock. It is the main goal of this work to perform a parameter study of the magnetic field strength and plasma parameters downstream of an inclined fast shock as functions of upstream parameters and downstream pressure anisotropy. For closing the set of equations we use two threshold conditions of plasma instabilities as additional equations to bound the range of pressure anisotropy, i.e., the mirror and fire hose instability. We show that the variations of all relevant physical quantities across the shock wave are strongly influenced by the upstream Mach numbers.

D1-15

STUDIES OF DAYSIDE MAGNETOPAUSE EROSION ON GEOSTATIONARY ORBIT USING WIND AND GOES DATA (1995–1998)

S. M'uhlbachler,[1,2] C.J. Farrugia,[3] H.K. Biernat,[1,2,4] V.S. Semenov,[5] N.V. Erkaev,[6] D.F. Vogl,[1] D. Langmayr,[1,2] R.P. Lepping,[7] K.W. Ogilvie,[7] and H. Singer[8]
[1]Space Research Institute AAS, Graz, Austria
[2]Institute for Geophysics, Astrophysics, and Meteorology, University of Graz, Austria
[3]Institute for Study of Earth, Oceans, and Space, University of New Hampshire, Durham, USA
[4]Institute for Theoretical Physics, University of Graz, Austria
[5]Institute of Physics, University of St. Petersburg, Russia
[6]Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
[7]NASA Goddard Space Flight Center, USA
[8]NOAA Space Environment Center, Boulder, USA

During periods of southward interplanetary field and basically constant dynamic pressure, the magnetopause can move earthward due to the so-called phenomenon of magnetopause erosion. In this study, we present several erosion events monitored at geostationary orbit by the GOES spacecrafts underlaying WIND measurements in the solar wind. We selected a number of events using 4 years of WIND observations (1995–1998). Specific selection criteria are based on obtaining a progressively decreasing IMF B_z negative, to have various levels of erosion, with and without dynamic pressure changes and of different durations in time. To figure out the erosion effect on geostationary orbit, we have to compare the measured depression in the geostationary magnetic field strength with the magnetic field strength 24 hours before and after within nearly the same solar wind conditions.

D1-16

INSTANTANEOUS IONOSPHERE RESPONSE TO THE MAGNETIC FIELD CHANGE

E.L. Afraimovich, E.A. Kosogorov, L.A. Leonovich, O.S. Lesyuta, and I.I. Ushakov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
afra@iszf.irk.ru,

An "instantaneous" ionospheric response to the sudden commencement (SSC) of strong magnetic storms was detected using a new technology for global detection (GLOBDET) of ionospheric disturbances.

The analysis has been made for a set of 90 to 300 GPS stations, and for 7 days (January 6, April 23, 1998; April 6, June 8, July 13, 14, 15, 2000) with a different level of geomagnetic activity (Dst from −6 to −295 nT; the Kp index from 0 to 9).

The global negative perturbation of total electronic contents well correlates with derivative of strength of magnetic field (coefficient of correlation are not lower – 0.819), but delays concerning these changes on time about 3–10 minutes.

On the dayside of the Earth the largest value of the net response amplitude was found to be of order $0.38 \cdot 10^{16}$ m^{-2} (1–2 % of the background TEC value), and the delay with respect to the SC in mid-latitudes was about 200 s. In higher latitudes the delay goes as long as 15 min. On the nightside these values are $0.08 \cdot 10^{16}$ m^{-2} and 30 min, respectively.

The velocity of the traveling disturbance from the middle to high latitudes on the dayside as well as from the dayside to the nightside was about 10–20 km/s.

D1-17

BEHAVIOR OF IONOSPHERE OVER KHARKOV DURING THE GEOMAGNETIC STORMS

Ye.I. Grigorenko, V.N. Lysenko, and S.V. Chernyaev
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

The observation results of ionosphere response on the geomagnetic disturbances are discussed. The results are obtained with the Kharkov incoherent scatter radar.

The ionosphere effects of severe magnetic storm on September 25, 1998 with the planetary index A_p = 121 are detail considered. Storm was accompanied with large changes in the ionosphere behavior. The height of the electron density peak h_mF2 increases at night by about 70 km and in the daytime by about 50 km in comparison to previous quiet days. The peak electron densities N_mF2 fall by factor of about 4 before sunrise and by factor of 4,5 before local noon. The ion temperature increases by about 200...300 K in the daytime. The observed events are accounted for the thermosphere disturbance effects including the rebuilding of the global thermosphere circulation caused by the high-latitude heating, the change of neutral atmosphere composition and so on. The observations showed also that on the disturbed day the vertical velocity V_z and the ion O^+ flux, that was calculated from measured parameters, reverse its direction that occurs on the quiet day, and become upward ones at the height range of 200...500 km. Such behavior of ionosphere is evidence of the significant change of plasma exchange processes between lower and upper regions of ionosphere.

The topside H^+ ion behavior during the magnetic disturbances is considered on the example of magnetic storm on February 18, 1999 (Ap = 54). The comparison with the quiet winter day on December 8–9, 1999 showed that in the nighttime during the magnetic storm the H^+ ions appear at altitudes up to 900 km only after midnight when the disturbance is falling. The percentage of H^+ ion is lower by factor of 1.5 than on the quiet night. It can be possibly accounted for the flux tube through Kharkov radar being depleted by the storm.

D1-18

ENERGETIC ELECTRON PRECIPITATION AND CONVECTION ELECTRIC FIELD DURING THE HIGH SPEED SOLAR WIND STREAMS

V.A. Kuzmin
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
v.a.kuzmin@ikfia.ysn.ru

High speed solar wind streams interacting with the Earth's magnetosphere generate the electric fields inside it, which form the energetic electron population. We present a correlation analysis of the precipitation frequency (F) of energetic electrons registered with the Tixie riometer with the convection electric field (Ec) calculated within the framework of the simplified model of viscous interaction of the solar wind with the magnetospheric field in the LLBL region, and also with solar wind electric field (Ey) and the electric field across the polar cap (Em – magnetosphere's electric field), during the passage of the Earth through high speed streams in 1994. A high correlation of energetic electron precipitation frequency with Ec, R(F, Ec) = 0.74 and with Em, R(F, Em) = 0.79 is shown. Apparently a high correlation (F, Ec) can be explained by the increase of an arriving electrons from the plasma layer tail region into the acceleration regions located in the auroral and inner magnetosphere due to the convection and electron drift velocity enhancement. At the same time, the high correlation with the magnetospheric electric field points to the necessity to take into account the contribution of the electric field from other sources.

D1-19

LONGITUDE-DEPENDENT PECULIARITIES IN THE RESPONSE OF IONOSPHERE TO GEOMAGNETIC STORM

E.S. Kazimirovsky, O.M. Pirog, N.M. Polekh, and L.V. Chistyakova
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
pir@iszf.irk.ru

We investigate the May 15, 1995 magnetic storm effects on the mid- and low-latitude ionosphere. The study is based on using the data from three chains of ionospheric stations located approximately along the meridians 20°, 140° and 280°E in the geomagnetic latitude range 13°–65°N. Variations in f_0F2 are considered. Estimates of the zonal electric fields are made. Results of our analysis show that the main ionospheric effects of the storm under consideration are: 1) long-lasting intense negative disturbances during the storm main and recovery phases at subauroral and mid-latitudes; 2) positive disturbances at stations of the European and American chains observed prior to the storm, regardless of the local time; 3) a positive peak of Δf_0F2 at stations of the Asian chain during the storm main phase in the evening hours; 4) a similarity of the form of the Δf_0F2-variations at different latitudes, and a delay in the development of the disturbance in f_0F2 with a decrease in latitude; 5) the largest effect on the F-region is observed at the Asian chain; and 6) the magnitude of the zonal electric field is determined by the storm phase, and on the three meridians it is maximal near a maximum D_{st}; irrespective of the local time. The resulting differences of the Δf_0F2-variations, and also the differences of zonal electric field variations, can be driven both by the local time of the sudden storm commencement and by magnetic dip. It is not accidentally the largest effects are observed along the meridian 140°E where the difference between the geographic and magnetic poles is the largest.

D1-20

REACTION OF F1 IONOSPHERIC LAYER ON THE ACTION OF MAGNETOSPHERIC PROCESSES IN THERMOSPHERE

L.A. Shchepkin and G.P. Kushnarenko
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
chepk@iszf.irk.ru

The influence of magnetospheric processes on the high latitude upper atmosphere essentially exposed in the F1 layer behavior. A clearly defined reaction of the layer development on the magnetic field strength bays was observed at Murmansk.[1]

The average pattern of spatial-temporal variations of the layer degree development over Antarctica is a peculiar kind. Here the UT control of the F1 layer is strong.[2]

A peculiar kind of spatial changeability of the diurnal asymmetry of the layer development over Antarctica was depicted in Ref. 3. The revealed pattern is well described by the model calculations with help of the thermospheric model MSIS-86. The layer is better developed in the afternoon hours LT in the magnetic pole longitudinal sector and is vice versa in the opposite sector.

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D1-21

ESTIMATIONS OF YEAR TO YEAR CHANGEABILITY OF GAS COMPOSITION AT 120 km OVER IRKUTSK WITH MEASUREMENTS OF F1-LAYER DEGREE DEVELOPMENT

L.A. Shchepkin, G.P. Kushnarenko, and G.M. Kuznetsova
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
chepk@iszf.irk.ru

The investigation is carried out at the base of exceptional row of the parameter of the F1-layer degree of development (A^1) measurements at Irkutsk during years 1980–1997. The value of A is closely related to the thermospheric gas composition. The connection of A with the thermospheric characteristics is described by the simple analytical expression[2]. With its help the changes of the gas composition departures from the model of the thermosphere MSIS-86[3] were calculated for summer months (April to September). These departures show the trend to rise of the relative molecular content from 1980 to 1997. This trend is more expressed then compared with one described with help of the model.[3]

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D1-22

MAIN IONOSPHERIC TROUGH POLAR WALL BOUNDARY IN MORNING SECTOR DURING MAGNETO-QUIET CONDITIONS

A.E. Stepanov, V.L. Khalipov, and E.D. Bondar
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
a_e_stepanov@ikfia.ysn.ru

On data of high-latitude ionospheric stations of Yakutian meridian chain the boundary of a polar wall of a main ionospheric trough (MIT) in a morning sector (00–06 LT) during magneto-quiet conditions are analyzed. As have shown statistical study, conducted on a large array of data, in a morning sector in periods of very quiet geomagnetic conditions (Kp = 0–1) the positions of a MIT polar wall boundary have two branches dispersing to a pole and equator from common approximation line. The purpose of the present work is the clearing up of such behavior of a polar wall at morning hours. The values of interplanetary magnetic field (IMF) parameters were considered in cases when the boundary of a polar wall displaced either to a pole or to equator. Is revealed that in a morning sector the displacement of the boundary toward a pole is observed only for negative By and large positive Bz IMF values. For concrete events the pictures of a large-scale convection designed on a model dependent from IMF parameters are resulted.

D1-23

IONOSPHERE EFFECTS OF SOLAR ECLIPSE ON AUGUST 11, 1999

V.I. Taran and Ye.I. Grigorenko
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

Continuous measurements of electron concentration, electron and ion temperatures, vertical plasma velocity and hydrogen ion density up to altitude of 1500 km were carried out at the Kharkov incoherent scatter radar equipped with 100 m zenith parabolic antenna during the eclipse on the August 11, 1999. The eclipse maximum phase (83%) occurred at 1113 UT.

The eclipse has caused significant changes of ionosphere behavior. The electron temperature *Te* decreases by the value of ~ 500–600 K at all altitudes almost simultaneously, that is evidence of the high thermal conductivity of the electron gas. The ion temperature *Ti* decreases with the amplitude which increases with altitude rise, but with the delay about the eclipse commencement. The decrease of solar radiation flux leads to fall of ionization rate and the infringement of balance between processes of ion production, loss and plasma transfer. These effects cause the downward plasma diffusion from the upper ionosphere. But the electron density at the F2 region peak does not change significantly because the competing influence of diffusive and loss apparently balance one another during eclipse. The increase of downward plasma diffusion is confirmed by the increase of downward plasma velocity *Vz* in the F region of ionosphere, and above ~ 650 km the velocity changes its direction. Derived quaintities of the O^+ ion flux in the upper *F2* layer show that at the maximum phase of the eclipse the flux becames downward one, i.e. similar to the nighttime flux. The plasma diffusion increase from the upper ionosphere leads also to the increase of the hydrogen ion percentage concentration at maximum obscuration by value up to 40% and to the fall of transition altitude, where $N(O^+) = N(H^+)$, by about of 120 km. Observed effects is evidence of significant infringement of processes of plasma transfer and of plasma exchange between ionosphere and protonosphere.

D1-24

PECULIARITIES OF TOPSIDE HYDROGEN ION BEHAVIOR OVER KHARKOV

V.I. Taran, Ye.I. Grigorenko, and G.A. Kiyashko
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

The questions of the hydrogen ion production and destruction theory, connected with photochemical and diffusion processes are discussed. Some experimental results on the topside hydrogen ion behavior that have been obtained by the Kharkov incoherent scatter radar (ISR) are presented.

The diurnal-seasonal peculiarities of the ion H^+ behavior at the altitudes up to 1300–1500 km at high solar activity are considered. The observations have shown that H^+ ions become predominant ions in the winter nighttime at altitudes about 650 km, and in summer – about 1200 km. In winter during the night period the H^+ concentration exceeds that for summer by a factor of ~ 7 at the altitude of 850 km. The effects of conjugate-point photoelectrons are clearly seen on the diurnal variations of H^+ ions. This influence is observed both in winter, when sunrise at conjugate point occurs ~ 4 hours earlier than local one, and in summer, when it is late by ~ 2.5 hours about local sunrise. The comparison of the measurement results at the Kharkov radar with the data obtained by the Arecibo radar and with the Atmosphere Explorer data are discussed.

D1-25

IONIZED AND NEUTRAL UPPER ATMOSPHERE COMPONENT PARAMETERS OBTAINED FROM INCOHERENT SCATTER DATA

D.A. Dzyubanov, V.I. Taran, and V.K. Bogovsky
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

Incoherent scatter method allows us to measure such ionospheric plasma characteristics as electron concentration, charged particles temperature, plasma drift velocity, and ion composition. From these parameters some neutral component characteristics in particular thermospheric wind velocity and neutral particle temperature are calculated. Parameters are measured by Kharkov incoherent scatter radar (ISR) adequately represent the European region ionosphere and can advantageously can add results obtained in other regions, particularly in Northern-American. It connected with absence of ionosphere spherical symmetry because of geodetic and geomagnetic pole discrepancy and situation of mid-latitude ISR for the most part in USA. As existing ionospheric and thermospheric models are creating using radar data obtained in other regions it is worth to use Kharkov ISR data to develop these models. In report the results of comparison F-region characteristics with IRI-95 for different seasons and solar activity levels are presented as well as systematic differences taking place. There are differences in night-time electron temperatures and electron concentration ad different solar-geophysical conditions. Calculated neutral particle temperatures and MSIS-86 are compared too. The temperature calculated from experimental data is more than model values about by 100K.

D1-26

AZIMUTHAL ASYMMETRY OF IONOSPHERE REGIONS WITH FLOWING IN AND FLOWING OUT FIELD-ALIGNED CURRENTS DURING THE SUBSTORM EXPANSION PHASE ONSET

V.A. Velichko, R.N. Boroyev, and M.G. Gelberg
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia

The analysis of mid-latitude geomagnetic station data in a moment of the substorm expansion phase onset has been carried out. The longitudinal asymmetry of the regions with flowing in and flowing out field-aligned currents in the substorm current wedge has been found which depends on the IMF By-component sign. At By<0 the longitudinal size of a band of currents flowing into the ionosphere in the Birkeland's loop is larger, and at By>0 it is smaller than for the region of flowing out currents of the ionosphere. Probably, the observed azimuthal asymmetry of the regions with flowing in and flowing out field aligned currents is associated with the longitudinal shift of the substorm center in the ionosphere.

D1-27

E-LAYER PEAK HEIGHT VARIATIONS DURING GEOMAGNETIC DISTURBANCES

T.G. Zhivolup
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

According to Kharkov incoherent scatter radar data the E-layer peak height increasing by 2–3 km during geomagnetic disturbances was observed.

The theoretical explanation of this effect was made by utilizing the oscillation-excited ion O_2^+ theory.[1]

Using the diffusion equation for each atmospheric component of the Jacchia-71 model and equation obtained in Ref. 2 for determining the peak height of the oscillation-excited ions $O_2^+(h_m)$ the equation which relates the atmospheric temperature gradient to its density and is the equation for calculation of h_m was obtained.

Using the density profiles $\rho(h)$ which were calculated according to the modified Jacchia-71 models for summer, winter and equinox seasons and atmospheric temperature change with height according to the Jacchia-71 model the magnitude of the h_m change (the E-layer peak height is located close to h_m) was calculated. For different seasons in the midday time with atmospheric density increasing at 1.5 times and atmospheric temperature increasing at 1.25 times the height h_m (and consequently the E-layer peak height) were increasing by 2.3–2.4 km. These theoretical results are in good agreement with the Kharkov incoherent scatter radar measurement data.

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D1-28

IMF INFLUENCE ON THE IONOSPHERE FMIN PARAMETER VARIATIONS

E.K. Zikrach and L.D. Filippov
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
zikrach@ikfia.ysn.ru

By data of Yakutian longitudinal stations (Tixie, Yakutsk, Zhigansk) chain from 1985 to 1993 the investigation on fmin parameter dependence with sector structure IMF sign has been carried. It is indicated that influence of sector structure IMF on season variations of fmin parameter for Tixie and Zhigansk stations is shown only for midnight. By data of Yakutsk station that influence is not detected. Results are discussed.

D1-29

SIMULTANEOUS OBSERVATIONS OF NARROW TROUGHS OF IONIZATION IN BOTH HEMISPHERES

L.V. Shestakova, E.K. Zikrach, and A.E. Stepanov
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
zikrach@ikfia.ysn.ru

By data "Kosmos-900" satellite analyze of dynamic and parameters of ionization narrow troughs on conjugated regions of north and south hemispheres has been carried out. Most probability of occurrence of ionization narrow troughs on both hemispheres is observed for magnetic disturbance time. Synchronous changes of these troughs parameters were noted. The results are discussed.

D1-30

ELECTRIC FIELD GENERATION IN THE PLASMA SHEET

V.V. Denisenko and A.V. Kitaev
Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
denisen@icm.krasn.ru

Results of modelling of the ionospheric electric field that is due to a plasma motion in the plasma sheet are presented. The plasma sheet is approximated by a thin electrically conducting layer that moves at the equatorial plane of the magnetotail across the magnetic field lines. The model of plasma flow in the plasma sheet is based on the average data obtained from ISEE-3 observations. We combined the model of the magnetospheric magnetic field, the model of the diffusive magnetopause, and the model of the ionospheric conducting layer to calculate the electric potential at the magnetopause, in the plasma sheet, and in the ionosphere.

The obtained electric potential distribution in the ionosphere is similar to that known from observations. The positive and negative peaks of electric potential located at dawn and dusk sides of the auroral oval correspond to the same peaks in the far plasma sheet at distance of about 150 Re where the plasma flow of high velocity is observed. The calculated potential drop across the polar cap is equal to 100 kV that is twice greater then the observed magnitude. This confirms an assumption that a resistance to the field-aligned currents in the magnetosphere should be taken into account.

D1-31

PROPAGATION OF SLOW MHD WAVES ALONG THE DIPOLE MAGNETIC TUBES

N.V. Erkaev and V.A. Shaidurov

Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
erkaev@icm.krasn.ru

Variations of plasma pressure in a magnetic flux tube can produce MHD waves evolving into shocks. In the case of low plasma beta, the plasma pressure pulses in the magnetic flux tube generates MHD slow shocks propagating along the tube. In the case of converging magnetic field lines, like in a dipole magnetic field, the cross section of a magnetic flux tube decreases enormously with increasing magnetic field strength. In such a case, the propagation of MHD waves along the magnetic flux tubes is rather different from that in the case of uniform magnetic field. The propagation of MHD slow shocks is studied numerically using ideal MHD equations in an approximation suitable for a thin magnetic flux tube. In this approximation, the total pressure (sum of magnetic and plasma pressures), is a known function of the distance along the tube. Numerical method used for calculations is based on a conservative finite difference numerical scheme in material coordinates. The result obtained in the numerical study show that the intensity of the slow shock increases very much while the shock is propagating along the narrowing magnetic flux tube towards a region of a strong magnetic field.

D1-32

INFLUENCE OF CURVATURE AND THICKNESS OF MAGNETOPAUSE ON ITS INSTABILITY

I.L. Archoukova and N.V. Erkaev

Institute of Computational Modelling SB RAS, Krasnoyarsk, Russia
erkaev@icm.krasn.ru

Magnetospheric boundary (magnetopause) flowed by solar wind plasma is considered to be a thin layer with constant thickness and curvature radius. The plasma parameters and the magnetic field are assumed to obey the ideal incompressible magnetohydrodynamics. A Fourier analysis is used to calculate small perturbations of magnetic field and plasma parameters near the magnetopause in a linear approximation. The instability growth rate is obtained as a function of the magnetopause thickness, curvature radius, velocity and magnetic field vectors given on the both sides of the magnetopause. The resulting instability is a combination of interchange and Kelvin-Helmholtz instabilities of the magnetospheric boundary. For a fixed plasma velocity, the instability is the strongest in a case of anti-parallel magnetic fields at the magnetopause. The instability decreases if the magnetosheath magnetic field deviates from the direction anti-parallel to the geomagnetic field. Instability growth rate is an increasing function of plasma velocity component perpendicular to the magnetic field. On the other hand, plasma flow along the magnetic field diminishes the instability growth rate. For zero plasma velocity, the instability growth rate is positive only within a relatively small angle interval for the deviation of the magnetosheath magnetic field from the anti-geomagnetic direction. This angle interval depends on the curvature radius and inner structure of the magnetopause.

D1-33

INVESTIGATION OF RESPONSE FUNCTION OF EARTH RADIATION BELT ON THE LARGE-SCALE INCREASE OF SOLAR WIND

I.V. Koshlyak

Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
space_f@mail.ru

It is known that outside radiation belt of Earth (ORBE) reacts to large-scale solar wind increase one and the same way. It lets to hope for possibility of determination and investigation of function response of outside magnetosphere to influence solar wind isolated large-scale influences. Knowing of response function will let, from the scientific viewpoint, to understand the nature of dynamic of sources and particle streams better ORBE. With this goal excepts of precipitation of energetic electrons ORBE (to 2 MeV) from materials of satellite GOES (period from 1986 to 1995) has been done. These events have been compared with data of solar wind (recurrent streams), and with data Kp and Dst indexes during the same period. Special dependence in quantity of intensity of precipitated electrons from Kp and Dst indexes has been found.

Session D2. INHOMOGENEOUS STRUCTURE OF IONOSPHERE

D2-01

RESPONSE OF THE IONOSPHERE TO SMALL AND LARGE SOLAR FLARES AS DEDUCED USING DATA FROM THE GLOBAL GPS NETWORK

E.L. Afraimovich, A.T. Altynsev, V.V. Grechnev, and I.A. Leonovich
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
lal@iszf.irk.ru,

Presented are the results derived from analyzing the response of the ionosphere to small and large solar flares. The analysis used technology of a global detection of ionospheric effects from solar flares (GLOBDET), on the basis of phase measurements of the total electron content (TEC) in the ionosphere using an international GPS network. The essence of the method is that use is made of appropriate filtering and a coherent processing of variations in total electron content (TEC) in the ionosphere which is determined from GPS data, simultaneously for the entire set of visible (over a given time interval) GPS satellites at all stations used in the analysis. This technique makes it possible to detect the response of the ionosphere to relatively small solar flares (of the order of 10^{-7} W/m^2 in the range of X-rays: 0.5–4 Angstrom when the response amplitude on separate beams is below the level of background fluctuations. For large solar flares, the response amplitude of the total electron content in the ionosphere depends on the flare location on the Sun.

D2-02

AIRGLOW CHARACTERISTICS OF ARTIFICIAL FEATURES AT THE TWILIGHT TIME AT UPPER-ATMOSPHERIC HEIGHTS

G.S. Kudryashev and V.G. Kovtunenko
Irkutsk Military Aviation Engineering Institute, Irkutsk, Russia
avt@iszf.irk.ru

A gaseous mixture of pyrotechnic composition was injected at 140 km altitude in the AF-10 experiment on September 18, 1985, within the program on "Active Experiments, and Anthropogenic Effects in the Ionosphere". The objective of the experiment was to measure airglow spectra of artificial features (AF) carrying important information about the AF evolution, the degree of excitation of the AF components, and about their interaction with the ionosphere. This experiment was distinguished by the fact that the cloud was created in the evening twilight near the boundary of the illuminated ionosphere. The active experiment revealed a significant decrease in the AF airglow brightness 0.5–0.6 s after the injection. In the visible range, the cloud represents a dark region about 1 km in diameter, with a small bright central core, and a weak airglow crescent at the boundary of the illuminated zone. This effect is explained as resulting from a cooling of combustion products as they escape into the ionosphere. To explain the airglow time of 0.5–0.6 s, it is suggested that, in addition to the injected mixture cooling factor, a substantial role is played by the AF evolution dynamics. In this paper it is shown that the 0.5–0.6 s time interval is a typical time of transition from the initial continual expansion phase of the gaseous cloud to the transition phase of free-molecular flow.

D2-03

OBSERVATION OF POWERFUL COHERENT ECHOES DURING JULY 15–16, 2000 MAJOR GEOMAGNETIC STORM

O.I. Berngardt, G.A. Zherebtsov, A.P. Potekhin, and B.G. Shpynev
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

High Solar activity at July 2000 leaded to powerful affection of solar wind particles on magnetosphere and ionosphere. It manifested as set of geomagnetic disturbances during July 13–16. In the time of highest disturbances when electric field in ionosphere exceed threshold 30 mV/m, conditions are created for two-stream instability generation.

These instabilities produce strong electron density fluctuations, which are registered by radar as coherent echoes. The power of the echoes is very sensitive to beam position geometry. Angle to magnetic field lines must be very close to perpendicular. In this paper we consider the condition of existing of such instability, and spatial region where good condition of echoes observation exist for Irkutsk IS Radar. Some examples of July 14–15, 2000 echoes are analyzed.

One of the most interesting effects, well shown in experimental data, is the modulation of echoes power with period of 15–20 minutes. This period differ from usual geomagnetic pulsation. Using the data from GPS satellite suggest global feature of the pulsation. Their period changes in different phase of the storm, that probably caused by changing magnetosphere-ionosphere structure.

D2-04
ON KINETIC THEORY OF THE ION-ACOUSTIC INSTABILITY IN THE IONOSPHERIC E-REGION

Yu.A. Sukovatov
Department of Physics, Altai State University, Barnaul, Russia
komarov@phys.dcn-asu.ru

It is well-known that different types of coherent radar backscattering from the ionospheric E-region are caused by the presence of plasma irregularities. At the E-region heights these irregularities in general are caused by the plasma instabilities. At present time type I events (phase velocity near the ion-acoustic velocity) are associated with the Farley-Buneman instability. The main problem in this interpretation is that observations show that the phase velocities of type I events are close to the ion-acoustic velocity while from the theory of the FBI it follows that these velocities should be close the electron drift velocity.

Some theories were proposed to explain transformation of dispersion equation of the Farley-Buneman waves to the dispersion equation for the ion sound.

In this paper another approach to the problem is considered. We consider another instability of the E-region plasma – the ion-acoustic instability, which can directly generate the ion-acoustic waves.

Dynamics of electrons is described in the quasihydrodynamical approximation, the ions are described by kinetic equation. The dispersion equation, the growth rate, and the decrement of Landau damping are calculated. We discuss the correspondence of the proposed theory to the observations of the type I events.

D2-05
ANNUAL AND INTERANNUAL CHANGES OF PARAMETERS SPORADIC E-REGION OF IONOSPHERE ABOVE EAST SIBERIA AND NORTHEAST OF RUSSIA

A.V. Vinitskii,[1] V.V. Kazantseva,[1] V.F. Petrukhin,[2] E.A. Ponomarev,[2] and N.A. Sutyrin[2]
[1]*Institute of Space Researches and Radio Wave Propagation, Paratunka, Kamchatka, Russia*
root@ikir.lrus.kamchatka.su
[2]*Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia*
nasut@iszf.irk.ru

The analysis of the data about a sporadic E-layer of an ionosphere for 1979–1989 is conducted on observations of observatories of Irkutsk and Magadan. The features of annual variations of the altitude, frequency, probability characteristics E_s in midday of local time, and also their change from one year by one year happen concordantly in both items of observation. The new mechanism of derivation of a sporadic stratum of an ionosphere in outcome counter driving of ionospheric plasma by means of vertical convergence of streams of neutral gas is justified. The quality standard of this output is conducted. The heights of observation Es and layout of maximum vertical lapse rates of a meridian wind are compared.

D2-06
ANOMALOUS STATE OF THE UPPER ATMOSPHERE IN 1984–1985

A.V. Vinitskii,[1] V.V. Kazantseva,[1] V.D. Kokourov,[2] V.F. Petrukhin,[2] and N.A. Sutyrin[2]
[1]*Institute of Space Researches and Radio Wave Propagation, Paratunka, Kamchatka, Russia*
root@ikir.lrus.kamchatka.su
[2]*Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia*
nasut@iszf.irk.ru

The anomalous state of the upper atmospheric layers, recorded by ground-based observing facilities in 1984–85, is analyzed and discussed.

It is found that, following a strong geomagnetic disturbances in October 1984, the minimum effective heights of the F2 layer (h'F2) decreased by 15–20 km; the effective heights (h'E_s) of a sporadic stratum E_s have decreased on

15–20 km, this period showed also a long-lasting velocity reversal of the prevailing wind zonal component, and an increase of the velocity of the meridian component of the prevailing wind in the lower ionosphere.

An analysis of the ionospheric data from stations Irkutsk (104°27'E, 52°10'N) and Magadan (151°01'E, 60°07'N) spanning the time interval from October 1984 to August 1985, suggests the electron density height distribution in the E and F region did not change its form substantially, but there occurred the above-mentioned shift in height.

The observed wind regime variations are also explicable in terms of the fact that for the concerned period, information about the dynamic regime that is obtained by the radio method, was derived for the height range with a different circulation regime.

Some likely mechanisms responsible for the anomalous state of the upper atmosphere are discussed.

D2-07

ANALYSIS OF STABILITY OF TOPSIDE IONOSPHERE PLASMA

M.V. Tolstikov and V.B. Ivanov
Irkutsk State University, Irkutsk, Russia
ivb@ivb.baikal.ru

Stability of the topside ionosphere plasma with respect to the evolution of initial perturbations of concentration has been investigated theoretically. In contradistinction to the publication[1] where the preliminary results of such investigation have been found using the numerical methods the presented data have been obtained based on the approximated analytical solution of the equations describing the dynamics of perturbations of plasma density. The analysis has been carried out based on the method of dispersion equation of investigation of plasma stability and using the approximation of geometrical optics to consider the propagation of quasi-wave perturbations. Such approaches allow us to reveal a physical reason of the instability owing to the divergence of the vertical velocity of background plasma. Moreover, the conditions for which the considered phenomenon can occur: the night ionosphere of the middle and temperately high latitudes at the altitudes which are more then 500 km have been determined. Exactly in this case the velocity divergence has a necessary sign. Instability must be revealed as the area of intensified fluctuations of the plasma concentration with typical vertical scales of the order of tens kilometers and typical times of the order of tens seconds.

1. V.B.Ivanov and V.M.Polyakov, Evolution of wave perturbations in the upper ionosphere. Part II. Izvestiya VUZov, Radiofizika, **41**, No. 9, 1086 (1998).

D2-08

INHOMOGENEOUS STRUCTURE OF THE HIGH-LATITUDE IONOSPHERE AS OBSERVED AT NORILSK

Yu.V. Lipko
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
lipko@iszf.irk.ru

In March and August-September 1995, February 1996, and in March-April 1998, observations of the inhomogeneous structure of the high-latitude ionosphere were carried out at Norilsk (geomagnetic latitude and longitude are 64.2 and 160.4, and $L = 5.3$).

Small-scale irregularities (with the lifetime of several seconds, and the spatial scale less than 5–7 km), and medium-size wave irregularities (with the period of 10–50 min, and the horizontal size of tens and hundreds of kilometers) of the ionospheric F layer were investigated under different geophysical conditions. A total of 300 hours of observations was recorded, including 250 reflections from the F2 layer, and the other reflections from the sporadic E layer.

The following results were obtained:

1. The propagation directions and velocities of small- and medium-scale irregularities are different. Medium-scale irregularities travel predominantly in a southward direction with velocities of 40–100 m/s. The prevailing direction of small-scale irregularities is eastward and westward,, and their velocities lie in the range of from 100 to 200 m/s.

2. For the Norilsk region, for each season we obtained a diurnal variation of averaged parameters of ionospheric irregularities of the frequency; Doppler shift; of the width of the Doppler spectrum; propagation directions and velocities of medium-scale wave irregularities; of the zenith angle; and of the anisotropy and lifetime of small-scale irregularities.

3. A dependence of medium-scale irregularity parameters on geomagnetic activity was obtained. Auroral activity has a significant effect on the frequency Doppler shift, the width of the Doppler spectrum, the zenith angle, and on the propagation velocity of medium-scale irregularities.

4. The conclusions drawn on the basis of the observations from the 1970s that auroral activity influences the drift of small-scale ionospheric irregularities, specifically the 1.5–2-fold increase of the velocity during the substorm, were confirmed.

D2-09

VARIATION OF SPECTRUM OF IONOSPHERIC INHOMOGENEITIES DURING SOLAR ECLIPSE

I.N. Poddelsky
Institute of Cosmophysical Researches and Radio Wave Propagation FEB RAS, Stecolny, Magadan, Russia
uaoibt@mailru.com

In this investigation here are given the evidences of satellite's radio signal scintillations during the solar eclipse, March 18, 1988. The solar eclipse began at 12.58 and terminated at 14.53, local time. At the point of observation the Sun's disk was registered to be covered up to 47%.

Study of fluctuations spectrum of satellite's radio signal during solar eclipse shows that law of decrease of spectral density close to sedate with the index of degree changing from 2.5 (before the eclipse) to 4–5 (in the initial phase) with the separation of maximum of spectrum in the field of scales 4–5 km. On the measure of increasing an area of closing a disk of Sun occurs a reduction of factor degrees with simultaneous "erosion" of maximum and increase "broken" spectrum. Through certain time after solar eclipse (order several hours) is installed a regular average daily type of spectrum typical for a given time of the day and value of geomagnetic activity.

Thereby possible to expect that on heights of layer F2 at a period of the solar eclipse it is come up for the initial phase and disappeared (after the maximum phase) additional lumpy structures (with scales of units and groups of ten of kilometres) which have the time of life 15–20 minutes.

Data of study give the basis to consider that changing an electronic concentration during solar eclipse is stipulate not only by reducing of processes ionisation, as well as by variations of concentrations of main molecular component, but in the same way changing a dynamic mode of ionosphere. Besides, in the ionosphere during solar eclipse are to appear acoustics-gravitational waves in analogy with motion of solar terminator. Appearance of these waves is accompanied by transferring disturbances of ionosphere, that is become in fluctuations of ionosphere layers height and in arising of the small-scale's inhomogeneities.

D2-10

COMPARISON OF THE DATA FROM THE IRKUTSK INCOHERENT SCATTER RADAR WITH INTERNATIONAL IONOSPHERIC MODEL IRI-95

A.P. Potekhin, O.I. Berngardt, A.V. Zavorin, B.G. Shpynev, and A.V. Tashilin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

Beginning with year 1997 reliable ionosphere parameters measurements carried out by Irkutsk's Incoherent Scatter Radar according the World Day IS program. Received data are new for practice of ionospheric observation in East-Siberian sector, so it was a good opportunity to make comparison of derived ionospheric parameter with the same one from International Reference Ionosphere model (IRI-95). For this analysis we use data, measured during quiet magnetic condition ($K_p < 4$) of years 1997–2000. All experimental data were averaged over one hour interval to exclude small-scale irregularity from analyses. Altitude interval was chosen from 200 to 500 km. Comparison was made for equinox and solstice periods.

Results of comparison for spring, summer, and autumn seasons give good qualitative and quantitative agreement between IRI-95 and experiment both for electron density N_e, electron T_e and ion T_i temperatures in chosen altitude interval. Maximum disagreement was 10–20% for temperatures and 25–30% for density. Analysis of these deviations shows, that the main reason of IRI-95 disagreement is incorrect modeling of electron density dynamic.

The more significant disagreement observed during winter solstice when electron density difference was more then 50% and temperature disagreement was more then 30%. It appears basically due to forming at mid latitude winter ionosphere the night N_e maximum, which caused by interaction of conjugate ionosphere heating flow and local neutral wind. In the paper, mechanism of creation of such effect is described. The analysis shows that for advancing IRI-95 model some correction have to be made to increase its accuracy.

D2-11

INFLUENCE OF THE DYNAMIC ATMOSPHERE CONDITIONS ON ABSORPTION AND REFLECTION OF RADIOWAVES AND ON PROBABILITY OF OBSERVATIONS OF THE E-LAYER SPORADIC IONOSPHERE

V.F. Petrukhin, E.A. Ponomarev, and N.A. Sutyrin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

The outcomes of the analysis of the data of ionospheric exploration represented on a sporadic E-layer above Irkutsk for period 1960–96. Is shown, that the absolute probability of observations of separate types of sporadic E-layer (for example, type "with") at particular clocks of summer can reach 100 %. It testifies, on the one hand, to the particular mechanism of generation of discontinuities of an electron concentration, with another – about ideal conditions of distribution and reflection of radiowaves in this period. Is shown, that the dependences of probabilities of observation E sporadic from heights of their derivation and frequencies of exploration have the seasonal legitimacies, which are defined not only dynamic characteristics of area of heights of derivation E sporadic, but also physical properties (Fresnel zone, electron concentration of the environment and its discontinuities).

D2-12

SEASONAL VARIABILITY OF DIURNAL VARIATIONS OF PROBABILITIES OBSERVATIONS OF A SPORADIC E-LAYERS OF AN IONOSPHERE ABOVE EAST SIBERIA IN A DEPENDENCE OF THE SOUNDING FREQUENCY

V.F. Petrukhin, E.A. Ponomarev, and N.A. Sutyrin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

The outcomes of the analysis of the data of ionospheric sounding on a sporadic E-layer of an ionosphere above Irkutsk for 1960–96 are reduced. Geographical coordinates of the item of measurements – (52.47 N, 104.03 E), geomagnetic coordinates – (41.06 N, 174.75 E). Three seasons subjected to the analysis: winter (November – February), summer (May – August), autumn–spring (March, April, September, October). Is shown, that the diurnal variations of probabilities of observation of a sporadic E-layers experience at the sounding frequency dependence. It is a corollary, on the one hand, of immediate solar control (absorption, change of an electron concentration, terminator), with another – outcome of operation of the geophysical factors, which influence creation of parameters of discontinuities of an electron concentration and, therefore, on the sounding frequency. In a frequency dependence of exploration the diurnal variations E of a sporadic type "c" can be approximated by one or two parabolic functions. The parameters of these functions depend on a zenith angle of the Sun. For a sporadic stratum of a type "l" of probability of observation within day have more composite character, as apart from diurnal change of a zenith angle of the Sun on them the strong influence renders the morning and evening terminator.

Session D3. METHODS FOR REMOTE SENSING OF IONOSPHERE AND THERMOSPHERE

D3-01

RADIOTOMOGRAPHY OF IONOSPHERE AND ATMOSPHERE

V.E. Kunitsin[1] and E.D. Tereshchenko[2]
[1]Moscow State University, Moscow, Russia
vek@esa.phys.msu.su
[2]Polar Geophysics Institute, Murmansk, Russia

Modern satellite systems and technique of radiosonde observation give a possibility to determine the integrals over beams from the refractive index of the ionosphere and atmosphere. Motion of a transmitter on a satellite and a set of receivers on Earth allow us to obtain the series of tomography data. The last years the different tomography methods allowing us to reconstruct a spatial structure of physical media are developed intensively: the distributions of electronic concentration and density of neutrals during the radiosonde observation of the ionosphere and magnetosphere; the distributions of temperature, density, pressure, and humidity during the radiosonde observation of the atmosphere etc. Investigations by the method of satellite radiotomography (RT) which are carried out the last years are discussed in the paper. Numerous experiments have been carried out in Europe, America, and Asia jointly with the members of a set of foreign universities and research centers. Corresponding navigation systems have been used as the sources of radiosonde observation.

Developed tomography methods allowed us both to investigate the well-known ionosphere structures and to find a set of new ones (quasi-wave structures, inclined dip of ionization, fingerwise structures, localized inhomogeneities and others). RT investigations of the ionization dip whose formation is connected with magnetosphere-ionosphere interaction have given an information on variations of its shape. Reconstructions of different stages of formation of the dip and the quasi-wave structures accompanying to this process have been obtained. RT reconstructions of the moving ionosphere disturbances have given an information on the parameters of disturbances and have allowed us to investigate the atmosphere-ionosphere interactions. RT investigations of a structure and dynamics of the equatorial anomaly have been carried out.

RT investigations of strong disturbances of the ionosphere caused by the anthropogeneous factors, in particular, the perturbations caused by the rocket starts, industrial explosions, and power short-wavelength radiation have been carried out. Experiments to study the nonlinear interaction with the auroral ionosphere of the power radiowaves from the heating stand in Troms have given an information on both the large-scale disturbances of the background ionosphere and the small-scale structure of "spot" in area of the heating up. RT sections of disturbances of the upper atmosphere which are connected with the industrial explosions at the surface of Earth have been obtained. Several events reflecting an interaction of geospheres have been recorded.

Variants of the tomography investigations using different sources of sounding on the base of both the existing satellite systems and the possible specialized satellites have been considered. General questions of the tomography monitoring of near-earth medium, different schemes of tomography sounding, problems of the uniqueness, and limitations and accuracy of tomography reconstructions have been considered. Prospects of the creation of tomography systems for the regional and global monitoring of the near-earth medium are discussed.

D3-02

DIAGNOSTICS OF IONOSPHERE INHOMOGENEITIES BY THE METHOD OF VERTICAL DOPPLER SOUNDING: NUMERICAL EXPERIMENT

A.V. Barabanov and V.B. Ivanov
Irkutsk State University, Irkutsk, Russia
ivb@ivb.baikal.ru

Technique to research an inhomogeneous structure of the ionosphere with the vertical Doppler sounding has been proposed in Ref. 1. The proposed calculation formula has been obtained using certain simplifying assumptions such as the ignoring of horizontal deviations of the radiowave propagation path and the ignoring of the vertical

displacements of reflection point in the presence of random inhomogeneities of the plasma concentration. It is impossible practically to analyze the validity of such simplifications by some analytical methods. In this connection, it has made an attempt to perform such analysis based on the mathematical simulation of radiowave propagation in a medium with random inhomogeneities of the refractive index. In the approximation of geometry optics the fluctuations of phase of radiosignal reflected by the ionosphere have been calculated. Exactly these characteristics can be obtained in nature experiment of the vertical Doppler sounding. Possibilities of the proposed diagnostics have been estimated in the numerical experiment. Quantitative characteristics of random inhomogeneities, for which the calculation formula gives satisfactory results, have been determined.

1. N.T. Afanas'ev and V.B. Ivanov, On a possibility to diagnose ionosphere inhomogeneities by the method of vertical Doppler sounding. International conference "Physics of ionosphere and atmosphere of Earth". Abstracts. Irkutsk, 12 (1998).

D3-03

RECONSTRUCTING OF HIGH-ALTITUDE PROFILE OF ELECTRON CONCENTRATION IN IONOSPHERE WITH USING SIGNALS OF SATELLITE RADIONAVIGATIONAL SYSTEMS

D.A. Rizshkov and V.V. Chernuhov
Irkutsk Military Aviation Institute, Irkutsk, Russia
afra@iszf.irk.ru

A technique is proposed for reconstructing of parameters space-time distributions of electronic concentration in ionosphere, based on a parametrization of the solution of system of integral equations connecting measured delays of navigational satellites signals to distribution of electronic concentration along beams «navigational satellite–receiver» for a network of two-frequency receivers GPS.

Results obtained are compared with Millstone-Hill incoherent scatter radar data.

Estimating the accuracy of electron density reconstructing through a comparison of the results obtained with experimental measurements of electron density, it was shown that for all of the time intervals under consideration the mean deviation of the reconstructed values from measurements did not exceed 11.9% for N_m, and 22.7%, for z_m, and the standard deviation was 7.1% and 5.2%, respectively.

The proposed method can be used to maintain the operation of HF communication and detection and ranging systems, space target tracking radars, satellite navigation and geodesy facilities, and of a number of other radio engineering systems.

D3-04

METHODS FOR DESCRIBING OUTPUT SIGNALS OF THE CHIRP-SONDE

M.A. Davydenko, O.I. Berngardt, N.V. Ilyin, S.Ya. Mikhailov, and V.E. Nosov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
nosov@iszf.irk.ru

The effectiveness of the various radio engineering systems operating in the decametric range is determined in many respects by space-time variations the ionospheric channel of characteristics; investigations of these variations make wide use of pulsed ionosondes which have relatively simple implementation but not optimal in regard to their noise immunity and resolving power. To obtain high quality information in modern practice of exploiting ionospheric channel requires a significant increase of the radiation power of the ionosonde, which is extremely undesirable and, in many cases, unfeasible. For that reason, ionospheric research has recently witnessed the introduction of optimal signal reception and processing methods. Specifically, ionospheric research is now leaning heavily on ionosondes, in which signal processing procedures are based on the principle of frequency compression. Such ionosondes has received the name chirp-ionosondes. A large number of publications is devoted to the description of the operation of such ionosondes. An analysis of such publications showed that some of them do not give any strict proof, and some of the results are in conflict with each other.

This paper gives a detailed analysis of the various procedures for describing signals at the chirp-ionosonde output, presents results of their experimental verification, proposes a new method of description, and offers recommendations for the selection of the description procedure in regard to practical tasks and for the selection of the main parameters of the sonde.

D3-05

USE OF METHODS OF INTEGRAL REPRESENTATION FOR FIELD MOMENTS IN PROBLEMS OF TOMOGRAPHIC DIAGNOSTICS OF EARTH'S TROPOSPHERE AND IONOSPHERE

A.V. Kulizhsky, S.N. Kolesnik, and M.V. Tinin
Irkutsk State University, Irkutsk, Russia
vmt@api.isu.runnet.ru

At present, in connection with a rapid advancement of the GPS satellite network, there emerged additional opportunities to investigate the spatial-temporal structure of the Earth's atmosphere. Very promising, in our opinion, are the data on amplitude fluctuations of radio signals emitted by the GPS satellites. A relative simplicity and precision of the measuring equipment, combined with a physical interrelation between amplitude fluctuations and the inhomogeneous structure of the atmosphere, render these data a valuable source of information about the spatial-temporal behavior of the small-scale component of dielectric permittivity of the atmosphere.

In this connection, of high current importance remains the problem of obtaining straightforward formulas for the fourth moment of the field of the wave propagating in a medium with inhomogeneities. Using rigorous methods and approaches to solving problems of this kind is made difficult by the unwieldy character of results obtained. At the same time, by using asymptotic formulas, it will be possible to employ (with a certain impairment of the accuracy of resulting formulas) numerical algorithms, which are convenient for a rapid processing of experimental data.

This paper proposes to use the method of mixed integral representations in order to obtain asymptotic expressions of the fourth moment of the field of the wave propagating in a small-scale medium. Such an approach will make it possible to take into account, in a unified manner, the influence of the large-scale and small-scale components of the inhomogeneous structure of the atmosphere on intensity fluctuations.

Further, the paper discusses the possibility of using results obtained in problems of diffraction tomography of the upper and lower layers of the Earth's atmosphere by employing GPS data on amplitude fluctuations of radio signals.

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D3-06

LOW-LATITUDE IONOSPHERE DIAGNOSTIC USING IONOGRAM OF TRANSEQUATORIAL HF PROPAGATION

V.I. Kurkin,[1] G.V. Kotovich,[1] S.N.Ponomarchuk,[1] S.J. Anderson,[2] and B.D. Ward[2]
[1]Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
kurkin@iszf.irk.ru
[2]Defence Science Technology Organization, Australia

Low-latitude ionosphere is characterized by complex and dynamical structure. A diagnostics opportunity of large-scale irregularities changes for low-latitude ionosphere using oblique-incidence sounding ionogram on transequatorial path Alice Springs (Australia) – Irkutsk is discussed in this paper. The experiments in March 1996 and in August 1998 are analyzed. Last period includes a solar eclipse of August 22, 1998 near to equator. Using results of numerical modeling, the interpretation of oblique-incidence sounding ionogram was carried out. The interrelation of changes recorded ionogram due change of low-latitude ionosphere is established both in time disturbance similar a solar eclipse and at day-to-day ionospheric variations. The occurrence of additional signals with the minimal delays at night and morning hours is caused by presence of a sporadic E-layer along a propagation path. Change of ionospheric F-layer near to equator such as a stratification or the reduction of ionization in crests of equatorial anomaly results in occurrence of additional signals, which delay lays between 3F and 4F modes. The received results open new diagnostic opportunities for regions of Asian – Pacific longitudinal sector poorly equipped with ground facilities.

D3-07

RECONSTRUCTION OF E-LAYER ELECTRON DENCITY PROFILE FROM FARADAY MEASUREMENT AT IRKUTSK IS RADAR

B.G. Shpynev
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

Electron density profile derivation carried out on Irkutsk IS Radar using Faraday rotation measurement by linearly polarized antenna. Low altitude limit of measurements is 165 km due to ground clutters, so it is impossible to make direct measurements in E layer region. To get indirect estimates of E layer electron density, a new method is proposed, using the determined feature of Faraday rotation. It means that value of Faraday phase from ground to low

experiment limit gives information about total electron content in this interval. Using this idea, the algorithm was developed to derive electron density in low ionosphere. For calculation we use E layer model as Chapman layer with altitude of maximum at 110 km and half thick of 15 km.

For testing the algorithm, we use experimental data during major geomagnetic storm on July 15–16, 2000. Results of calculation show good qualitative agreement of E layer parameters with the data of Asian ionosonde, which observed global shielding of signal from F region. Electron density profiles at Irkutsk also have shape, typical for polar ionosphere with major E layer. This method was also implemented to other ionospheric data and manifested as good one for qualitative analyses low ionosphere dynamic.

Method may be significantly developed if we will use in the model real critical frequency of E maximum and its altitude from ionosonde data, which can be simply derived from vertical sounding ionogram.

D3-08

MF RADAR SOUNDING OF THE POLAR MESOSPHERE IN SUMMER 1999

V.D. Tereshchenko, E.B. Vasiliev, S.M. Chernyakov, M.V. Yakimov, N.A. Ovtchinnikov, V.A. Tereshchenko, and A.M. Tarichenko
Polar Geophysical Institute KSC RAS, Murmansk, Russia
vladter@pgi.ru

MF radar observations of mesospheric backscatter were carried out during summer 1999 at Tumannyi (69.0°N, 35.7°E) using the PGI radar of vertical radiation. The MF radar was operated with peak power of ~ 100 kW, a frequency – 2.72 MHz, a time resolution of 1 s, and a range resolution of 2.25 km. The antenna array consisted of 32 (4×8) extended range cross-vibrators with a rotating field polarization and was suitable for transmission and reception of radiowaves. The beam width – 19° (north-east) and 30° (north-west).

The observations indicated the presence of intensive radioreflections from mesospheric layers at the altitude range of 74–99 km. Usually, these reflections look like as 2 or 3 of distinct layers, which located at heights 74–82, 82–89 and 89–99 km. The features of MF radioreflections from altitudes between 82–89 km are very similar to VHF radar measurements of Polar Mesospheric Summer Echoes (PMSE). The distinctive feature of these observations was a registration of the sharp gradients of electron density at the same heights, where reflections were more intensive.

An analyse of digital ionograms in Loparskaya (68.6°N, 33.3°E) have shown that intensive sporadic E-layers are observed during strong MF radar returns appearance from the mesopause region.

D3-09

SOLAR-TERRESTRIAL OPTICS AS AN INFORMATION BASIS FOR MODELLING AND FORECASTING OF THE IONOSPHERIC AND SPACE WEATHER

S.V. Avakyan
Federal Research Center "Vavilov State Optical Institute", St.Petersburg, Russia
avak@soi.spb.su

Radio observations of the solar activity have shown themselves very limited in presenting the real character of solar activity variations. The main point is that they don't provide any opportunity for the quantitative evaluation of the flare activity of Sun. The actual information can be obtained only from the optical observations of the solar disk (including sunspots) and also from the X-ray images of the Sun provided during the recent years by the SOHO mission. However all these observations have to be supplemented with the direct measurements of the ionizing flux in X-ray and extreme ultraviolet spectral range under 134 nm which is the most geo-effective.

Till present the permanent space monitoring of this radiation is fulfilled performed only at the edges of this spectral range and the main part of the ionizing spectrum of Sun – from 0.8 nm to 115 (119) nm is not observed though this is the spectral range which determines the condition of the diurnal E and F regions.

This paper presents the results of creating[1] and successful testing[2] the optical apparatus for the permanent space patrol of the solar radiation in the full ionizing spectral range as well as the prospects of the patrol realization in Russia. The work is undertaken in the State Optical Institute. The results of the space solar patrol measurements will be used for ionospheric modelling and forecasting. These tasks need presentations and quantitative information associated with the following three points:

– the magnitude and spectral-temporal distribution of particle fluxes which energy either partly or fully dissipate at the atmosphere,

– the processes of interaction of these energetic particles with atmospheric gases,

– the magnitudes of the degree of the ionization and optical excitation of the upper atmosphere and also ion and neutral fragment composition.

The last point is associated with the whole complex of experimental data on the remote sensing and in situ measurements of the upper atmosphere. Obviously the data of these measurements correspond to the current state of the space weather. The optical and especially UV emission of the upper atmosphere often occurs in the resonance or weakly forbidden lines and bands. This gives a unique opportunity to determine the rate of excitation (and often of ion production) directly from the intensity of optical emission. Therefore the measurements of the intensities of the upper atmosphere optical emissions enables to determine the values of exciting and ionizing fluxes. For this purpose it is only necessary to have the information on the probabilities of elementary processes such as ionization and excitation. The paper summarizes the results of creating the data bases on modelling the optical ionospheric and anthropogeneous phenomena in the upper atmosphere of Earth. The data bases was created in the State Optical Institute and published as handbooks.[3,4]

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D3-10

FEATURES OF THE IONOSPHERE PARAMETERS MEASUREMENT BY CORRELATION PROCESSING OF INCOHERENT SCATTER SIGNAL

V.N. Lysenko, A.N. Eryomin, and Yu.V. Cherniak
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

The sounding of the ionosphere by simple radio-frequency pulses with duration 0.8 ms in VHF range allow to obtain incoherent scatter (IS) signal normalized correlation functions (NCF) in the altitude range 200...1500 km and to calculate the ionosphere plasma parameters, such as ion and electron temperature, ion composition and others, with an acceptable statistical error. However at altitudes from 200 to 700 km the height profiles of these parameters will be distorted because of sounding pulse duration influence, scattering cross-section change with height and the different instrumental factors influence.

In the presented report the calculation algorithm of the height profiles NCF is considered. Measured CF of IS signal is subjected to height spline integration according to a particular rule. The obtained values of integrated CF's for different heights are normalized to corresponding powers. For all values of measured CF's the coefficients are calculated at each lag. The calculated coefficients depend on duration of transmitted radio-frequency pulse of IS radar, the shape of the signal power profile, instrumental parameters such as the antenna switch restoring characteristic and others. The coefficients are used for determination of the height profiles of correction coefficients, on that normalized integrated CF are divided. The ionosphere parameters are determined by finding minimum of discrepancy between resulting NCF and covariance functions obtained from theoretical ones. This report presents the results of the checking of the correction algorithm by calculation of the initial NCF height profiles using ionosphere parameters obtained from IRI-95 and results of data processing, obtained by the Kharkov IS radar.

D3-11

INVESTIGATIONS OF THE IRKUTSK INCOHERENT RADAR DIRECTIONAL PATTERN BASED ON RESULTS OF RADIO ASTRONOMICAL OBSERVATIONS

A.V. Medvedev, A.V. Zavorin, V.P. Lebedev, B.I. Lubyshev, and V.E. Nosov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
medvedev@iszf.irk.ru

The Irkutsk incoherent scatter radar is a unique facility in Russia, and is designed for geophysical and radio-probing research on the upper atmosphere. The range of scientific problems tackled with this radar is very broad. Thanks to its huge potential and investigative capabilities, the radar represents an exceptionally sophisticated engineering facility, and a maximum possible knowledge of all its characteristics is necessary for carrying out accurate measurements of space environment parameters, and for scientific experiments. Of particular interest in this respect is the antenna system of the radar. This paper presents the main design features of the antenna, the technique for investigating the directional pattern (DP) from cosmic radio sources, and research results on the DP from the "Cygnus-A" radio source. Examples are given of the typical errors of determining the coordinates of cosmic objects which are caused by inaccurate knowledge of the directivity pattern. The results obtained are useful for a correct selection of the IS radars operating modes, and for assessing its potential for investigating the ecological situation in the space environment.

D3-12

SEPARATION OF OVERLAPPING SIGNALS AT IONOSPHERIC WAVE SOUNDINGS

K.G. Ratovsky and A.V. Medvedev
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
ratovsky@iszf.irk.ru

The problem of separating interfering waves is of interest in different fields employing wave soundings of the medium. To solve this problem, a variety of methods are used: space-diversity reception (separation from the arrival angle), Doppler filtering (separation from the carrier frequency spectrum), as well as the separation of signals over time from the group delay. This paper investigates the interference of impulse signals. The following model of the interference pattern is adopted: the signal to be analyzed represents the sum of two signals, each of which is a replica of the emitted impulse with its own amplitude, phase and delay. By the separation is meant a correct determination of all parameters of the two signals. The proposed method of solving this problem implies determining the values of parameters which ensure a minimum standard deviation between the reflected signal and its model representation. In the absence of noise, the algorithm is useful for separating the impulses with an arbitrarily small overlapping. To verify the validity of the method in the presence of noise, a numerical simulation was carried out. Based on this, we plotted the dependencies of the error of determining the signal parameters on the noise level, and the delay differences of interfering signals. The dependencies were calculated for different relationships of amplitudes and phase differences of the two signals. The simulation made it possible to estimate the resolving power of the technique, and to compare it with other methods of determining overlapping signal parameters. In this paper we investigate the emitted impulses of different forms, and the simulation revealed that the form of the emitted impulse has a substantial influence on the methods resolving power.

D3-13

USE OF OBLIQUE-INCIDENCE IONOSPHERIC SOUNDING DATA TO DETERMINE ITS FINE STRUCTURE

N.T. Afanasiev, A.A. Zhzhenykh, M.K. Ivelskaya, V.I. Sazhin, M.V. Tinin, and V.E. Unuchkov
Irkutsk State University, Irkutsk, Russia
vmt@api.isu.runnet.ru

The fine structure of the ionosphere that is caused by the presence (at a regular background) of random electron density irregularities with spatial scales from a few kilometers to several tens of kilometers, can lead in particular to the excess of maximum observable frequencies (MOF) of communication along the path over maximum usable frequencies (MUF) corresponding to a "smooth" ionosphere. On the basis of solving the inverse problem, information about the excess of the MOF over the MUF can be used to specify the fine structure parameters of the ionosphere.

We have developed a technique for determining the effective parameters of the fine structure with a Gaussian anisotropic spectrum of irregularities occupying the entire ionospheric layer and having the intensity proportional to

background values of electron density. A regular ionosphere is specified by a model updated to current conditions by a set of dedicated techniques using measurements of signal characteristics from an auxiliary arbitrary radio link.

The technique was tested using oblique-incidence sounding data in a system of mid-latitude paths. We explore the possibility of determining, on this basis, the periods of an approximate constancy of the values of the effective parameters of the fine structure, which corresponds to the conditions of their consistent variation.

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D3-14

IDENTIFICATION OF DIRECT ULTRAVIOLET RADIATION IN MEASUREMENTS WITH THE SPECTROPHOTOMETER WITH A WIDE ENTRANCE APERTURE

A.Yu. Shalin and A.V. Mikhalev
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
shalin_a@iszf.irk.ru

The contribution from direct and scattered ultraviolet radiation (295–345 nm) is estimated in measurements with the spectrophotometer with a fixed entrance aperture (~ 32° in the plane measure). It is shown that in a certain range of angular altitudes of the Sun and wavelength it is possible to identify from the recorded signals the component of direct ultraviolet radiation (UVR). The error associated with the contribution of scattered UVR at 345 nm wavelength in the range of the Sun's altitudes 30–60° can be as high as 6–2%, and, accordingly, 15–3% at 310 nm wavelength. The contribution of scattered radiation to the measured quantity becomes substantial at minimum solar altitudes in the short-wavelength part of the spectral range.

The procedure of identifying direct UVR was applied in processing and analyzing the daily near-noon values of UVR recorded at Irkutsk during 1998–2000. The experimental data on the UVR annual variation amplitude obtained at Irkutsk (the range of solar angular altitudes is ~ 14–60°) were compared with calculated values of annual variation amplitudes of direct and scattered UVR. It is concluded that the observed changes in recorded UVR are to a greater extent correlated with changes in direct radiation. The proposed method of identifying direct UVR is intended for a patrol monitoring and investigation of long-lasting (such as interseasonal and interannual) variations of UVR.

D3-15

HF DOPPLER OBSERVATIONS DURING THE NORTH STAR ACTIVE PLASMA EXPERIMENT

K.I. Gorely,[1] N.F. Blagoveshchenskaya,[2] V.V. Klimenko,[3] and P.V. Nagorsky[4]
[1]Institute of Dynamics of Geospheres RAS, Russia
gorely@idg.chph.ras.ru
[2]Scientific Research Institute of Arctic and Antarctica, Russian Hydrometeorologic Committee, Russia
nataly@aari.nw.ru
[3]Norilsk Complex Magneto-Ionospheric Station, Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
klimenko.cmis@norcom.ru
[4]Siberian Physical-Technical Institute, Tomsk State University, Tomsk, Russia
nagorsky.rff@elefot.tsu.ru

HF Doppler measurements during the NORTH STAR plasma injection experiment over Alaska have been conducted at a 7000-km transpolar path under the high auroral activity. The HF diagnostic path is located at a distance about 400 km from the plasma injection point that is possibly more than spatial dimension of the artificially disturbed region for experiments of this sort.

Summarizing the experimental results from HF Doppler oblique ionospheric sounding during the NORTH STAR experiment one can distinguish the following:

–Doppler effects produced by the plasma injection are not clearly evident, but it is not inconceivable that this injection affects on the development of the auroral substorm;

–the rocket intersection of the E layer with the engine running, gives rise to the ionospheric modification manifesting itself as additional tracks on dynamic Doppler spectra;

–Doppler data clearly show the dynamics if the substorm development over Alaska, whether it be natural or artificial origin.

D3-16

INFLUENCE OF GLOBAL IRREGULARITIES OF IONOSPHERE ON THE DOPPLER SHIFT OF SEPARATE MODE OF RADIO LINK KHABAROVSK – IOSHKAR OLA

B.A. Ivanov and A.A. Kolchev
Mari State Technical University, Ioshkar Ola, Russia
ivanov@marstu.mari.su

The new method of simultaneous measurement Doppler shift, signal group delay and time of stationary for each mode of ionospheric propagation of HF on the basis of use of periodic LFM signal is theoretically proved. Potential resolution of this method and a range of Doppler shift are determined.

This method was applied at experimental diagnostics of dynamic processes in the ionosphere on the radio link Khabarovsk–Ioshkar Ola. It is established that during global irregularities on this radio link the basic contribution to shift of frequency brings horizontal moving tops of jumps of the mode propagation along a radio link. Values the Doppler shift were in a range a minus 1.2–2.8 Hz, the width of Doppler spectrum – 0.2–0.35 Hz, and the time of stationary – 10–50 s. It is revealed, that the width of Doppler spectrum grows, and the time of stationary decreases with growth of the order of the mode.

Simultaneous measurement of the Doppler shift for mode *3F2*, *4F2*, *5F2*, has allowed to estimate the speed of moving of global irregularities along a radio link which was equal to speed of moving terminator.

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D3-17

ESTIMATION OF PARAMETERS OF IONOSPHERIC IRREGULARITIES ON THE BASIS OF DISPERSIVE CHARACTERISTICS OF RADIO LINKS

V.A. Ivanov, D.V. Ivanov, and A.A. Kolchev
Mari State Technical University, Ioshkar Ola, Russia
ivanov@marstu.mari.su

In this paper results of experimental researches and modelling of pulse responses for ionospheric broadband radio links are considered. Researches of their dependence on dispersive properties of ionospheric radio links were carried out.

On the basis of the carried out researches the new method of an estimation of parameters of ionospheric irregularities under a pulse responses of the ionospheric radio links with a band 1 MHz was offered. It was shown that at presence at a dispersive curve of stationary points the pulse response has peaks on a pedestal. Thus quantity of peaks equally to number of stationary points in a band of the channel, and the amplitude and duration is defined by behavior of a dispersive curve in vicinities of these points. Analytical expressions for an estimation of position, heights and duration of peak were received, and also heights of a pedestal and the errors of approach are appreciated. It is shown, that occurrence of stationary points on dispersive curves is caused by mesoscale irregularities. On an experimental dispersive curve the parameters of irregularities electronic concentration $l \sim 2$–10 km and $DN/N \sim 0.001$–0.0001 were appreciated.

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D3-18

INFLUENCE SEASONAL AND PERIODIC VARIATIONS OF TERMOSPHERIC PARAMETERS UPON NIGHT INTENSITY OF ATOMIC OXYGEN RED LINE

R.A. Kononov and A.V. Taschilin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
ruslan@iszf.irk.ru

According to observed data, night moving of integral intensity of the upper atmosphere in red line 630 nm on average widths has a few typical particularities, such as reinforcements of phosphorescence around midnight and in before twilight periods. The appearance of these particularities and their characteristics depends on season, level of solar and geomagnetic activity. For the reason studies of mechanisms to generations of observed variations of red line emissions is executed calculation of change of these values on base of models ionospheric-plasmaspheric interaction for various geophysical agree (winter, summer, $F_{10,7} = 70, 150, 200$). Model takes into account nitric-oxygen cycle of chemical reactions, which is main above 100 km and includes coordinated a description of ions (O^+, N^+, H^+, He^+, O_2^+, NO^+, N_2^+), of the temperatures of electrons and ions, of the photoelectrons and of the horizontal neutral wind. Analysis of calculations allows quantitative to value contribution of change the neutral composition, velocities winds, conditions of luminosity in process of shaping the observed night emissions of atomic oxygen in lines 630 nm.

D3-19

ADAPTIVE REGIONAL MODEL OF TOTAL ELECTRON CONTENT

V.V.Chernukhov, A.D. Bazarzhapov, and M.A. Mezhetov
Irkutsk Military Aviation Institute, Irkutsk, Russia
afra@iszf.irk.ru

Adaptive regional total electron content space distribution model, based on the data of the IGS international network of GPS-stations is proposed in the report. The method of the spherical harmonic analysis with the selection of the spectrum of approximating harmonic with the greatest contribution was applied at creation of the model. The method essence consists in such spherical harmonics series spectrum selection when the harmonics, with orthogonal projection exceeding an input data errors level appropriate number of times, are used in an approximating function. The comparative estimation of results obtained by the least square process and proposed method has executed. The usage of the least squares process when solving the problem of the spherical harmonics analysis at reconstructing the space distribution of the total electronic contents because of the poor conditionality of normal equations system, results in considerable errors of approximating strongly dependent on selected the length of series. The selection of the spherical harmonics series spectrum with the greatest contribution allows to regularize the normal equation system solution and to increase its accuracy and stability.

The model can be used to increase the accuracy of detecting satellite radio navigation system users in a relative navigation mode, at ionospheric monitoring etc.

D3-20

INTEGRAL REPRESENTATION FOR THE FIELD OF THE WAVE PROPAGATING IN A MEDIUM WITH RANDOM INHOMOGENEITIES OF DIFFERENT SCALES

M.V.Tinin and S.N.Kolesnik
Irkutsk State University, Irkutsk, Russia
vmt@api.isu.runnet.ru

In a theoretical description of the propagation of waves in randomly inhomogeneous media, various approximate methods are extensively used to describe the propagation in media with either large-scale or small-scale irregularities. In real conditions, the medium very often includes different-scale irregularities. In this connection, of considerable current importance becomes the problem of developing a method for describing the field of the wave propagating in a medium with different-scale irregularities. In a paper (Kravtsov Yu.A. and Tinin M.V. "Representation of a wave field in a randomly inhomogeneous medium in the form of the double weighted Fourier transform", Radio Science, **35**, No. 6, 1315–1322 (2000)), such a method was developed within the small-angle approximation.

In this paper, using the method of the fifth parameter the wave equation is reduced to a parabolic equation. By employing – when solving this parabolic equation – the approach developed in the cited reference, we obtained an integral representation for the field of the wave propagating in a medium with different-scale irregularities. It was shown that the resulting solution is consistent with the geometrical optics method, the phase screen method, and with the Born approximation. Thus our developed method makes it possible to simultaneously take into account both strong intensity fluctuations caused by the presence of large-scale irregularities, and different diffraction effects (backscattering, for example) characteristic for the wave propagating in a small-scale medium.

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D3-21

MEASUREMENT RESULTS OF THE TEMPERATURE AND DENSITY OF NEUTRAL ATMOSPHERE AT HEIGHTS 90–110 km IN SUMMER 1999–2000 USING ARTIFICIAL PERIODIC INHOMOGENEITIES

A.V. Tolmacheva and V.V. Belikovich
Research Radio-Physical Institute, Nizhny Novgorod, Russia
ariadna@nirfi.sci-nnov.ru

The results of atmosphere temperature and density measurements in summer 1999–2000 at height interval 95–110 km are presented. The measurements were carried out using artificial periodic inhomogeneities (API) of ionospheric plasma.[1] The periodic structure was creating by Sura facility. Short radio pulses during pauses between switching on the power transmitters sounded the API. The digital registration of the Bragg back scattered signal amplitudes was applied with height step ~ 1 km. At this height range the API relax in a process of an ambipolar

diffusion. It is possible to determine the atmospheric parameters on a height dependence of API relaxation time, in assumption of the thermal equilibrium.

A height temperature and density profiles and their temporal variations were obtained. Time resolution was equal about of 5 minutes. The data were compared of the measurements, obtained in autumn and winter of 1990–1991. The effects of a sunrise and sunset on these parameters were investigated. The measurements carried out during the solar eclipse 11.08.1999 were analyzed.

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1. V.V. Belikovich, E.A Benediktov, N.P. Goncharov, and A.V. Tolmacheva, Diagnostics of the ionosphere and neutral atmosphere at E-region heights using artificial periodic inhomogeneities. J. Atmos. Sol. Terr. Phys., **59**, No. 18, 2447–2460 (1997).

D3-22

UPPER ATMOSPHERE PARAMETERS MEASUREMENTS USING ARTIFICIAL PERIODIC INHOMOGENEITIES

A.V. Tolmacheva, V.V. Belikovich, and N.V. Bakhmet'eva
Research Radio-Physical Institute, Nizhny Novgorod, Russia
ariadna@nirfi.sci-nnov.ru

The artificial periodic inhomogeneities (API) investigations, which were carried out in Research Radio-Physical Institute, Russia during last twenty-five years lead to appearance of some methods of the ionosphere and atmospheric parameter diagnostics. These methods were based on the action on the ionosphere by the powerful standing wave for creation of the periodic structures; sounding of the API by the short pulses and the registration of the amplitudes and phases of Bragg back scattered signals in dependence on altitude and time. The analysis of these characteristics gives a possibility to define some important parameters of the ionosphere plasma and atmosphere including an electron density, a vertical motion velocity in D- and E-regions, an electron and ion temperatures in the F-region, a detachment rate of electrons from negative ions in the lower ionosphere.[1]

Methods of diagnostics using API have a high time resolution (1–2 minutes) and can easy carry out for investigation of the D- and E-regions, where the amplitude of the inhomogeneities is enough large one and the scattered signals is many greater then noise level. The results of measurements using Sura facility and applying of scattered signal digital registration with step about of 1 km in 1999–2000 are given.

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1. V.V. Belikovich, E.A Benediktov, N.P. Goncharov, and A.V. Tolmacheva, Diagnostics of the ionosphere and neutral atmosphere at E-region heights using artificial periodic inhomogeneities. J. Atmos. Sol. Terr. Phys., **59**, No. 18, 2447–2460 (1997).

D3-23

NEW WAY TO SPACE ERGODICITY PROBLEM AT INCLINED SOUNDIG OF RANDOM-INHOMOGENEOUS REFRACTED MEDIA

A.G. Vologdin, V.D. Gusev, and L.I. Prikhodko
Moscow State University, Moscow, Russia
postmast@atmos.phys.msu.su

Definition of the space probability characteristics of the waves, which propagate in random-inhomogeneous geophysical media, is impossible without ergodicity hypothesis, because repetition of the nature conditions is not realized.

At inclined incidence waves on plane-layered random-inhomogeneous medium its proved the possibility to obtain the space statistical phase characteristics via averaging over horizontal straight line, instead of averaging over volume. This presents new and essentially more simple solution of the space ergodicity problem. That way permits to found statistical characteristics with arbitrary exactitude, because there are not limitations for increase of the interval of averaging over horizontal line in conditions of indicated problem. One can value indispensable magnitude of the space interval from ergodicity condition's fulfillment with indispensable degree of exactitude. Its important on principle that this averaging gives the possibility to study stochastic fields (random functions of space coordinates) without masking of the regular properties. Use of new way to ergodicity permitted to show, that definition of space statistical characteristics on the time measurements can be implemented only in the presence of irregularities drift

with constant velocity. Therefore, one may count that Taylor's hypothesis, which ties in with hypothesis of 'frosty' turbulence, is proved.

Application of new solution of the space ergodicity problem permits essentially to simplify the reception and working of space nature measurements at wave sounding of various layers atmosphere and ocean.

D3-24

OPTIMIZATION OF IONOSPHERIC PLASMA DRIFT VELOCITY MEASUREMENT BY INCOHERENT SCATTER TECHNIQUE

L.Ya. Emelyanov
Institute of Ionosphere ESM and ASU, Kharkov, Ukraine
iion@kpi.kharkov.ua

In this paper the peculiarities of ionospheric plasma drift velocity measurement using the quadrature components of the incoherent scatter signal correlation function are submitted. The results of modeling of influence of sounding pulse duration and characteristics of receiver filters on systematic error of velocity determination for different combinations of plasma parameters (electron T_e, ion T_i temperatures and percentage of light ions) are presented. Theoretical correlation functions of electron density fluctuations are used for modeling. Such modeling allows using of receiver filters which are optimal for concrete conditions of measurements depending on altitude range and geophysical conditions. The methods of decrease of errors are considered including the errors connected with the finite receiver bandwidth and transmitted pulse duration, with influence of possible signal phase change during radar range sweep in case of pulse sounding.

It is possible to decrease considerably the root-mean-square error of measuring V_d at the upper ionosphere and to improve height resolution at altitudes of ionization peak for sounding by pulses with duration about 800 mcs due to choice of CF ordinates $R(\tau_k)$ with certain delays τ_k , to account of a weight of each ordinate, to trapezoidal smoothing of a concrete amount of CF samples on radar range sweep. The improvement of accuracy is also provided with use of the ratio of unnormalized quadrature CF instead of their coefficients of correlation for calculation of V_d. Taking into account of possible difference of quadrature channels of output receiver section is provided with introduction of the correct coefficient that is obtained from the values of noise power on these channels outputs averaged over large interval in the end of the radar range sweep.

The optimization allows extending the altitude range of the plasma drift velocity measurement.

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D4-01

MAGNETOSPHERIC DISTURBANCES, AND THE GPS OPERATION

E.L. Afraimovich, O.S. Lesyuta, and I.I. Ushakov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
afra@iszf.irk.ru

We have investigated a dependence of the relative density of phase slips in the GPS navigation system on the disturbance level of the Earth's magnetosphere. The study is based on using Internet-available selected data from the global GPS network, with the simultaneously handled number of receiving stations ranging from 160 to 323. The analysis used four days from the period 1999–2000, with the values of the geomagnetic field disturbance index Dst from 0 to – 300 nT. During strong magnetic storms, the relative density of phase slips on mid latitudes exceeds the one for magnetically quiet days by one-two orders of magnitude as a minimum, and reaches a few and (for some of the GPS satellites) even ten percent of the total density of observations. Furthermore, the level of phase slips for the GPS satellites located on the sunward side of the Earth was by a factor of 5–10 larger compared with the opposite side of the Earth. The high positive correlation of an increase in the density of phase slips and the intensity of ionospheric irregularities during geomagnetic disturbances as detected in this study points to the fact that the increase is slips is caused by the scattering of the GPS signal from ionospheric irregularities.

D4-02

BACKWARD SCATTERING FROM THE STRATIFIED-IRREGULAR, NONSTATIONARY IONOSPHERE

I.I. Orlov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
orlov@iszf.irk.ru

This paper addresses the backscattering of high-frequency radio waves from the stratified-irregular, nonstationary ionosphere. The electron density in this case is represented as two components. One describes a regular dependence of electron density on the height. This component is assumed to be stationary. The other component describes the nonstationary small-scale ionospheric structure that is responsible for the backscattering of high-frequency radio waves.

The chief goal of this paper is to obtain expressions for the backscattered signal in the case of the presence of small-scale nonstationary irregularities by using the time description of the scattering process. The resulting expressions for signals at the receiver input take into account the contribution to the phase structure of the signal from the regular component of the ionosphere, while small-scale irregularities are responsible for the backscattering. Results of this research effort can be used in developing procedures of processing experimental data acquired by one-position incoherent scatter radars.

D4-03

SET OF TECHNIQUES FOR UPDATING THE BASIC MODEL OF THE IONOSPHERIC DECAMETRIC RADIO CHANNEL TO CURRENT CONDITIONS

V.I. Sazhin
Irkutsk State University, Irkutsk, Russia
sazhin@physdep.isu.runnet.ru

The basic model of the radio channel combines the method of characteristics for calculating the signal parameters, and the semi-empirical model of the ionosphere. On the basis of the estimating solution of the inverse problem, it was possible to develop a set of interrelated techniques for updating the input parameters of the model to current conditions from measured characteristics of the signal received on reference radio links.

A description of the new updating techniques that complement those proposed previously is given. Presented is the technique for updating the effective form of the electron density height profile N(h) in the peak region from measurements of signals from the Earth's artificial satellites of the global positioning system (GPS). An evaluation of the updating efficiency was carried out for the critical frequency of the ionosphere from vertical-incidence sounding data. By using, as an auxiliary path, radio links with reception of signals from broadcasting stations, a technique was developed for specifying the critical frequency and the height of the ionospheric maximum, as well as the effective form of the N(h) profile in the main absorbing ionospheric D region from measurements of parameters of the angular spectrum and the signal field strength.

The fact that the complex includes several techniques for specifying the values of separate input parameters of the model ensures the conduct of a verification and consistent improvement of the correspondence of the model and actual values of the parameter, and improves the updating efficiency. It is shown that the application of this complex makes it possible to considerably reduce the errors in describing by the model the current state of the radio channel. The updated model can be further used in a spatial region and a time interval determined by corresponding correlation radii of the main ionospheric parameters.

This work was done with financial support of the RFBR, grant No. 00–15–98509.

D4-04

ON ASYMMETRY OF DISTRIBUTIONS OF REFRACTION INDEX IN EASTERN REGIONS OF RUSSIA

N.Ts. Gomboyev, A.S. Batoroyev, and V.E. Munkoyev
Department of Physical Problems, Buryatian Scientific Center SB RAS, Ulan-Ude, Russia
ofp@bsc.buryatia.ru

For the first time for a vast territories of Eastern Siberia, the North and Far East of Russia evaluation and analysis of refraction index N of atmosphere near ground surface and its asymmetry coefficient $\boldsymbol{A}$ have been conducted according to 10-year data at 29 aerological stations. To know peculiarities of $\boldsymbol{N}$ distribution is necessary for calculation VHF paths – of communication lines, and besides for more accurate and precise definition of refraction model of atmosphere. Let us take asymmetry weak (inconsiderate) at $0 \le |\boldsymbol{A}| \le 0.25$, moderate at $0.25 < |\boldsymbol{A}| \le 0.5$ and strong at $|\boldsymbol{A}| > 0.5$[1]. In accordance with these criteria $\boldsymbol{N}$ distribution was typified depending on $\boldsymbol{A}$ (Table).

Table

Reiteration of N distribution types depending on A irrelevantly of the time of a day in percents of total number of stations (%)

Types of distribution	Subtypes of distribution	Seasons (of the year)				Average annual
		I	IV	VII	X	
Normal	–	40.9	51.6	52	38.7	45.8
Negative asymmetrical	Moderate	2.7	9.8	5.7	12.9	7.8
	Strong	5.5	8.0	13.2	10.7	9.4
Positive asymmetrical	Moderate	29.1	17.9	16.0	10.7	18.4
	Strong	21.8	13.4	12.3	26.9	18.6

Three main types: normal, negative and positive asymmetrical are defined. As we see more than half of all cases of $\boldsymbol{N}$ distribution are asymmetrical, and reiteration of positive asymmetry is twice more frequent than of negative asymmetry. There are only 46% of normal distribution. Seasonal and diurnal $\boldsymbol{A}$ variations are not regular. It can be noted that large negative values of $\boldsymbol{A}$ are more frequent in summer, and large positive ones – in winter. The centers of cold (Verkhoyansk, Oimyakon) are the exceptions where large negative $\boldsymbol{A}$ values are observed only in winter season. For coastal regions (Nagayeva Bukhta, Ayan, Poronaysk) larger negative asymmetry in $\boldsymbol{N}$ distribution is (more) characteristic not only in summer, but also in spring months.

Thus, the results of the work disprove the opinion of normal $\boldsymbol{N}$ distributions, which existed earlier, and show the necessity to use more complicated lows of distribution of random values for their approximation. The paper presents Tables of diurnal and seasonal $\boldsymbol{A}$ values, the results obtained are compared with asymmetry of distributions of the corresponding meteorological parameters.

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D4-05

ON SIGNAL STRUCTURE OF THE OVER-THE-HORIZON SEA SURFACE RADAR

M.V. Ignatenko and M.V. Tinin
Irkutsk State University, Irkutsk, Russia
vmt@api.isu.runnet.ru

Obtaining information about the state of the sea surface using HF radars has been the subject of intense investigations during the past several decades. As a result of experimental and theoretical research, it was ascertained that the spectrum of the signal scattered by the sea surface has two (and sometimes more) peaks. These peaks appear as a result of the Bragg scattering from sea waves with the wavelength of about half the sounding signal wavelength. The height of these peaks is proportional to the height of sea waves.

Most theoretical investigations made to date have adopted, as the incident wave, a plane wave with a certain wave vector. In real conditions, however, with the finite beam width, the ionosphere-reflected beam of waves of a finite width is usually incident on the scattering sea surface, which must be taken into account when investigating the form of the spectrum and processing it by extracting information about the sea surface.

This paper investigates the scattering of fluctuating ionospheric radio waves from the sea surface by taking into consideration the finiteness of the beam of the receive and transmit antennas. A numerical simulation is used to investigate the influence of the finiteness of the beam width, the time of coherent integration, and ionospheric irregularities on the structure of the spectrum of the received signal of the overt-the-horizon sea surface radar.

This work was done with financial support from the RFBR, grants No. 00–02–17780 and No. 00–15–98509.

D4-06

RESEARCHES OF TIME-AND-FREQUENCY CHARACTERISTICS OF PEDERSEN MODES ON THE RUSSIAN OBLIQUE CHIRP SOUNDERS NETWORK

V.A. Ivanov,[1] N.V. Ryabova,[1] D.V. Skvortsov,[1] I.N. Poddel'skiy,[2] and S.V.Rozanov[2]
[1]*Mari State Technical University, Ioshkar-Ola, Russia*
ivanov@marstu.mari.su
[2]*Institute of Space Researches and Radio Wave Propagation FEB RAS, Magadan, Russia*

Interest to research of the top beam (Pedersen mode) is caused by its sensitivity to regular and casual variations of electronic concentration near to maximum of an F-layer in which area the quasi-critical beams are propagated. Measurements were carried out on the Russian network oblique chirp sounders. Two subauroral radio links of similar distances (5.7 Mm) are chosen: Khabarovsk–Ioshkar Ola, Magadan–Ioshkar Ola. In the report results of researches of daily variations of Δf_p Pedersen ($2F2_p$) received during round-the-clock supervision in November 1998 and May 1999. Correlation analysis Δf_p and 3 hour indexes of magnetic activity K_p were carried out. It is determined, that in November there is the significant correlation between Δf_p and K_p. Correlation is $\rho_{max} = 0.6$ for radio link Khabarovsk–Ioshkar Ola and $\rho_{max} = 0.7$ for a radio link Magadan–Ioshkar Ola. In May the correlation peak was not found out. Correlation between Δf_p and K_p specifies the important role of ionospheric irregularities in formation of the top beam. Time shift between maximums of correlation of two radio links was ~ 6 hours. Synthesis of beam trajectories for model of an ionosphere of Standard Ionospheric Model-88 has allowed to determine a position of tops of hopes and to estimate the speed of moving of disturbances which appeared equal 140–100 km/h. This work was supported by the Russian Foundation for Basic Research (project No. 99–02–17309) and the Ministries of Education.

D4-07

ADAPTATION CAPABILITIES OF THE IRI FOR HF PROPAGATION

G.V. Kotovich and S.Ya. Mikhailov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
uzel@iszf.irk.ru

The application of the IRI model in predicting the Maximum Usable Frequency (MUF) on paths of different extent is discussed in Ref. 1. Its implementation by PC software renders this model attractive for forecasting the MUF both in the long-term prediction mode and by adapting this model to current conditions. When calculating the channel capacity, it is necessary to predict, in addition to the MUF, the delays as well.

In this paper we investigate the delays and the number of rays at lower-than-MUF sounding frequencies obtained both in calculations of propagation characteristics using the IRI model and in experiment. It is shown that the radio ray trajectories are affected considerably by the lower-lying ionization. Under conditions of the horizontal

ionospheric inhomogeneity, the variation of the equal electron density levels along the path in the transition region (from the E to F layer) should be taken into account when calculating the ray trajectory. An analysis is made of the state of the ionosphere obtained in the IRI model for the transition hours when the path traverses the solar terminator. It is shown that with the currently existing adaptation scheme in the IRI model according to vertical-incidence sounding data, when calculating the one-hop propagation at frequencies close to the MUF the low angle ray is absent during the transition hours, whereas it is observed on experimental oblique-incidence sounding ionograms. The spatial distribution of electron density in the IRI model is compared with modeling results derived from the Semi-Empirical Ionospheric Model (SEIM)[2] under the same adaptation conditions. The criterion for assessing the adaptation capabilities of models is provided by a comparison of calculated oblique-incidence ionograms with experimentally observed ones and analysis ray trajectories at separate frequencies. The possibility of simultaneously using vertical incidence and oblique incidence ionograms in diagnosing the spatial distribution of electron density is discussed.

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D4-08

CALCULATION OF THE COMPLEX REFLECTION COEFFICIENTS AND FIELD'S STRUCTURE IN INHOMOGENEOUS ABSORBING IONOSPHERE BY THREE – DIAGONAL MATRIX ALGORITHM

L.I. Prikhodko, V.D. Gusev, and A.G. Vologdin
Moscow State University, Moskow, Russia
postmast@atmos.phys.msu.su

The account of the absorption of ionospheric waves, due to the losses caused by the collisions between electrons and neutral particles and ions, is necessary in problem of the ionospheric propagation. It is known, that the effective electron collision frequency changes with the altitude z. This brings great difficulties to the resolving of the boundary problem for wave equation.

For the common admission model for the isotropic plane-layered ionosphere the complex permittivity writes:

$$\varepsilon_c(\omega,z)=\varepsilon(\omega,z)+i(1-\varepsilon(\omega,z))\frac{\nu_{eff}(\omega,z)}{\omega}, \qquad (1)$$

where $\varepsilon(\omega, z)$ and $\nu_{eff}(\omega, z)$ are the profiles of the permittivity and the effective electron collision frequency, ω – frequency of radio sounding.

For the account of the diffraction effects and the complicated wave phenomena is necessary the precise solution of the Helmholtz equation for the function (1), or the numerical modeling of the boundary problem. In the present paper Three – Diagonal Matrix Algorithm (TDMA) is used for the calculations of the complex reflection coefficients and the field's structure in the inhomogeneous medium. By means of numerical simulation of the indicated wave characteristics one may investigate as the cases of partial, as that of almost full wave reflection from the layer and determine the reflection coefficient dependence on the frequency.

For the isotropic plane-layered ionosphere and the scalar monochromatic waves in the case of vertical probing of the layer $(0 \le z \le L)$ one can write the Helmholtz equation for the complex field amplitude E:

$$\frac{d^2E}{dz^2}+k^2\varepsilon_c(\omega,z)E=0 \qquad (2)$$

with the boundary conditions at the lower $(z=0)$ and upper $(z=L)$ bounds:

$$\frac{dE(0)}{dz}=-ik(2-E(0)), \qquad \frac{dE(L)}{dz}=-ikE(L) \qquad (3)$$

From the numerical solution for (2), (3) one finds the complex reflection and propagation coefficients and the field's structure. In this paper these calculations are presented for the parabolic ionospheric layer ε with the different profiles of ν_{eff} from z.

Notice, that using this method, we can consider the reflection from the arbitral profiles ε and ν_{eff} because we don't need the fundamental system of solutions (2).

Sessions E1-E4. STRUCTURE AND DYNAMICS OF THE MIDDLE ATMOSPHERE

E-03

INFLUENCE OF STRATOSPHERIC WARMING ON THE PARAMETERS OF THE MIDDLE AND LOW ATMOSPHERE

V.V. Koshelev, G.A. Zherebtsov, N.A. Abushenko, S.A. Tashchilin, A.V. Mikhalev, R.A. Kononov, I.V. Medvedeva, A.Yu. Shalin, E.L. Afraimovich, and O.S. Lesuta
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
koshelev@iszf.irk.ru

The complex observation results of atmospheric parameters are presented above Siberia territory during November – December of 2000-year period. Experiment research data have been got with the help of:

- Remote sensing of atmosphere (space and time distribution of temperature and total ozone content).
- Net of GPS stations (total content concentration electron and inhomogeneity in ionosphere structure)
- The plant for measurement of atmosphere intensity emission on the 557.7 and 630.0 nm band.
- Photometry system for measurement spectral intensity of sun ultraviolet in 290–340 nm range.

According to the results of observation it is possible to find out the stratospheric warming influence effects on the parameters middle and low atmosphere surely. The shortly consider the bottom of interaction.

E-04

ACTIVE RADIATION ATMOSPHERIC CONSTITUENTS IN THE ATMOSPHERIC DEPTH OVER CENTRAL EURASIA

V.N. Aref'ev,[1] F.V. Kashin,[1] and V.K. Semyonov[2]
[1]*Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Russia*
las@iem.obninsk.ru
[2]*Kyrgyz State National University, Kyrgyzstan*
svk@it.kg

An analysis of 15–20-year measurement results of water vapor, ozone, nitrogen dioxide total contents, height-averaged carbon dioxide concentration and atmospheric spectral transparency (AST) in the visible wavelength range was made by the up-to-date methods of mathematical statistics.

The character and several causes of variations of radiation-active atmospheric constituents (water vapor, carbon dioxide, ozone, nitrogen dioxide and aerosol) in a scantly explored central part of the Eurasian continent are studied. It has been stated that the paired coefficients of the linear correlation characterize in main the extent of coincidence of seasonal variations extreme times. The linear trends are determined: a positive one for water vapor (1.1 ± 0.6), carbon dioxide (0.56 ± 0.18), nitrogen dioxide (0.26 ± 0.03), AST ($0.55 - 0.36 \pm 0.06$) and a negative one for ozone (0.40 ± 0.09)% per year. During the observation period an average annual total content of water vapor increased by about 21% (0.235 g/cm^2), of nitrogen dioxide by about 9.8%, a carbon dioxide concentration increased by about 13% (43.5 ppm) and ozone content decreased by about 7% (24 D.U.).

Periodic oscillations of different duration have been revealed. All the atmospheric constituents studied have harmonics of 6 and 12 months connected with seasonal variations. Quasi-biennial (21–27 months) oscillations connected with the stratospheric circulation are explicitly traced in the stratospheric components (ozone and nitrogen dioxide). A weak quasi-biennial harmonic is found in carbon dioxide, the content of which in the stratosphere does not exceed 10% of its value in the whole atmosphere. Water vapor, carbon dioxide and AST have also quasi-triennial (35–37 months) oscillations. Harmonics with the periods of 51–54 months typical of the El Nino phenomenon were registered for the tropospheric components – water vapor, carbon dioxide and AST. Long-period oscillations controlling considerably a year-to-year variability are divided into two groups. For nitrogen dioxide and carbon

dioxide these are 7-year (81 and 84 months) harmonics, their nature being still unclear. The harmonic for carbon dioxide is more than the annual one. The harmonics with the period of 8.5–9 years (102, 106 and 110 months) are peculiar for ozone, AST and water vapor. The periods of these harmonics are close to the time interval between two most powerful eruptions of the El Chichon and Pinatubo volcanic eruptions that had a noticeable impact on the radiation-active atmospheric constituents, and close to an 11-year periodicity of the solar activity.

From the analysis of the experimental data it follows that during 1986–1987 all the atmospheric constituents measured, but AST, had some noticeable differences as compared with other years of observations: water vapor and nitrogen dioxide had a sharp increase of contents and carbon dioxide, in contrast, had a sharp decrease of concentration, ozone had a disturbance in a quasi-biennial cycle.

To describe the variations in mean monthly and average annual values of the atmospheric constituents studied statistical models with empirical parameters obtained on the basis of the experimental data were used.

The studies were carried out under the financial support of the Russian Foundation for Basic Research (Grants Nos. 99-05-64275 and 00-07-90092) and International Science and Technology Center (Grant ISTC KR-157-98).

E-05

STUDY OF THE EFFECT OF GRAVITY WAVE PROPAGATION ON MINOR SPECIES DISTRIBUTION IN MIDDLE ATMOSPHERE

Jiyao Xu
Laboratory of Space Weather, Center for Space Science and Applied Research, Chinese Academy of Sciences, Beijing, China.

The paper aims to study the effect of gravity wave propagation on atmospheric trace gas distributions in mesosphere and lower thermosphere. Two models are used in this research. One is a linear three-dimensional photochemical-dynamical coupling inertia gravity wave model. Another is a two-dimensional, time-dependent, nonlinear, compressible, diabatic, nonhydrostatic photochemical-dynamical gravity wave model. Important photochemical reactions in middle atmosphere are considered in these models. The models include diabetic process produced by photochemistry and the effect of gravity wave on atmospheric chemical species. In the second model, the pseudospectral method is used in the horizontal direction and the finite difference approximations are used in vertical direction z and time t. And FICE method is used to solve the model. The calculations show that the gravity wave propagation can induce large fluctuations of oxygen compound and hydrogen compound in mesopause region. Gravity waves can change the distributions of atmospheric species in mesopause region where the oxygen compound has great vertical gradient. The effect of gravity waves on the distributions of atmospheric species in night is greater than that in daytime.

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E-06

LOWER THERMOSPHERE TEMPERATURE BEHAVIOR DURING WINTER STRATOSPHERIC WARMING

V.M. Ignat'ev and S.V. Nickolashkin
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
nikolashkin@ikfia.ysn.ru

The behavior of lower thermosphere temperature is considered during stratosphere warming above Northeast Siberia in February-March 2000. The measurements of temperature were carried out by the new built Fabry-Perot spectrometer on a thermal broadening of emission 557.7 nm [OI] in moonless periods on optical station Maimaga near Yakutsk (63N, 129.7E). The spectrometer had the aperture of 140 mm, free spectral interval is 0.0104 nm, instrumental width – 0.0015 nm. The data on temperatures of stratosphere at levels 50, 10 and 2 mb were obtained from NOAA via the Internet. A minor type stratospheric warming in January – February 2000 began on high altitudes and it obviously covered large atmosphere layer including lower thermosphere, a mesosphere and

stratosphere and was spread downwards with decreasing amplitude Temperature of lower thermosphere has increased in February approximately on 40 K (20%) in a maximum of warming and was kept at least up to the end of February though warming to this time already has disappeared.

At March 2000 the second stratosphere warming was began. It is supposed, that from this moment the penetration of planetary scale wave disturbances in lower thermosphere became impossible that has resulted in its monotonic cooling at the rate 8 K/day at absence of other additional sources of a thermal energy. These outcomes allow us to make a conclusion that the planetary scale wave disturbances under certain satisfactory conditions can be spread up to lower thermosphere heights.

E-07
RESEARCH OF SPATIAL-TEMPORAL CONNECTIONS BETWEEN METEOROLOGICAL PARAMETERS OF STRATOSPHERE AND TOTAL OZONE DYNAMICS

A. Yu.Belinskaya, Ed. S.Kazimirovsky, and N. A. Abushenko
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
bai@iszf.irk.ru

Problem of the interrelation between the thermodynamics of stratosphere and total ozone content (TOC) variations has been discussed for a long time. However, both numeral models and the results of observations don't permit to consider this problem solved. East-Siberian region is especially interesting due to its climatic conditions (center of winter anticyclone) and due to very low TOC observed in some winters. The research has been carried out with the used of satellite data of the vertical sounding of atmosphere by TOMS and TOVS over East-Siberian region. Both TOC variations response to the stratospheric warming and the influence of thermodynamic regime of middle stratosphere on ozone has been considered. The results obtained witness about the presence of the spatial-temporal interconnections between the TOC variation and meteorological parameters of low and middle stratosphere.

E-08
ADAPTIVE FORECASTING OF THE OZONE LAYER DYNAMICS

I.Yu. Sakash, V.B. Kashkin, and J.P. Lankin
Krasnoyarsk State Technical University, Krasnoyarsk, Russia
lan7@mailru.com

Ozone is a small atmospheric admixture, it makes up only 0.64×10^{-6} of the entire atmosphere. However significance of ozone in atmospheric processes is great enough to causes large interest to oscillatings of its concentration, related to processes of its formation and breaking down. Being optically active gas ozone takes up ultraviolet Sun radiation (range 200–300 nm) in the main, determines thermal behavior of stratosphere, essentially influences temperature stratification and prevents the entry of biologically active ultraviolet radiation onto the Earth surface.

Currently interest to the problem of atmospheric ozone has essentially increased in connection with clearing up the possibility of anthropogeneous influencing on its content. The probably changes coordinate with some global climatic consequences.

Ozone influence on the climate has very complex nature because to feedback processes which define heat exchange in atmosphere due to radiation transfer, circulation and stirring. A detailed estimation of possible influence mechanism for ozone can be obtained as a result of systematic observations, development and realization of enough reliable physical and mathematical models. Among of the most effective methods of adaptive models construction is up to date neuroinformatics methods,[1] permitting modeling and creation of expert systems.

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E-09

SENSITIVITY OF STRATOSPHERE AND MESOSPHERE CLIMATE TO OBSERVED CHANGES OF OZONE AND CARBON DIOXIDE CONCENTRATION

E. M. Volodin
Institute for Numerical Mathematics RAS, Moscow, Russia
volodin@inm.ras.ru

Troposphere-stratosphere-mesosphere general circulation model climate is studied with its sensitivity to observed increasing of carbon dioxide everywhere and to decreasing of ozone in the stratosphere and mesosphere. The model is capable to reproduce main features of observed stratosphere-mesosphere circulation, including reducing of easterly and westerly winds with height in the mesosphere and colder summer upper mesosphere than winter upper mesosphere.

For prescribed increasing of carbon dioxide by 5% per decade and decreasing of ozone by 5% per decade in the layer 200–0.003 mb, model trend of zonal wind and temperature in the stratosphere in tropics and northern hemisphere midlatitudes is not far from that one calculated from Randel stratospheric analyses for 1979–1996. In the mesosphere, model trend of temperature is not far from that one observed with lidar in France in 1979–1991.

Maximum cooling near 4 K par decade occurs at 60–65 km height. The impact of ozone to total model trend of temperature in the mesosphere is 2–3 times greater than the impact of carbon dioxide. Model shows that changes of ozone and carbon dioxide induces significant increasing of relative humidity in the summer polar upper mesosphere.

E-10

RECONSTRUCTION SPATIALLY-TEMPORARY DISTRIBUTIONS OF METEOROLOGICAL FIELDS ON OBSERVATIONAL DATA

E.G. Klimova
Institute of Computational Technologies SB RAS, Novosibirsk, Russia
klimova@ict.nsc.ru

The problem of reconstruction spatially-temporary distributions of meteorological fields on observational data with the use of forecast models of atmosphere is called the data assimilation problem. One of the most perspective approaches to a problem of the meteorological data assimilation is the application of the Kalman filter theory. Algorithm of a Kalman filter allows on sequence of observations for various instants and forecast model, which is considered as dynamical – stochastic system to receive an optimum evaluation of a state of atmosphere in a sense of a minimum mean-square of an estimation error. A serious problem at application of the Kalman filter algorithm to actual forecast models is the high order of the forecast errors covariance matrixes, used in this algorithm.

In the report the simplified mathematical models of processes in atmosphere used for calculation of forecast errors covariance matrixes are considered, the properties of these models are investigated. It is supposed that the forecast implements with the help of the regional model based on full equations. The results of numerical experiment are presented.

E-11

THEORETICAL SIMULATION OF FAR WAVE ACTION OF ANTARCTIC OZONE SOURCE OF ATMOSPHERIC THERMAL TIDES ON THERMOHYDRODYNAMIC STATE OF THE UPPER ATMOSPHERE OF NORTHERN HEMISPHERE

A.A.Gavrilov,[1] A.P.Kapitsa,[2] and O.V.Kaidalov[1]
[1]*Scientific-Production Association "Typhoon", Obninsk, Russia*
a_gavrilov@hotmail.com
[2]*Moscow State University, Moscow, Russia*

Technology to reveal a mechanism of the far wave action (teleconnection in foreign publications) of anomalous changes of the Antarctic ozone source (h = 15–50 km) of atmospheric thermal tides on thermohydrodynamic state of the mesosphere and lower thermosphere (h = 80–110 km) of Northern Hemisphere is presented. The technology is based on the non-steady-state model of tides, which is developed by authors and takes into account the large-scale variations of ozone content by the latitude and longitude for the calculation of a source.

Numerical experiments with the developed model show that the non-steady-state tidal disturbances initiated by the Antarctic ozone source of tides propagate nearly to horizontal in the meridian direction into the Northern Hemisphere. After 5–8 twenty-four-hour periods they reach to the high-latitude lower thermosphere of the Northern

Hemisphere. It is shown that the energy and momentum fluxes generated by the propagating tidal disturbances cause a change of the background thermohydrodynamic state of the polar mesosphere and lower thermosphere.

Theoretical and experimental investigations of the correlation between the seasonal changes of the Antarctic ozone source of atmospheric tides and the variations of parameters of the twelve-hour tidal wind in the middle-latitude lower thermosphere of the Northern Hemisphere which are obtained with the remote radiophysical methods have been carried out.

E-12

DYNAMIC REGIME DIAGNOSIS AT THE MESOSPHERIC-THERMOSPHERIC HEIGHTS USING THE IONOSPHERIC AND GEOMAGNETIC DATA

A.B. Vinitsky

Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS, Stecolny, Magadan, Russia

The mesospheric-lower thermospheric heights are least accessible for the direct experimental methods of atmospheric dynamic research. It does actual to use indirect methods, which allow to determine various characteristics of dynamical regime at this heights.

In this investigation the methodical principles of dynamical regime diagnosis are proposed. They are based on the experimental relationships between ionospheric D, Es, F regions and geomagnetic characteristics. The constructed circulation scheme at the stratospheric-thermospheric heights in the form of space inclined, mowing in different directions, thin atmospheric layers is also used. This scheme was constructed on the basis of existent experimental wind data and agreed the dominant motions at different heights. Zonal and meridian wind coupling at the heights 80–110 km due to this scheme gives the double whirl wind structure at the hemisphere and allows to adjust the wind and Sq-electric currents systems. The analysis of the observed agreeable variations of height, frequency, probability parameters of D, Es, F layers and geomagnetic field elements, times of their extreme daily value gives possibility to estimate the deformations of space inclined wind structure. Particularly, it is possible to estimate the variations of turbopause level, vertical motions and thermospheric neutral gas composition.

E-13

ACOUSTIC GRAVITY WAVES IN THE LOWER IONOSPHERE: OBSERVATIONS USING API TECHNIQUE AND THE THEORETICAL EVALUATIONS

N.V. Bakhmet'eva and G.I. Grigor'ev

Research Radio-Physical Institute, Nizhny Novgorod, Russia

natali@nirfi.sci-nnov.ru

Acoustic gravity waves (AGW) and their ionospheric signature have been studied for many years. We presents some results of determination of AGW parameters in terms of measurements vertical velocity V, temperature T and density ρ of neutral gas at the height range 90–120 km. The measurements have been carried out in 1990–1992 near Nizhny Novgorod (56.15°N, 44.3°E) using SURA heating facility by API technique. The method bases on the measurements of amplitudes and phases of back scattered signals from artificial periodic inhomogeneities (API or ionospheric arrays)[1]. On base on these values V, T and ρ some AGW characteristics as vertical wavelengths, periods, amplitudes and phase velocities were determined. A spectral analysis of the time series gave evidence for dominant periods in the range of 15 min and 4 h. The vertical wavelength varied from 3 to 20 km. The relative amplitudes of the T and ρ variations amounted to 3–30%. It has been supposed the quasi-periodic oscillation in the measured atmospheric parameters was caused by AGW propagation. The measured relative amplitude is compared with theoretical evaluation for AGW based on the dispersion and polarization relations for the linear AGW theory[2]. The comparison shows the experimental data agree well with theory for short-period waves. For long-period waves more detail evaluations with allowance for vertical and horizontal winds, nonlinear wave interactions and use real profiles of neutral temperature will be done.

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E-14

STUDYING OF DYNAMIC OF STRATOSPHERIC WARMING IN ASIATIC REGION ON BASE SATELLITE OBSERVATIONS

V. V. Koshelev, N. A. Abushenko, and S.A. Tashchilin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
koshelev@iszf.irk.ru

The power stratospheric warming have been analyzed the bases on satellite data observation of generation, development and disappearance of thermal-pressure structure low and middle stratosphere till 26 November until 15 December 2000. For studying have been used data about temperature and geopotential values on the standard isobaric levels 10, 20 and 30 GPa from TOVS/NOAA. The observations have been took measurements above region with coordinates 30–70° latitude and 75–140° longitude (North hemisphere). The satellite information had been received on the station of Center of Remote Sensing (Institute of Solar-Terrestrial Physics SB RAS), twice of day (04–05 a.m. and 04–05 p.m. of local time). The origin of stratospheric warming in beginning moment on level 10 GPa have been noted in low latitudes in this region (30–35° latitude 100–120° longitude). The migration was observated during evolution of warming in meridian direction to north latitude 65°. The temperature in center warming zone on the 10 GPa level exceeded mean value on 20–25 K in maximal phase of development this phenomena. The shifting of base warming zone was noted in the beginning on the lower levels (20 and 30 GPa.) to east direction (120–135° longitude) and after that northern-west direction (55–60° latitude).

E-15

MICROWAVE ULTRAREFRACTOMETRY OF THE ATMOSPHERE

R.Z. Sharipov and A.V. Alekseev
Pacific Oceanological Institute FEB RAS, Vladivostok, Russia
avaleks@febras.marine.su

The statistic data of refractive index formed from long sets of continuous observations are presented for the electromagnetic waves with 10 GHz frequencies. The very index is the integral parameter of meteorological state of the atmosphere. Its variations can characterize different processes in the atmosphere. The refractometer with the active range 10 GHz was used. The additional modification and design were made for the high sensitivity and stability. As a result the refractive index was detected with the error not more 0.05%. There are the intensive oscillations of the refractive index with different periods from the analyzing of the long set data. As a rule the oscillations are generated by typhoons and earthquakes before two or three days of their appearance if the amplitude of the earthquakes is approximately five or six amounts in the Richter scale. The short period oscillations are connected with the motion of atmospheric cyclone fronts but the long period ones can be interpreted as earthquake precursors. The identification of typhoons and their comparison with the oscillations of refractive index were made on the base of the satellite maps. The long period oscillations were compared with the data of the National Earthquake Information Center (NEIC, USA).

The real phenomenological mechanism is discussed for the intensive variations of the refractive index. The very mechanism includes modulation of lithosphere-atmosphere coupling by the tidal gravitation forces. This mechanism can be source of the atmosphere infrasound also.

E-16

THEOREMS OF MATHEMATICAL PHYSICS ON INTERNAL AND SELF GRAVITATIONAL INSTABILITY OF A SPHEROIDAL ATMOSPHERE

R.V. Filippov
Al-Farabi Kazakh National State University, Almaty, Kazakhstan
filippov_romanv@mail.ru

In the context of widely discussed problem of experimental determination of small perturbations of gravitational potentials of different nature a need for detailed description of properties of the influence of this kind of perturbations on a spheroidal atmosphere in general and on the earth's atmosphere in particular arises.

Two the following theorems were being proved.

1."On self-gravitational instability of a spheroidal atmosphere"

Spheroidal atmosphere is unstable for small perturbations of gravitational potential of the body that holds the atmosphere.

2."On internal gravitational instability of a spheroidal atmosphere"

Spheroidal atmosphere is unstable for small variations of the gravity constant G.
It is worth to notice that instability is seen not in the usual context but in the meaning that:
$\delta\rho/\rho > \delta\phi/\phi$ and even $\delta\rho/\rho >> \delta\phi/\phi$ in the 1st theorem and
$\delta\rho/\rho > \delta G/G$ and also $\delta\rho/\rho >> \delta G/G$ in the 2nd.

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E-17

TOWARD THE POSSIBILITY OF INVESTIGATING WAVE PROCESSES IN THE GROUND ATMOSPHERE WITH A SOLAR TELESCOPE

N.I. Kobanov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
kobanov@iszf.irk.ru

When investigating the Sun with ground-based facilities, any instabilities of the Earth's atmosphere are regarded as unavoidable evil. Their effect can lead to the distortion of observational data and eventually to erroneous conclusions. This is especially true in regard to investigations of magnetic field and line-of-sight velocity oscillations in helioseismology. Every so often such investigations use the telluric lines as reference ones. Yet when the accuracy of measurements exceeds 1–10 m/s, these reference lines are no longer reliable, and they can by themselves be the source of errors. At the Sayan Solar Observatory, investigations were carried out, which indicated the existence of quasi-periodic variations in the position and form of the telluric H_2O and O_2 spectral lines. The periods of these fluctuations lie in the region of the solar oscillations under investigation, from 3 to 40 minutes. This fact should be taken into consideration when using the telluric lines as reference ones. Measurements of this kind can also be useful in investigating wave processes in the Earth's atmosphere.

E-18

SIMULATION OF PROPAGATION PATHS OF INTERNAL GRAVITATIONAL WAVES IN A MESOSPHERE AND LOWER THERMOSPHERE

N.K. Barsukova[1] and N.A. Sutyrin[2]
[1]Irkutsk Military Air Engineering Institute, Irkutsk, Russia
[2]Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
nasut@iszf.irk.ru

The analysis of propagation paths IGW in a nonisothermal anisotropic atmosphere in ray-approximation is conducted. The area of heights of a mesosphere and lower thermosphere surveyed, where the approximation of the non-viscous and low-ionized plasma when the usable known equation of a magnetohydrodynamics for travelling speed of ionospheric gas as unit is usable. For calculation of speed of a background wind were utilized a lapse rate of pressure and electron concentration on the modern empirical models. The cases of penetration, capture and reflection IGW in dependence of geophysical conditions surveyed.

E-19

SEASONAL PECULIARITIES OF PLANETARY WAVES ACTIVITY AT OZONE IN THE MIDDLE LATITUDES

G.V. Vergasova, E.S. Kazimirovsky, and A.Yu. Belinskaya
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
vega@iszf.irk.ru

The characteristics (periods and amplitudes) of planetary waves (1–30 days) and long-term variations (>30 days) in the total ozone content are investigated for the time interval from 1979 to 1992. The total ozone content (TOC) data for third stations: Irkutsk (East Siberia), Collm (Central Europe) and Saskatoon (Canada), which are well spaced along the 52° latitude circle, but have essentially different longitudes, were provided by TOMS ("Nimbus-7" satellite) measurements. The sliding multiple correloperiodogram-analysis was applied.

The spectrum of TOC oscillations (their periods and amplitudes) changed from day to day, from season to season and from year to year. The periods of oscillations as well as amplitudes have very strongly changed. The appearance, the lifetime and the disappearance of the different oscillations are evident from presented dynamical spectrums. The considerable longitudinal differences at the dynamical spectrums were found: the distinct peaks of

oscillations (without considerable variations of their periods and amplitudes from day to day) were observed for Saskatoon. The seasonal peculiarities of planetary waves at TOC variations in the middle latitudes consist in different periods of oscillations for each of seasons.

E-20

INTEGRATED MEASUREMENTS OF TOTAL OZONE, UV-B RADIATION, AND NO_2 IN BURYATIA

E.V. Batueva,[1] A.V. Bazarov,[1] M.V.Grishaev,[2] V.V. Zuev,[2] and S.V. Smirnov[2]
[1]Department of Physical Problems, Buryatian Scientific Center SB RAS, Ulan-Ude, Russia
root@lrkf.bsc.buryatia.ru
[2]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
zuev@ldsa.tomsk.su

To determine the relationship between diurnal UV-B flux and ozone measured simultaneously in Istomino village (52.17°N, 106.33°E), we performed integrated study of total nitrogen dioxide (NO_2) and its vertical distribution, total ozone, and UV-B flux using high-sensitivity, automated spectrophotometer that provides measurements of spectra in the 290–450 nm wavelength range.

We used solar radiation scattered at zenith for NO_2 and total ozone measurements, and solar radiation scattered from full celestial sphere for UV-B radiation measurements.

Simultaneously, we measured total ozone using M-124 filter ozonometer No. 029, designed by prof. Gushchin, that provides ozone measurements in the 280–346 nm wavelength range. The total ozone measurements were made every hour for angular solar elevations from 5° in zenith measurements and from 20° in solar measurements. The obtained data were then used to calculate the diurnally mean total ozone.

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E-21

POSSIBLE COUPLING OF THE TOTAL OZONE CONTENT VARIATIONS WITH DYNAMICAL REGIME IN THE LOWER THERMOSPHERE DURING HELIOCYCLE

G.V. Vergasova and E.S. Kazimirovsky
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
vega@iszf.irk.ru

The relationship between the total ozone content (TOC) at the field of prevailing wind and semidiurnal tide amplitudes in the lower thermosphere above two mid-latitude observatories Irkutsk (East Siberia) and Collm (Central Europe), and its variations from year to year during solar activity cycle are investigated.

The character of TOC connection with the prevailing wind and semidiurnal tide system have undergone the essential changes at transition period from solar activity maximum in 1981 to minimum in 1986, and again to maximum in 1991 for both observatories. Near solar activity maximum (1984–1986) the total ozone content has decreased considerably. The high TOC exists mainly under north-west winds. Minimal TOC values were observed on both observatories (Irkutsk and Collm) under south-east winds. The lower total ozone content was observed under high semidiurnal amplitudes in the lower thermosphere.

E-22

IRREGULAR VARIATIONS OF GROUND-LEVEL ULTRAVIOLET RADIATION

A.V. Mikhalev, M.A. Chernigovskaya, and A.Yu. Shalin
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
mikhalev@iszf.irk.ru

We present and analyze the data of daily observations of ground-level near-noon ultraviolet (UV) radiation of the Sun in the wavelength range 295–345 nm at Irkutsk (East Siberia, 52°N, 104°E) for 1998–2000.

The study revealed an asymmetry of the seasonal variation of UV radiation with respect to the summer solstice, and its dependence on the wavelength in the spectral range under consideration. Irregular variations of ground-level UV radiation, typical of the region, were identified, which depend on the season, and on the selected spectral range. The detected features of the irregular variations are interpreted in terms of the existence of a pronounced annual variation in total ozone content, the variation (during different seasons) of the proportion of the contribution to the attenuation of UV radiation from the Rayleigh and aerosol scattering, the absorption by ozone, and of the specific climatic weather regime in East Siberia.

E-23

COMPARISON OF STRATOSPHERIC NITROGEN DIOXIDE VARIATIONS OVER ZVENIGOROD AND TOMSK

M.V. Grishaev,[1] V.V. Zuev,[1] and A.S. Elokhov[2]
[1]Institute of Atmospheric Optics SB RAS, Tomsk, Russia
grishaev@iao.ru
[2]Institute of Atmospheric Physics RAS, Moscow, Russia
aelokhov@mtu-net.ru

The report presents the results of analysis of observations of total nitrogen dioxide and its vertical distribution, made in Tomsk since 1996 and in Zvenigorod (Moscow region) since 1993. These long time series were compiled using data of ground-based spectrophotometric measurements. The comparison of the two records revealed close correlation between them.

We analyze the causes and factors responsible for periodic variations and trend observed in the time behavior of total nitrogen dioxide. For instance, in the period of observations in Tomsk, from January 1996 to January 2001, the linear trend of monthly mean total NO_2 with account of seasonal variations was found to be $(-4.59 \pm 0.24)\cdot 10^{14}$ mol/cm^2 per year for the twilight measurements.

The work is supported by the Russian Fund for Basic Research (Grants 99-05-64943 and 00-05-64733).

E-24

VERTICAL DISTRIBUTION OF OZONE OVER TOMSK ACCORDING TO LIDAR OBSERVATIONS IN 1996–2001

S.I. Dolgii, S.L. Bondarenko, V.V. Zuev, A.V. Nevzorov, and S.V. Smirnov
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
dolgii@iao.ru

The report presents the results of analysis of data of lidar sensing of vertical ozone distribution, performed at the Siberian Lidar Station (56.48°N, 85.05°E), Tomsk during period 1996–2001. We compare ozone content in the vertical column and in the layers, calculated both from lidar and spectrophotometric measurement data. The comparison revealed a high correlation between total ozone and its content in the lower stratosphere.

Also, we analyze the annual behavior of ozone content at different altitudes in the stratosphere. The calculation of altitudinal ozone trend for the observation period from 1996 to 2001 shows that the ozone content decreases in the middle stratosphere in the layer 22–30 km and increases in the lower stratosphere in the layer 14–16 km.

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E-25

DUST IN THE STRATOSPHERE ACCORDING TO TWILIGHT PHOTOMETRIC MEASUREMENTS

N. Mateshvili, Yu. Mateshvili, G. Mateshvili, and O. Avsadjanishvili
Abastumani Astrophysical Observatory Alexander, Tbilisi, Republic of Georgia
matesh@yahoo.com

The twilight sounding method has been used in Abastumani Astrophysical Observatory, Georgia, since 1942 on purpose to monitor aerosols in the middle and upper atmosphere.

Prominent enhancements of the twilight sky brightness were observed after strong eruptions of such volcanoes as Sent Helens, El Chichon and Pinatubo. The additional scattered light was associated with a volcanic dust loading of the atmosphere in 15 km to 27 km altitudinal range. The Pinatubo dust of its eruption of June 1991 appeared in the stratosphere over Abastumani as early as in August 1991 and its amount kept to increase until the winter of 1991.

E-26

MIDDLE ATMOSPHERE INVESTIGATION USING THE ARTIFICIAL PERIODIC INHOMOGENEITIES

V.V. Belikovich and E.A. Benediktov
Research Radio-Physical Institute, Nizhnii Novgorod, Russia
belik@nirfi.sci-nnov.ru

The results of the D-region investigation using the artificial periodic inhomogeneities (API) were presented. Measurements were carried out using Sura facility in 1999–2000 by application of scattered signal digital registration with step about of 1 km. The height profiles of relaxation time and amplitude of the back scattered signals were

measured. The interpretation of these data, based on the model with one negative ion O_2^-, is able to obtain the atmospheric temperature and density height profiles at height interval 55–80 km and the concentration of the atomic oxygen on height about of 80 km. The behavior of the D-region during sunrise and sunset by the measurements in August 2000 were analyzed. The alternation of the temperature and density on the height 100 km were obtained. It is noted that many signals scattered on natural irregularities, formed groups in the thin layers were observed at the height interval 85–13 km. Obviously, it is necessary to consider as a weak sporadic layers, which can not be registered by usual ionosonde.

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E-27

THE VARIATION OF VLF-SIGNALS CHARACTERISTICS DURING THE EARTHQUAKES

I.N. Poddelsky
Institute of Cosmophysical Researches and Radio Wave Propagation FEB RAS, Stecolny, Magadan, Russia
uaoibt@mailru.com

Owing to increasing seismic threats, the earthquake prediction problem assumes considerable significance at present for the whole world.

Some results of the researches of the seismic influence on the ionosphere are shown by appearing through the earthquake zone of VLF radio waves. The search of the reaction to the large scale seismic events is carried out on the observations of phase-amplitude characteristics of VLF-field along the traces: Magadan (60°N, 151°E) – Hawaii, Magadan – Japan, Magadan – Australia on 1992–1997. The representative data are evident about significant influence of large scale seismic phenomena to the conditions of VLF propagation and sometimes they are long before the earthquake. As research work has demonstrated, information on an impending earthquake is formed in the VLF-signals during the passage of signals over dangerous areas owing to changes in the phase velocity of their propagation in a waveguide formed by the ionosphere lower boundary and the Earth's surface. The effect of seismotectonic processes are appeared in the change of conditions of the Earth- ionosphere wave guide probably and in the conditions of summation different modes (rays) of VLF-field at the reception point that is appeared in the decreasing (or only variation) of the amplitude of detected signal, the variation of the day motion of the phase- amplitude characteristics the appearance of its "diffusing". Usually the interaction of the earthquake appears on the base direction and then on the adjacent directions and lasts for a long time (more than day). It doesn't effect the traces which are moved off the base trace.

The discovered effects are needed careful study and statistic confirmation and can be used ahead of time for the establishment of the zone and the time of the seismic effects. According to analytical data on the phase-and-amplitude parameters of the signals reflecting the data on impending earthquake symptoms, a short-term prediction stating the place, time and magnitude of the earthquake is possible as early as 5 to 10 days before the event. Subsequently, these data can be specified more precisely.

E-28

LOWER POLAR IONOSPHERE RESEARCHES BY THE PARTIAL RADIOREFLECTIONS TECHNIQUE

V.D. Tereshchenko, M.V. Yakimov, E.B. Vasiljev, S.M. Chernyakov, and O.F. Ogloblina
Polar Geophysical Institute KSC RAS, Murmansk, Russia
vladter@pgi.ru

The lower polar ionosphere researches are carried out on the modified measuring complex of the observatory Tumanny (69.0°N, 35.7°E) since 1999. Investigations of dynamic processes caused by movements of neutral atmosphere, variations of electron density are implemented and analysis of statistical and frequency characteristics of scattered signals are carried out.

Calculations of the electron concentration were carried out by technique of differential absorption. Analysis of the date has shown that there are regions of lower electron density at heights near the mesopause with life times from one minute till several hours. Radioechoes from the regions had enhanced intensities.

Layers of electron concentration irregularities with scales more than 100 m at heights from 70 till 99 km were detected by the technique of spaced receiving of scattered signals. During the solar eclipse of 1999 August 11 during short time an enhanced intensity of a radioecho was detected at heights near the mesopause.

E-29

ADAPTIVE SIMULATION OF ATMOSPHERIC PHENOMENA

J.P. Lankin
Institute of Biophysics SB RAS, Krasnoyarsk, Russia
lan7@mailru.com

It is well-known that the atmosphere represents a dynamical nonequilibrium high complicated system. Its modeling is connected to a series of essential difficulties, as by virtue of dynamism and nonlinearity of atmospheric processes, and because of necessity of taking into consideration a large number of parameters, defining its state. However it is not the only problem. The results of last analytical investigations in the fields of methodology[1] and mathematics[2] show, that the existing cognitive models are bounded in their possibilities in applying to complex objects. In the paper[2] the general abstract characteristic of perturbation theory is obtained, from which follows that variation of starting and/or boundary conditions during verification of the model, as a rule, is not enough for modeling of complex systems and processes. The effective progress in decision of considered problems is possible on the employment of new generation system models[1,3] which are leaning upon adaptive principles. Among the most effective methods of adaptive models constructing the most up to date methods of neuroinformatics stand out[4], because of multivariable modeling permission, allowing considerably simplification of adaptive, dynamic and non-linear systems.

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E-30

INVESTIGATION OF VERTICAL 3ROPAGATION OF NONLINEAR WAVES IN THE ATMOSPHERE

S.P. Kshevetskii and N.M. Gavrilov
Kaliningrad State University, Kaliningrad, Russia
kshev@email.albertina.ru

By means of numerical simulation, the vertical propagation of internal gravity and acoustic waves in the atmosphere is investigated and their contribution to turbulence is examined. On present representations, many atmospheric internal gravity waves arise at stratosphere heights. Then the waves slowly propagate upward, while their amplitudes exponentially increase. Through of increase of wave amplitudes at some height the stability condition gets broken, and the waves are breaking down, making background turbulence in the medium and high atmosphere. It is supposed that the process goes to some saturation until the turbulent dissipation of energy becomes equal to energy inflow through of wave disintegration. Direct affirming of such scenario of turbulence formation in the medium and upper atmosphere does not exist. Moreover, some laboratory experiments indicate that some other mechanisms of turbulence exist. For example, turbulent spots are often originated from smooth IGW at the account of wave disintegration into solitons of very small-size scales. For simulation, the authors utilised nonhydrostatic nonlinear model of atmospheric processes. This model has earlier been utilised for simulation of decay of internal waves into solutions. The wave is set as a sine radiant near an earth surface. The further changes of wave evolution are modelled numerically. It is shown that the wave behaviour essentially depends on the wave sign and that the wave disintegration happens by spots. It is shown that the vertically propagated AWs render significant influence on formation of background turbulence.

Session F1. LONG-PERIOD TRENDS OF ATMOSPHERIC PARAMETERS

F1-01

MODERN NATURE-CLIMATE CHANGES IN SIBERIA: NEW METHODS AND RESULTS OF ANALYSIS AND INSTRUMENTAL OBSERVATIONS

M.V. Kabanov
Institute of Optical Monitoring SB RAS, Tomsk, Russia
kabanov@iom.tsc.ru

Methods and certain results of the versatile analysis of nature-climate changes in Siberia during the last century are considered in the review. The statistical data of instrumental observations are the base of the analysis. Detailed results of the analysis are considered in separate papers represented in Symposium.

Statistical analysis of long-standing series of instrumental observations of the surface temperature of air with the singling out of the long-duration trends of annual average temperature, amplitudes of inter-season variations and anomalies of monthly average temperatures shows that the getting warmer in Siberia has a several centers with trends of the accelerated getting warmer which is higher then 0.5°/10 years. In this case the amplitude of inter-season variations of the monthly average temperature has a different dependence on the annual average temperature over a territory that allows us to elaborate the taxonomic classification of climatic regions if Siberia.

Developed system-evolutionary analysis of the climatic series provides the more thorough revealing of regional peculiarities of the nature-climatic changes by both the temperature condition and the other climatic characteristics. Multidimensional phase patterns allow us to trace the evolutionary paths of the set of climatic characteristics with more detailed referencing to the nature-territorial complexes under study.

Wavelet analysis applied to the analysis of the nature-climate changes discloses a multilevel nature of the temporal variability of climatic characteristics that provides a scientific-grounded interpretation of the observed changes occurring under action of natural or anthropogeneous factors.

F1-02

INTER-YEARLY VARIATIONS OF SURFACE TEMPERATURE OF AIR IN TOMSK

I.I. Ippolitov, M.V. Kabanov, and S.V. Loginov
Institute of Optical Monitoring SB RAS, Tomsk, Russia
ceo@iom.tsc.ru

Hidden periodicity in the inter-yearly changes of temperature has been analyzed at the example of the set of annual average temperatures for Tomsk during 1881–1998. Methods of the wavelet transform and Fourier transform have been used for the analysis. The power spectrum $|W(k,s)|^2$ of observation sets for the surface temperature has revealed the periodic structures of scales 2–3, 7–10, 12–25, and 30–50 years. The least scale of 2–3 years is attributed to quasi-two-year cycle. Wavelet analysis of set of the Wolf number during 1700–1998 and the critical frequencies of the layer F_2 of the ionosphere during 1936–1998 has been carried out. Correlation analysis has showed a presence of the significant correlation between 22-years cycle of the Wolf numbers and the variations of temperature in the scales of 12–25 years only. Quasi-periodic structure in the scales of 30–50 years which undergoes during 20 century a reformation to smaller scales has been noticed. We notice an interval of the time between 1940–1950 when a significant growth of the solar constant has occurred. We suppose that this growth could cause a change of the atmospheric circulation regime, which has finished to the end of the seventies, and the changes in temperature regime which are connected with it. Peculiarities of inter-yearly variations of the temperature in other cities in Siberia are discussed.

F1-03

LONG-TERM DYNAMICS OF CHARACTERISTICS OF STRATOSPHERIC AEROSOL LAYER ACCORDING TO DATA OF LIDAR OBSERVATIONS IN TOMSK (56.5°N, 85.0°E)

V.D. Burlakov, A.V. Elnikov, and V.V. Zuev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
elnikov@iao.ru

In the report, we analyze the results of the study of stratospheric aerosol layer (SAL), performed at the Siberian Lidar Station, IAO SB RAS, Tomsk, since 1986. We consider the optical characteristics of stratospheric aerosol, determined from laser sensing data for wavelength 532 nm: vertical profiles of scattering ratio and aerosol backscattering coefficient, as well as its integrated value for the entire stratospheric layer. The stratospheric aerosol optical depth and aerosol particle size spectrum are estimated from multifrequency sensing data.

The observation period is characterized by the presence of trace residual amounts of del Ruiz aerosol in 1986, decrease of aerosol content to a minimum level by 1989–90, rapid growth of aerosol loading after Pinatubo eruption in June 1991 with increase of stratospheric aerosol optical depth up to 0.2, and establishment of "new background period" by 1997. Interestingly, in the latter period, since 1997, the aerosol loading of the stratosphere never exceeds, and at times even goes below the pre-Pinatubo, background, 1989–90 values, which does not support the existing hypothesis that the stratospheric aerosol mass increases by up to 5% yearly due to anthropogenic factors. Earlier, based on analysis of results for background period 1989–90 and subsequent years, the absence of significant differences in seasonally mean (winter-summer) profiles of aerosol stratification and uniform exponential behavior of altitude distributions of aerosol backscattering coefficient were proposed as criteria of background SAL state for the Northern Hemisphere mid-latitudes. The data of 1999–2001 measurements do not contradict these criteria and largely agree with data for 1989–90.

The work is perform at the Siberian Lidar Station (Reg. No. 01–64) under support of Ministry of Science of the Russian Federation.

F1-04

OBSERVATION OF OPTICAL FLASHES OF THE NIGHT STAR SKY ON THE ATMOSPHERIC CHERENKOV INSTALLATION TUNKA

O.A. Gress, T.I. Gress, L.V. Pan'kov, Yu.V. Parfenov, Yu.A. Semeney, and L.A. Kuzmichev
Applied Physics Institute of Irkutsk State University, Irkutsk, Russia
gress@api.isu.runnet.ru, par@api.isu.runnet.ru

C Brief description: Varied processes occurring in the cosmos space act upon its condition and anyway atmosphere displays information on these processes. In particular, nocturnal glow contains rich physical information in itself. Experiment on the study of fluctuations of night glow is conducted on the base of 13 module atmospheric Cherenkov telescope TUNKA (103.04 E, 51.49 N, 950 g/cm^2), situated in Tunka valley in 50 km from Lake Baikal near Tori village. Basic task of TUNKA installation is a registration of Cherenkov flashes of light from Extensive Air Shower (EAS) initiated by primary cosmic particles with the energy $3 \cdot 10^{14}$ eV. Observation of light flashes radiating in night atmosphere is one more experiment which is run for Cherenkov installation TUNKA to study the background conditions for EAS registration. Installation works in cloudless and moonless nights. At a period from the December 1997 on the December 2000 was registered large quantity of light flashes of radiating night atmosphere with duration from 16 ms to few hundred seconds. Value of minimum registered intensities of light bursts is around $3 \cdot 10^{-8}$ W/m^2. Coincidence of optical flashes with the gamma-bursts from the catalogue of BATSE experiment observatories "Compton" was analyzed.

F1-05

LIDAR INVESTIGATIONS OF FEATURES OF WINTER STRATOSPHERIC WARMING ABOVE TOMSK FOR THE PERIOD 1996–2000

V.N. Marichev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
moroz@iao.ru

Using the results of the thermal sounding of the stratosphere obtained in the lidar station of the Institute of Atmospheric Optics, the cases of winter stratospheric warming above Tomsk (56.5 N, 85.0 E) for the period of 1996–2000) have been analyzed. It is found that, at the observed interval of heights of 15–35 km, the stratospheric

warmings happened each winter and they proceeded in the intervals from several days up to one month. For even observation years, such the warmings were observed several times in winter, and it was observed once for the odd years of supervision. This fact may be explained by influence of the quasi-biannual stratosphere circulation cyclicity. A deviation of temperature at these warmings from a background temperature profile did not exceed $\Delta T = 30\ K$, that is essentially less than the values $\Delta T = 60 \div 80\ K$ marked for the stratosphere of polar latitudes.

Localization of heat in the top layers (25–35 km) was frequently accompanied by a cold snap of air in the lower layers. Cases of heating of air mass in all intervals of heights of 15–35 km were observed.

F1-06

LONG-TERM DYNAMICS OF THE ATMOSPHERIC AIR METEOPARAMETERS NEAR THE LARGE INDUSTRIAL CENTERS OF ALTAI DISTRICT

G.S. Zinchenko, I.A.Sutorikin, and N.N. Bezuglova
Institute for Water and Environmental problems, Barnaul, Russia
Sia@iwep.secna.ru

The problem that climatologists of Water and Ecology problems Institute, Russia tried to solve many times is the estimation of the trend components in the character of the long-term changes of the air environment regime meteocharacteristics of the different regions of Altai district. The constant interest to this problem is conditioned by the increasing of the anthropogeneous load on the environment: the building of reservoirs and waterways, ploughing up virgin lands, creating large industrial centers and so on.

This paper contains the description of the results of analysis of long-term air environment meteoparameters rows at the stations of Russian Hydrometeorological Committee, located not far from main industry centers Barnaul, Biisk, Rubtsovsk, Kamen-na-Obi, besides the special microclimatic data, made at these regions are considered. The data taking account of the changing of temperature, moisture, wind regimes; also of dust and pollutant transport and diffusion that depend on enterprise throw, expose as rule the presence of meaningful changing only at mezo- and microclimatic levels.

The apportionment of the anthropogenic component in the climate changing of the Altai region still stays problematic.

F1-07

LAKE BAIKAL AS THE SOURCE AND RECEPTOR OF PERTURBATIONS IN CLIMATE-ECOLOGY SYSTEM OF SIBERIA

V.V.Peneko and E.A.Tsvetova
Institute of Computational Mathematics and Mathematical Geophysics SB RAS, Novosibirsk, Russia
Penenko@sscc.ru

In the report, some aspects of interconnections between Lake Baikal and climate-ecology system of Siberia are discussed. The work is fulfilled with the help of numerical models, combination of direct and inverse modeling procedures, sensitivity studies and factor analysis.

Mathematical models have become a multifunctional tool for studying processes in the atmosphere and water objects. In particular, for solving the problems of evaluation of the prospects of industrial regions with human activity imposed on natural climatic and ecological factors, mathematical simulation is, apparently, the only means for obtaining information.

The Baikal region plays a specific role in the formation of climatic conditions and ecological environment in the south of Siberia. The specific feature of this region is that Lake Baikal is a powerful climate-forming factor there. The importance of this factor is amplified by the fact that this region is in the influence zone of the summer Sayan-Altai cyclogenesis and the winter Asian anticyclone.

Thus, forming a concept of studying in the lake-atmosphere system, we consider local-to-regional processes together with global phenomena, and do not separate the hydrothermodynamics of the system from the processes of pollutants' transport. This is necessary to evaluate both the role of transboundary transfer and external processes and sources for the region and the effect of the region in climatic system.

This work is supported by the Russian Foundation for Basic Research (Grants No. 00–15–98543, 01–05–65313) and Integration Grant of the SD Russian Academy of Sciences (No. 56).

F1-08

SOURCES OF POLLUTION OF THE ATMOSPHERE WITH THE POLYCYCLIC AROMATIC HYDROCARBONS IN INDUSTRIAL PRIBAIKALYE

L.I. Belykh, Yu.M. Malykh, E.E. Penzina, and A.N. Smagunova
Irkutsk State University, Irkutsk, Russia
smagunova@mail.ru

The emission of benzo(a)pyrene (B(a)P) and other polycyclic aromatic hydrocarbons in the atmosphere was studied and it was established that these processes depend on technology of aluminum, fuel-energy, building, petrochemical industries and on the type and operating conditions of used installations. The correlation between B(a)P content and associated pollutants, for example, dust, soot, ash, oxides of carbon, nitrogen, sulfur, resinous substances and polycyclic aromatic hydrocarbons was found. The methods of the calculation of the B(a)P mass emissions from automobiles with the petrol and diesel engines were offered. On the base of such studies the recommendations about necessary actions for reduction of the B(a)P emissions in the atmosphere were suggested.

F1-09

TOTAL LIQUID WATER CONTENT DISTRIBUTION IN CLOUD LAYER FROM MICROWAVE REMOTE SENSING

M.Yu. Shoom, L.M. Mitnik, and A.A. Nabiullin
Il'ychev Pacific Oceanological Institute FEB RAS, Vladivostok, Russia
mshoom@poi.dvo.ru

Variability of the liquid water content in clouds is one of the manifestations of atmospheric turbulence. In this study temporal and one-dimension spatial distributions of the total liquid water content Q in the extensive cloud layers are statistically analyzed. The distributions were found from the ground measurements of the brightness temperature of the atmosphere $T_B(\lambda)$ at wavelengths of $\lambda = 0.8$ and 2.3 cm which were carried out in the period of winter monsoon at the northern Taiwan coast. The duration of passive microwave observations of unbroken clouds ranged from 14 to 225 h. The values of Q were retrieved from the increments of the brightness temperature of the cloud atmosphere relative to the clear one taking into account air temperature and humidity. The frozen turbulence hypothesis were applied to determine spatial distributions of Q. Spatial frequencies of Q variations were found using data on wind speed and direction at the cloud level. The spectral analysis was performed to estimate scale invariant regimes. The regimes are defined by the scales were spectra follow power law $E(x) \sim \exp(-\beta x)$. The lower limit of the scales was restricted by the antenna field of view at the cloud level and was about 400 m, the upper one was a function of the observation duration and the used averaging method and ranged from 40 to 400 km. In all (more than ten) cases studied scale-invariant regimes were revealed. Two types of spectra were found: 1) scale-invariant spectra covering the hole scale range analyzed with the spectral slope β being ranged from 2 to 2.5, and 2) spectra with two scale-invariant ranges with $\beta > 2.5$ at lower scales and $\beta < 2$ at upper scales. The results are discussed in respect to two-dimension turbulence theory.

F1-10

AMPLITUDE-PHASE CHARACTERISTICS OF SAT ANNUAL CYCLE IN ASIA: TENDENCIES OF CHANGE DERIVED FROM OBSERVATIONS AND REANALYSES AND FROM NUMERICAL EXPERIMENTS WITH IAP RAS CM.

A.V. Eliseev and I.I. Mokhov
Obukhov Institute of Atmospheric Physics RAS, Moscow, Russia
lesha@omega.ifaran.ru

Amplitude-phase characteristics (APCs) of the annual cycle (AC) of surface air temperature (SAT) are analyzed using the data of observations and reanalyses for the XX century as well as the results of numerical experiments with the IAP RAS global climate model (IAP RAS CM) since the middle XIX up to the late XXI centuries under greenhouse-gas forcing. Tendencies of change of AC APCs are compared with those for the annual mean SAT Tsm.

The results of analysis of observations and reanalyses are in general agreement among each other. It is found that under local annual mean warming southward of the characteristic position of the snow-ice boundary (SIB) amplitudes of the annual (Ts1) and semiannual (Ts2) harmonics decrease, spring (autumn) phase comes later (earlier) with a corresponding shortening of interval of exceeding (when SAT is higher than Tsm). Northward of the characteristic SIB position under local annual mean warming tendencies for the amplitude AC characteristics (Ts1)

do not change while for the phase ones (Ts2, moments of spring and autumn phases, interval of exceeding) they are reversed. In the Far East (southward about 50 N) growth of Tsm is accompanied by earlier both spring and autumn phases while interval of exceeding changes only insignificantly. Over the Pacific Ocean a positive correlation among Ts1 and Tsm is found.

Using energy-balance climate model it is shown that tendencies of change of the SAT AC APCs in the middle and high latitudes are to be associated to the influence of the albedo-SAT feedback due to the SIB movement. In the middle and subtropical latitudes they could be explained as a result of the interannual cloudiness variability.

IAP RAS CM simulates present-day values of SAT AC APCs in Asia reasonably well. The model also qualitatively simulates their variability due to albedo-SAT feedback. In contrast, tendencies resulting from the cloudiness variability do not reproduced by this model.

A relation between SAT AC APCs and permafrost is discussed.

F1-11

LONG-PERIOD TRENDS IN LOWER SUB-AURORAL IONOSPHERE

S.E.Kobyakova and V.F.Smirnov
Institute of Cosmophysical Researches and Aeromony SB RAS, Yakutsk, Russia
v.f.smirnov@ikfia.ysn.ru,

Results of the analysis of long-period trends in the layers E and D of the ionosphere by the ionosphere measurements of the parameters foE, h'E, and fmin at the Yakutsk station during 1956–1995 and the atmospheric temperature in the surface layer are presented.

It is shown that in three last cycles of the solar activity a growth of the average values of the parameters foE, h'E, and fmin for the midday hours and the daily average air temperature in the surface layer is observed. In the midnight values of fmin the global changes are not observed. Analysis of the variations of the ionosphere parameters and temperature in the surface layer reveals their certain connection.

F1-12

PECULIARITIES OF TOTAL CIRCULATION OF THE ATMOSPHERE OF NORTH HEMISPHERE DURING THE WARM AND COLD WINTERS AT SIBERIA TERRITORY

A.A. Karakhanyan and V.I. Mordvinov
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
v_mordv@iszf.irk.ru

By the data of NCEP/NCAR Reanalysis the distributions of baric-field for North hemisphere during cold and warm winters of 1948–2000 at Siberia territory have been compared. To select the extreme periods the data of measurements of the surface temperature which are interpolated in nodes of a regular grid, and also the data of direct observations at the weather stations of Eastern Siberia have been used. For cold periods a predominance of meridian forms of circulation is typical, and the amount of changes of circulation types continuously increases from the middle of the fifties.

F1-13

ANALYSIS OF CLIMATIC CHANGES ON THE PHASE PORTRAITS

E.A. Dyukarev and V.I. Shihlov
Institute for Optical Monitoring SB RAS, Tomsk, Russia

The methods and means of the system-evolutionary analysis of mesoclimate states ensemble in multidimensional phase space of meteorological variables based on the results of instrumental observation provide the new opportunities of estimation of spatial and temporary features of modern climate changes. The method of graphic climate representation includes procedures of processing of long-term series of meteorological data, calculation of the estimation characteristics for certain periods (month, season, year), and construction of meteorological portraits such as state points and phase paths. The techniques of the analysis use procedures of picking out of particular areas at state space for long-time intervals in a graphic dialogue mode, determination of the variability characteristics of the state ensembles.

Two-dimensional portraits (at space of monthly average temperature and total precipitation) allowed us to obtain the characteristics of interdecadal and long-term variability of Siberian climate. The features of abnormal fluctuations, the tendency of air temperature increasing and total precipitation during cold seasons have been revealed. It has been found that the duration of warm period increases up to 220 days at Barabinsk station, and the monthly total precipitation at summer decreases up to 65 mm. The duration of the period without precipitation reaches 33 days in a steppe zone at droughty years (1998) and 22 days in the southern taiga area. The analysis shows that water rotation processes at land cover such as plant transpiration, water exchange with earth waters have essential influence on atmospheric precipitation. The forests, which support and regulate the local water rotation, attenuate the climate aridity.

F1-14

ESTIMATION OF APERIODIC CLIMATE PARAMETERS CHANGES

E.A. Dyukarev and V.I. Shihlov
Institute for Optical Monitoring SB RAS, Tomsk, Russia

The method of revelation and estimation of aperiodic climate changes have been suggested. Based on the analysis of secular series of continuous sum of annual mean air temperatures, the time intervals with relatively constant temperatures have been picked. It has been found that for Tomsk weather station the alternation of warm and cold periods with duration from 5 to 30 years is typical. The warmest period started at the end of 70^{th}, and it continues at the present time. The mean annual air temperature in Tomsk at the last period is about 0.7°C. The coolest period with the mean temperature −1°C extends from 1966 to 1977. The analysis of the long-term series of mean annual temperature and yearly total precipitation has been conducted for 32 weather stations in East Siberia. The investigation of spatial distribution of temperature and total precipitation let us determine the areas with synchronous changing of climate periods.

F1-15

CHANGES OF A REGIONAL CLIMATE, CAUSED BY THE NATURAL FACTORS BOTH BY ANTROPOGENEOUS INFLUENCE

K.A Karimov and R.D.Gainutdinova
Institute of Physics National Academy of Sciences, Bishkek, Kyrgyzstan
kazimir@academy.aknet.kg

The researches of the basic peculiarities of the regional tendencies of change of a climate in Kyrgyzstan in conditions of constantly amplifying antropogeneous loading are carried out. The quantitative estimations of a background temperature for last 70 years in middle- and high-altitude areas of Kyrgyzstan are received. The general tendency of growth of temperature in lower atmosphere on researched regions for the 70-year's period is revealed. The speeds of warming thus make 0.007–0.03 degrees per year. Is marked that with increase of height of region a deviation of seasonal temperatures from background decrease.

The periodical components in long-term numbers of lower atmosphere temperature have been calculated. Components with the periods 1.0; 3.0; 6.5; 12.5; 37 and 49 years most precisely are allocated.

The connection of a thermodynamic regime of a lower layer atmosphere with changes of a level of 11-years cycles of solar activity is investigated. In cycles with a high level of solar activity the multi-years norm of a lower layer atmosphere temperature grows by 0.3 degrees.

The specific contribution of greenhouse effect and dynamic factors in a gain of a lower layer atmosphere temperature is designed. The estimations show, that greenhouse effect connected with increase in region of the concentration CO_2 on 7% for 10 years can result in increase of a lower layer atmosphere temperature on 0.28 degrees, that makes half from an actual level of increase of temperature. The stayed half, obviously, is caused by the factor connected to dynamic carry of heat from low latitudes.

F1-16

VARIATIONS AND LONG-TERM TRENDS OF TOTAL OZONE AND STRATOSPHERIC NITROGEN DIOXIDE OVER NORTHERN TIEN SHAN

V.K. Semenov,[1] V.P. Sinyakov,[1] L.I. Sorokina,[1] N.I. Ignatova,[1] F.V. Kashin,[2] and K.N. Visheratin[2]
[1]Kyrgyz State National University, Bishkek, Kyrgyzstan
svk@it.kg
[2]Institute of Experimental Meteorology, SPA "Typhoon", Obninsk, Russia
las@iem.obninsk.ru

The measurements of total ozone (O_3) (since 1980) and nitrogen dioxide (NO_2) total content (since 1983) at the Issyk-Kul station (Northern Tyan Shan) have shown the basic contributions into the gases content variabilities are brought by seasonal variations (69% for O_3 and 50–70% for NO_2). In the O_3 variations quasibiennal oscillations with amplitude of 3–8% and negative trend were observed. For the whole period of observation the depletion rate of ozone layer over the Northern Tyan Shan in a linear approximation is minus (0.38±0.08)% per year, and for the period of simultaneous measurements of O_3 and NO_2 it is minus (0.29±0.10)% per year.

The NO_2 total contents at the sunrise on the average were usually by 1.4 time less as compared with the sunset. In long-term changes of the half-sum of the sunset and sunrise measurement data of NO_2 total content a statistically valid linear positive trend (0.38±0.29)% per year was found. Multiparametric regression models of monthly mean values of O_3 and NO_2 variability, considering a change of solar activity, indices of the El Niño/Southern Oscillation and the North-Atlantic Oscillation phenomena, changes of zonal, meridian and vertical components of wind speed in the lower stratosphere over the observation site, a change of temperature in the lower stratosphere, the variations of the optical thickness of the atmospheric aerosol are described. The correlation coefficients between the variability of O_3 and NO_2 for various periods of observations are determined.

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F1-17

INFLUENCE OF QUASI-BIANNUAL STRATOSPHERE CIRCULATION CYCLICITY ON THE VERTICAL DISTRIBUTION OF OZONE AND TEMPERATURES ABOVE WESTERN SIBERIA

V.N. Marichev
Instutute of Atmospheric Optics SB RAS, Tomsk, Russia
moroz@iao.ru

On the basis of lidar sounding data of ozone and temperature in the stratosphere above Tomsk in the winter period of 1996–2000, an influence of the quasi-biannual stratosphere circulation cyclicity (QBO) on their vertical distributions has been shown. Interannual variability of the ozone content and temperature is observed distinctly in the range of heights of 18–30 km. as the synchronous oscillations of the period of 2 years. Maximum amplitudes of the oscillations by ozone as well as temperature are detected at the height of localization for maximum of the ozone layer of H = 20 km. Periodicity of the oscillations begins to appear from the lower heights for temperature ($H < 16$ km), but it appears at $H \leq 36$ km for ozone. Positive anomalies for vertical distributions of ozone and temperature as well as the total ozone column were observed for even years (1996, 1998, 2000), and negative anomalies- for odd years (1997, 1999)

F1-18

CURRENT STATE AND LONG-TERM CHANGES OF THE OZONOSPHERE OVER TOMSK

S.V. Smirnov and V.V. Zuev
Institute of Atmospheric Optics SB RAS, Tomsk, Russia
smirnov@iao.ru

Observation and analysis results of total ozone changes over Tomsk since 1979 are presented. This long-term time series was formed from the data of ground-based spectrophotometric measurements of total ozone carried out from 1993 in Tomsk and TOMS measurements. Data comparison shown a correlation more 95 %.

Analysis of causes and interconnections determining oscillations and a trend in total ozone behavior is also performed in the paper. So the linear trend in monthly means of total ozone (seasonally adjusted) for observation period from March 1993 to January 2001 in Tomsk equals 1.08±0.24 % per year.

The research is supported by the Russian Fund of Basic Researches under grant No. 99–05–64943.

F1-19

NUMERICAL MODEL OF THE ATMOSPHERIC BOUNDARY LAYER WITH THE SURFACE INHOMOGENEITY

N.N. Bezuglova,[1] Yu.A. Sukovatov,[2] and I.A. Sutorikhin[1]
[1]Institute for Water and Environmental Problems, Barnaul, Russia
[2]Altai State University, Barnaul, Russia
sia@iwep.secna.ru

Modelling pollutant diffusion and transport processes in the atmosphere in conditions of horizontal inhomogeneity depends on the necessity to solve the practical problems, connected with the increasing numbers of pollutant and aerosol anthropogenic sources.

The presence of the nonuniform surface may influence the mezo-scale atmospheric processes. To research more completely the structure of the boundary layer, connected with inhomogeneity, the numerical model made on the basis of model[1] is used (as the example Blagoveschensky region Altai district is considered). The model takes account of the two-dimensional surface inhomogeneity. The monótonous difference scheme with the directed differences of the 2nd order by vertical step[2] is used to compute the meteoelements and pollutant vertical profiles. This scheme is stable and computes for large horizontal scale (dozens km). To evaluate the changes of the meteoelements and pollutant vertical profiles along the horizontal axes (X and Y) the alternative directions method is used.[2]

The model with two-dimensional surface inhomogeneity shows more realistically the features of the boundary layer structure connected with the inhomogeneity.

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Session F2. EFFECT OF SOLAR ACTIVITY ON WEATHER AND CLIMATE

F2-02

COSMIC RAYS AND GLOBAL WARMING ON THE EARTH

P.E. Pokrevsky[1,2] and Y.I. Stozhkov[2]
[1]Fedorov Institute of Applied Geophysics, Russian Hydrometeorologic Committee, Moscow, Russia
[2]Lebedev Physical Institute RAS, Moscow, Russia

The cosmic ray fluxes in 4 consecutive solar activity minima (1964–1965, 1976–1977, 1987 and 1996–1997) are considered. The data obtained in long-term stratospheric measurements and at ground level (neutron monitor and ionization chamber data) are used. The long-term negative trend is derived from these experimental data. The value of the effect is (0.01–0.09)% per year. The data of radioactive isotopes of 10Be and 14C which are produced by cosmic rays in the atmosphere also show the gradual decrease of their concentrations on the timescale of some thousand years. The decrease of the charge particle flux in the atmosphere decreases the global cloud coverage. In turn, it can give the increase of the surface temperatures that it observed in the last century.

F2-03

EFFECT OF SOLAR AND GEOPHYSICAL FACTORS ON THE AEROSOL CHARACTERISTICS. PLANS OF ATMOSPHERIC INVESTIGATIONS IN IRKUTSK

M.V. Panchenko,[1] S.M. Sakerin,[1] V.V. Koshelev,[2] V.A. Kovalenko,[2] and T.V. Khodzher[3]
[1]Institute of Atmospheric Optics, Tomsk, Russia
[2]Institute of Solar-Terrestrial Physics, Irkutsk, Russia
[3]Limnological Institute, Irkutsk, Russia

The direct effect of aerosol on the change of climatic characteristics in connection with such geophysical factors as volcanic eruptions, powerful dust emissions, vast fires, etc. is well known. The effect of solar phenomena (11–year cycles, flashes, etc.) on the tropospheric processes and especially on aerosol is rather indirect and is now widely discussed.

The peculiarities of the long–term variations of aerosol characteristics and the possible reasons of the changes are discussed in this paper. It is shown that the peaks of the aerosol optical depth observed in 20 century with periodicity of about 10 years are related to the volcanic factors. The role of the solar activity of global aerosol should appear in more intricate form, and, more likely, one should expect it to be apparent in the change of atmospheric circulation (hence, in the change of the aerosol weather in specific geographical regions). The region of lake Baikal is the most felicitous for comprehensive study of such problems. To reveal the mechanisms of the effect of global and local factors on aerosol, the joint (IAO, ISTP and LI SB RAS) researches were organized. Measurements of the spectral transparency of the atmosphere (wavelength range 0.37 to 1.06 μm) in monitoring regime were started in Irkutsk in November 2000. The problems of the complex experiment and expediency of extending the wavelength range to the UV region are considered. Besides, the traditional directions of aerosol investigations in the region of Irkutsk – revealing of regional peculiarities, urban effect, etc. are touched upon.

The work was supported in part by Siberian Branch of the Russian Academy of Sciences (Integration Grant No. 56).

F2-04

SOLAR FLUX VARIABILITY AND GLOBAL CLIMATE

Yu.A. Sklyarov, Yu.I. Brichkov, A.I. Kotuma, and N.V. Fomina
Saratov State University, Saratov, Russia
sklyarov@sgu.ssu.runnet.ru

The problem of direct and indirect effect of total solar flux variability on global climate is considered. The current satellite precision data of solar constant (SC) measurements during 21–23 cycles of solar activity including author's data are given. Details of construction of combined satellite SC measurement series (composite) and evaluation of its absolute scale are given. The measurement data in two successive minima of solar activity do not reveal of the long-term trend of SC. The other possible causes of continuing of global warming are considered. One of its peculiarities is that in general the global temperature growth results from the rise of minima daily temperatures. This effect leads to decrease of diurnal temperature range (difference between maximum and minimum values of temperature). Both the possible long-term SC trend and increasing greenhouse gases concentration do not give explanation to this phenomenon. The other mechanisms of solar flux modulation and corresponding radiation effect on the land-ocean-atmosphere system are discussed. Among them are indirect greenhouse radiation effects such as changes in cloudiness, aerosol loading, atmospheric water vapor content, rise of the near surface haze etc. It is stressed that for separation of direct solar effect on global climate the long-term precision measurements of the SC are needed.

F2-05

SOLAR ACTIVITY AND EARTH CLIMATE AT THE BEGINNING OF 21 CENTURY

V.S. Bashkirtsev and G.P Mashnich
Institute Solar-Terrestrial Physics SB RAS, Irkutsk, Russia
vsb@iszf.irk.ru, mashnich@iszf.irk.ru

The analysis of sequences of data of the Wolf numbers, surface air temperature in Irkutsk and for all Earth from 1882 to present is made. A course of local temperature (Irkutsk) and global (all Earth) follow to the course of a solar activity. Based on closely related solar – earth connections and expected depression of the solar activity to 2025 there is forecasted decrease in global surface air temperature in coming the proximate 25 years.

F2-06

GLOBAL AND LOCAL VARIATIONS OF AN ELECTRICAL FIELD OF AN ATMOSPHERE

U.V. Shamansky
Irkutsk State University, Irkutsk, Russia
suv@ home.isu.ru

The author carried out registration of electrical potential of an electrical field of an atmosphere, electrical conductivity of air, basic meteorological sizes and total solar radiation during two six-monthly expeditions at Indian Ocean. For the comparative analysis the data of supervision behind atmospheric electricity at continental stations were used.

The middle daily variations of an electrical field on ocean, where the action of the local factors is reduced represent a unitary variation with a maximum at 19 hours of Greenwich o'clock and minimum to 6–7 hours. On existing representations, insolated by the sun the surface of oceans varies within day on that to the law, as daily course of an electrical field. The mechanisms of generation of global and local variations till now are not absolutely clear. The phases of daily variations of an electrical field and electrical conductivity of air on ocean and continent depend on a number of the meteorological factors: cloudiness, vertical gradient of temperature, humidity of air, speed and direction of a wind. The daily average meanings electrical potential of an electrical field on ocean correlate with indexes of circulation of an atmosphere of Blinova. The spectra of variations of an electrical field have a maximum come on periods 5–9 day, daily, half-daily and components with shorter periods. In a rather wide strip of frequencies an inclination of spectral lines submit to the law "– 5/3" of Kolmogorov-Obukhov, that is connected with turbulence of air.

The atmosphere -electrical characteristics are sensitive to pollution of an atmosphere. With approach to coast and with port parking electrical conductivity of air is reduced in 2–3 times in comparison with opened parts of ocean.

For research of a nature of solo-earthly connections and their influences on an atmosphere the unitary variations of an electrical field, which characterize all earthly atmosphere, can act in a role of a universal index.

F2-07

RELATION OF THUNDERSTORM ACTIVITY TO COSMIC RAY VARIATIONS

V.A. Mullayarov, V.I. Kozlov, and R.R. Karimov
Institute of Cosmophysical Researches and Aeronomy, Yakutsk, Russia
v.a.mullayarov@ysn.yakutia.ru

Thunderstorm activity variations relative to the onset of > 10 MeV proton flow rise and in the periods of galactic cosmic ray decreases (Forbush-effects) are studied by the superposed epoch technique. Thunderstorm activity is estimated by VLF-noise level registered in Yakutsk. The regular VLF-noises at frequencies in the vicinity of spectral maximum (8–10 kHz) received by the loop antenna in the east-west plane in Yakutsk are mainly caused by the thunderstorm activity in the African world center and in summer – by the local thunderstorms.

In summer day and winter night hours the decrease of the VLF-noise level up to minimum is observed on the third day after the proton burst and then the increase – on the forth-fifth day. With respect to the onset of Forbush-decreases one can distinguish two phases of the effect: during the first phase the decrease of the VLF-noise amplitude occurs on the 0, −1 day, and during the second one the increase takes place on the +1, 2 day with the excess of the initial undisturbed level.

The obtained results allow to connect the considered reasons and to imagine the thunderstorm activity variations in common sequence. The simultaneous consideration of effects shows that the decrease of the VLF-noise level is caused by the burst of protons and the increase of the noise level during subsequent days is caused by GCR Forbush-decreases.

By similar way one can explain the behavior of the thunderstorm activity when the Earth passes the positive sector of the interplanetary magnetic field. The decrease of the VLF-noise level in one thirds of the sector is possibly connected with the increased flow of protons, and the increase of the VLF-noise level in two thirds of the sector – with Forbush-decreases.

F2-08

RELATIONSHIPS OF LOW ATMOSPHERIC PARAMETERS WITH IONOSPHERIC AND GEOMAGNETIC CHARACTERISTICS IN THE NORTH-EAST OF RUSSIA

A.V. Vinitsky and V.V. Kazantseva
Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS, Stecolny, Magadan, Russia

It is established that the correlations of tropospheric, stratospheric parameters with solar, geomagnetic activity in the different regions of the Earth may be absent, or may be statistically considerable, but have a differ sign. In the same place correlations have a differ sign in connection with quasi-biennial oscillation phase.

In this study relationships between tropospheric, lower stratospheric, ionospheric, geomagnetic characteristics and their dependence from solar and geomagnetic activity are considered at the boundary of atmospheric centers of action. There is the more sensitive tropospheric situation for the external action in this region. A study is made on the basis of aerological soundings, vertical soundings of ionosphere, geomagnetic field variations measurements performed at the Magadan observatory (lat. – 60 07`N; long. – 151 01`E.) from 1966 to 1989

Significant correlation of the ground level pressure with geomagnetic activity is obtained. Its sign changes during the year. Tropospheric, low stratospheric temperature variations are in accordance with near midnight value of low part ionospheric F- region height. The later agrees to the variations of horizontal component and declination of geomagnetic field in their maximum during the day. In these variations the superposition of solar and geomagnetic activity occurs. The obtained relations may be used for solving the problem of long-range and short-range weather forecast in the North-East of Russia.

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