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Atmospheric Transmittance/Radiance: Computer Code LOWTRAN 6 Supplement: Program Listings

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per cm per cm

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This supplement lists the LOWTRAN 6 computer code for predicting atmospheric transmittance and the thermal radiation emitted by the atmosphere and earth from 350 to 40,000 cm^{-1} at a spectral resolution of 20 cm^{-1}. The program is based on the LOWTRAN 5 (1980) computer code. Solar/lunar scattered radiation has been added to the code, as well as a new spherical refractive geometry subroutine and an improved water vapor continuum model. Other modifications to the code include a wind-dependent maritime aerosol model, a vertical structure aerosol model, a cirrus cloud model, and a

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rain model.

The computer code contains representative (geographical and seasonal) atmospheric models and representative aerosol models with an option to replace them with user-derived or measured values. The program can be run in one of three modes, namely, to compute only atmospheric transmittance, to compute atmospheric transmittance and radiance, or to compute atmospheric transmittance, atmospheric radiance, and scattered solar/lunar background radiance for a given slant path geometry.

Two new programs now available with the LOWTRAN 6 package, the plot program and the filter function program, are listed in this supplement.

Contents

Illustrations

Tables

Atmospheric Transmittance/Radiance: Computer Code LOWTRAN 6 Supplement: Program Listings

1. INTRODUCTION

This supplement contains a brief description of the program structure and a complete listing of the FORTRAN computer code for LOWTRAN 6. An index identifying the location of each subroutine and a short description of the function of each subroutine is included.

Section 3 contains the program structure and complete listing of the LOWTRAN 6 plot program. An index and a brief description of each subroutine is included.

Section 4 contains the program structure and complete listing of the LOWTRAN 6 filter function program. An index and brief description of each subroutine is also included.

The technical description of LOWTRAN 6 along with basic user instructions, sample input and output, and other specialized sections are detailed in the main report.

2. LOWTRAN 6 PROGRAM STRUCTURE

The three programs contained in this supplement adhere principally to ANSI standard FORTRAN 77. The major exception is the use of type HOLLERITH instead of type CHARACTER for character data.

(Received for publication 29 July 1983)

Figure 1 depicts the LOWTRAN code structure. The NSMDL, GEO, SSGEO, and TRANS subroutines are shown in Figures 2, 3, 4, and 5 respectively. Table 1 is a description of the main subroutines in LOWTRAN shown in Figure 1. Tables 2, 3, and 4 contain descriptions of the SSGEO, GEO and TRANS subroutines respectively. Table 5 has descriptions for the data subroutines.

The page number location for each subroutine is included in the above mentioned tables.

The complete listing of the LOWTRAN 6 computer code is in Table 6.

3. LOWTRAN PLOT: PROGRAM STRUCTURE

The plot program for LOWTRAN 6 is a separate program package available with LOWTRAN 6. The plot code structure is shown in Figure 6. Descriptions of each subroutine and page number location are shown in Table 7. (See Appendix A of the main LOWTRAN 6 report for possible differences in system plotting routines.)

Table 8 is the complete listing of the LOWTRAN 6 plot program.

4. FILTER FUNCTION: PROGRAM STRUCTURE

The filter function program is an independent program package available for use on LOWTRAN 6 Tape 7 output. The filter function code structure is shown in Figure 7. Descriptions of each subroutine and page number location are listed in Table 9.

Table 10 is the complete listing of the LOWTRAN 6 filter function program.

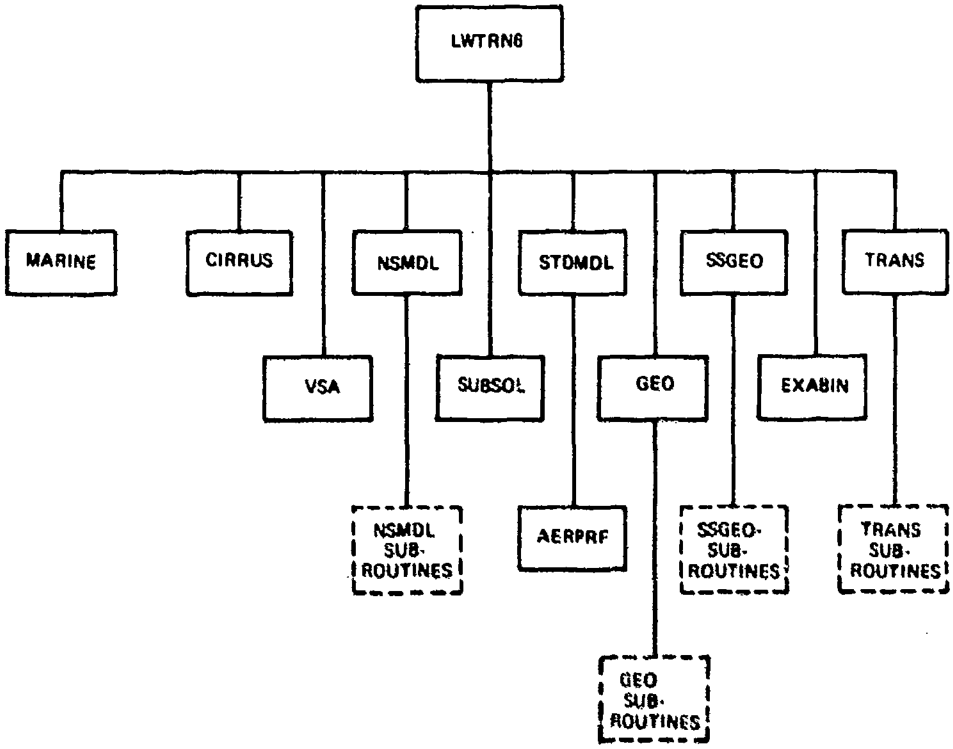

Figure 1. LOWTRAN 6 Main Program Structure. The boxes enclosed by dashes are modules of subroutines for the calculation of non-standard models, air mass geometry, single scattering geometry and transmittance

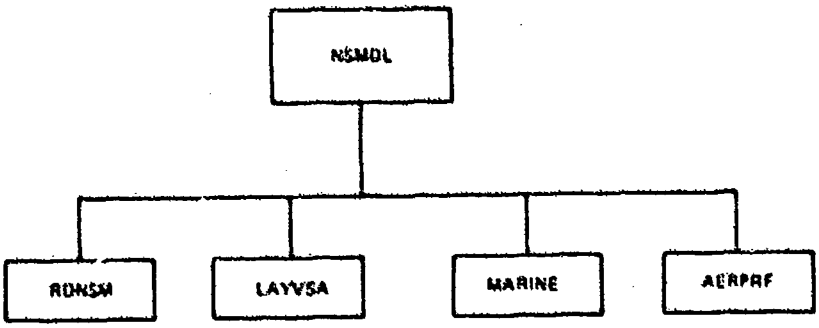

Figure 2. Program Structure for the Non-standard Model Subroutines

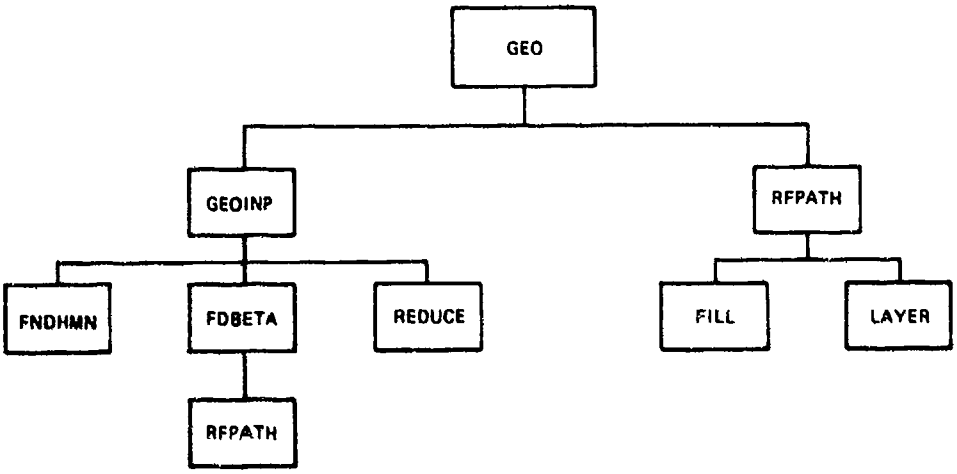

Figure 3. Program Structure for the Air Mass Subroutines

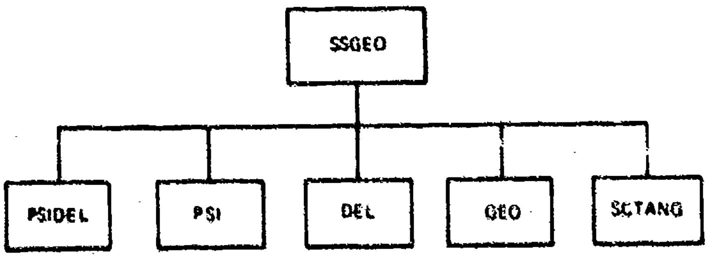

Figure 4. Program Structure for the Single Scattering Geometry Subroutines

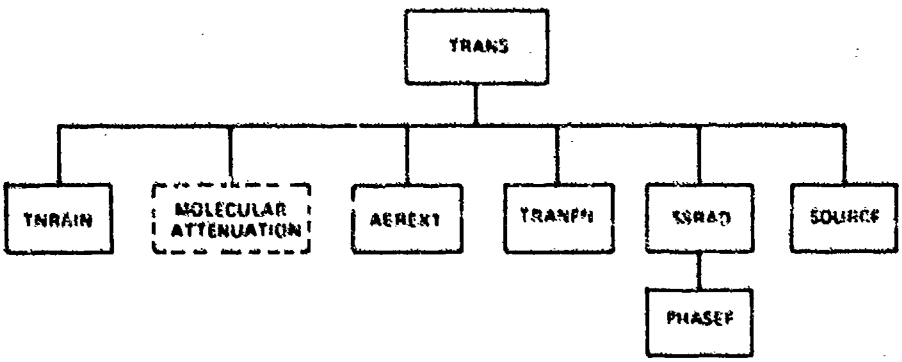

Figure 5. Program Structure for the Transmittance Subroutines. The dashed box labelled Molecular Attenuation includes the following subroutines: C1DTA, C2DTA, C3DTA, C4DTA, C6DTA, SLF296, SLF260, FRN296 and HNO3

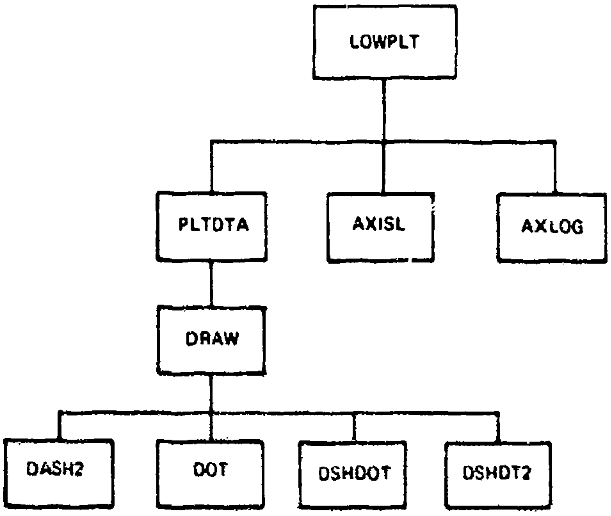

Figure 6. Plot Program Structure

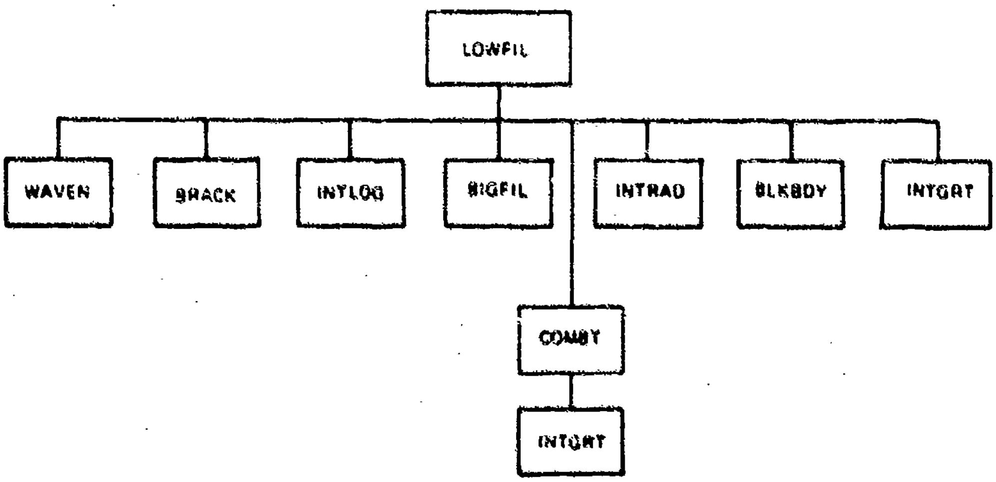

Figure 7. Filter Program Structure

Table 1. Description of LWTRN6 Subroutines

Subroutine	Description	Page No.
LWTRN6	MAIN DRIVER PROGRAM. READS CONTROL CARDS.	16
MARINE	DETERMINES AEROSOL EXTINCTION AND ABSORPTION COEFFICIENTS FOR THE NAVY MARITIME MODEL.	92
CIRRUS	GENERATES ALTITUDE PROFILES OF CIRRUS CLOUD DENSITY.	89
RANDOM	CALLS MACHINE DEPENDENT FUNCTION RANF WHICH IS A UNIFORM RANDOM NUMBER GENERATOR.	91
VSA	ARMY VERTICAL STRUCTURE ALGORITHM OF AEROSOL EXTINCTION AND RELATIVE HUMIDITY FOR LOW VISIBILITY/LOW CEILING CONDITIONS.	97
NSMDL	FOR USER DEFINED ATMOSPHERIC OR AEROSOL PROFILES.	33
LAYVSA	RESTRUCTURES THE ATMOSPHERIC PROFILE FOR FINER LAYERING NEAR THE GROUND FOR USE WITH THE VSA OPTION.	94
RDNSM	READS MODEL 7 DATA FOR ARMY VERTICAL STRUCTURE ALGORITHM.	96
SUBSOL	CALCULATES THE SUBSOLAR POINT ANGLES BASED UPON TIME AND DAY.	84
STDMDL	SETS UP ATMOSPHERIC PROFILES OF ATTENUATOR DENSITIES.	37
AERPRF	COMPUTES SCALING FACTOR PROFILES FOR AEROSOLS.	39
GEO	DRIVER FOR AIR MASS SUBROUTINES. CALCULATES ATTENUATOR AMOUNTS FOR THE SLANT PATH.	41
SSGEO	OBTAINS ATTENUATOR AMOUNTS FROM SCATTERING POINTS ALONG OPTICAL PATH TO THE EXTRATERRESTRIAL SOURCE.	73
EXABIN	LOADS AEROSOL EXTINCTION AND ABSORPTION COEFFICIENTS FOR THE APPROPRIATE MODEL AND RELATIVE HUMIDITY.	70
TRANS	CALCULATES TRANSMITTANCE, ATMOSPHERIC RADIANCE, AND SOLAR/LUNAR SCATTERED RADIANCE FOR SLANT PATH.	61

Table 2. Description of SSGEO Subroutines

		Page No.
SSGEO	OBTAINS ATTENUATOR AMOUNTS FROM SCATTERING POINTS ALONG OPTICAL PATH TO THE EXTRATERRESTRIAL SOURCE.	73
PSIDEL	CALCULATES THE RELATIVE AZIMUTH BETWEEN THE LINE OF SIGHT AND THE DIRECT SOLAR/LUNAR PATH.	77
PSI	RETURNS SOLAR AZIMUTH RELATIVE TO LINE OF SIGHT AT CURRENT SCATTERING LOCATION.	79
DEL	RETURNS SOLAR ZENITH ANGLE AT ANY POINT ALONG OPTICAL PATH.	80
GEO	DRIVER FOR AIR MASS SUBROUTINES. CALCULATES ATTENUATOR AMOUNTS FOR THE SLANT PATH.	41
SCTANG	RETURNS THE SCATTERING ANGLE AT ANY POINT ALONG THE OPTICAL PATH.	78

Table 3. Description of Air Mass Subroutines

		Page No.
GEO	DRIVER FOR AIR MASS SUBROUTINES. CALCULATES ATTENUATOR AMOUNTS FOR THE SLANT PATH.	41
GEOINP	INTERPRETS GEOMETRY INPUT PARAMETERS INTO THE STANDARD FORM H1, H2, ANGLE, AND LEN.	45
FNDHMN	CALCULATES HMIN, THE MINIMUM ALTITUDE ALONG THE PATH AND PHI, THE ZENITH ANGLE AT H2.	51
REDUCE	ELIMINATES SLANT PATH SEGMENTS WHICH EXTEND BEYOND THE HIGHEST PROFILE ALTITUDE.	48
FDBETA	CALCULATES ANGLE, GIVEN H1, H2 AND BETA BY ITERATION.	49
RFPATH	DETERMINES THE REFRACTED PATH AND THE ABSORBER AMOUNTS THROUGH ALL THE LAYERS.	54
FILL	DEFINES THE BOUNDARIES OF THE SLANT PATH AND INTERPOLATES DENSITIES AT THESE BOUNDARIES.	57
LAYER	CALCULATES THE PATH AND AMOUNTS THROUGH ONE LAYER.	58
RADREF	COMPUTES RADIUS OF CURVATURE OF THE REFRACTED RAY FOR A HORIZONTAL PATH.	53
FINDSH	FINDS LAYER BOUNDARIES AND SCALE HEIGHT AT GROUND FOR INDEX OF REFRACTION.	53
SCALHT	CALCULATES SCALE HEIGHT OF INDEX OF REFRACTION.	53
ANDEX	COMPUTES INDEX OF REFRACTION AT A SPECIFIC HEIGHT.	53
EXPINT	PERFORMS EXPONENTIAL INTERPOLATIONS FOR THE GEOMETRY ROUTINES.	51

Table 4. Description of TRANS Subroutines

		Page No.
TRANS	CALCULATES TRANSMITTANCE, ATMOSPHERIC RADIANCE, AND SOLAR/LUNAR SCATTERED RADIANCE FOR SLANT PATH.	61
AEREXT	INTERPOLATES AEROSOL ATTENUATION COEFFICIENTS TO REQUIRED WAVENUMBER.	72
HNO3	DETERMINES NITRIC ACID ABSORPTION COEFFICIENT TO REQUIRED WAVENUMBER.	72
TRANFN	CALCULATES TRANSMITTANCE FOR OZONE, UNIFORMLY MIXED GASES AND WATER VAPOR.	68
SOURCE	CONTAINS SOLAR INTENSITY DATA AND CALCULATES LUNAR INTENSITY.	82
TNRAIN	CALCULATES TRANSMITTANCE OF RAIN AS A FUNCTION OF RAIN RATE AND SLANT RANGE.	88
SSRAD	PERFORMS THE LAYER BY LAYER SINGLE SCATTERING RADIANCE SUM.	81
PHASEF	CHOOSES CORRECT PHASE FUNCTION BASED ON RELATIVE HUMIDITY, FREQUENCY, SCATTERING ANGLE AND MODEL.	85
INTERP	PERFORMS LINEAR OR LOGARITHMIC INTERPOLATION.	88
PF	RETURNS THE APPROPRIATE PHASE FUNCTION FROM THE STORED DATA BASE.	88
C1DTA	RETURNS WAVER VAPOR BAND ABSORPTION COEFFICIENT AT REQUIRED WAVENUMBER.	67
C2DTA	RETURNS UNIFORMLY MIXED GASES ABSORPTION COEFFICIENT AT REQUIRED WAVENUMBER.	67
C3DTA	RETURNS OZONE BAND ABSORPTION COEFFICIENT AT REQUIRED WAVENUMBER.	67
C4DTA	RETURNS N_2 CONTINUUM ABSORPTION COEFFICIENT AT REQUIRED WAVENUMBER.	68
C6DTA	RETURNS MOLECULAR SCATTERING ATTENUATION COEFFICIENT AT REQUIRED WAVENUMBER.	68
C8DTA	RETURNS OZONE U.V. AND VISIBLE ABSORPTION COEFFICIENT AT REQUIRED WAVENUMBER.	68
SLF296	LOADS SELF BROADENED WATER VAPOR CONTINUUM AT 296° K.	69
SLF260	LOADS SELF BROADENED WATER VAPOR CONTINUUM AT 260° K.	69
FRN296	LOADS FOREIGN BROADENED WATER VAPOR CONTINUUM AT 296° K.	69
SINT	PERFORMS INTERPOLATION FOR WATER VAPOR CONTINUUM.	69

Table 5. Description of Block Data Subroutines

		Page No.
MDTA	MODEL ATMOSPHERIC DATA.	102
TITLE	TITLES FOR OUTPUT.	105
PRFDTA	AEROSOL PROFILE DATA.	106
EXTDTA	AEROSOL EXTINCTION AND ABSORPTION DATA.	108
SF296	SELF BROADENED ABSORPTION COEFFICIENTS FOR WATER VAPOR CONTINUUM AT 296° K.	114
SF260	SELF BROADENED ABSORPTION COEFFICIENTS FOR WATER VAPOR CONTINUUM AT 260° K.	122
BFH20	FOREIGN BROADENED ABSORPTION COEFFICIENTS FOR WATER VAPOR CONTINUUM AT 296° K.	130
TRFN	LOWTRAN TRANSMITTANCE FUNCTIONS.	138
C1D	WATER VAPOR BAND MODEL ABSORPTION COEFFICIENTS.	139
C2D	UNIFORMLY MIXED GASES BAND MODEL ABSORPTION COEFFICIENTS.	144
C3D	OZONE BAND MODEL ABSORPTION COEFFICIENTS.	147
C4D	NITROGEN CONTINUUM ABSORPTION COEFFICIENTS AND UV OZONE ABSORPTION COEFFICIENTS.	148
MARDTA	NAVY MARINE AEROSOL EXTINCTION AND ABSORPTION DATA.	149
PHSDTA	70 AVERAGED PHASE FUNCTIONS AND TRUTH TABLE IDENTIFYING CORRECT PHASE FUNCTION.	153

Table 6. Listing of Computer Code LOWTRAN 6

Pages 15 to 163

```
C*    PROGRAM LWTRN6
      PROGRAM LWTRN6(INPUT=140,OUTPUT=140,TAPE7=140,TAPE5=INPUT,
     1    TAPE6=OUTPUT)
C
C*******************************************************************
C     LOWTRAN6  (LAST REVISED JUNE, 1983)
C
C                AUTHORS
C                F.X.KNEIZYS
C                E. P. SHETTLE
C                W. O. GALLERY
C                J. H. CHETWYND JR.
C                L. W. ABREU
C                J. E. A. SELBY
C                S. A. CLOUGH
C                R. W. FENN
C
C     PROGRAM LOWTRAN CALCULATES THE TRANSMITTANCE AND/OR RADIANCE
C     OF THE ATMOSPHERE  FROM 350 CM-1 TO 40000 CM-1 (0.25 TO 28.57
C     MICRONS) AT 20 CM-1 SPECTRAL RESOLUTION ON A LINEAR
C     WAVENUMBER SCALE.
C
C     DETAILED MODEL AND PROGRAM DESCRIPTION CAN BE FOUND IN
C        KNEIZYS, F. X.,SHETTLE, E. P. ,GALLERY, W. O.,CHETWYND, J. H.,
C        ABREU, L. W., SELBY, J. E. A., CLOUGH, S. A., FENN, R. W.
C        (1983) ATMOSPHERIC TRANSMITTANCE/RADIANCE- COMPUTER CODE
C        LOWTRAN 6
C            AFGL TECHNICAL REPORT (IN PREPARATION)
C*******************************************************************
C
C     THE FOLLOWING CARDS SHOULD BE KEYPUNCHED BY THE USER
C     AND MAILED TO   F.X.KNEIZYS,AFGL/OPI,HANSCOM AFB,MASS 01731
C     THE CARDS WILL BE USED TO UPDATE THE AFGL MALING LIST
C     AND FOR NOTIFICATION TO THE USER OF ERRORS IN THE CODE
C
C
C               (USE COLUMNS 21 TO 72)
C     LOWT6     NAME
C     LOWT6 COMPANY
C     LOWT6 ADDRESS
C
C
C*******************************************************************
C     PROGRAM ACTIVATED BY SUBMISSION OF FIVE  (OR MORE)
C      CARD SEQUENCE AS FOLLOWS
C
C     CARD 1     MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRT,TBOUND,SALB
C                          FORMAT(8I5,2F10.3)
C
C     CARD 2     IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,RAINRT
C                          FORMAT(6I5,4F10.3)
C
C                CARD 2A    CTHIK,CALT,ISEED                (ICIR=1)
C                           FORMAT(2F10.3,I10)
C
C                CARD 2B    ZCVSA,ZTVSA,ZINVSA       (IVSA=1)
C                           FORMAT(3F10.3)
C
C                CARD 2C  ML,TITLE                  (MODEL=7,IM=1)
```

```
C                          FORMAT(I5,18A4)
C
C                    CARD 2C  (1 TO ML) Z,P,T,DP,RH,WH,WO,AHAZE,VIS1,IHA1,ISE
C                              FORMAT(3F10.3,2F5.1,3E10.3,F7.3,3I1)
C
C                    CARD 2D    (1 TO 10)(DUMMY,EXTC(1,I),ABSC(1,I),I=1,40)
C                        FORMAT(4(F6.2,2F7.5))    (IHAZE=7)
C
C        CARD 3      H1,H2,ANGLE,RANGE,BETA,RO,LEN      FORMAT(6F10.3,I5)
C
C                    CARD 3*         H1,P,T,DP,RH,WH,WO,RANGE         (MODEL=0)
C                        FORMAT(3F10.3,2F5.1,2E10.3,F10.3)
C
C                    CARD 3A1     IPARM,IPH,IDAY,ISOURC             (IEMSCT=2)
C                                 FORMAT(4I5)
C
C                    CARD 3A2   PARM1,PARM2,PARM3,PARM4,TIME,PSIPO,ANGLEM,G
C                                 FORMAT(8F10.3)                  (IEMSCT=2)
C
C                    CARD 3B1 NANGLS             (IPH=1)
C                        FORMAT(I5)
C
C                    CARD 3B2(1 TO NANGLS)     (IPH=1)
C                           (ANGF(I),F(1,I),F(2,I),F(3,I),F(4,I),I=1,NANGLS)
C                        FORMAT(F10.3,4E10.3)
C
C        CARD 4      V1, V2, DV                         FORMAT(3F10.3)
C
C        CARD 5      IRPT                               FORMAT(I5)
C
C*****************************************************************************
C
C        CARD 1      MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRT,TBOUND,SALB
C                              FORMAT(8I5,2F10.3)
C
C                    MODEL SELECTS ONE OF SIX GEOGRAPHICAL MODEL ATMOSPHERES
C                    OR SPECIFIES THAT USER-DEFINED METEROLOGICAL
C                    DATA ARE TO BE USED.
C
C
C        MODEL=0  IF METEOROLOGICAL DATA ARE SPECIFIED(HORIZONTAL PATH ONLY
C              1 TROPICAL ATMOSPHERE
C              2 MIDLATITUDE SUMMER
C              3 MIDLATITUDE WINTER
C              4 SUBARTIC    SUMMER
C              5 SUBARTIC    WINTER
C              6 1962 U.S. STANDARD ATMOSPHERE
C              7 IF A NEW MODEL ATMOSPHERE( OR RADIOSONDE DATA) IS TO BE IN
C
C
C                 ITYPE INDICATES THE TYPE OF ATMOSPHERIC PATH
C
C        ITYPE=1  FOR A HORIZONTAL (CONSTANT-PRESSURE) PATH
C              2 VERTICAL OR SLANT PATH BETWEEN TWO ALTITUDES
C              3 FOR A VERTICAL PATH TO SPACE
C
C
C                IEMSCT DETERMINES THE MODE OF EXECUTION OF THE PROGRAM
C
```

```
C      IEMSCT=0     PROGRAM EXECUTION IN TRANSMITTANCE MODE.
C             1     PROGRAM EXECUTION IN RADIANCE MODE.
C             2     PROGRAM EXECUTION IN RADIANCE MODE WITH SOLAR/LUNAR
C                     SCATTERED RADIANCE INCLUDED.
C
C
C             M1,M2,M3 ARE USED TO MODIFY OR SUPPLEMENT THE ALTITUDE
C             PROFILES OF TEMPERATURE AND PRESSURE,WATER VAPOR,AND OZONE
C
C      M1=M2=M3=0 FOR NORMAL OPERATION OF PROGRAM
C
C      M1=1     TROPICAL             TEMPERATURE AND PRESSURE PROFILES
C         2     MIDLATITUDE SUMMER.TEMPERATURE AND PRESSURE PROFILES
C         .
C         .
C         6     1962 U.S. STANDARD TEMPERATURE AND PRESSURE PROFILES
C
C      M2=1     TROPICAL             WATER VAPOR PROFILE
C         2     MIDLATITUDE SUMMER WATER VAPOR PROFILE
C         .
C         .
C         6     1962 U.S. STANDARD WATER VAPOR PROFILE
C
C      M3=1     TROPICAL             OZONE PROFILE
C         2     MIDLATITUDE SUMMER OZONE PROFILE
C         .
C         .
C         6     1962 U.S. STANDARD OZONE PROFILE
C
C      IM=0     FOR  NORMAL OPERATION OF PROGRAM OR WHEN SUBSEQUENT
C                    CALCULATIONS ARE TO BE RUN WITH MODEL =7
C         1     WHEN RADIOSONDE DATA ARE TO BE READ INITIALLY.
C
C      NOPRT=0 FOR NORMAL OPERATION OF PROGRAM.
C
C            1 TO SUPRESS PRINTING OF TRANSMITTANCE /OR RADIANCE TABLE
C                   AND ATMOSPHERIC PROFILES
C
C               TBOUND USED IN RADIANCE MODE FOR SLANT PATHS WHICH
C               INTERSECT THE EARTH. IF TBOUND IS LEFT BLANK,
C               THE PROGRAM WILL USE THE TEMPERATURE OF THE FIRST
C               ATMOSPHERIC LAYER AS THE BOUNDARY TEMPERATURE
C
C      TBOUND =TEMPERATURE OF THE EARTH AT THE LOCATION AT WHICH THE
C               CALCULATION IS TO BE PERFORMED.
C
C       SALB = SURFACE ALBEDO OF THE EARTH AT THE LOCATION
C               AND AVERAGE FREQUENCY OF THE CALCULATION (0 TO 1.)
C               IF SALB IS LEFT BLANK THE PROGRAM ASSUMES
C               THE SURFACE IS A BLACKBODY.
C
C
C**********************************************************************
C
C      CARD 2   IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,RAINRT
C                           FORMAT(6I5,4F10.3)
C
C                IHAZE SELECTS THE TYPE OF EXTINCTION AND A DEFAULT
C                METEROLOGIACL RANGE FOR THE BOUNDRY-LAYER AEROSOL MODEL
```

```
C              (0 TO 2KM ALTITUDE)
C              IF VIS IS ALSO SPECIFIED ON CARD 2 IT WILL OVERRIDE THE
C              DEFAULT IHAZE VALUE
C
C       IHAZE=0  NO AEROSOL ATTENUATION INCLUDED IN CALCULATION.
C            =1  RURAL EXTINCTION, 23-KM VIS.
C            =2  RURAL EXTINCTION, 5-KM VIS.
C            =3  NAVY MARITIME EXTINCTION,SETS OWN VIS.
C            =4  MARITIME EXTINCTION, 23-KM VIS.    (LOWTRAN 5 MODEL)
C            =5  URBAN EXTINCTION, 5-KM VIS.
C            =6  TROPOSPHERIC EXTINCTION, 50-KM VIS.
C            =7  USER DEFINED  (TEN CARDS)
C            =8  FOG1 (ADVECTION FOG) EXTINCTION, 0.2-KM VIS.
C            =9  FOG2 (RADIATION FOG) EXTINCTION, 0.5-KM VIS.
C
C              ISEASN SELECTS THE SEASONAL DEPENDENCE OF THE PROFILES
C              FOR BOTH THE TROPOSPHERIC (2 TO 10 KM) AND
C              STRATOSPHERIC(10 TO 30 KM) AEROSOLS.
C
C       ISEASN=0 DEFAULTS TO SEASON OF MODEL
C                (MODEL 0,1,2,4,6,7) SUMMER
C                (MODEL 3,5)         WINTER
C             =1 SPRING-SUMMER
C             =2 FALL - WINTER
C
C              IVULCN SELECTS BOTH THE PROFILE AND EXTINCTION TYPE
C              FOR THE STRATOSPHERIC AEROSOLS AND DETERMINES TRANSITION
C              PROFILES ABOVE THE STRATOSPHERE TO 100 KM.
C
C       IVULCN=0 DEFAULT TO STRATOSPHERIC BACKGROUND
C             =1 STRATOSPHERIC BACKGROUND
C             =2 AGED VOLCANIC TYPE/MODERATE VOLCANIC PROFILE
C             =3 FRESH VOLCANIC TYPE/HIGH VOLCANIC PROFILE
C             =4 AGED VOLCANIC TYPE/HIGH VOLCANIC PROFILE
C             =5 FRESH VOLCANIC TYPE/MODERATE VOLCANIC PROFILE
C
C              ICSTL IS THE AIR MASS CHARATER(1 TO 10) ONLY USED WITH
C              NAVY MARITIME MODEL(IHAZE=3)
C
C       ICSTL = 1 OPEN OCEAN
C               .
C               .
C               .
C              10 STRONG CONTINENTAL INFLUENCE
C
C              ICIR DETERMINES THE INCLUSION OF CIRRUS CLOUD ATTENUATION
C
C       ICIR=0   NO CIRRUS
C           =1   USE CIRRUS PROFILE
C
C              IVSA DETERMINES THE USE OF THE ARMY VERTICAL STRUCTURE
C              ALGORITHM FOR AEROSOLS IN THE BOUNDARY LAYER.
C       IVSA=0   NOT USED
C           =1   VERTICAL STRUCTURE ALGORITHM
C
C       VIS =    METEROLOGICAL RANGE (KM) (WHEN SPECIFIED,SUPERSEDES
C                DEFAULT VALUE SET BY IHAZE)
C
C       WSS =    CURRENT WIND SPEED (M/S).         ONLY WITH (IHAZE=3)
```

```
C     WHH =     24 HOUR AVERAGE WIND SPEED (M/S).  ONLY WITH (IHAZE=3)
C
C     RAINRT = RAIN RATE (MM/HR).               DEFAULT VALUE IS ZERO.
C
C*************************************************************************
C
C     OPTIONAL INPUT CARDS AFTER CARD 2
C     SELECTED BY PARAMETERS ICIR,IVSA,MODEL,AND IHAZE ON CARD 1 AND 2.
C
C
C     CARD 2A   CTHIK,CALT,ISEED                    (ICIR=1)
C                         FORMAT(2F10.3,I10)
C                    INPUT CARD FOR CIRRUS ALTITUDE PROFILE
C                    SUBROUTINE WHEN ICIR = 1.
C
C     CHTIK     = CIRRUS THICKNESS (KM)
C                 0  USE THICKNESS STATISTICS
C                 .NE. 0 USE DEFINED THICKNESS
C     CALT      = CIRRUS BASE ALTITUDE(KM)
C                 0 USE CALCULATED VALUE
C                 .NE. 0 USE DEFINED BASE ALTITUDE
C
C     ISEED     = RANDOM NUMBER INITIALIZATION FLAG.
C                 0 USE DEFAULT MEAN VALUES FOR CIRRUS
C                 .NE. 0 INITIAL VALUE OF SEED FOR RANF FUNCTION
C
C
C*************************************************************************
C
C     CARD 2B                ZCVSA,ZTVSA,ZINVSA      (IVSA=1)
C                             FORMAT(3F10.3)
C               INPUT CARD FOR ARMY VERTICAL STRUCTURE
C               ALGORITHM SUBROUTINE WHEN IVSA=1.
C
C     ZCVSA = CLOUD CEILING HEIGHT (KM) =0 UNKNOWN HEIGHT
C             ZCVSA LT 0 NO CLOUD CEILING
C             ZCVSA GT 0 KNOWN CLOUD CEILING
C             ZCVSA =  0 UNKNOWN CLOUD CEILING HEIGHT
C                    PROGRAM CALCULATES CLOUD HEIGHT
C
C     ZTVSA = THICKNESS OF CLOUD OR FOG (KM),
C                  THICKNESS = 0 DEFAULTS TO 200 METERS
C
C     ZINVSA= HEIGHT OF THE INVERSION (KM)
C                  =    0 DEFAULTS TO 100 METERS
C                  LT   0 NO INVERSION LAYER
C
C*************************************************************************
C
C     CARD 2C  ML,TITLE                   (MODEL=7,IM=1)
C                      FORMAT(I5,18A4)
C             ADDITIONAL ATMOSPHERIC MODEL        (MODEL=7)
C             NEW MODEL ATMOSPHERE CAN BE INSERTED PROVIDED THE
C             PARAMETERS MODEL AND IM ARE SET EQUAL TO 7 AND 1
C             RESPECTIVELY ON CARD 1.
C
C     ML=      NUMBER OF ATMOSPHERIC LEVELS TO BE INSERTED
C                   (MAXIMUM OF 34)
C
```

```
C     TITLE=   IDENTIFICATION OF NEW MODEL ATMOSPHERE
C
C
C     CARD 2C        (1 TO ML)
C              Z,P,T,DP,RH,WH,WO,AHAZE,VIS1,IHA1,ISEA1,IVUL1
C                        FORMAT(3F10.3,2F5.1,3E10.3,F7.3,3I1)
C     Z =      ALTITUDE OF LAYER (KM)
C     P =      PRESSURE AT LAYER (MB)
C     T =      TEMPERATURE (C)
C     DP =     DEW POINT (C)
C     RH =     RELITIVE HUMIDTY PERCENT
C     WH =     WATER DENSITY (GM/M3)
C     WO =     OZONE DENSITY (GM/M3)
C     AHAZE=   AEROSOL NUMBER DENSITY(NORMALIZED BY THE USER TO THE
C                   REQUIRED METEOROLOGICAL RANGE USING THE LOWTRAN
C                   EXTINCTION COEFFICIENTS)
C
C     VIS1  =  METEOROLOGICAL RANGE (KM) FOR ALTITUDE,Z
C     IHA1  =  AEROSOL EXTINCTION AND METEOROLOGICAL RANGE CONTROL
C                   FOR THE ALTITUDE,Z
C
C     ISEA1 =  AEROSOL SEASON CONTROL FOR THE ALTITUDE,Z
C     IVUL1 =  AEROSOL PROFILE AND EXTINCTION CONTROL FOR ALTITUDE,Z
C
C*********************************************************************
C
C               CARD 2D (DUMMY,EXTC(1,I),ABSC(1,I),I=1,40)(IHAZE=7)
C                   FORMAT(4(F6.2,2F7.5))
C
C              USER DEFINED AEROSOL EXTINCTION AND ABSORPTION
C              COEFFICIENTS WHEN IHAZE = 7 ON CARD 2.
C
C     DUMMY     = WAVELENGTH OF AEROSOL COEFFICIENT
C                   (NOT USED BY PROGRAM BUT CORRESPONDING TO
C                   WAVELENGTHS DEFINED IN ARRAY VX2
C                   IN SUBROUTINE EXTDA)
C
C     EXTC(1,I) = AEROSOL EXTINCTION COEFFICIENT
C     ABSC(1,I) = AEROSOL ABSORPTION COEFFICIENT
C
C*********************************************************************
C
C     CARD 3     H1,H2,ANGLE,RANGE,BETA,RO,LEN     FORMAT(6F10.3,I5)
C            USED TO DEFINE THE GEOMETRICAL PATH PARAMETERS FOR A GIVEN
C            PROBLEM.
C
C     H1   =  INITIAL ALTITUDE(KM)
C     H2   =  FINAL ALTITUDE(KM)
C
C                   IN THE RADIANCE MODE OF THE PROGRAM EXECUTION
C            H1, THE INITIAL ALTITUDE,ALWAYS DEFINES THE POSITION OF
C            THE OBSERVER (OR SENSOR).
C
C     ANGLE =INITIAL ZENITH ANGLE (DEGREES) AS MEASURED FROM H1
C     RANGE =PATH LENGTH (KM)
C     BETA  =EARTH CENTER ANGLE SUBTENDED BY H1 AND H2 (DEGREES)
C
C     RO =   RADIUS OF THE EARTH (KM) AT THE PARTICULAR GEOGRAPHICAL
C            LOCATION AT WHICH THE CALCULATION IS TO BE PERFORMED.
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C              IF RO BLANK PROGRAM USES RADIUS FOR APPROPATE MODEL
C              ATMOSPHERE. (MODEL 0 OR 7 DEFAULT = 6371.23 KM)
C
C      LEN =0 FOR NORMAL OPERATION OF PROGRAM
C          =1 SELECTS THE DOWNWARD TYPE 2 LONG PATH
C
C             IT IS NOT NECESSARY TO SPECIFY EVERY QUANITY GIVEN ABOVE
C             ONLY THOSE THAT ADEQUATELY DESCRIBE THE PROBLEM ACCORDING
C             TO THE PARAMETER ITYPE
C
C             ITYPE=1 READ H1,RANGE
C                  =3 READ H1,ANGLE OR H1,HMIN
C                  =2 READ H1,H2,ANGLE   OR H1,H2,RANGE   OR H1,H2,BETA
C                     OR H1,ANGLE,RANGE
C
C*****************************************************************
C
C     CARD 3*        H1,P,T,DP,RH,WH,WO,RANGE        (MODEL=0)
C                    FORMAT(3F10.3,2F5.1,2E10.3,F10.3)
C                    OPTIONAL CARD FOR HORIZONTAL PATHS (MODEL=0,ITYPE=1)
C                    IF METEROLOGICAL DATA ARE TO BE USED FOR HORIZONTAL
C                    PATH ATMOSPHERIC TRANSMITTANCE CALCULATIONS, THEN
C                    SET MODEL = 0 ON CARD 1. (ALSO SET ITYPE=1)
C                    THE FOLLOWING PARAMETERS CAN THEN BE SPECIFIED ON
C                    CARD 3
C
C     CARD 3*        H1,P,T,DP,RH,WH,WO,RANGE        (MODEL=0)
C                    FORMAT(3F10.3,2F5.1,2E10.3,F10.3)
C                    WHERE THE ABOVE PARAMETERS REFER TO ALTITUDE(KM),
C                    PRESSURE(MB),AMBIENT TEMP(C),DEW POINT TEMP(C),
C                    RELATIVE HUMIDITY(%),WATER VAPOR DENSITY(GM M-3),
C                    OZONE DENSITY(GM/M**3), AND PATH LENGTH (KM)
C
C*****************************************************************
C
C     CARD 3A1   IPARM,IPH,IDAY,ISOURC              (IEMSCT=2)
C                          FORMAT(4I5)
C            INPUT CARD FOR SOLAR/LUNAR SCATTERED RADIATION WHEN
C            IEMSCT = 2
C
C            IPARM =0,1,2 AND CONTROLS THE METHOD OF SPECIFYING THE
C            SOLAR/LUNAR GEOMETRY ON CARD 3A2.
C
C            IPH DETERMINES THE TYPE OF PHASE FUNCTION USED IN THE CAL
C
C     IPH=0       HENYEY-GREENSTEIN AEROSOL PHASE FUNCTION
C        =1       USER SUPPLIED AEROSOL PHASE FUNCTION (SEE CARD 3B)
C        =2       MIE GENERATED DATA BASE OF AEROSOL PHASE FUNCTIONS FOR T
C                 LOWTRAN MODELS.
C
C     IDAY=       DAY OF THE YEAR, I.E. FROM 1 TO 365   (REQUIRED)
C
C     ISOURC=0  EXTRATERRESTRIAL SOURCE IS THE SUN
C           =1  EXTRATERRESTRIAL SOURCE IS THE MOON
C
C*****************************************************************
C
C     CARD 3A2  PARM1,PARM2,PARM3,PARM4,TIME,PSIPO,ANGLEM,G
C                         FORMAT(8F10.3)                 (IEMSCT=2)
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```
C              INPUT CARD FOR SOLAR/LUNAR SCATTERED RADIATION WHEN
C              IEMSCT = 2
C              DEFINITIONS OF PARM1,PARM2,PARM3,PARM4 DETERMINED BY
C              VALUE OF IPARM ON CARD 3A1.
C
C                         FOR IPARM=0
C
C      PARM1= OBSERVER LATITUDE (-90 TO +90)
C             NOTE- IF ABS(PARM1) IS GREATER THAN 89.5 THE OBSERVER IS
C             ASSUMED TO BE AT EITHER THE NORTH OR THE SOUTH POLE.  IN TH
C             CASE THE PATH AZIMUTH IS UNDEFINED.  THE DIRECTION OF LINE
C             SIGHT MUST BE SPECIFIED AS THE LONGITUDE THAT THE PATH LIES
C             THIS QUANTITY RATHER THAN THE USUAL AZIMUTH IS READ IN FOR
C      PARM2= OBSERVER LONGITUDE (0 TO 360)
C      PARM3= SOURCE (SUN OR MOON) LATITUDE, SEE NOTE REGARDING SUN ANGLE
C      PARM4= SOURCE (SUN OR MOON) LONGITUDE
C
C                         FOR IPARM=1
C                 (TIME MUST BE SPECIFIED,CANNOT BE USED WITH ISOURC=1
C
C
C      PARM1= OBSERVER LATITUDE (-90 TO +90)
C      PARM2= OBSERVER LONGITUDE (0 TO 360)
C             PARM3,PARM4 ARE NOT REQUIRED
C
C                         FOR IPARM=2
C
C      PARM1= AZIMUTHAL ANGLE BETWEEN THE OBSERVER'S LINE OF SIGHT
C             AND THE OBSERVER-TO-SUN PATH, MEASURED FROM THE LINE
C             OF SIGHT, POSITIVE EAST OF NORTH, BETWEEN -180 AND 180
C      PARM2= THE SUN'S ZENITH ANGLE
C
C              PARM3,PARM4 ARE NOT REQUIRED
C
C
C              REMAINING CONTROL PARAMETERS
C
C      TIME=  GREENWICH TIME IN DECIMAL HOURS, I.E. 8X45 AM IS 8.75,
C             5X20 PM IS 17.33 ETC.
C
C      PSIPO= PATH AZIMUTH (DEGREES EAST OF NORTH, I.E. DUE NORTH IS 0.0
C             DUE EAST IS 90.0 ETC.
C
C      ANGLEM=PHASE ANGLE OF THE MOON, I.E. THE ANGLE FORMED
C             BY THE SUN, MOON AND EARTH (REQUIRED IF ISOURC=1)
C
C      G=     ASYMMETRY FACTOR FOR USE WITH H.G. PHASE FUNCTION
C
C*******************************************************************
C      CARD 3B1 NANGLS          (IPH=1)
C                    FORMAT(I5)
C
C              INPUT CARD FOR USER DEFINED PHASE FUNCTIONS WHEN IPH=1.
C
C      NANGLS=  NUMBER OF ANGLES FOR THE USER DEFINED PHASE
C              FUNCTIONS(MAXIMUM OF 50)
C
C*******************************************************************
C
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C     CARD 3B2(1 TO NANGLS)     (IPH=1)
C             (ANGF(I),F(1,I),F(2,I),F(3,I),F(4,I),I=1,NANGLS)
C                  FORMAT(F10.3,4E10.3)
C              INPUT CARD FOR USER DEFINED PHASE FUNCTION WHEN IPH=1.
C              FOR AVERAGE FREQUENCY OF CALCULATION
C
C     ANGF(I)= PHASE ANGLE IN DECIMAL DEGREES
C                   (0.0 TO 180.0)
C
C     F(1,I)=  USER DEFINED PHASE FUNCTION AT ANGF(I)
C              BOUNDARY LAYER (0 TO 2KM))
C
C     F(2,I)=  USER DEFINED PHASE FUNCTION AT ANGF(I)
C              TROPOSPHERE(2 TO 10 KM)
C
C     F(3,I)=  USER DEFINED PHASE FUNCTION AT ANGF(I)
C              STRATOSPHERE(10 TO 30 KM)
C
C     F(4,I)=  USER DEFINED PHASE FUNCTION AT ANGF(I)
C              MESOSPHERE(30 TO 100 KM)
C
C**********************************************************************
C
C     CARD 4     V1, V2, DV                        FORMAT(3F10.3)
C
C              THE SPECTRAL RANGE OVER WHICH DATA ARE REQUIRED AND
C              THE SPECTRAL INCREMENTS AT WHICH THE DATA ARE TO BE
C              PRINTED OUT IS DETERMINED BY CARD 4.
C
C     V1 =     INITIAL FREQUENCY (WAVENUMBER CM-1 )
C     V2 =     FINAL FREQUENCY(WAVENUMBER CM-1 )
C     DV =     FREQUENCY INCREMENT (OR STEP SIZE) (CM-1)
C              NOTE  DV MUST BE A MULTIPLE OF 5 CM-1
C
C**********************************************************************
C
C     CARD 5     IRPT                              FORMAT(I5)
C     IRPT=0  TO END PROGRAM
C         =1  READ ALL DATA CARDS (1,2,3,4,5)
C         =2  NOT USED
C         =3  READ CARD 3   THE GEOMETRY CARD AND CARD 5
C         =4  READ CARD 4 TO CHANGE FREQUENCY AND CARD 5
C     GT 4 OR IRPT=2 WILL CAUSE PROGRAM TO STOP
C**********************************************************************
C
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON                WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /MODEL/ ZM(34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      COMMON /SOLS/ AH1(68),ARH(68),WPATHS(68,16),PA(68),PR(68),ATHETA(3
     15),ADBETA(35),LJ(69),JTURN,ANGSUN
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      COMMON /MART/ RHH
      COMMON /USRDTA/ NANGLS,ANGF(50),F(4,50)
      COMMON /MDLZ/ HMDLZ(8)
      COMMON /ZVSALY/ ZVSA(10),RHVSA(10),AHVSA(10),IHVSA(10)
      COMMON /TITL/ HHAZE(5,16),HSEASN(5,2),HVULCN(5,5),BLANK,VSB(9),
     X HMET(5,2),HMODEL(5,8),HTRRAD(6,4)
C*****HDATE AND HTIME CARRY THE DATA AND TIME AND MUST BE DOUBLE
C*****PRECISION ON A 32 BIT WORD COMPUTER
C@    DOUBLE PRECISION HDATE,HTIME
      DATA IRPT / 0 /
C*****IRD, IPR, AND IPU ARE UNIT NUMBERS FOR INPUT, OUTPUT, AND
C*****TAPE7 RESPECTIVELY
      IRD = 5
      IPR = 6
      IPU = 7
C@    OPEN (IRD,FILE='INPUT')
C@    OPEN (IPR,FILE='OUTPUT')
C@    OPEN (IPU,FILE='TAPE7')
      PI=2.0*ASIN(1.0)
      CA=PI/180.
      DEG= 1.0/CA
C*****GCAIR IS THE GAS CONSTANT FOR AIR IN UNITS OF MB/(GM CM-3 K)
      GCAIR = 2.87053E+3
C*****BIGNUM AND BIGEXP ARE THE LARGEST NUMBER AND THE LARGEST ARGUMENT
C*****EXP ALLOWED AND ARE MACHINE DEPENDENT. THE NUMBERS USED HERE ARE F
C*****A TYPICAL 32 BIT-WORD COMPUTER.
      BIGNUM = 1.0E36
      BIGEXP = 87.0
      KMAX=16
C*****NL IS THE NUMBER OF BOUNDARIES IN THE STANDARD MODELS 1 TO 6
C*****BOUNDARY 34 (AT 99999 KM) IS NO LONGER USED
      NL = 33
C*****CALL TIME AND DATE:
C*****THE USER MAY WISH TO INCLUDE SUBROUTINES FDATE AND FCLOCK WHICH
C*****RETURN THE DATE AND TIME IN MM/DD/YY AND HH.MM.SS FORMATS
C*****RESPECTIVELY. THE REQUIRED ROUTINES FOR A CDC 6600 ARE INCLUDED AT
C*****THE MAIN PROGRAM IN COMMENT CARDS.
C@    CALL FDATE(HDATE)
C@    CALL FCLOCK(HTIME)
C
C*****START CALCULATION
C
C
  100 CONTINUE
      WRITE(IPR,1000)
 1000 FORMAT('1',20X,'***** LOWTRAN 6 *****')
C@    WRITE(IPR,1010) HDATE,HTIME
 1010 FORMAT('1',20X,'***** LOWTRAN 6 *****',10X,2(1X,A8,1X))
C
C*****CARD 1
C
      READ(IRD,1110)MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
 1110 FORMAT(8I5,2F10.3)
C
      WRITE(IPR,1111)MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
 1111 FORMAT('0 CARD 1  *****',8I5,2F10.3)
      M=MODEL
      NPR = NOPRNT
C*****CARD 2 AEROSOL MODEL
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      READ(IRD,1200)IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     X RAINRT
1200  FORMAT(6I5,4F10.3)
      WRITE(IPR,1201)IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     X RAINRT
1201  FORMAT('0 CARD 2  *****',6I5,4F10.3)
C
      IF(VIS.LE.0.0.AND.IHAZE.GT.0) VIS=VSB(IHAZE)
      RHH= 0.
      IF(MODEL.EQ.0.OR.MODEL.EQ.7) GO TO 205
      IF((MODEL.EQ.3.OR.MODEL.EQ.5).AND.ISEASN.EQ.0) ISEASN=2
C
      IF(IHAZE.EQ.3) CALL MARINE(VIS,MODEL,WSS,WHH,ICSTL,EXTC,ABSC,1)
      ICH(1)=IHAZE
      ICH(2)=6
      ICH(3)=9+IVULCN
205   IF(RAINRT.EQ.0) GO TO 210
      WRITE(IPR,1205) RAINRT
1205  FORMAT('0 RAIN MODEL CALLED, RAIN RATE = ',F9.2,' MM/HR')
 210  ICH(4)=15
      IF(ICH(1).LE.0)ICH(1)=1
      IF(ICH(3).LE.9)ICH(3)=10
      IFLGA=0
      IFLGT=0
      CTHIK=-99.
      CALT=-99.
      ISEED=-99
      IF(ICIR.EQ.0) GO TO 230
C*****CARD 2A CIRRUS CLOUDS
      READ(IRD,1210)CTHIK,CALT,ISEED
1210  FORMAT(2F10.3,I10)
      WRITE(IPR,1211)CTHIK,CALT,ISEED
1211  FORMAT('0 CARD 2A *****',2F10.3,I10)
      IF(CTHIK.NE.0) IFLGT=1
      IF(CALT.NE.0)  IFLGA=1
      IF(ISEED.EQ.0) IFLGT=2
      IF(ISEED.EQ.0) IFLGA=2
      CALL CIRRUS(CTHIK,CALT,ISEED,CPROB)
      WRITE(IPR,1220)
1220  FORMAT(15X,'CIRRUS ATTENUATION INCLUDED')
      IF(IFLGT.EQ.0) WRITE(IPR,1221) CTHIK
1221  FORMAT(15X,'CIRRUS ATTENUTION STATISTICALLY DETERMENED TO BE',
     X F10.3,'KM')
      IF(IFLGT.EQ.1) WRITE(IPR,1222) CTHIK
1222  FORMAT(15X,'CIRRUS THICKNESS USER DETERMINED TO BE',F10.3,'KM')
      IF(IFLGT.EQ.2) WRITE(IPR,1223) CTHIK
1223  FORMAT(15X,'CIRRUS THICKNESS DEFAULTED TO MEAN VALUE OF    ',
     X F10.3,'KM')
      IF(IFLGA.EQ.0) WRITE(IPR,1224)CALT
1224  FORMAT(15X,'CIRRUS BASE ALTITUDE STATISCALLY DETERMINED TO BE',
     X F10.3,' KM')
      IF(IFLGA.EQ.1) WRITE(IPR,1225) CALT
1225  FORMAT(15X,'CIRRUS BASE ALTITUDE USER DETERMINED TO BE',
     X F10.3,' KM')
      IF(IFLGA.EQ.2) WRITE(IPR,1226) CALT
1226  FORMAT(15X,'CIRRUS BASE ALTITUDE DEFAULTED TO MEAN VALUE OF',
     X F10.3,'KM')
      WRITE(IPR,1227)CPROB
1227  FORMAT(15X,'PROBABILTY OF CLOUD OCCURRING IS',F7.1,
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     X ' PERCENT')
230   CONTINUE
C*****CARD 2B VERTICAL STRUCTURE ALGORITHM
      ZCVSA=-99.
      ZTVSA=-99.
      ZINVSA=-99.
      IF( IVSA. EQ. 0 ) GO TO 240
      READ (IRD,1230) ZCVSA,ZTVSA,ZINVSA
1230  FORMAT(3F10.3)
      WRITE(IPR,1231)ZCVSA,ZTVSA,ZINVSA
1231  FORMAT('0 CARD 2B *****',3F10.3)
C
      CALL VSA(IHAZE,VIS,ZCVSA,ZTVSA,ZINVSA,ZVSA,RHVSA,AHVSA,IHVSA)
C
240   IF (MODEL.NE.7) ML=NL
      DO 250 I=1,5
      IF(M.NE.0)HMODEL(I,7)=HMODEL(I,M)
250   IF(M.EQ.0)HMODEL(I,7)=HMODEL(I,8)
      IF (MODEL.NE.7.OR.IM.EQ.0) GO TO 260
C
C*****CARD 2C1 USER SUPPLIED ATMOSPHERIC PROFILE
C
      READ (IRD,1250) ML,(HMODEL(I,7),I=1,5)
1250  FORMAT(I5,18A4)
      WRITE(IPR,1251)ML,(HMODEL(I,7),I=1,5)
1251  FORMAT('0 CARD 2C1*****',I5,18A4)
      CALL NSMDL
260   CONTINUE
C
C
C*****CARD 2D
C
      IF(IHAZE.NE.7) GO TO 300
C*****CARD 2D USER SUPPLIED AEROSOL EXTINCTION AND ABSORPTION
      READ(IRD,1260)(DUMMY,EXTC(1,I),ABSC(1,I),I=1,40)
1260  FORMAT(4(F6.2,2F7.5))
      WRITE(IPR,1261)(EXTC(1,I),ABSC(1,I),I=1,40)
1261  FORMAT('0 CARD 2D *****',4(6X,2F7.5))
300   CONTINUE
C
C
C*****CARD 3 GEOMETERY PARAMETERS
C
      IF (MODEL.NE.0) GO TO 310
C
C*****CARD 3*
C*****HORIZONTAL PATH MODEL =0
C
      ML=1
      LEN=0
      CALL NSMDL
      GO TO 321
C
  310 CONTINUE
C
      IF(IVSA.EQ.0) GO TO 312
C
C*****VSA OUTPUTS FINE LAYERING OF THE ATMOSPHERE NEAR THE GROUND
C
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```
      M=7
      IF(MODEL.NE.0.AND.MODEL.NE.7)CALL NSMDL
312   CONTINUE
C
      IF (MODEL.EQ.0) GO TO 320
C
C*****CARD 3
C
      IF(IEMSCT.EQ.3) GO TO 315
      READ(IRD,1312)H1,H2,ANGLE,RANGE,BETA,RO,LEN
1312  FORMAT(6F10.3,I5)
      WRITE(IPR,1313)H1,H2,ANGLE,RANGE,BETA,RO,LEN
1313  FORMAT('0 CARD 3  *****',6F10.3,I5)
      GO TO 320
C*****CARD 3 FOR DIRECTLY TRANSMITTED SOLAR RADIANCE (IEMSCT = 3)
  315 CONTINUE
      READ(IRD,1316) H1,H2,ANGLE,IDAY,RO
 1316 FORMAT(3F10.3,I5,5X,F10.3)
      WRITE(IPR,1317) H1,H2,ANGLE,IDAY,RO
 1317 FORMAT('0 CARD 3'' *****',3F10.3,I5,5X,F10.3)
      ITYPE = 3
      RANGE = 0.0
      BETA = 0.0
      LEN = 0
C*****RO IS THE RADIUS OF THE EARTH
320   RE=6371.23
      IF (MODEL.EQ.1) RE=6378.39
      IF (MODEL.EQ.4) RE=6356.91
      IF (MODEL.EQ.5) RE=6356.91
      IF (RO.GT.0.0) RE=RO
C
  321 CONTINUE
      IPARM =-99
      IPH   =-99
      IDAY  =-99
      ISOURC=-99
C
      PARM1 =-99.
      PARM2 =-99.
      PARM3 =-99.
      PARM4 =-99.
      TIME  =-99.
      PSIPO =-99.
      ANGLEM=-99.
      G     =-99.
C
      IF (IEMSCT.NE.2) GO TO 330
C
C*****CARD 3A1
C
      READ(IRD,1320) IPARM,IPH,IDAY,ISOURC
1320  FORMAT(4I5)
      WRITE(IPR,1321) IPARM,IPH,IDAY,ISOURC
1321  FORMAT('0 CARD 3A1*****',4I5)
C
C*****CARD 3A2
C
      READ(IRD,1322)PARM1,PARM2,PARM3,PARM4,TIME,PSIPO,ANGLEM,G
1322  FORMAT(8F10.3)
```

```
      WRITE(IPR,1323)PARM1,PARM2,PARM3,PARM4,TIME,PSIPO,ANGLEM,G
1323  FORMAT('0 CARD 3A2*****',8F10.3)
C
      IF (IPH.NE.1) GO TO 330
C
C*****CARD 3B1 USER DEFINED PHASE FUNCTION
C
C*****READ USER DEFINED PHASE FUNCTION
C
      READ(IRD,1326)NANGLS
1326  FORMAT(I5)
      WRITE(IPR,1327)NANGLS
1327  FORMAT(' CARD 3B1*****',I5)
C
C*****CARD 3B2
C
      READ(IRD,1328)(ANGF(I),F(1,I),F(2,I),F(3,I),F(4,I),I=1,NANGLS)
1328  FORMAT(5E10.3)
      WRITE(IPR,1329)(ANGF(I),F(1,I),F(2,I),F(3,I),F(4,I),I=1,NANGLS)
1329  FORMAT('0 CARD 3B2*****',5E10.3)
C
  330 CONTINUE
C
      IF (IRPT.EQ.3) GO TO 500
C
C*****CARD 4 WAVENUMBER
C
 400  CONTINUE
      READ(IRD,1400)V1,V2,DV
1400  FORMAT(3F10.3)
      WRITE (IPR,1401) V1,V2,DV
1401  FORMAT('0 CARD 4  *****',3F10.3)
      IF (IRPT.EQ.4) GO TO 560
500   CONTINUE
      WRITE(IPR,1410) (HTRRAD(I1,IEMSCT+1),I1=1,6)
1410  FORMAT('0 PROGRAM WILL COMPUTE ',6A4)
      MDEL=MODEL
      IF(MODEL.EQ.0)MDEL=8
      MM1=MDEL
      MM2=MDEL
      MM3=MDEL
      IF(M1.NE.0)MM1=M1
      IF(M2.NE.0)MM2=M2
      IF(M3.NE.0)MM3=M3
      IF(MODEL.EQ.0) GO TO 510
      WRITE(IPR,1500) MM1,(HMODEL(I1,MM1),I1=1,5),MM2,(HMODEL(I2,MM2),
     X I2=1,5),MM3,(HMODEL(I3,MM3),I3=1,5)
1500  FORMAT('0 ATMOSPHERIC MODEL',/,
     X 10X,'TEMPERATURE = ',I4,5X,5A4,/,
     X 10X,'WATER VAPOR = ',I4,5X,5A4,/,
     X 10X,'OZONE       = ',I4,5X,5A4)
C
510   IF(M.EQ.7) GO TO 520
      IF(ISEASN.EQ.0)ISEASN=1
      IF(IVULCN.LE.0) IVULCN=1
      IHVUL=IVULCN+9
      IHMET=1
      IF(IVULCN.GT.1)IHMET=2
      IF(IHAZE.EQ.0) GO TO 520
```

```
      WRITE(IPR,1510)(HHAZE(I,IHAZE),I=1,5),VIS,(HHAZE(I2,6),I2=1,5),
     X (HHAZE(II,6),II=1,5),(HSEASN(IA,ISEASN),IA=1,5),
     X (HHAZE(I3,IHVUL),I3=1,5),
     X (HVULCN(IB,IVULCN),IB=1,5),(HSEASN(IC,ISEASN),IC=1,5),
     X (HHAZE(I4,15),I4=1,5),(HMET(I5,IHMET),I5=1,5)
1510  FORMAT('0 AEROSOL MODEL',/,10X,'REGIME',
     A T35,'AEROSOL TYPE',T60,'PROFILE',T85,'SEASON',/,/,
     B 10X,'BOUNDARY LAYER (0-2 KM)',T35,5A4,T60,F5.1,
     C ' KM VIS AT SEA LEVEL',/,10X,'TROPOSPHERE  (2-10KM)',T35,
     D 5A4,T60,5A4,T85,5A4,/,10X,'STRATOSPHERE (10-30KM)',
     E T35,5A4,T60,5A4,T85,5A4,/,10X,'UPPER ATMOS (30-100KM)',
     F T35,5A4,T60,5A4)
520   CONTINUE
      IF(ITYPE.EQ.1) WRITE(IPR,1515) H1,RANGE
1515  FORMAT('0 HORIZONTAL PATH',/,10X,'ALTITUDE = ',F10.3,' KM',/,
     1      10X,'RANGE    = ',F10.3,' KM')
      IF(ITYPE.EQ.2) WRITE(IPR,1516) H1,H2,ANGLE,RANGE,BETA,LEN
1516  FORMAT('0 SLANT PATH, H1 TO H2',/,
     1      10X,'H1     = ',F10.3,' KM',/,10X,'H2     = ',F10.3,' KM',/,
     2      10X,'ANGLE = ',F10.3,' DEG',/,10X,'RANGE = ',F10.3,' KM',/,
     3      10X,'BETA  = ',F10.3,' DEG',/,10X,'LEN   = ',I6)
      IF(ITYPE.EQ.3) WRITE(IPR,1517) H1,H2,ANGLE
1517  FORMAT('0 SLANT PATH TO SPACE',/,
     1      10X, 'H1    = ',F10.3,' KM',/,10X,'HMIN  = ',F10.3,' KM',/,
     2      10X,'ANGLE = ',F10.3,' DEG')
      IF (IEMSCT.NE.2) GO TO 550
C
C*****INTREPRET SOLAR SCATTERING PARAMETERS
C
C
      IF (IPARM.EQ.1) CALL SUBSOL (PARM3,PARM4,TIME,IDAY)
C
      WRITE (IPR,1530)
1530  FORMAT('0 SINGLE SCATTERING CONTROL PARAMETERS SUMMARY '/)
      IF(IPARM.NE.2) WRITE (IPR,1532) PARM1,PARM2,PARM3,PARM4,TIME,PSIPO
     1,IDAY
1532  FORMAT(10X,'OBSERVER LATITUDE =',T35,F10.2,' DEG NORTH OF EQUATOR'
     X,10X,'OBESRVER LONGITUDE =',T35,F10.2,' DEG WEST OF GREENWICH',/,
     X 10X,'SUBSOLAR LATITUDE =',T35,F10.2,' NORTH OF EQUATOR',/,
     X 10X,'SUBSOLAR LONGITUDE =',T35,F10.2,' WEST OF GREENWICH',/,
     X 10X,'TIME (<0 IS UNDEF)=',T35,F10.3,' GREENWICH TIME',/,
     X 10X,'PATH AZIMUTH =',T35,F10.3,' DEG EAST OF NORTH',/,
     X 10X,'DAY OF YEAR =',T35,I10)
      IF (IPARM.EQ.2) WRITE (IPR,1534)PARM1,PARM2,TIME,PSIPO,IDAY
1534  FORMAT(10X,'RELATIVE AZIMUTH =',T35,F10.3,' DEG EAST OF NORTH',/,
     X 10X,'SOLAR ZENITH =',T35,F10.3,' DEG ',/,
     X 10X,'TIME (<0 UNDEF) =',T35,F10.3,' GREENWICH TIME',/,
     X 10X,'PATH AZIMUTH =',T35,F10.3,' DEG EAST OF NORTH',/,
     X 10X,'DAY OF THE YEAR =',T35,I6)
      IF (ISOURC.EQ.0) WRITE (IPR,1535)
1535  FORMAT('0 EXTRATERRESTIAL SOURCE IS THE SUN')
      IF (ISOURC.EQ.1) WRITE (IPR,1536) ANGLEM
1536  FORMAT('0 EXTRATERRESTIAL SOURCE IS THE MOON, MOON PHASE ANGLE =',
     X F10.2,' DEG')
      IF (IPH.EQ.0) WRITE (IPR,1538) G
1538  FORMAT('0 H-G PHASE FUNCTION ,G=',F10.3)
      IF (IPH.EQ.1) WRITE (IPR,1540)
1540  FORMAT('0 USER SUPPLIED PHASE FUNCTION')
      IF (IPH.EQ.2) WRITE (IPR,1542)
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```
1542  FORMAT('0 PHASE FUNCTION FROM MIE DATA BASE')
550   CONTINUE
      V1 =FLOAT(INT(V1/5.0+0.1))*5.0
      V2 =FLOAT(INT(V2/5.0+0.1))*5.0
      ALAM1=10000./V1
      ALAM2=10000./V2
      IF(DV.LT.5.)DV=5.
      DV=FLOAT(INT(DV/5+0.1))*5.0
      WRITE (IPR,1555) V1,ALAM1,V2,ALAM2,DV
1555  FORMAT('0 FREQUENCY RANGE '/,10X,' V1 = ',F12.1,' CM-1  ('
     X F10.2,' MICROMETERS)',/,10X,' V2 = ',F12.1,' CM-1  (',F10.2,
     X ' MICROMETERS)',/10X,' DV = ',F12.1,' CM-1')
C
C*****LOAD ATMOSPHERIC PROFILE INTO /MODEL/
C
      CALL STDMDL
C
C*****TRACE PATH THROUGH THE ATMOSPHERE AND CALCULATE ABSORBER AMOUNTS
C
      ISSGEO=0
      CALL GEO (IERROR,BENDNG )
C
      IF(IERROR.GT.0) GO TO 630
      IF(IEMSCT.EQ.3 .AND. IERROR.EQ. -5) GO TO 557
      GO TO 558
  557 CONTINUE
      WRITE(IPR,1557)
 1557 FORMAT('0 DIRECT PATH TO SUN INTERSECTS THE EARTH: SKIP TO ',
     1     'NEXT CASE')
      GO TO 630
  558 CONTINUE
C
      IF(IEMSCT.EQ.2)
     X CALL SSGEO(IERROR,IPH,IPARM,PARM1,PARM2,PARM3,PARM4,PSIPO,G)
      IF(IERROR.GT.0) GO TO 630
C
C
C*****LOAD AEROSOL EXTINCTION AND ABSORPTION COEFFICIENTS
C
      CALL EXABIN
C
C*****WRITE HEADER DATA TO TAPE 7
C
560   WRITE(IPU,1110)MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      WRITE(IPU,1200)IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     X RAINRT
      WRITE(IPU,1210) CTHIK,CALT,ISEED
      WRITE(IPU,1230)ZCVSA,ZTVSA,ZINVSA
      WRITE(IPU,1250) ML,(HMODEL(I,MODEL),I=1,5)
      IF(MODEL.NE.0)WRITE (IPU,1312) H1,H2,ANGLE,RANGE,BETA,RO,LEN
      IF(MODEL.EQ.0) WRITE(IPU,1560)(HMDLZ(K),K=1,8)
1560  FORMAT(3F10.3,2F5.1,2E10.3,2F10.3)
      WRITE(IPU,1320)  IPARM,IPH,IDAY,ISOURC
      WRITE(IPU,1322) PARM1,PARM2,PARM3,PARM4,TIME,PSIPO,ANGLEM,G
      WRITE(IPU,1400) V1,V2,DV
      READ(IRD,1600)IRPT
1600  FORMAT(I5)
      WRITE(IPU,1600) IRPT
C
```

```
      IRAIN=0
      IF(RAINRT.GT.0) IRAIN=1
C
      CALL TRANS (IPH,ISOURC,IDAY,ANGLEM)
C
C*****WRITE END OF FILE ON TAPE 7
1610  CONTINUE
      WRITE(IPU,1620)
1620  FORMAT(' -9999.')
630   CONTINUE
C
      WRITE(IPR,1630)IRPT
1630  FORMAT('0 CARD 5 *****',I5)
      IF (IRPT.EQ.0) GO TO 900
      IF (IRPT.GT.4) GO TO 900
      GO TO (100,900,300,400), IRPT
  900 STOP
C@    END
C@    THE FOLLOWING TIME AND DATE SUBROUTINES APPLY TO A CDC 6600
C@    SUBROUTINE FDATE(HDATE)
C@    CALL DATE(GDATE)
C@    HDATE=SHIFT(GDATE,6)
C@    RETURN
C@    END
C@    SUBROUTINE FCLOCK(HTIME)
C@    CALL CLOCK(GTIME)
C@    HTIME=SHIFT(GTIME,6)
C@    RETURN
      END
```

```
      SUBROUTINE NSMDL
C*******************************************************************
C     USED FOR USER DEFINED ATMOSPHERIC MODELS (MODEL=0 OR 7)
C     DEFINES ALTITUDE DEPENDENT VARIABLES Z,P,T,WH,WO AND HAZE
C     LOADS HAZE INTO APPROPRATE LOCATION
C*******************************************************************
      COMMON /IFIL/IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /MART/ RHH
      COMMON /MDATA/ZM(34),P(34,7),T(34,7),WH(34,7),WO(34,7),
     X HMIX(34)
      COMMON /MODEL/  Z(34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON              WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /ZVSALY/ ZVSA(10),RHVSA(10),AHVSA(10),IHVSA(10)
      COMMON /MDLZ/HMDLZ(8)
      COMMON /TITL/ HZ(5,15),SEASN(5,2),VULCN(5,5),BLANK,VSB(9),
     X HMET(5,2),HMODEL(5,8)
      DIMENSION AHOL1(5),AHOL2(5),AHOL3(5),AHAST(34),AHLVSA(5),AHUS(5),
     1 ITY1(35),IH1(34),IS1(34),IVL1(34)
      DATA AHLVSA/4HVSA ,4HDEFI,4HNED ,4H    ,4H    /
      DATA  AHUS /4HUSER,4H DEF,4HINED,4H    ,4H    /
C
C     F(A) IS SATURATED WATER WAPOR DENSITY AT TEMP T,A=TZERO/T
C
      F(A)=EXP(18.9766-14.9595*A-2.43882*A*A)*A
C     CALL DRYSTR
      IF(MODEL.EQ.7.AND.IVSA.EQ.1)CALL RDNSM(ML,IM)
      IF(MODEL.EQ.0) M=MODEL
      ICL=0
      T0=273.15
      IC1=1
      N=7
      IF(IVULCN.LE.0) IVULCN=1
      IF(ISEASN.LE.0) ISEASN=1
C     FOR MODEL EQ ZERO
      IHA1=0
      ISEA1=0
      IVUL1=0
      VIS1=0.
      AHAZE=0.
C       END OF MODEL ZERO DEFAULT
      IF (M.NE.0) WRITE(IPR,100)
      K=0
C
C     LOOP OVER LAYERS
C
 1    K=K+1
      IF(M.EQ.0)READ(IRD,85)H1,P(1,7),TMP,DP,RH,WH(K,7),WO(K,7),RANGE
      IF(K.GT.1) GO TO 5
      HMDLZ(1)=H1
      HMDLZ(2)=P(1,7)
      HMDLZ(3)=TMP
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      HMDLZ(4)=DP                                                        NSM
      HMDLZ(5)=RH                                                        NSM
      HMDLZ(6)=WH(K,7)                                                   NSM
      HMDLZ(7)=WO(K,7)                                                   NSM
      HMDLZ(8)=RANGE                                                     NSM
    5 IF(M.EQ.0)WRITE(IPR,90)H1,P(1,7),TMP,DP,RH,WH(K,7),WO(K,7),RANGE   NSM
      IF(M.EQ.0) GO TO 8                                                 NSM
      IF(IVSA.EQ.1) GO TO 7                                              NSM
      IF(M.EQ.7)READ(IRD,80)Z(K),P(K,7),TMP,DP,RH,WH(K,7),WO(K,7),AHAZE,NSM
     1VIS1,IHA1,ISEA1,IVUL1                                              NSM
    7 IF(IVSA.EQ.1)CALL LAYVSA(K,TMP,DP,RH,AHAZE,VIS1,IHA1,ISEA1,IVUL1)  NSM
      WRITE(IPR,95)Z(K),P(K,7),TMP,DP,RH,WH(K,7),WO(K,7),AHAZE,VIS1,     NSM
     1 IHA1,ISEA1,IVUL1                                                  NSM
    8 IF (M.EQ.0) Z(K)=H1                                                NSM
      AHAST(K)=AHAZE                                                     NSM
C     IHA1  IS IHAZE FOR THIS LAYER                                      NSM
C     ISEA1 IS ISEASN FOR THIS LAYER                                     NSM
C     IVUL1 IS IVULCN FOR THE LAYER                                      NSM
      IF(ISEA1.EQ.0) ISEA1=ISEASN                                        NSM
      IF(IHA1.GT.0.OR.IVUL1.GT.0) GO TO 10                               NSM
      ITYAER=IHAZE                                                       NSM
      IF (Z(K).GT.2.0) ITYAER=6                                          NSM
      IF (Z(K).GT.9.0) ITYAER=IVULCN+9                                   NSM
      IF (Z(K).GT.30.) ITYAER=15                                         NSM
      IHA1=IHAZE                                                         NSM
      IVUL1=IVULCN                                                       NSM
      GO TO 15                                                           NSM
   10 IF(IVUL1.GT.0)ITYAER=IVUL1+9                                       NSM
      IF(IHA1.GT.0) ITYAER=IHA1                                          NSM
      IF(ITYAER.GT.15) ITYAER=15                                         NSM
      IF(IHA1.LE.0) IHA1=IHAZE                                           NSM
      IF(IVUL1.LE.0) IVUL1=IVULCN                                        NSM
   15 IF (K.EQ.1) GO TO 20                                               NSM
      IF(N.EQ.7.AND.ITYAER.EQ.6.AND.Z(K).GT.2.0) GO TO 17                NSM
      IF (ITYAER.EQ.ICH(IC1)) GO TO 20                                   NSM
   17 IC1=IC1+1                                                          NSM
      ICL=0                                                              NSM
      IF(RH.GT.0.)RHH=RH                                                 NSM
      N=IC1+10                                                           NSM
      IF (IC1.LE.4) GO TO 20                                             NSM
      IC1=4                                                              NSM
      N=14                                                               NSM
      ITYAER=ICH(IC1)                                                    NSM
   20 ICH(IC1)=ITYAER                                                    NSM
      J=IFIX(Z(K)+1.0E-6)+1                                              NSM
      IF (Z(K).GE.25.0) J=(Z(K)-25.0)/5.0+26.                            NSM
      IF (Z(K).GE.50.0) J=(Z(K)-50.0)/20.0+31.                           NSM
      IF (Z(K).GE.70.0) J=(Z(K)-70.0)/30.0+32.                           NSM
      IF (J.GT.33) J=33                                                  NSM
      FAC=Z(K)-FLOAT(J-1)                                                NSM
      IF (J.LT.26) GO TO 25                                              NSM
      FAC=(Z(K)-5.0*FLOAT(J-26)-25.)/5.                                  NSM
      IF (J.GE.31) FAC=(Z(K)-50.0)/20.                                   NSM
      IF (J.GE.32) FAC=(Z(K)-70.0)/30.                                   NSM
      IF (FAC.GT.1.0) FAC=1.0                                            NSM
   25 L=J+1                                                              NSM
      T(K,7)=TMP+T0                                                      NSM
      IF (M1.GT.0) P(K,7)=P(J,M1)*(P(L,M1)/P(J,M1))**FAC                 NSM
      IF(P(K,7).LE.0.)P(K,7)=3.0E-4                                      NSM
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```
      IF (M1.GT.0) T(K,7)=T(J,M1)*(T(L,M1)/T(J,M1))**FAC
      IF(Z(K).GE.100.)WH(K,7)=0.
      IF(Z(K).GE.100.)GO TO 35
      IF (M2.GT.0) WH(K,7)=WH(J,M2)*(WH(L,M2)/WH(J,M2))**FAC
      IF(RH.GT.0.) WH(K,7)=0.
      IF (WH(K,7).GT.0.0) GO TO 35
      IF (RH.GT.0.0) GO TO 30
      DPK=T0+DP
      TT=T0/DPK
      WH(K,7)=DPK*F(TT)/T(K,7)
      GO TO 35
   30 TA=T0/T(K,7)
      WH(K,7)=F(TA)*0.01*RH
   35 CONTINUE
      IF (M3.GT.0) WO(K,7)=WO(J,M3)*(WO(L,M3)/WO(J,M3))**FAC
      HSTOR(K)=0.
      IF (HMIX(J).LE.0.) GO TO 40
      IF (HMIX(L).LE.0.) GO TO 40
      HSTOR(K)=HMIX(J)*(HMIX(L)/HMIX(J))**FAC
   40 CONTINUE
      DENSTY(7,K)=0.
      DENSTY(12,K)=0.
      DENSTY(13,K)=0.
      DENSTY(14,K)=0.
      DENSTY(15,K)=0.
      PS=P(K,7)/1013.0
      TS=273.15/T(K,7)
      WTEMP=WH(K,7)
      RELHUM(K)=0.
      IF(WTEMP.LE.0.) GO TO 45
      RELHUM(K) = 100.0*WTEMP/F(TS)
      IF( RELHUM(K) .GT. 100.) RELHUM(K)=100.
      IF( RELHUM(K) .LT.   0.) RELHUM(K)=0.
45    RHH=RELHUM(K)
      RH=RHH
      IF(IHAZE.EQ.0) GO TO 50
      IF (VIS1.LE.0.0) VIS1=VIS
      IF (AHAZE.EQ.0.0) GO TO 47
      DENSTY(N,K)=AHAZE
C     AHAZE IS IN LOWTRAN NUMBER DENSTY UNITS
      GO TO 50
47    IF(ITYAER.EQ.3.AND.ICL.EQ.0)CALL MARINE(VIS1,MODEL,WSS,WHH,ICSTL,
     X EXTC,ABSC,IC1)
      IF(ITYAER.EQ.3.AND.ICL.EQ.0)VIS=VIS1
      ICL=1
      CALL AERPRF (J,VIS1,HAZ1,IHA1,ISEA1,IVUL1,NN)
      CALL AERPRF (L,VIS1,HAZ2,IHA1,ISEA1,IVUL1,NN)
      HAZE=0.
      IF ((HAZ1.LE.0.0).OR.(HAZ2.LE.0.0)) GO TO 50
      HAZE=HAZ1*(HAZ2/HAZ1)**FAC
      DENSTY(N,K)=HAZE
50    ITY1(K)=ITYAER
      IH1(K)=IHA1
      IF(AHAZE.NE.0)IH1(K)=-99
      IS1(K)=ISEA1
      IVL1(K)=IVUL1
      IF(K.LT.ML) GO TO  1
C
C     END OF LOOP
```

```
C
      IF(ML.LT.20) WRITE (IPR,903)
903   FORMAT('0 ')
      IF(ML.GE.20) WRITE (IPR,900)
900   FORMAT('1  ')
      WRITE(IPR,905)
C
905   FORMAT(T7,'Z',T17,'P',T26,'T',T32,'REL H', T41,'H2O', T52,'O3',
     1    T80,'AEROSOL',/,T6,'(KM)',T16,'(MB)',T25,'(K)',T33,'(%)',
     2    T39,'(GM M-3)',T49,'(GM M-3)',T59,'TYPE',T80,'PROFILE',
     3    T101,'SEASON',/)
      DO 60 KK=1,ML
      DO 52 IJ=1,5
      AHOL1(IJ)=BLANK
      AHOL2(IJ)=BLANK
52    AHOL3(IJ)=BLANK
      IF(IHAZE.EQ.0) GO TO 60
      ITYAER=ITY1(KK)
      IHA1=IH1(KK)
      ISEA1=IS1(KK)
      IVUL1=IVL1(KK)
      DO 54 IJ=1,5
      AHOL1(IJ)=HZ(IJ,ITYAER)
      AHOL2(IJ)=AHUS(IJ)
      IF(IVSA.EQ.1) AHOL2(IJ)=AHLVSA(IJ)
      IF(AHAST(KK).EQ.0) AHOL2(IJ)=AHOL1(IJ)
54    IF (Z(KK).GT.2.0) AHOL3(IJ)=SEASN(IJ,ISEA1)
60    WRITE(IPR,915)Z(KK),P(KK,7),T(KK,7),RELHUM(KK),WH(KK,7),WO(KK,7),
     X AHOL1,AHOL2,AHOL3
915   FORMAT(2F10.3,2F8.2,1P2E10.3,2X,5A4,1X,5A4,1X,5A4)
68    IF (IC1.GE.4) GO TO 75
      IC2=IC1+1
      DO 70 KK=IC2,4
   70 ICH(KK)=ICH(KK-1)
   75 CONTINUE
      M=7
      IF(MODEL.EQ.0)WRITE(IPR,903)
      IF(MODEL.NE.0) MODEL=M
      RETURN
C
   80 FORMAT (3F10.3,2F5.1,2E10.3,E10.3,F7.3,3I1)
   85 FORMAT (3F10.3,2F5.1,2E10.3,2F10.3)
  90  FORMAT('0 CARD 3* *****',3F10.3,2F5.1,1P2E10.3,0PF10.3,
     X 'MODEL ZERO INPUT')
   95 FORMAT (3E10.3,2F5.1,3E10.3,F10.3,4I3,4(1X,2A4,A2))
  100 FORMAT ('  MODEL ATMOSPHERE NO. 7')
      END
```

```
      SUBROUTINE STDMOL
C**********************************************************************
C     THIS SUBROUTINE LOADS ONE OF THE 6 STANDARD ATMOSPHERIC PROFILES
C     INTO COMMON/MODEL/ AND CALCULATES THE DENSITIES OF THE
C     VARIOUS ABSORBING GASES AND AEROSOLS
C**********************************************************************
      COMMON /IFIL/IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /MDATA/ Z(34),P(34,7),T(34,7),WH(34,7),WO(34,7),
     X HMIX(34)
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /MODEL/ ZM(34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON              WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
C     XLOSCH = LOSCHMIDT'S NUMBER,MOLECULES CM-2,KM-1
      DATA PZERO /1013.25/,TZERO/273.15/,XLOSCH/2.6868E24/
C     RV GAS CONSTANT FOR WATER IN MB/(GM M-3 K)
C     CON CONVERTS WATER VAPOR FROM GM M-3 TO MOLECULES CM-2 KM-1
      DATA RV/4.6152E-3/,CON/3.3429E21/
C     CONSTANTS FOR INDEX OF REFRACTION, AFTER EDLEN, 1965
      DATA A0/83.42/,A1/185.08/,A2/4.11/,
     X     B1/1.140E5/,B2/6.24E4/,C0/43.49/,C1/1.70E4/
C
C     F(A) IS SATURATED WATER WAPOR DENSITY AT TEMP T,A=TZERO/T
      F(A)=EXP(18.9766-14.9595*A-2.43882*A*A)*A
C     H2O CONTINUUM IS STORED AT 296 K RHZERO IS AIR DENSITY AT 296 K
C     IN UNITS OF LOSCHMIDT'S
C
C     CALL DRYSTR
      RHZERO=(273.15/296.0)
C
C     LOAD ATMOSPHERE PROFILE INTO /MODEL/
      MM1=M
      IF(M1.NE.0.AND.M.NE.7) MM1=M1
      MM2=M
      IF(M2.NE.0.AND.M.NE.7) MM2=M2
      MM3=M
      IF(M3.NE.0.AND.M.NE.7) MM3=M3
      IF (M.LT.7) ML=NL
      DO 25 I=1,ML
      IF(M.NE.7)ZM(I)=Z(I)
      PM(I)=P(I,MM1)
      TM(I)=T(I,MM1)
      PP=PM(I)
      TT=TM(I)
      F1=(PP/PZERO)/(TT/TZERO)
      F2=(PP/PZERO)*SQRT(TZERO/TT)
      WTEMP=WH(I,MM2)
      RELHUM(I)=0.
C     RELHUM IS CALCULATED ONLY FOR THE BOUNDRY LAYER (0 TO 2 KM)
C
C     SCALED H2O DENSITY
      DENSTY(1,I)= 0.1*WTEMP*F2**0.9
```

```
      IF (ZM(I).GT.2.0) GO TO 15
      TS = TZERO / TT
      RELHUM(I)=100.0*(WTEMP/F(TS))
15    CONTINUE
C     UNIFORMALY MIXED GASES DENSITYS
      DENSTY(2,I)=F1*F2**0.75
C     UV OZONE
      DENSTY(8,I)=46.6667*WO(I,MM3)
C     IR OZONE
      DENSTY(3,I)= DENSTY(8,I)*F2**0.4
C     N2 CONTINUUM
      DENSTY(4,I)=0.8*F1*F2
C     SELF BROADENED WATER
      RHOAIR = F1
      RHOH2O = CON *WTEMP/XLOSCH
      RHOFRN = RHOAIR - RHOH2O
      DENSTY(5,I)= XLOSCH*RHOH2O**2/RHZERO
C     FOREIGN BROADENED
      DENSTY(10,I)= XLOSCH*RHOH2O*RHOFRN/RHZERO
C     MOLECULAR SCATTERING
      DENSTY(6,I) = F1
C     AEROSOL FOR 0 TO 2KM
      IF(M.EQ.7) GO TO 20
      CALL AERPRF(I,VIS,HAZE,IHAZE,ISEASN,IVULCN,N)
      DENSTY(7,I)=0.
C     AEROSOL FOR 2 TO 9KM
      DENSTY(12,I)=0.
C     AEROSOL FOR 9 TO 30KM
      DENSTY(13,I)=0.
C     AEROSOL FOR  ABOVE 30KM
      DENSTY(14,I)=0.
C       LOAD AEROSOLS
      DENSTY(N,I)=HAZE
      DENSTY(N,I)=HAZE
20    CONTINUE
C     RELITIVE HUMIDITY WEIGHTED BY BOUNDRY LAYER AEROSOL (0 TO 2 KM)
      DENSTY(15,I)=RELHUM(I)*DENSTY(7,I)
C     DENSITY (9,I) NO LONGER USED
      DENSTY(9,I)=0.
      IF(ICH(1).GT.7) DENSTY(15,I)=RELHUM(I)*DENSTY(12,I)
C     HNO3 IN ATM * CM /KM
      DENSTY(11,I)= F1* HMIX(I)*1.0E-4
      IF(MODEL.EQ.7) DENSTY(11,I)=F1*HSTOR(I)*1.0E-4
C       CIRRIUS CLOUD
       IF(ICIR.EQ.0) DENSTY(16,I) = 0.
C     RFNDX = REFRAKTIVITY 1-INDEX OF REFRACTION
C     FROM EDLEN, 1950
      PPW=RV*WTEMP*TT
      AVW=0.5*(V1+V2)
      RFNDX(I)=((A0+A1/(1.-(AVW/B1)**2) +A2/(1.0-(AVW/B2)**2))*
     X (PP/PZERO)*(TZERO+15.0)/TT-(C0-(AVW/C1)**2)*PPW/PZERO)*1.E-6
25    CONTINUE
      IF(NPR.EQ.1) GO TO 40
      WRITE(IPR,910)
      DO 30 I=1,ML
       WRITE(IPR,905) I,ZM(I),PM(I),TM(I),(DENSTY(K,I),K=1,8),RFNDX(I),
     X DENSTY(6,I)
30    CONTINUE
      WRITE (IPR,915)
      DO 35 I=1,ML
      WRITE(IPR,905) I,ZM(I),PM(I),TM(I),(DENSTY(K,I),K=10,11),
     X DENSTY(7,I),DENSTY(12,I),DENSTY(13,I),DENSTY(14,I),DENSTY(16,I),
     X DENSTY(16,I),RELHUM(I)
35    CONTINUE
40    CONTINUE
      RETURN
  905 FORMAT (I4,0PF9.3,F9.3,F7.1,1X,1P9E10.3)
910   FORMAT('1',/,'  ATMOSPHERIC PROFILES',//,
     1 3X,'I',T10,'Z',T18,'P',T26,'T',T35,'H2O',T44,'CO2+',T55,'O3',
     2 T65,'N2',T73,'CNTMSLF',T83,'MOL SCAT',T95,'N-1', T103,
     3 'O3 (UV)',/,
     4 T9,'(KM)',T17,'(MB)',T25,'(K)',T39,'(SCALED  LOWTRAN  UNITS)',
     5 T73 '(MOL/CM2 KM)',T84,'(-)',T95,'(-)',T100,
     6 '(ATM CM/KM)',/)
915   FORMAT('1',/,'  ATMOSPHERIC PROFILES',//,
     1 3X,'I',T10,'Z',T18,'P',T26,'T',T33,'CNTMFRN',T45,'HNO3',
     2 T53,'AEROSOL 1',T63,'AEROSOL 2', T73,'AEROSOL 3',T83,
     3 'AEROSOL 4',T93,'AER1*RH',T103,'CIRRUS',T113,'RH',/,
     4 T9,'(KM)',T17,'(MB)',T25,'(K)',T31,'MOL/CM2 KM',T42,
     5 'ATM CM/KM',T54,'(-)',T64,'(-)',T74,'(-)',T84,'(-)',T94,
     6 '(-)',T104,'(-)',T113,'(PERCNT)',/)
      END
```

```
      SUBROUTINE AERPRF (I,VIS,HAZE,IHAZE,ISEASN,IVULCN,N)
C**********************************************************************
C     WILL COMPUTE DENSITY    PROFILES FOR AEROSOLS
C**********************************************************************
      COMMON/PRFD  /ZHT(34),HZ2K(34,5),FAWI50(34),FAWI23(34),SPSU50(34),
     1SPSU23(34),BASTFW(34),VUMOFW(34),HIVUFW(34),EXVUFW(34),BASTSS(34),
     2VUMOSS(34),HIVUSS(34),EXVUSS(34),UPNATM(34),VUTONO(34),
     3VUTOEX(34),EXUPAT(34)
      DIMENSION VS(5)
      DATA VS/50.,23.,10.,5.,2./
      HAZE=0.
      N=7
      IF (IHAZE.EQ.0) RETURN
      IF (ZHT(I).GT.2.0) GO TO 15
      DO 5 J=2,5
      IF (VIS.GE.VS(J)) GO TO 10
    5 CONTINUE
      J=5
   10 CONST=1./(1./VS(J)-1./VS(J-1))
      HAZE=CONST*((HZ2K(I,J)-HZ2K(I,J-1))/VIS+HZ2K(I,J-1)/VS(J)-HZ2K(I,J
     1)/VS(J-1))
      RETURN
   15 IF (ZHT(I).GT.9.0) GO TO 35
      N=12
      CONST=1./(1./23.-1./50.)
      IF (ISEASN.GT.1) GO TO 25
      IF (VIS.LE.23.) HAZE=SPSU23(I)
      IF (VIS.LE.23.) RETURN
      IF (ZHT(I).GT.4.0) GO TO 20
      HAZE=CONST*((SPSU23(I)-SPSU50(I))/VIS+SPSU50(I)/23.-SPSU23(I)/50.)
      RETURN
   20 HAZE=SPSU50(I)
      RETURN
   25 IF (VIS.LE.23.) HAZE=FAWI23(I)
      IF (VIS.LE.23.) RETURN
      IF (ZHT(I).GT.4.0) GO TO 30
      HAZE=CONST*((FAWI23(I)-FAWI50(I))/VIS+FAWI50(I)/23.-FAWI23(I)/50.)
      RETURN
   30 HAZE=FAWI50(I)
      RETURN
   35 IF (ZHT(I).GT.30.0) GO TO 75
      N=13
      HAZE=BASTSS(I)
      IF (ISEASN.GT.1) GO TO 55
      IF (IVULCN.EQ.0) HAZE=BASTSS(I)
      IF (IVULCN.EQ.0) RETURN
      GO TO (40,45,50,50,45), IVULCN
   40 HAZE=BASTSS(I)
      RETURN
   45 HAZE=VUMOSS(I)
      RETURN
   50 HAZE=HIVUSS(I)
      RETURN
   55 IF (IVULCN.EQ.0) HAZE=BASTFW(I)
      IF (IVULCN.EQ.0) RETURN
      GO TO (60,65,70,70,65), IVULCN
   60 HAZE=BASTFW(I)
      RETURN
   65 HAZE=VUMOFW(I)
      RETURN
   70 HAZE=HIVUFW(I)
      RETURN
   75 N=14
      IF (IVULCN.GT.1) GO TO 80
      HAZE=UPNATM(I)
      RETURN
   80 HAZE=VUTONO(I)
      RETURN
      END
```

```
      SUBROUTINE DRYSTR
C*****************************************************************************
C     THIS SUBROUTINE REPLACES THE STRATOSPHERIC (16 KM AND ABOVE)
C     WATER VAPOR PROFILE STORED IN MDLATM WITH
C     A "DRY" WATER VAPOR PROFILE CORRESPONDING TO
C     A CONSTANT MASS MIXING RATIO OF DRYMIX (DRYMIX=2.6 PPMM
C     FROM R. PENNDORF 1978 ANALYSIS OF OZONE AND WATER VAPOR
C     FIELD MEASUREMENT DATA FAA-EE-78-29)
C     TO INCLUDE THE DRY PROFILE, THE USER MUST INCLUDE A CALL TO
C     DRYSTR IN THE MAIN PROGRAM
C*****************************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /MDATA/ Z(34),P(34,7),T(34,7),WH(34,7),WO(34,7),
     1                                  HMIX(34)
      DATA DRYMIX /2.6E-6/,RV /2.8705E-3/
      DO 10 I=1,6
      DO 10 N=17,33
10    WH(N,I)=DRYMIX*P(N,I)/(RV*T(N,I))
      WRITE(IPR,900) DRYMIX
900   FORMAT(' WATER VAPOR PROFILE HAS BEEN REPLACED BY A',/,
     X' DRY WATER VAPOR PROFILE CORRESPONDING TO A MASS MIXING RATIO OF'
     X,1PE10.1)
      RETURN
      END
```

```
      SUBROUTINE GEO(IERROR,BENDNG)
C***********************************************************************
C     THIS SUBROUTINE SERVES AS AN INTERFACE BETWEEN THE MAIN
C     LOWTRAN6 PROGRAM 'LWTRN6' AND THE NEW SET OF SUBROUTINES,
C     INCLUDING 'GEOINP', 'REDUCE', 'FDBETA', 'EXPINT', 'FNDHMN',
C     'FINDSH', 'SCALHT', 'ANDEX', 'RADREF', 'RFPATH', 'FILL',
C     AND 'LAYER', WHICH CALCULATE THE ABSORBER
C     AMOUNTS FOR A REFRACTED PATH THROUGH THE ATMOSPHERE.
C     THE INPUT PARAMETERS ITYPE, H1, H2, ANGLE, RANGE, BETA, AND LEN
C     ALL FUNCTION IN THE SAME WAY IN THE NEW ROUTINES AS IN THE OLD.
C***********************************************************************
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON             WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /IFIL/IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,REE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /MODEL/ ZM(34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /RFRPTH/ ZP(35),PP(35),TP(35),RFNDXP(35),SP(35),
     1    PPSUM(35),TPSUM(35),RHOPSM(35),DENP(16,35),AMTP(16,35)
      COMMON /SOLS/ AH1(68),ARH(68),
     X   WPATHS(68,16),PA(68),PR(68),ATHETA(35),ADBETA(35),LJ(69),JTURN,
     X ANGSUN
      DIMENSION KMOL(16)
C*****KMOL(K) IS A POINTER USED TO REORDER THE AMOUNTS WHEN PRINTING
      DATA KMOL/1,2,3,11,8,5,9,10,4,6,7,12,13,14,16,15/
C*****INITIALIZE CONSTANTS AND CLEAR CUMULATIVE VARIABLES
C*****DELTAS IS THE NOMINAL PATH LENGTH INCRENMENT USED IN THE RAY TRACE
      DELTAS = 5.0
      IERROR = 0
      RE = REE
      IMOD = ML
      IMAX = ML
C*****ZERO OUT CUMULATIVE VARIABLES
      DO 100 I=1,35
      PPSUM(I) = 0.0
      TPSUM(I) = 0.0
      RHOPSM(I) = 0.0
      DO 100 K=1,KMAX
      AMTP(K,I) = 0.0
  100 CONTINUE
      ZMAX=ZM(IMAX)
      IF(MODEL.EQ.0)  GO TO 145
      IF(ISSGEO.EQ.1) GO TO 200
      IF(ITYPE.GE.2)  GO TO 200
C*****HORIZONTAL PATH, MODEL EQ 1 TO 7:  INTERPOLATE PROFILE TO H1
      DO 120 I=2,ML
      I2 = I
      IF(H1.LT.ZM(I))  GO TO 130
  120 CONTINUE
  130 CONTINUE
      I1 = I2-1
      FAC = (H1-ZM(I1))/(ZM(I2)-ZM(I1))
```

```
      ZP(1) = H1
      CALL EXPINT(PP(1),PM(I1),PM(I2),FAC)
      TP(1) = TM(I1)+(TM(I2)-TM(I1))*FAC
      DO 140 K=1,KMAX
      CALL EXPINT(DENP(K,1),DENSTY(K,I1),DENSTY(K,I2),FAC)
  140 CONTINUE
C*****CALCULATE ABSORBER AMOUNTS FOR A HORIZONTAL PATH
 145  WRITE(IPR,36)  H1,RANGE,MODEL
   36 FORMAT('0HORIZONTAL PATH AT ALTITUDE = ',F10.3,
     1    ' KM WITH RANGE = ',F10.3,' KM, MODEL = ',I3)
      IKMAX = 1
      IF(MODEL.EQ.0) TP(1)=TM(1)
      TBBY(1) = TP(1)
      DO 160 K=1,KMAX
      IF(MODEL.EQ.0)  DENP(K,1) = DENSTY(K,1)
      W(K) = DENP(K,1)*RANGE
      WPATH(1,K) = W(K)
  160 CONTINUE
      WTEM = (296.0-TP(1))/(296.0-260.0)
      IF(WTEM.LT.0.)WTEM=0.
      IF(WTEM.GT.1)WTEM=1.
      W(9)=W(5)*WTEM
      WPATH(1,9) = W(9)
      GO TO 320
  200 CONTINUE
C*****SLANT PATH SELECTED
C*****INTERPRET SLANT PATH PARAMETERS
      CALL GEOINP(H1,H2,ANGLE,RANGE,BETA,ITYPE,LEN,HMIN,PHI,IERROR)
      IF(IERROR.EQ.0) GO TO 210
      IF(ISSGEO.NE.1)WRITE(IPR,38)
   38 FORMAT('0GEO:  IERROR NE 0: END THIS CALCULATION AND SKIP TO'
     1     ,' THE NEXT CASE')
      RETURN
  210 CONTINUE
C*****CALCULATE THE PATH THROUGH THE ATMOSPHERE
      IAMT = 1
      CALL RFPATH(H1,H2,ANGLE,PHI,LEN,HMIN,IAMT,BETA,RANGE,BENDNG)
C*****UNFOLD LAYER AMOUNTS IN AMTP INTO THE CUMULATIVE
C*****AMOUNTS IN WPATH FROM H1 TO H2
      DO 220 I=1,IPATH
      IF(H1.EQ.ZP(I)) IH1 = I
      IF(H2.EQ.ZP(I)) IH2 = I
  220 CONTINUE
      JMAX = (IPATH-1)+LEN*(MINO(IH1,IH2)-1)
      IKMAX = JMAX
C*****DETERMINE LJ(J), WHICH IS THE NUMBER OF THE LAYER IN AMTP(K,L),
C*****STARTING FROM HMIN, WHICH CORRESPONDS TO THE LAYER J IN
C*****WPATH(J,K), STARTING FROM H1
C*****INITIAL DIRECTION OF PATH IS DOWN
      L = IH1
      LDEL = -1
      IF(LEN.EQ.1 .OR. H1.GT.H2)  GO TO 230
C*****INITIAL DIRECTION OF PATH IS UP
      L = 0
      LDEL = 1
  230 CONTINUE
      JTURN = 0
      JMAXP1=JMAX+1
      DO 250 J=1,JMAXP1
```

```
C*****TEST FOR REVERSING DIRECTION OF PATH FROM DOWN TO UP
      IF(L.NE.1 .OR. LDEL.NE.-1)  GO TO 240
      JTURN = J
      L = 0
      LDEL = +1
  240 CONTINUE
      L = L+LDEL
      LJ(J) = L
  250 CONTINUE
C*****LOAD TBBY AND WPATH
C*****TBBY IS DENSITY WEIGHTED MEAN TEMPERATURE
      AMTTOT=0.
      DO 255 K=1,KMAX
  255 WPATH(1,K) = 0.0
      DO 265 J=1,JMAX
      L = LJ(J)
      TBBY(J) = TPSUM(L)/RHOPSM(L)
      AMTTOT=AMTTOT+RHOPSM(L)
      J1 = J-1
      IF(J1.EQ.0)  J1 = 1
      DO 260 K=1,KMAX
      IF(K.EQ.9) GO TO 260
      WPATH(J,K) = WPATH(J1,K)+AMTP(K,L)
  260 CONTINUE
      WTEM = (296.0-TBBY(J))/(296.0-260.0)
      IF(WTEM.LT.0.0) WTEM = 0.
      IF(WTEM.GT.1.0) WTEM = 1.0
      WPATH(J,9) = WPATH(J1,9)+WTEM*AMTP(5,L)
265   CONTINUE
      DO 270 K=1,KMAX
      W(K) = WPATH(JMAX,K)
  270 CONTINUE
C*****INCLUDE BOUNDARY EMISSION IF:
C*****     1. NON ZERO TBOUND IS READ IN ON CARD 1
C*****     2. SLANT PATH INTERSECTS THE EARTH (TBOUND
C*****        SET TO TEMPERATURE OF LOWEST BOUNDARY)
      IF(TBOUND.EQ.0.0.AND.H2.EQ.ZM(1)) TBOUND=TM(1)
C*****PRINT CUMULATIVE ABSORBER AMOUNTS
      IF(NPR.EQ.1) GO TO 315
      WRITE(IPR,42)
   42 FORMAT(////,' CUMULATIVE ABSORBER AMOUNTS FOR THE PATH FROM'
     1     ,' H1 TO Z',//,T3,'J',T9,'Z',T18,'TBAR',T30,'H2O',
     2     T42,'CO2+',T54,'O3',T66,'HNO3', T77,'O3 UV',T86,'CNTMSLF1 ',
     +     T098,'CNTMSLF2',T111,'CNTMFRN'
     3                /,T8,'(KM)',T19,'(K)',T31,'(SCALED LOWTRAN UNITS)',
     4     T62,'(ATM CM)',T74,'(ATM CM)',
     5     T84,'(MOL CM-2)',T96,'(MOL CM-2)',T108,'(MOL CM-2)',/)
C*****GOING DOWN, LP = 0,    GOING UP, LP = 1
      LP = 1
      IF(LEN.EQ.1 .OR. H1.GT.H2)  LP = 0
      DO 300 J=1,JMAX
      L = LJ(J)
      IF(J.EQ.JTURN)  LP = 1
      LZ = L+LP
      IF(NPR.NE.1)WRITE(IPR,44)J,ZP(LZ),TBBY(J),(WPATH(J,KMOL(K)),K=
     X 1,8)
   44 FORMAT(I3,F9.3, F9.2,1P8E12.3)
  300 CONTINUE
      IF(NPR.NE.1)WRITE(IPR,46)
```

```
   46 FORMAT(///,T3,'J',T09,'Z',T17,'N2 CONT',T28,'MOL SCAT',T43,
     1     'AER 1',T55,'AER 2',T67,'AER 3',T79,'AER 4',T091,'CIRRUS',/
     2     ,T8,'(KM)',/)
      LP = 1
      IF(LEN.EQ.1  .OR. H1.GT.H2) LP = 0
      DO 310 J=1,JMAX
      L = LJ(J)
      IF(J.EQ.JTURN) LP = 1
      LZ = L+LP
      IF(NPR.NE.1)WRITE(IPR,48) J,ZP(LZ),(WPATH(J,KMOL(K)),K=9,15)
   48 FORMAT(I3,F9.3,1P7E12.3)
  310 CONTINUE
C*****PRINT PATH SUMMARY
315   IF(ISSGEO.EQ.1) GO TO 320
      WRITE(IPR,40)H1,H2,ANGLE,RANGE,BETA,PHI,HMIN,BENDNG,LEN
   40 FORMAT(//,'0SUMMARY OF THE GEOMETRY CALCULATION',//,
     1 10X,'H1        = ',F10.3,' KM',/,10X,'H2       = ',F10.3,' KM',/,
     110X,'ANGLE    = ',F10.3,' DEG',/,10X,'RANGE    = ',F10.3,' KM',/,
     310X,'BETA     = ',F10.3,' DEG',/,10X,'PHI      = ',F10.3,' DEG',/,
     4 10X,'HMIN     = ',F10.3,' KM',/,10X,'BENDING = ',F10.3,' DEG',/,
     5 10X,'LEN      = ',I10)
  320 CONTINUE
C*****CALCULATE THE AEROSOL WEIGHTED MEAN RH
      IF(W(7).GT.0.0 .AND. ICH(1).LE.7)  W(15) = W(15)/W(7)
      IF(W(12).GT.0.0 .AND. ICH(1).GT.7)  W(15) = W(15)/W(12)
C*****PRINT TOTAL PATH AMOUNTS
      IF(ISSGEO.EQ.1) RETURN
      WRITE(IPR,50)  (W(KMOL(K)),K=1,16)
   50 FORMAT(////,' EQUIVALENT SEA LEVEL TOTAL ABSORBER AMOUNTS',//,
     1     T18,'H2O',T30,'CO2+',T42,'O3',T54,'HNO3',T65,'O3 UV',
     2     T75,'CNTMSLF1',T87,'CNTMSLF2',T100,'CNTMFRN',
     +  /,T20,'(SCALED LOWTRAN UNITS)',
     3                   T50,'(ATM CM)',T63,'(ATM CM)',T73,
     4     '(MOL CM-2)',T85,'(MOL CM-2)',T97,'(MOL CM-2)',
     +     //,10X,1P8E12.3,///,
     5     T15,'N2 CONT',T26,'MOL SCAT',T41,'AER 1', T53,'AER 2',
     6     T65,'AER 3',T77, 'AER 4',T87,'CIRRUS',T99,'MEAN RH'/,
     7     T99,'(PRCNT)',//,10X,1P7E12.3,0PF12.2)
      RETURN
      END
```

```
      SUBROUTINE GEOINP(H1,H2,ANGLE,RANGE,BETA,ITYPE,LEN,HMIN,PHI,
     1    IERROR)
C*********************************************************************
C     GEOINP INTERPRETS THE ALLOWABLE COMBINATIONS OF INPUT PATH
C     PARAMETERS INTO THE STANDARD SET H1,H2,ANGLE,PHI,HMIN, AND LEN.
C     THE ALLOWABLE COMBINATIONS OF INPUT PARAMETERS ARE- FOR ITYPE = 2,
C     (SLANT PATH H1 TO H2) A. H1, H2, AND ANGLE, B. H1, ANGLE, AND
C     RANGE, C. H1, H2, AND RANGE, D. H1, H2, AND BETA -
C     FOR ITYPE = 3 (SLANT PATH H1 TO SPACE H2 = 100 KM),
C     A. H1 AND ANGLE, B. H1 AND HMIN (INPUT AS H2).
C     THE SUBROUTINE ALSO DETECTS BAD INPUT (IMPOSSIBLE GEOMETRY) AND
C     ITYPE = 2 CASES WHICH INTERSECT THE EARTH, AND RETURNS THESE
C     CASES WITH ERROR FLAGS.
C     THE SUBROUTINE FNDHMN IS CALLED TO CALCULATE HMIN, THE MINIMUM
C     HEIGHT ALONG THE PATH, AND PHI, THE ZENITH ANGLE AT H2, USING THE
C     ATMOSPHERIC PROFILE STORED IN /MODEL/
C*********************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      ITER = 0
      IF(ITYPE.NE.3) GO TO 120
C*****SLANT PATH TO SPACE
C*****NOTE: IF BOTH HMIN AND ANGLE ARE ZERO, THEN ANGLE IS
C*****ASSUMED SPECIFIED
      IF(H2.NE.0.0)  GO TO 110
C*****CASE 3A: H1,SPACE,ANGLE
      IF(NPR.NE.1)WRITE(IPR,10)
   10 FORMAT(//,' CASE 3A: GIVEN H1,H2=SPACE,ANGLE')
      H2 =  ZMAX
      CALL FNDHMN(H1,ANGLE,H2,LEN,ITER,HMIN,PHI,IERROR)
      IF(IERROR.EQ.-5) RETURN
      GO TO 200
  110 CONTINUE
C*****CASE 3B: H1,HMIN,SPACE
      IF(NPR.NE.1)WRITE(IPR,12)
   12 FORMAT(//,' CASE 3B: GIVEN H1, HMIN, H2=SPACE')
      HMIN = H2
      H2 = ZMAX
      IF(H1.LT.HMIN) GO TO 9001
      CALL FNDHMN(HMIN,90.0,H1,LEN,ITER,HMIN,ANGLE,IERROR)
      CALL FNDHMN(HMIN,90.0,H2,LEN,ITER,HMIN,PHI,IERROR)
      IF(HMIN.LT.H1) LEN = 1
      GO TO 200
  120 CONTINUE
      IF(ITYPE.NE.2) GO TO 9002
      IF(RANGE.NE.0.0.OR.BETA.NE.0.0) GO TO  30
C*****CASE 2A: H1, H2, ANGLE
      IF(NPR.NE.1)WRITE(IPR,16)
   16 FORMAT(//, ' CASE 2A: GIVEN H1, H2, ANGLE')
      IF(H1.GE.H2.AND.ANGLE.LE.90.0) GO TO 9004
      IF(H1.EQ.0.0 .AND. ANGLE.GT.90.0) GO TO 9007
      IF(H2.LT.H1.AND.ANGLE.GT.90.0.AND.NPR.NE.1) WRITE(IPR,15) LEN
   15 FORMAT(//,' EITHER A SHORT PATH (LEN=0) OR A LONG PATH ',
     1    'THROUGH A TANGENT HEIGHT (LEN=1) IS POSSIBLE: LEN = ',
     2    I3)
      H2ST = H2
      CALL FNDHMN(H1,ANGLE,H2,LEN,ITER,HMIN,PHI,IERROR)
      IF(H2.NE.H2ST)  GO TO 9007
```

```
      GO TO 200
  130 CONTINUE
      IF(BETA.EQ.0.0) GO TO 133
      CALL FDBETA(H1,H2,BETA,ANGLE,PHI,LEN,HMIN,IERROR)
      GO TO 200
  133 CONTINUE
      IF(ANGLE.EQ.0.0) GO TO 140
C*****CASE 2B: H1, ANGLE, RANGE
C*****ASSUME NO REFRACTION
      IF(NPR.NE.1)WRITE(IPR,18)
   18 FORMAT(//,' CASE 2B:, GIVEN H1, ANGLE, RANGE',//
     1     10X,'NOTE: H2 IS COMPUTED FROM H1, ANGLE, AND RANGE ',
     2     'ASSUMING NO REFRACTION')
      R1 = RE+H1
      R2 = SQRT(R1**2+RANGE**2+2.0*R1*RANGE*COS(+ANGLE/DEG))
      H2 = R2-RE
      IF(H2.GE.0.0)  GO TO 135
      H2 = 0.0
      R2 = RE+H2
      RANGE = -R1*COS(ANGLE/DEG)-SQRT(R2**2-R1**2*(SIN(ANGLE/DEG))**2)
      IF(NPR.NE.1)WRITE(IPR,17) RANGE
   17 FORMAT(//,10X,'CALCULATED H2 IS LESS THAN ZERO:',/,
     1     10X,'RESET H2 = 0.0 AND RANGE = ',F10.3)
  135 CONTINUE
C*****NOTE: GEOMETRIC PHI IS NEEDED TO DETERMINE LEN(0 OR 1).
C*****PHI IS THEN RECOMPUTED IN FNDHMN
      PHI = 180.0-ACOS((R2**2+RANGE**2-R1**2)/(2.0*R2*RANGE))*DEG
      LEN = 0
      IF(ANGLE.GT.90.0.AND.PHI.GT.90.0) LEN = 1
      CALL FNDHMN(H1,ANGLE,H2,LEN,ITER,HMIN,PHI,IERROR)
      GO TO 200
  140 CONTINUE
C*****CASE 2C: H1, H2, RANGE
      IF(NPR.NE.1)WRITE(IPR,19)
   19 FORMAT(//,' CASE 2C: GIVEN H1, H2, RANGE',//,
     1     10X,'NOTE: ANGLE IS COMPUTED FROM H1, H2, AND RANGE ',
     2     'ASSUMING NO REFRACTION')
      IF(ABS(H1-H2).GT.RANGE) GO TO 9003
      R1 = H1+RE
      R2 = H2+RE
      ANGLE = 180.0-ACOS((R1**2+RANGE**2-R2**2)/(2.0*R1*RANGE))*DEG
      PHI = 180.0-ACOS((R2**2+RANGE**2-R1**2)/(2.0*R2*RANGE))*DEG
      LEN = 0
      IF(ANGLE.GT.90.0.AND.PHI.GT.90.0) LEN = 1
      CALL FNDHMN(H1,ANGLE,H2,LEN,ITER,HMIN,PHI,IERROR)
  200 CONTINUE
C*****TEST IERROR AND RECHECK LEN
      IF(IERROR.NE.0)  RETURN
      LEN = 0
      IF(HMIN.LT.AMIN1(H1,H2)) LEN = 1
C*****REDUCE PATH ENDPOINTS ABOVE ZMAX TO ZMAX
      IF(HMIN.GE.ZMAX) GO TO 9008
      IF(H1.GT.ZMAX .OR. H2.GT.ZMAX)  CALL REDUCE(H1,H2,ANGLE,PHI,ITER)
C*****AT THIS POINT THE FOLLOWING PARAMETERS ARE DEFINED:
C*****     H1,H2,ANGLE,PHI,HMIN,LEN
      IF(NPR.NE.1)WRITE(IPR,20)  H1,H2,ANGLE,PHI,HMIN,LEN
   20 FORMAT(///,' SLANT PATH PARAMETERS IN STANDARD FORM',//,
     1  10X,'H1       = ',F10.3,' KM',/,10X,'H2       = ',F10.3,' KM',/,
     2  10X,'ANGLE    = ',F10.3,' DEG',/,10X,'PHI      = ',F10.3,' DEG',/,
```

```
     3    10X,'HMIN     = ',F10.3,' KM',/,10X,'LEN      = ',I10)
      RETURN
C*****
C*****ERROR MESAGES
C*****
 9001 CONTINUE
      WRITE(IPR,40) H1,HMIN
   40 FORMAT('0GEOINP, CASE 3B (H1,HMIN,SPACE): ERROR IN INPUT DATA',
     1    //,10X,'H1 = ',F12.6,'    IS LESS THAN HMIN = ',F12.6)
      GO TO 9900
 9002 WRITE(IPR,42) ITYPE,ITYPE
   42 FORMAT('0GEOINP: ERROR IN INPUT DATA, ITYPE NOT EQUAL TO ',
     1    ' 2, OR 3.   ITYPE = ',I10,E23.14)
      GO TO 9900
 9003 WRITE(IPR,43) H1,H2,RANGE
   43 FORMAT('0GEOINP, CASE 2C (H1,H2,RANGE): ERROR IN INPUT DATA',//,
     110X,'ABS(H1-H2) GT RANGE;  H1 = ',F12.6,'    H2 = ',F12.6,
     2    '     RANGE = ',F12.6)
      GO TO 9900
 9004 CONTINUE
      WRITE(IPR,44)  H1,H2,ANGLE
   44 FORMAT('0GEOINP, CASE 2A (H1,H2,ANGLE): ERROR IN INPUT DATA',
     1  //,10X,'H1 = ',F12.6,'    IS GREATER THAN OR EQUAL TO H2 = ',
     2    F12.6 ,/,10X,'AND ANGLE = ',F12.6,'    IS LESS THAN OR ',
     3    'EQUAL TO 90.0')
      GO TO 9900
 9007 WRITE(IPR,48)
   48 FORMAT('0GEOINP, ITYPE = 2: SLANT PATH INTERSECTS THE EARTH',
     1    ' AND CANNOT REACH H2')
      GO TO 9900
 9008 WRITE(IPR,50) ZMAX,H1,H2,HMIN
   50 FORMAT(' GEOINP-  THE ENTIRE PATH LIES ABOVE THE TOP ZMAX ',
     1    'OF THE ATMOSPHERIC PROFILE',//,10X,'ZMAX = ',G12.6,5X,
     2    '  H1 = ',G12.6,5X,'  H2 = ',G12.6,'  HMIN = ',G12.6)
 9900 IERROR = 1
      RETURN
      END
```

```
      SUBROUTINE REDUCE(H1,H2,ANGLE,PHI,ITER)
C*************************************************************************
C     ZMAX IS THE HIGHEST LEVEL IN THE ATMOSPHERIC PROFILE STORED IN
C     COMMON /MODEL/.  IF H1 AND/OR H2 ARE GREATER THAN ZMAX, THIS
C     SUBROUTINE REDUCES THEM TO ZMAX AND RESETS ANGLE AND/OR PHI
C     AS NECESSARY. THIS REDUCTION IS NECESSARY,FOR EXAMPLE FOR
C     SATELLITE ALTITUDES, BECAUSE (1) THE DENSITY PROFILES ARE
C     POORLY DEFINED ABOVE ZMAX AND (2) THE CALCULATION TIME FOR
C     PATHS ABOVE ZMAX CAN BE EXCESSIVE ( EG. FOR GEOSYNCHRONOUS
C     ALTITUDES)
C*************************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      IF(H1.LE.ZMAX .AND. H2.LE.ZMAX)  RETURN
      CALL FINDSH(H1,SH,GAMMA)
      CPATH = ANDEX(H1,SH,GAMMA)*(RE+H1)*SIN(ANGLE/DEG)
      CALL FINDSH(ZMAX,SH,GAMMA)
      CZMAX = ANDEX(ZMAX,SH,GAMMA)*(RE+ZMAX)
      ANGMAX = 180.0-ASIN(CPATH/CZMAX)*DEG
      IF(H1.LE.ZMAX) GO TO 120
      H1 = ZMAX
      ANGLE = ANGMAX
  120 CONTINUE
      IF(H2.LE.ZMAX)  GO TO 130
      H2 = ZMAX
      PHI = ANGMAX
  130 CONTINUE
       WRITE(IPR,20) ZMAX,ANGMAX
   20 FORMAT(///,' FROM SUBROUTINE REDUCE: ',/,
     1   4X,'ONE OR BOTH OF H1 AND H2 ARE ABOVE THE TOP OF THE ',
     2   'ATMOSPHERIC PROFILE ZMAX = ',F10.3,' AND HAVE BEEN RESET ',
     3   'TO ZMAX',/,4X,'ANGLE AND/OR PHI HAVE ALSO BEEN RESET TO ',
     4    'THE ZENITH ANGLE AT ZMAX = ',F10.3,' DEG')
  200 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE FDBETA(H1,H2,BETA,ANGLE,PHI,LEN,HMIN,IERROR)
C**********************************************************************
C     GIVEN H1,H2,AND BETA (THE EARTH CENTERED ANGLE) THIS SUBROUTINE
C     CALCULATES THE INITIAL ZENITH ANGLE AT H1 THROUGH AN ITERATIVE
C     PROCEDURE
C**********************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      DATA TOLRNC/1.0E-4/,ITERMX/10/
      IFLAG = 0
      IF(H1.GT.H2) GO TO 100
      IORDER = 1
      HA = H1
      HB = H2
      GO TO 120
  100 CONTINUE
      IORDER = -1
      HA = H2
      HB = H1
  120 CONTINUE
C*****SET PARAMETER TO SUPRESS CALCULATION OF AMOUNTS
      IAMT = 2
C*****GUESS AT ANGLE, INTEGRATE TO FIND BETA, TEST FOR
C*****CONVERGENCE, AND ITERATE
C*****FIRST GUESS AT ANGLE: USE THE GEOMETRIC SOLUTION(NO REFRACTION)
      ITER = 1
      RA = RE+HA
      RB = RE+HB
      SG = SQRT(RA**2+RB**2-2.0*RA*RB*COS(BETA/DEG))
      ANGLE1 = 180.0-ACOS((RA**2+SG**2-RB**2)/(2.0*RA*SG))*DEG
      HMIN = HA
      IF(ANGLE1.GT.90.0)  HMIN = RA*SIN(ANGLE1/DEG)-RE
      IF(HMIN.GE.0.0) GO TO 310
      IFLAG = 1
      HMIN = 0.0
      CALL FNDHMN(HMIN,90.0,HA,LEN,ITER,HMIN,ANGLE1,IERROR)
  310 CONTINUE
      IF(NPR.NE.1)WRITE(IPR,24)
   24 FORMAT(///,' CASE 2D: GIVEN H1, H2,  BETA:',//,
     1     ' ITERATE AROUND ANGLE UNTIL BETA CONVERGES',//,
     2     ' ITER    ANGLE',T21,'BETA',T30,'DBETA',T40,'RANGE',
     3     T51,'HMIN',T61,'PHI',T70,'BENDING',/,
     4     T10,'(DEG)',T21,'(DEG)',T30,'(DEG)',T41,'(KM)',
     5     T51,'(KM)',T60,'(DEG)',T71,'(DEG)',/)
      LEN = 0
      IF(ANGLE1.GT.90.0) LEN = 1
      CALL FNDHMN(HA,ANGLE1,HB,LEN,ITER,HMIN,PHI,IERROR)
      LEN = 0
      IF(HMIN.LT.HA) LEN = 1
      CALL RFPATH(HA,HB,ANGLE1,PHI,LEN,HMIN,IAMT,BETA1,RANGE,BENDNG)
      DBETA = BETA-BETA1
      IF(NPR.NE.1)WRITE(IPR,26)ITER,ANGLE1,BETA1,DBETA,RANGE,HMIN,PHI,
     X BENDNG
   26 FORMAT(I5,3F10.4,2F10.3,2F10.4)
      IF(IFLAG.EQ.1 .AND. BETA1.LT.BETA) GO TO 9005
      ITER = 2
      DANG = (BETA/25.0)**2
      IF(DANG.LT.0.001) DANG = 0.001
```

```
      ANGLE2 = ANGLE1-DANG
      IF(ANGLE2.LT.0.0)  ANGLE2 = 0.0
      LEN = 0
      IF(ANGLE2.GT.90.0) LEN = 1
      CALL FNDHMN(HA,ANGLE2,HB,LEN,ITER,HMIN,PHI,IERROR)
      LEN = 0
      IF(HMIN.LT.HA) LEN = 1
      CALL RFPATH(HA,HB,ANGLE2,PHI,LEN,HMIN,IAMT,BETA2,RANGE,BENDNG)
      DBETA = BETA-BETA2
      IF(NPR.NE.1)WRITE(IPR,26)ITER,ANGLE2,BETA2,DBETA,RANGE,HMIN,PHI,
     X BENDNG
      ANGLE3 = ANGLE2
      BETA3 = BETA2
      IF(ABS(DBETA).LE.TOLRNC) GO TO 340
  320 CONTINUE
      ITER = ITER+1
      ANGLE3 = ANGLE2+(ANGLE2-ANGLE1)*(BETA-BETA2)/(BETA2-BETA1)
      LEN = 0
      IF(ANGLE3.GT.90.0) LEN = 1
      CALL FNDHMN(HA,ANGLE3,HB,LEN,ITER,HMIN,PHI,IERROR)
      LEN = 0
      IF(HMIN.LT.HA) LEN = 1
      CALL RFPATH(HA,HB,ANGLE3,PHI,LEN,HMIN,IAMT,BETA3,RANGE,BENDNG)
      DBETA = BETA-BETA3
      IF(NPR.NE.1)WRITE(IPR,26)ITER,ANGLE3,BETA3,DBETA,RANGE,HMIN,PHI,
     X BENDNG
      IF(BETA3.LT.BETA.AND.HMIN.LT.0.0) GO TO 9005
      ANGLE1 = ANGLE2
      ANGLE2 = ANGLE3
      BETA1 = BETA2
      BETA2 = BETA3
      IF(ABS(BETA-BETA3).LT.TOLRNC) GO TO 340
      IF(ITER.GT.ITERMX) GO TO 9006
      GO TO 320
  340 CONTINUE
      IF(HMIN.LT.0.0) GO TO 9005
C*****CONVERGED TO A SOLUTION
      ANGLE = ANGLE3
      BETA = BETA3
C*****ASSIGN ANGLE AND PHI TO PROPER H1 AND H2
      IF(IORDER.EQ.1) GO TO 350
      TEMP = PHI
      PHI = ANGLE
      ANGLE = TEMP
  350 CONTINUE
      RETURN
C*****
C*****ERROR MESSAGES
C*****
 9005 CONTINUE
      IF(NPR.NE.1)WRITE(IPR,45)
   45 FORMAT('0FDBETA. CASE 20(H1,H2,BETA): REFRACTED TANGENT ',
     1     HEIGHT IS LESS THAN ZERO-PATH INTERSECTS THE EARTH',
     2   //,10X,'BETA IS TOO LARGE FOR THIS H1 AND H2')
      GO TO 9900
 9006 CONTINUE
      IF(NPR.NE.1)WRITE(IPR,46)H1,H2,BETA,ITER,ANGLE1,BETA1,ANGLE2,
     1    BETA2,ANGLE3,BETA3
   46 FORMAT('0FDBETA, CASE 20 (H1,H2,BETA): SOLUTION DID NOT ',
     1     ' CONVERGE',//,10X,'H1 = ',F12.6,'    H2 = ',F12.6,
     2     '     BETA = ',F12.6,'    ITERATIONS = ',I4,//,
     3    10X,'LAST THREE ITERATIONS ',//,
     4    (10X,'ANGLE = ',F15.9,'    BETA = ',F15.9))
 9900 IERROR = 1
      RETURN
      END
```

```
      SUBROUTINE EXPINT(X,X1,X2,A)
C     EXPONENTIAL INTERPOLATION
      IF(X1.EQ.0.0 .OR. X2.EQ.0.0)  GO TO 100
      X = X1*(X2/X1)**A
      RETURN
  100 X = X1+(X2-X1)*A
      RETURN
      END
```

```
      SUBROUTINE FNDHMN(H1,ANGLE,H2,LEN,ITER,HMIN,PHI,IERROR)
C**********************************************************************
C     THIS SUBROUTINE CALCULATES THE MINIMUM ALTITUDE HMIN ALONG
C     THE REFRACTED PATH AND THE FINAL ZENITH ANGLE PHI.
C     THE PARAMETER LEN INDICATES WHETHER THE PATH GOES THROUGH
C     A TANGENT HEIGHT (LEN=1) OR NOT (LEN=0).  IF ANGLE > 90 AND
C     H1 > H2, THEN LEN CAN EITHER BE 1 OR 0, AND THE CHOICE IS
C     LEFT TO THE USER.
C     THE (INDEX OF REFRACTION - 1.0) IS MODELED AS AN EXPONENTIAL
C     BETWEEN THE LAYER BOUNDARIES, WITH A SCALE HEIGHT SH AND AN
C     AMOUNT AT THE GROUND GAMMA.
C     CPATH IS THE REFRACTIVE CONSTANT FOR THIS PATH AND
C     EQUALS  INDEX(H1)*(RE+H1)*SIN(ANGLE).
C**********************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      DATA DH/1.0/,ETA/5.0E-8/
C*****ETA MAY BE TOO SMALL FOR SOME COMPUTERS. TRY 1.0E-7 FOR 32 BIT
C*****WORD MACHINES
C     CRFRCT IS REFRACTIVE CONSTANT FOR THE PATH
C
      CRFRCT(H) = (RE+H)*ANDEX(H,SH,GAMMA)
      N = 0
      CALL FINDSH(H1,SH,GAMMA)
      CPATH = CRFRCT(H1)*SIN(ANGLE/DEG)
      CALL FINDSH(H2,SH,GAMMA)
      CH2 = CRFRCT(H2)
      IF(ABS(CPATH/CH2).GT.1.0) GO TO 200
      IF(ANGLE.GT.90.0)  GO TO 100
      LEN = 0
      HMIN = H1
      GO TO 160
  100 CONTINUE
      IF(H1.LE.H2)  LEN = 1
      IF(LEN.EQ.1)  GO TO 110
      LEN = 0
      HMIN = H2
      GO TO 160
  110 CONTINUE
C*****LONG PATH THROUGH A TANGENT HEIGHT.
C*****SOLVE ITERATIVELY FOR THE TANGENT HEIGHT HT.
C*****HT IS THE HEIGHT FOR WHICH  INDEX(HT)*(RE+HT) = CPATH.
      CALL FINDSH(0.0,SH,GAMMA)
      CMIN = CRFRCT(0.0)
C*****FOR BETA CASES (ITER>0), ALLOW FOR HT < 0.0
      IF(ITER.EQ.0 .AND. CPATH.LT.CMIN)  GO TO 160
      HT1 = (RE+H1)*SIN(ANGLE/DEG)-RE
      CALL FINDSH(HT1,SH,GAMMA)
      CT1 = CRFRCT(HT1)
      HT2 = HT1-DH
      CALL FINDSH(HT2,SH,GAMMA)
      CT2 = CRFRCT(HT2)
C*****ITERATE TO FIND HT
      N = 2
  120 CONTINUE
      N = N+1
      HT3 = HT2+(HT2-HT1)*(CPATH-CT2)/(CT2-CT1)
```

```
      CALL FINDSH(HT3,SH,GAMMA)
      CT3 = CRFRCT(HT3)
      DC = CPATH-CT3
      IF(ABS((CPATH-CT3)/CPATH).LT.ETA)  GO TO 130
      IF(N.GT.15) GO TO 210
      HT1 = HT2
      CT1 = CT2
      HT2 = HT3
      CT2 = CT3
      GO TO 120
  130 CONTINUE
      HT = HT3
      HMIN = HT
      GO TO 160
  150 CONTINUE
      IF(ISSGEO.EQ.0) GO TO 155
      IERROR=-5.
      RETURN
155   CONTINUE
C*****TANGENT PATH INTERSECTS EARTH
      H2 = 0.0
      HMIN = 0.0
      LEN = 0
      CH2 = CMIN
      IF(ISSGEO.NE.1)WRITE(IPR,22) H1,ANGLE
   22 FORMAT(///,' TANGENT PATH WITH H1 = ',F10.3,' AND ANGLE = ',
     1     F10.3,' INTERSECTS THE EARTH',//,10X,'H2 HAS BEEN RESET ',
     2     'TO 0.0 AND LEN TO 0')
  160 CONTINUE
C*****CALCULATE THE ZENITH ANGLE PHI AT H2
      PHI = ASIN(CPATH/CH2)*DEG
      IF(ANGLE.LE.90.0 .OR. LEN.EQ.1)  PHI = 180.0-PHI
      RETURN
C*****H2 LT TANGENT HEIGHT FOR THIS H1 AND ANGLE
  200 CONTINUE
      WRITE(IPR,20)
   20 FORMAT('0H2 IS LESS THAN THE TANGENT HEIGHT FOR THIS PATH ',
     1     'AND CANNOT BE REACHED')
      IERROR = 2
      RETURN
  210 CONTINUE
      DC = CPATH-CT3
      WRITE(IPR,24)  N,CPATH,CT3,DC,HT3
   24 FORMAT(///,'0FROM SUBROUTINE FNDHMN :',//,
     1     10X,'THE PROCEEDURE TO FIND THE TANGENT HEIGHT DID NOT ',
     2     'CONVERG AFTER ',I3,'  ITERATIONS',//,
     3     10X,'CPATH   = ',F12.5,' KM',//,10X,'CT3     = ',F12.5,' KM',
     4     //,10X,'DC      = ',E12.3,' KM',//,
     5     10X,'HT3     = ',F12.5,' KM')
      STOP 20
      END
```

```
      SUBROUTINE FINDSH(H,SH,GAMMA)
C*****GIVEN AN ALTITUDE H, THIS SUBROUTINE FINDS THE LAYER BOUNDARIES
C*****ZM(I1) AND ZM(I2) WHICH CONTAIN H,  THEN CALCULATES THE SCALE
C*****HEIGHT (SH) AND THE VALUE AT THE GROUND (GAMMA+1) FOR THE
C*****INDEX OF REFRACTION
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /MODEL/ Z(34),P(34),T(34),RFNDX(34),DENSTY(16,34)
      DO 100 IM=2,IMOD
      I2 = IM
      IF(Z(IM).GE.H)  GO TO 110
  100 CONTINUE
      I2 = IMOD
  110 CONTINUE
      I1 = I2-1
      CALL SCALHT(Z(I1),Z(I2),RFNDX(I1),RFNDX(I2),SH,GAMMA)
      RETURN
      END
```

```
      SUBROUTINE SCALHT(Z1,Z2,RFNDX1,RFNDX2,SH,GAMMA)
C**********************************************************************
C     THIS SUBROUTINE CALCULATES THE SCALE HEIGHT SH OF THE (INDEX OF
C     REFRACTION-1.0) FROM THE VALUES OF THE INDEX AT THE ALTITUDES Z1
C     AND Z2 ( Z1 < Z2). IT ALSO CALCULATES THE EXTRAPOLATED VALUE
C     GAMMA OF THE (INDEX-1.0) AT Z = 0.0
C**********************************************************************
      RF1 = RFNDX1+1.0E-20
      RF2 = RFNDX2+1.0E-20
      RATIO = RF1/RF2
      IF(ABS(RATIO-1.0).LT.1.0E-05)  GO TO 100
      SH = (Z2-Z1)/ALOG(RATIO)
      GAMMA = RF1*(RF2/RF1)**(-Z1/(Z2-Z1))
      GO TO 110
  100 CONTINUE
C*****THE VARIATION IN THE INDEX OF REFRACTION WITH HEIGHT IS
C*****INSIGNIFICANT OR ZERO
      SH = 0.0
      GAMMA = RFNDX1
  110 CONTINUE
      RETURN
      END
```

```
      FUNCTION ANDEX(H,SH,GAMMA)
C**********************************************************************
C     COMPUTES THE INDEX OF REFRACTION AT HEIGHT H, SH IS THE
C     SCALE HEIGHT, GAMMA IS THE VALUE AT H=0 OF THE REFRACTIVITY =
C     INDEX-1
C**********************************************************************
      IF(SH.EQ.0.0) GO TO 10
      ANDEX = 1.0+GAMMA*EXP(-H/SH)
      RETURN
   10 ANDEX = 1.0+GAMMA
      RETURN
      END
```

```
      FUNCTION RADREF(H,SH,GAMMA)
C**********************************************************************
C     COMPUTES THE RADIUS OF CURVATURE OF THE REFRACTED RAY FOR
C     HORIZONTAL PATH:  RADREF = ANDEX/ D(ANDEX)/D(RADIUS)
C**********************************************************************
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      IF(SH.EQ.0.0) GO TO 20
      RADREF = SH*(1.0+EXP(H/SH)/GAMMA)
      RETURN
   20 RADREF = BIGNUM
      RETURN
      END
```

```
      SUBROUTINE RFPATH(H1,H2,ANGLE,PHI,LEN,HMIN,IAMT,BETA,RANGE,BENDNG)
C***********************************************************************
C     THIS SUBROUTINE TRACES THE REFRACTED RAY FROM H1 WITH A
C     INITIAL ZENITH ANGLE ANGLE TO H2 WHERE THE ZENITH ANGLE IS PHI,
C     AND CALCULATES THE ABSORBER AMOUNTS (IF IAMT.EQ.1) ALONG
C     THE PATH.  IT STARTS FROM THE LOWEST POINT ALONG THE PATH
C     (THE TANGENT HEIGHT HMIN IF LEN = 1 OR HA = MIN(H1,H2) IF LEN = 0)
C     AND PROCEEDS TO THE HIGHEST POINT.  BETA AND RANGE ARE THE
C     EARTH CENTERED ANGLE AND THE TOTAL DISTANCE RESPECTIVELY
C     FOR THE REFRACTED PATH FROM H1 TO H2
C***********************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /RFRPTH/ ZP(35),PP(35),TP(35),RFNDXP(35),SP(35),
     1    PPSUM(35),TPSUM(35),RHOPSM(35),DENP(16,35),AMTP(16,35)
      COMMON /SOLS/ AH1(68),ARH(68),
     X   WPATHS(68,16),PA(68),PR(68),ATHETA(35),ADBETA(35),LJ(69),JTURN,
     X ANGSUN
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      DIMENSION HLOW(2)
C*    CHARATER*2 HLOW
      DATA HLOW/2HH1,2HH2/
      IF(H1.GT.H2) GO TO 90
      IORDER = 1
      HA = H1
      HB = H2
      ANGLEA = ANGLE
      GO TO 95
   90 CONTINUE
      IORDER = -1
      HA = H2
      HB = H1
      ANGLEA = PHI
   95 CONTINUE
      JNEXT = 1
      IF(IAMT.EQ.1 .AND. NPR.NE.1)  WRITE(IPR,20)
   20 FORMAT('1CALCULATION OF THE REFRACTED PATH THROUGH THE ',
     1     'ATMOSPHERE',///,
     4     T3,'I',T11,'ALTITUDE',T27,'THETA',T34,'DRANGE',T44,'RANGE',
     5     T53,'DBETA',T63,'BETA',T72,'PHI',T80,'DBEND',T87,'BENDING',
     6     T 98,'PBAR',T106,'TBAR',T113,'RHOBAR',/,
     7     T07,'FROM',T18,'TO',/,T07,'(KM)',T17,'(KM)',T27,'(DEG)',
     8     T36,'(KM)',T45,'(KM)',T53,'(DEG)',T62,'(DEG)',T71,'(DEG)',
     9     T80,'(DEG)',T89,'(DEG)',T098,'(MB)',T106,'(K)',
     1     T111,'(GM CM-3)',/)
      IF(LEN.EQ.0) GO TO 100
C*****LONG PATH: FILL IN THE SYMETRIC PART FROM THE TANGENT HEIGHT
C*****TO HA
      CALL FILL(HMIN,HA,JNEXT)
      JHA = JNEXT
  100 CONTINUE
C*****FILL IN THE REMAINING PATH FROM HA TO HB
      IF(HA.EQ.HB) GO TO 110
      CALL FILL(HA,HB,JNEXT)
  110 CONTINUE
      JMAX = JNEXT
      IPATH = JMAX
C*****INTEGRATE EACH SEGMENT OF THE PATH
```

```
C*****CALCULATE CPATH SEPERATELY FOR LEN = 0,1
      IF(LEN.EQ.1) GO TO 115
      CALL FINDSH(HA,SH,GAMMA)
      CPATH = (RE+HA)*ANDEX(HA,SH,GAMMA)*SIN(ANGLEA/DEG)
      GO TO 116
  115 CONTINUE
      CALL FINDSH(HMIN,SH,GAMMA)
      CPATH = (RE+HMIN)*ANDEX(HMIN,SH,GAMMA)
  116 CONTINUE
      BETA = 0.0
      S = 0.0
      BENDNG = 0.0
      IF(LEN.EQ.0) GO TO 140
C*****DO SYMETRIC PART, FROM TANGENT HEIGHT(HMIN) TO HA
      IHLOW = 1
      IF(IORDER.EQ.-1)  IHLOW = 2
      IF(IAMT.EQ.1 .AND. NPR.NE.1) WRITE(IPR,24) HLOW(IHLOW)
   24 FORMAT(' ',T7,'TANGENT',T17,A2,/,T7,'HEIGHT',/)
      SINAI = 1.0
      COSAI = 0.0
      THETA = 90.0
      J2 = JHA-1
      DO 120 J=1,J2
      CALL SCALHT(ZP(J),ZP(J+1),RFNDXP(J),RFNDXP(J+1),SH,GAMMA)
      CALL LAYER(J,SINAI,COSAI,CPATH,SH,GAMMA,IAMT,DS,DBEND)
      DBEND = DBEND*DEG
      PHI = ASIN(SINAI)*DEG
      DBETA = THETA-PHI+DBEND
      PHI = 180.0-PHI
      S = S+DS
      BENDNG = BENDNG+DBEND
      BETA = BETA+DBETA
      IF(IAMT.NE.1) GO TO 118
      PBAR = PPSUM(J)/RHOPSM(J)
      TBAR = TPSUM(J)/RHOPSM(J)
      RHOBAR = RHOPSM(J)/DS
      IF(IAMT.EQ.1 .AND. NPR.NE.1) WRITE(IPR,22) J,ZP(J),ZP(J+1),
     1    THETA,DS,S,DBETA,BETA,PHI,DBEND,BENDNG,PBAR,TBAR,RHOBAR
   22 FORMAT(' ',I2,2F9.3,9F9.3,F8.2,1PE9.2)
  118 CONTINUE
      IF(ISSGEO.EQ.1) GO TO 119
      ATHETA(J)=THETA
      ADBETA(J)=DBETA
  119 CONTINUE
      THETA = 180.0-PHI
  120 CONTINUE
C*****DOUBLE PATH QUANTITIES FOR THE OTHER PART OF THE SYMETRIC PATH
      BENDNG = 2.0*BENDNG
      BETA = 2.0*BETA
      S = 2.0*S
      IF(IAMT.EQ.1 .AND. NPR.NE.1) WRITE(IPR,26) S,BETA,BENDNG
   26 FORMAT('0',T10,'DOUBLE RANGE, BETA, BENDING',/,
     1    T10,'FOR SYMMETRIC PART OF PATH',T40,F9.3,T58,F9.3,
     2    T85,F9.3,/)
      JNEXT = JHA
      GO TO 150
  140 CONTINUE
C*****SHORT PATH
      JNEXT = 1
```

```
C*****ANGLEA IS THE ZENITH ANGLE AT HA IN DEG
C*****SINAI IS SIN OF THE INCIDENCE ANGLE
C*****COSAI IS CARRIED SEPERATELY TO AVOID A PRECISION PROBLEM
C*****WHEN SINAI IS CLOSE TO 1.0
      THETA = ANGLEA
      IF(ANGLEA.GT.45.0) GO TO 145
      SINAI = SIN(ANGLEA/DEG)
      COSAI = -COS(ANGLEA/DEG)
      GO TO 150
  145 CONTINUE
      SINAI = COS((90.0-ANGLEA)/DEG)
      COSAI = -SIN((90.0-ANGLEA)/DEG)
  150 CONTINUE
C*****DO PATH FROM HA TO HB
      IF(HA.EQ.HB) GO TO 170
      J1 = JNEXT
      J2 = JMAX-1
      IHLOW = 1
      IF(IORDER.EQ.-1)  IHLOW = 2
      IHIGH = MOD(IHLOW,2)+1
      IF(IAMT.EQ.1 .AND. NPR.NE.1) WRITE(IPR,28) HLOW(IHLOW),
     1     HLOW(IHIGH)
   28 FORMAT(' ',T11,A2,' TO ',A2,/)
      DO 160 J=J1,J2
      CALL SCALHT(ZP(J),ZP(J+1),RFNDXP(J),RFNDXP(J+1),SH,GAMMA)
      CALL LAYER(J,SINAI,COSAI,CPATH,SH,GAMMA,IAMT,DS,DBEND)
      DBEND = DBEND*DEG
      PHI = ASIN(SINAI)*DEG
      DBETA = THETA-PHI+DBEND
      PHI = 180.0-PHI
      S = S+DS
      BENDNG = BENDNG+DBEND
      BETA = BETA+DBETA
      IF(IAMT.NE.1) GO TO 158
      PBAR = PPSUM(J)/RHOPSM(J)
      TBAR = TPSUM(J)/RHOPSM(J)
      RHOBAR = RHOPSM(J)/DS
      IF(IAMT.EQ.1 .AND. NPR.NE.1) WRITE(IPR,22) J,ZP(J),ZP(J+1),
     1     THETA,DS,S,DBETA,BETA,PHI,DBEND,BENDNG,PBAR,TBAR,RHOBAR
  158 CONTINUE
      IF(ISSGEO.EQ.1) GO TO 159
      ADBETA(J)=DBETA
      ATHETA(J)=THETA
  159 CONTINUE
      THETA = 180.0-PHI
  160 CONTINUE
  170 CONTINUE
      IF(ISSGEO.EQ.0) ATHETA(JMAX)=THETA
      IF(IORDER.EQ.-1) PHI = ANGLEA
      RANGE = S
      RETURN
      END
```

```
      SUBROUTINE FILL(HA,HB,JNEXT)
C***********************************************************************
C     THIS SUBROUTINE DEFINES THE ATMOSPHERIC BOUNDARIES OF THE PATH
C     FROM HA TO HB AND INTERPOLATES (EXTRAPOLATES) THE DENSITIES TO
C     THESE BOUNDARIES ASSUMING THE DENSITIES VARY EXPONENTIALLY
C     WITH HEIGHT
C***********************************************************************
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /MODEL/ Z(34),P(34),T(34),RFNDX(34),DENSTY(16,34)
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /RFRPTH/ ZP(35),PP(35),TP(35),RFNDXP(35),SP(35),
     1    PPSUM(35),TPSUM(35),RHOPSM(35),DENP(16,35),AMTP(16,35)
      IF(HA.LT.HB) GO TO 90
      WRITE(IPR,22) HA,HB,JNEXT
   22 FORMAT('OSUBROUTINE FILL- ERROR, HA .GE. HB',//,
     1    10X,'HA, HB, JNEXT = ',2E25.15,I6)
      STOP
   90 CONTINUE
C*****FIND Z(IA): THE SMALLEST Z(I).GT.HA
      DO 100 I=1,IMAX
      IF(HA.GE.Z(I)) GO TO 100
      IA = I
      GO TO 110
  100 CONTINUE
      IA = IMAX+1
      IB = IA
      GO TO 130
C*****FIND Z(IB): THE SMALLEST Z(I).GE.HB
  110 CONTINUE
      DO 120 I=IA,IMAX
      IF(HB.GT.Z(I)) GO TO 120
      IB = I
      GO TO 130
  120 CONTINUE
      IB = IMAX+1
  130 CONTINUE
C*****INTERPOLATE DENSITIES TO HA, HB
      ZP(JNEXT) = HA
      I2 = IA
      IF(I2.EQ.1) I2 = 2
      IF(I2.GT.IMAX) I2 = IMAX
      I1 = I2-1
      A = (HA-Z(I1))/(Z(I2)-Z(I1))
      CALL EXPINT(PP(JNEXT),P(I1),P(I2),A)
      TP(JNEXT) = T(I1)+(T(I2)-T(I1))*A
      CALL EXPINT(RFNDXP(JNEXT),RFNDX(I1),RFNDX(I2),A)
      DO 140 K=1,KMAX
      CALL EXPINT(DENP(K,JNEXT),DENSTY(K,I1),DENSTY(K,I2),A)
  140 CONTINUE
      IF(IA.EQ.IB) GO TO 160
C*****FILL IN DENSITIES BETWEEN HA AND HB
      I1 = IA
      I2 = IB-1
      DO 150 I=I1,I2
      JNEXT = JNEXT+1
      ZP(JNEXT) = Z(I)
      PP(JNEXT) = P(I)
```

```
      TP(JNEXT) = T(I)
      RFNDXP(JNEXT) = RFNDX(I)
      DO 150 K=1,KMAX
      DENP(K,JNEXT) = DENSTY(K,I)
  150 CONTINUE
  160 CONTINUE
C*****INTERPOLATE THE DENSITIES TO HB
      JNEXT = JNEXT+1
      ZP(JNEXT) = HB
      I2 = IB
      IF(I2.EQ.1) I2 = 2
      IF(I2.GT.IMAX) I2 = IMAX
      I1 = I2-1
      A = (HB-Z(I1))/(Z(I2)-Z(I1))
      CALL EXPINT(PP(JNEXT),P(I1),P(I2),A)
      TP(JNEXT) = T(I1)+(T(I2)-T(I1))*A
      CALL EXPINT(RFNDXP(JNEXT),RFNDX(I1),RFNDX(I2),A)
      DO 170 K=1,KMAX
      CALL EXPINT(DENP(K,JNEXT),DENSTY(K,I1),DENSTY(K,I2),A)
  170 CONTINUE
      RETURN
      END


      SUBROUTINE LAYER(J,SINAI,COSAI,CPATH,SH,GAMMA,IAMT,S,BEND)
C*********************************************************************
C     THIS SUBROUTINE CALCULATES THE REFRACTED PATH FROM Z1 TO Z2
C     WITH THE SIN OF THE INITIAL INCIDENCE ANGLE SINAI
C*********************************************************************
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /RFRPTH/ ZP(35),PP(35),TP(35),RFNDXP(35),SP(35),
     1    PPSUM(35),TPSUM(35),RHOPSM(35),DENP(16,35),AMTP(16,35)
      DIMENSION HDEN(20),DENA(20),DENB(20)
      DATA EPSILN/1.0E-5/
C*****INITIALIZE LOOP
      N = 0
      Z1 = ZP(J)
      Z2 = ZP(J+1)
      H1 = Z1
      R1 = RE+H1
      DHMIN = DELTAS**2/(2.0*R1)
      SINAI1 = SINAI
      COSAI1 = COSAI
      Y1 = COSAI1**2/2.0+COSAI1**4/8.0+COSAI1**6*3.0/48.0
      Y3 = 0.0
      X1 = -R1*COSAI1
      RATIO1 = R1/RADREF(H1,SH,GAMMA)
      DSDX1 = 1.0/(1.0-RATIO1*SINAI1**2)
      DBNDX1 = DSDX1*SINAI1*RATIO1/R1
      S = 0.0
      BEND = 0.0
      IF(IAMT.EQ.2) GO TO 110
C*****INITIALIZE THE VARIABLES FOR THE CALCULATION OF THE
C*****ABSORBER AMOUNTS
      PA = PP(J)
      PB = PP(J+1)
      TA = TP(J)
      TB = TP(J+1)
      RHOA = PA/(GCAIR*TA)
      RHOB = PB/(GCAIR*TB)
      DZ = ZP(J+1)-ZP(J)
      HP = -DZ/ALOG(PB/PA)
      IF(ABS(RHOB/RHOA-1.0).LT.EPSILN)  GO TO 90
      HRHO = -DZ/ALOG(RHOB/RHOA)
      GO TO 95
   90 HRHO = 1.0E30
   95 CONTINUE
      DO 105 K=1,KMAX
      DENA(K) = DENP(K,J)
      DENB(K) = DENP(K,J+1)
      IF(DENA(K).EQ.0.0 .OR. DENB(K).EQ.0.0)  GO TO 100
      IF(ABS(1.0-DENA(K)/DENB(K)).LE.EPSILN)  GO TO 100
C*****USE EXPONENTIAL INTERPOLATION
      HDEN(K) = -DZ/ALOG(DENB(K)/DENA(K))
      GO TO 105
C*****USE LINEAR INTERPOLATION
  100 HDEN(K) = 0.0
  105 CONTINUE
  110 CONTINUE
C*****
C*****LOOP THROUGH PATH
```

```
C*****INTEGRATE PATH QUANTITIES USING QUADRATIC INTEGRATION WITH
C*****UNEQUALLY SPACED POINTS
C*****
  115 CONTINUE
      N = N+1
      DH = -DELTAS*COSAI1
      IF(DH.LT.DHMIN) DH = DHMIN
      H3 = H1+DH
      IF(H3.GT.Z2) H3 = Z2
      DH = H3-H1
      R3 = RE+H3
      H2 = H1+DH/2.0
      R2 = RE+H2
      SINAI2 = CPATH/(ANDEX(H2,SH,GAMMA)*R2)
      SINAI3 = CPATH/(ANDEX(H3,SH,GAMMA)*R3)
      RATIO2 = R2/RADREF(H2,SH,GAMMA)
      RATIO3 = R3/RADREF(H3,SH,GAMMA)
      IF((1.0-SINAI2).GT.EPSILN)  GO TO 116
C*****NEAR A TANGENT HEIGHT. COSAI = -SQRT(1-SINAI**2) LOSES
C*****PRECISION. USE THE FOLLOWING ALGORITHM TO GET COSAI.
      Y3 = Y1+(SINAI1*(1.0-RATIO1)/R1+4.0*SINAI2*(1.0-RATIO2)/R2+
     1    SINAI3*(1.0-RATIO3)/R3)*DH/6.0
      COSAI3 = -SQRT(2.0*Y3-Y3**2)
      X3 = -R3*COSAI3
      DX = X3-X1
      W1 = 0.5*DX
      W2 = 0.0
      W3 = 0.5*DX
      GO TO 118
C*****
  116 CONTINUE
      COSAI2 = -SQRT(1.0-SINAI2**2)
      COSAI3 = -SQRT(1.0-SINAI3**2)
      X2 = -R2*COSAI2
      X3 = -R3*COSAI3
C*****CALCULATE WEIGHTS
      D31 = X3-X1
      D32 = X3-X2
      D21 = X2-X1
      IF(D32.EQ.0.0 .OR. D21.EQ.0.0) GO TO 117
      W1 = (2-D32/D21)*D31/6.0
      W2 = D31**3/(D32*D21*6.0)
      W3 = (2.0-D21/D32)*D31/6.0
      GO TO 118
  117 CONTINUE
      W1 = 0.5*D31
      W2 = 0.0
      W3 = 0.5*D31
C*****
  118 CONTINUE
      DSDX2 = 1.0/(1.0-RATIO2*SINAI2**2)
      DSDX3 = 1.0/(1.0-RATIO3*SINAI3**2)
      DBNDX2 = DSDX2*SINAI2*RATIO2/R2
      DBNDX3 = DSDX3*SINAI3*RATIO3/R3
C*****INTEGRATE
      DS = W1*DSDX1+W2*DSDX2+W3*DSDX3
      S = S+DS
      DBEND = W1*DBNDX1+W2*DBNDX2+W3*DBNDX3
      BEND = BEND+DBEND
```

```
      IF(IAMT.EQ.2)  GO TO 150
C*****CALCULATE AMOUNTS
      DSDZ = DS/DH
      PB = PA*EXP(-DH/HP)
      RHOB = RHOA*EXP(-DH/HRHO)
      IF((DH/HRHO).LT.EPSILN)  GO TO 120
      PPSUM(J) = PPSUM(J)+DSDZ*(HP/(1.0+HP/HRHO))*(PA*RHOA-PB*RHOB)
      TPSUM(J) = TPSUM(J)+DSDZ*HP*(PA-PB)/GCAIR
      RHOPSM(J) = RHOPSM(J)+DSDZ*HRHO*(RHOA-RHOB)
      GO TO 125
  120 CONTINUE
      PPSUM(J) = PPSUM(J)+0.5*DS*(PA*RHOA+PB*RHOB)
      TPSUM(J) = TPSUM(J)+0.5*DS*(PA+PB)/GCAIR
      RHOPSM(J) = RHOPSM(J)+0.5*DS*(RHOA+RHOB).
  125 CONTINUE
      DO 140 K=1,KMAX
      IF(ABS(HDEN(K)).EQ.0.0)GO TO 130
      IF((DH/HDEN(K)).LT.EPSILN) GO TO 130
C*****EXPONENTIAL INTERPOLATION
      DENB(K) = DENP(K,J)*EXP(-(H3-Z1)/HDEN(K))
      AMTP(K,J) = AMTP(K,J)+DSDZ*HDEN(K)*(DENA(K)-DENB(K))
      GO TO 140
  130 CONTINUE
C*****LINEAR INTERPOLATION
      DENB(K) = DENP(K,J)+(DENP(K,J+1)-DENP(K,J))*(H3-Z1)/DZ
      AMTP(K,J) = AMTP(K,J)+0.5*(DENA(K)+DENB(K))*DS
  140 CONTINUE
      PA = PB
      RHOA = RHOB
      DO 145 K=1,KMAX
  145 DENA(K) = DENB(K)
  150 CONTINUE
      IF(H3.GE.Z2) GO TO 160
      H1 = H3
      R1 = R3
      SINAI1 = SINAI3
      RATIO1 = RATIO3
      Y1=Y3
      COSAI1 = COSAI3
      X1 = X3
      DSDX1 = DSDX3
      DBNDX1 = DBNDX3
      GO TO 115
  160 CONTINUE
      SINAI = SINAI3
      COSAI = COSAI3
      SP(J) = S
      RETURN
      END
```

```
      SUBROUTINE TRANS(IPH,ISOURC,IDAY,ANGLEM)
C*************************************************************************
C     CALCULATES TRANSMITTANCE AND RADIANCE VALUES BETWEEN V1 AND V2
C        FOR A GIVEN ATMOSPHERIC SLANT PATH
C      K
C      1     WATER VAPOR BANDS
C      2     UNIFORMILY MIXED GASSES CO2,NO2,CO,CH4
C      3     INFRARED OZONE
C      4     N2 CONTINUUM
C      5     H2O SELF BROADENED CONTINUUM AT 296
C      6     MOLECULAR (RAYLIEGH) SCATTERING
C      7     BOUNDRY LAYER AEROSOL (0 TO 2 KM)
C            (TX(7) IS TOTAL AEROSOL TRANSMITTANCE)
C      8     ULTRAVIOLET OZONE
C      9     H2O SELF CONTINUUM 296-260  (TX(9) TOTAL TRANS)
C     10     H2O FORIGN CONTINUUM
C            (TX(10) IS AEROSOL ABSORPTION)
C     11     HNO3 (NITRIC ACID)
C     12     TROPOSPHERIC AEROSOL (2-10 KM)
C     13     STRATOSPHERIC  AEROSOL (10-30)
C     14     UPPER STRATOPHERIC (ABOVE 30KM)
C     15     AEROSOL WEIGHTED RELATIVE HUMITY (0 TO 2 KM)
C     16     CIRRUS CLOUDS
C*************************************************************************
      COMMON /IFIL/IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1   RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON            WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /AER/ XX1,XX2,XX3,XX4,YY1,YY2,YY3,YY4
      COMMON /SOLS/ AH1(68),ARH(68),
     X   WPATHS(68,16),PA(68),PR(68),ATHETA(35),ADBETA(35),LJ(69),JTURN,
     X ANGSUN
      COMMON /SRAD/ TEB1,TEB2,TASP1,TASP2,TMSP1,TMSP2,TEB2SV
      COMMON /ICLL/ ICALL,FPHS,FALB,FORBIT
      DIMENSION ABB(16)
      DATA   CF1/3.159E-28/,CF2/2.75E-04/
      RADMIN=1.0E+30
      RADMAX=0.
      TWOPI=PI*2.
      EMISS=1.-SALB
      VRMIN=0.
      VRMAX=0.
      SUMA=0.
      SUMS  =-99.
      SUMSSR=-99.
      RFLS  =-99.
      RFLSOL=-99.
      RADSUM=0.
      STSOL = 0.0
      SSOL = 0.0
      FACTOR=0.5
      IV1=V1/5.
```

```
      IV2=V2/5.+.99
      IV1=IV1*5
      IV2=IV2*5
      IF (IV1.LT.350) IV1=350
      IF (IV2.GT.50000) IV2=50000
      IF (DV.LT.5) DV=5
      IDV=DV
      IV=IV1-IDV
      IKLO=1
      ICOUNT=0
      ICALL  = 0
      IEMISS = 0
      ISCTTR = 0
      IF(IEMSCT.EQ.1 .OR. IEMSCT.EQ.2) IEMISS = 1
      IF(IEMSCT.EQ.2) ISCTTR = 1
      TRAIN=1.
      IF(RAINRT.NE.0) TRAIN=TNRAIN(RAINRT)
      TCRRIS = EXP(-WPATH(IKMAX,16)*2.)
      WRITE(IPU,234) TRAIN,TCRRIS
234   FORMAT(2F8.4)
      IF (IEMISS.EQ.0) IKMAX=IKLO
C*****BEGINING OF FREQUENCY LOOP
C
    5 IV=IV+IDV
      ITZERO=0
      IPATH=1
      SUMV=0.
      TLOLD=1.
      TSOLD=1.
      IF (ICOUNT.EQ.0) GO TO 15
      IF (ICOUNT.EQ.50) GO TO 15
      GO TO 20
   15 ICOUNT=0
      IF(IEMSCT.EQ.0) WRITE(IPR,900)
      IF(IEMSCT.EQ.1) WRITE(IPR,910)
      IF(IEMSCT.EQ.2) WRITE(IPR,920)
      IF(IEMSCT.EQ.3) WRITE(IPR,930)
   20 DO 25 K=1,KMAX
      TX(K)=0.0
      IF (K.LT.4) TX(K)=1.0
   25 CONTINUE
      ICOUNT=ICOUNT+1
      SUM=0.0
      V=IV
C*****   WATER BAND ABSORPTION
     CALL C1DTA (ABB(1),V)
C*****   UNIFORMLY MIXED GASES
     CALL C2DTA (ABB(2),V)
C*****   OZONE
     CALL C3DTA (ABB(3),V)
C*****   N2 CONTINUUM
C
     CALL C4DTA(ABB(4),V)
C
C*****   WATER CONTINUUM
      CALL  SLF296(V,SH2OT0)
      CALL  SLF260(V,SH2OT1)
      CALL  FRN296(V,FH2O)
      T0=296.
```

```
      T1=260.
C*****PROTECT AGAINST EXPONENTIAL UNDERFLOW AT HIGH FREQUENCY
      IF(V/(T1*0.6952).GT.BIGEXP) GO TO 105
      XD=EXP(-V/(T0*0.6952))
      RADFN0=V*(1.-XD)/(1.+XD)
      XD=EXP(-V/(T1*0.6952))
      RADFN1=V*(1.-XD)/(1.+XD)
      FDG=(CF1*EXP(-CF2*V))
      GO TO 108
  105 CONTINUE
      RADFN0 = V
      RADFN1 = V
      FDG = 0.0
  108 CONTINUE
      ABB(5)=SH2OT0*RADFN0
      CALL C6DTA(ABB(6),V)
      ABB(7)=0.
      CALL C8DTA(ABB(8),V)
      ABB(9)=(SH2OT1*RADFN1)-(SH2OT0*RADFN0)
      ABB(10)=(FH2O+FDG)*RADFN0
C*****HNO3 ABSORPTION CALCULATION
      CALL HNO3 (V,ABB(11))
      CALL AEREXT (V)
      TEB1  =-99.
      TEB2SV=-99.
C*****
C*****BEGINNING OF LAYER LOOP
      DO 210 IK=IKLO,IKMAX
      IF (IEMISS.EQ.0) GO TO 120
      IF(ISCTTR.EQ.0) GO TO 116
111   CONTINUE
C*****LOAD APPROPRIATE ABSORBER AMOUNTS INTO W(K)
      IF(IPATH-2) 112,114,116
112   CONTINUE
C*****LOAD W(K) WITH WPATHS(1,K) TO OBTAIN THE FIRST
C*****SUN PATH TRANSMITTANCE
      DO 113 K=1,KMAX
113   W(K)=WPATHS(1,K)
      IF(W(1).GE.0.0) GO TO 120
      TX(6)=0.0
      TX(7)=0.0
      TX(9)=0.0
      TX(10)=0.0
      GO TO 206
114   CONTINUE
C*****LOAD W(K) WITH WPATH(IK,K)+WPATHS(IK+1,K)
C*****TO OBTAIN L PATH TRANSMITTANCES
      IKP1=IK+1
      DO 115 K=1,KMAX
115   W(K)=WPATH(IK,K)+WPATHS(IKP1,K)
      IF(WPATHS(IKP1,1).GE.0.0) GO TO 120
      TX(6)=0.0
      TX(7)=0.0
      TX(9)=0.0
      TX(10)=0.0
      GO TO 206
116   CONTINUE
C*****LOAD W(K) WITH WPATH(IK,K) TO OBTAIN THE OPTICAL
C*****PATH TRANSMITTANCES
```

```
      DO 117 K=1,KMAX
117   W(K)=WPATH(IK,K)
  120 CONTINUE
      SUM=0.
      DO 125 JK=4,11
      X(JK)=ABB(JK)*W(JK)
  125 SUM=SUM+TX(JK)
      TX(5)=TX(5)+TX(10)+TX(9)
      TX(1)=TRANFN(W(1),ABB(1),1)
      TX(2)=TRANFN(W(2),ABB(2),1)
      TX(3)=TRANFN(W(3),ABB(3),2)
      TX(10)=YY1*W(7)+YY2*W(12)+YY3*W(13)+YY4*W(14)
      TX(7)=XX1*W(7)+XX2*W(12)+XX3*W(13)+XX4*W(14)
      SUM=SUM+TX(7)
      TX(16)=W(16)*2.
      SUM=SUM+TX(16)
      TX(9)=SUM
      DO 205 K=4,KMAX
      IF (TX(K).GT.BIGEXP) GO TO 200
      TX(K)=EXP(-TX(K))
      GO TO 205
  200 TX(K)=1.0/BIGNUM
  205 CONTINUE
      TX(9)=TX(1)*TX(2)*TX(3)*TX(9)*TRAIN
      IF(ISCTTR.EQ.0) GO TO 209
206   CALL SSRAD(IPH,IK,ITZERO,IPATH,V,SUMSSR)
      IF(IPATH.EQ.3) GO TO 208
      IPATH=IPATH+1
      GO TO 111
208   IPATH=2
209   IF (IV.GE.13000) TX(3)=TX(8)
      ALAM=1.0E+04/V
      IF (IEMSCT.EQ.0 .OR. IEMSCT.EQ.3) GO TO 220
      BBIK=BBFN(TBBY(IK),V)
      TLNEW=(TX(9)*TX(10))/(TX(7)*TX(6))
      TSNEW=(TX(7)*TX(6))/TX(10)
      DTAU=TLOLD-TLNEW
      IF (DTAU.LT.1.0E-5.AND.TLNEW.LT.1.0E-5) GO TO 220
      IF(DTAU.LE.0.) DTAU=0.
      SUMV=SUMV+0.5*BBIK*DTAU*(TSOLD+TSNEW)
      TLOLD=TLNEW
      TSOLD=TSNEW
  210 CONTINUE
  220 CONTINUE.
C*****END OF LAYER LOOP
      IF (IV.GT.IV1) FACTOR=1.0
      IF (IV.GE.IV2) FACTOR=0.5
      SUMA=SUMA+FACTOR*DV*(1.0-TX(9))
      GO TO (300,400,400,600) (IEMSCT+1)
  300 CONTINUE
C*****TRANSMITTANCE ONLY
      TX(10)=1.-TX(10)
      WRITE(IPR,906) V,ALAM,TX(9),(TX(K),K=1,7),TX(11),TX(10),SUMA
      WRITE(IPU,907) V,ALAM,TX(9),(TX(K),K=1,7),TX(11),TX(10),SUMA
      GO TO 700
  400 CONTINUE
C*****ATMOSPHERIC RADIANCE ONLY
C*****INCLUDE EMISSION OF BOUNDARY ATTENUATED BY TOTAL TRANSMISSION
      IF(TBOUND.LE.0.0) GO TO 405
```

```
      BBG=BBFN(TBOUND,V)*TX(9)*EMISS
      SUMV = SUMV + BBG
  405 SUMVV=SUMV
      SUMV=(1.0E+04/V**2)*SUMV
      IF(IEMSCT.EQ.2) GO TO 500
      RADSUM=RADSUM+DV*FACTOR*SUMV
      WRITE(IPR,916) V,ALAM,SUMV,SUMVV,RADSUM,TX(9)
      WRITE(IPU,917) V,ALAM,SUMV,SUMVV,RADSUM,TX(9)
      SUMT=SUMV
      SUMTT=SUMVV
      GO TO 700
  500 CONTINUE
C*****SOLAR SCATTERED RADIANCE
C*****MULTIPLY SUMSSR BY THE EXTRATERRESTRIAL SOURCE STRENGTH SS
      CALL SOURCE(V,ISOURC,IDAY,ANGLEM,SS)
      SUMSSR=SUMSSR*SS
C*****SUMSSR IS THE SCATTERED RADIANCE IN (W/CM2-STER-MICROMETER)
      SUMS=(1.0E4/V**2)*SUMSSR
C*****RFLSOL IS GROUND-REFLECTED DIRECT SOURCE RADIANCE
      RFLSOL=0.
      RFLS=0.
      IF(H2.GT.0.) GO TO 510
      IF(TEB1.LE.0.)  GO TO 510
      IF(ANGSUN.GE.0.) RFLFAC=SALB*COS(ANGSUN*CA)/TWOPI
      RFLSOL=RFLFAC*TEB1*SS
      RFLS = 1.0E4/V**2*RFLSOL
  510 CONTINUE
      SUMT=SUMV+SUMS+RFLS
      SUMTT=SUMVV+SUMSSR+RFLSOL
      RADSUM=RADSUM+DV*FACTOR*SUMT
      WRITE(IPR,926) V,ALAM,SUMV,SUMVV,SUMS,SUMSSR,RFLS,RFLSOL,
     X    SUMT,SUMTT,RADSUM,TX(9)
      WRITE(IPU,927) V,ALAM,SUMV,SUMVV,SUMS,SUMSSR,RFLS,RFLSOL,
     X    SUMT,SUMTT,RADSUM,TX(9),TEB1,TEB2SV
      GO TO 700
  600 CONTINUE
C*****DIRECTLY TRANSMITTED SOLAR IRRADIANCE
C*****SOLIL IS SOLAR IRRADIANCE IN WATTS/(CM2 MICROMETER)
      CALL SOURCE(V,0,IDAY,0.0,SOLIL)
      SOLIV = SOLIL*1.0E+4/V**2
      TSOLIV = SOLIV*TX(9)
      TSOLIL = SOLIL*TX(9)
      STSOL = STSOL+TSOLIV*DV*FACTOR
      SSOL = SSOL+SOLIV*DV*FACTOR
      WRITE(IPR,936) V,ALAM,TSOLIV,TSOLIL,SOLIV,SOLIL,STSOL,SSOL,TX(9)
      WRITE(IPU,937) V,ALAM,TSOLIV,TSOLIL,SOLIV,SOLIL,STSOL,SSOL,TX(9)
      SUMT = TSOLIV
      RADSUM = STSOL
C*****
  700 CONTINUE
      IF(IEMSCT.EQ.0) GO TO 710
      IF(SUMT.GE.RADMAX) VRMAX = V
      IF(SUMT.GE.RADMAX) RADMAX= SUMT
      IF(SUMT.LE.RADMIN) VRMIN=V
      IF(SUMT.LE.RADMIN) RADMIN=SUMT
  710 CONTINUE
      IF (IV.LT.IV2) GO TO 5
C*****END OF FREQUENCY LOOP
      IF(ICIR.NE.0) WRITE(IPR,720) TX(16)
```

```
      IF(RAINRT.GT.0.0) WRITE(IPR,730) TRAIN
      AB=1.0-SUMA/FLOAT(IV-IV1)
      WRITE(IPR,740) IV1,IV,SUMA,AB
      IF(IEMSCT.EQ.0) GO TO 770
      WRITE(IPR,750) RADSUM,RADMIN,VRMIN,RADMAX,VRMAX
      IF(IEMSCT.EQ.3) GO TO 770
      WRITE(IPR,760) TBOUND,EMISS
  770 CONTINUE
      RETURN
C*****
C*****FORMAT STATEMENTS FOR SPECTRAL DATA
C*****PAGE HEADERS
  900 FORMAT (1H1,/ 1X,32H  FREQ WAVELENGTH  TOTAL      H2O,5X,4HCO2+,5X,
     1'OZONE  N2 CONT  H2O CONT MOL SCAT  AEROSOL  HNO3    ',
     +'AEROSOL  INTEGRATED'
     2                   /2X,14H CM-1  MICRONS,9(4X,5HTRANS),4X,17H ABS
     3ABSORPTION,/)
  910 FORMAT (1H1,20X,28HRADIANCE(WATTS/CM2-STER-XXX),
     X /,'0   FREQ',T10,'WAVLEN',T19,'ATMOS RADIANCE',T39,
     X ' INTEGRAL',T049,'TOTAL',/2X,'(CM-1)',T10,'(MICRN)',T19,'(CM-1)',
     X T29,'(MICRN)',T39,'(CM-1)',T49,'TRANS',/)
  920 FORMAT (1H1,45X,28HRADIANCE(WATTS/CM2-STER-XXX),
     X /,'0  FREQ',T11,'WAVLEN',T21,'ATMOS RADIANCE',T41,
     X 'PATH SCATTERED',T61,'GROUND REFLECTED',T85,'TOTAL',T98,
     X ' INTEGRAL',T110,'TOTAL',/2X,'(CM-1)',T10,'(MICRN)',T20,'(CM-1)',
     X T30,'(MICRN)',T40,'(CM-1)',T50,'(MICRN)',T60,'(CM-1)',T70,
     X'(MICRN)',T80,'(CM-1)',T90,'(MICRN)',T100,'(CM-1)',T110,'TRANS',/)
  930 FORMAT('1',22X,'IRRADIANCE (WATTS/CM2-XXXX)',/
     1     '0  FREQ',T11,'WAVLEN',T23,'TRANSMITTED ',T45,
     2     'SOLAR',T61,'INTEGRATED',T80,'TOTAL',/,
     3     2X,'(CM-1)',T10,'(MICRN)',T20,'(CM-1)',T30,'(MICRN)',
     4     T40,'(CM-1)',T50,'(MICRN)',T60,'TRANS.',T70,'SOLAR',
     5     T80,'TRANS')
C*****SPECTRAL DATA TO UNIT=IPR (=6)
  906 FORMAT(1X,F7.0,F8.3,10F9.4,F12.3)
  916 FORMAT(1X,F7.0,F8.3,1P3E10.2,0P 9.4)
  926 FORMAT(1X,F7.0,F8.3,1P9E10.2,0PF9.4)
  936 FORMAT(1X,F7.0,F8.3,1P6E10.2,0PF9.4)
C*****SPECTRAL DATA TO UNIT=IPU (=7)
  907 FORMAT(F7.0,F8.3,10F8.4,F12.4)
  917 FORMAT(F7.0,F8.3,1P2E9.2,54X,E9.2,0PF8.4)
  927 FORMAT(F7.0,F8.3,1P8E9.2,0P3F8.4)
  937 FORMAT(F7.0,F8.3,1P6E9.2,27X,0PF8.4)
C*****SUMMARY VALUES
  720 FORMAT('0TRANSMISSION DUE TO CIRRUS = ',F10.4)
  730 FORMAT('0TRANSMISSION DUE TO RAIN = ',F10.4)
  740 FORMAT('0INTEGRATED ABSORPTION FROM',I5,' TO',I5,' CM-1 =',F10.2,
     1' CM-1',/,' AVERAGE TRANSMITTANCE =',F8.4,/)
  750 FORMAT('0INTEGRATED RADIANCE = ',1PE10.3,' WATTS CM-2 STER-1',/,
     X ' MINIMUM RADIANCE     = ',E10.3,' WATTS CM-2 STER-1 (CM-1)-1 ',
     X 'AT ', 0PF10.1,' CM-1',/,
     X ' MAXIMUM RADIANCE     = ',1PE10.3,' WATTS CM-2 STER-1 (CM-1)-1 ',
     X 'AT ',0PF10.1,' CM-1')
  760  FORMAT(' BOUNDARY TEMPERATURE = ',F10.2,' K',/,
     X ' BOUNDARY EMISSIVITY = ',F11.3)
       END
```

```
      FUNCTION BBFN(T,V)
C**************************************************************************
C     BLANK BODY FUNCTION IN UNITS OF WATTS/(CM2 STER MICROMETER)
C**************************************************************************
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      BBFN = 0.0
      X = 1.43879*V/T
C*****PROTECT AGAINST EXPONENTIAL OVERLOW
      IF(X.GT.BIGEXP) RETURN
      BBFN = 1.190956E-16*V**5/(EXP(X)-1.0)
      RETURN
      END
```

```
      SUBROUTINE C1DTA (C1L,V)
C     RETURNS WATER VAPOR BAND ABSORPTION COEFFICIENT AT WAVENUMBER V
      COMMON /C1/C1(2580)
      C1L=-5.
      IF(V.LT.350.) RETURN
      IF(V.GT.14520.) RETURN
      IV=V
      L=(IV-350)/5+1
      IF(IV.GT.9195.AND.IV.LT.9875) RETURN
      IF(IV.GE.9875)L=(IV-9875)/5+1771
      IF(IV.GT.12795.AND.IV.LT.13400) RETURN
      IF(IV.GE.13400) L=(IV-13400)/5+2356
      C1L=C1(L)
      RETURN
      END
```

```
      SUBROUTINE C2DTA (C2L,V)
C **  UNIFORMLY MIXED GASSES
      COMMON/C2/ C2(1575)
      C2L=-5.
      IF(V.LT.500.) RETURN
      IF(V.GE.13190.) RETURN
      IV=V
      L=(IV-500)/5+1
      IF(IV.GT.8070.AND.IV.LE.12970) RETURN
      IF(IV.GE.12950) L=(IV-12950)/5+1516
      C2L=C2(L)
      RETURN
      END
```

```
      SUBROUTINE C3DTA (C3L,V)
C **  OZONE
      COMMON /C3/ C3(540)
      C3L=-5.
      IF(V.LT.575.) RETURN
      IF(V.GT.3270.) RETURN
      IV=V
      L=(IV-575)/5+1
      C3L=C3(L)
      RETURN
      END
```

```
      SUBROUTINE C4DTA (C4L,V)
C **  N2 CONTINUUM
      COMMON /C4C8/ C4(133),C8(102)
      C4L=0.
      IF(V.LT.2080.) RETURN
      IF(V.GT.2740.) RETURN
      IV=V
      L=(IV-2080)/5+1
      C4L=C4(L)
      RETURN
      END
```

```
      SUBROUTINE C6DTA(C6L,V)
C **  MOLECULAR SCATTERING
      C6L=0.
      IF(V.LE.3000.) RETURN
      C6L=V**4/(9.26799E+18-1.07123E+09*V**2)
      RETURN
      END
```

```
      SUBROUTINE C8DTA (C8L,V)
C **  OZONE U.V + VISIBLE
      COMMON /C4C8/ C4(133),C8(102)
      C8L=0.
      IF(V.LT.13000.) RETURN
      IF(V.GT.50000.) RETURN
      IV=V
      IF(IV.GT.24200.AND.IV.LT.27500) RETURN
      XI=(V-13000.0)/200.0+1.
      IF(IV.GE.27500) XI=(V-27500.0)/500.+57.
      N=XI+1.001
      XD=XI-FLOAT(N)
      C8L=C8(N)+XD*(C8(N)-C8(N-1))
      RETURN
      END
```

```
      FUNCTION TRANFN(W,ABB,K)
C     LOWTRANS EMPIRICAL FUNCTION FOR BAND MODEL TRANSMITTANCE
C     K = 1 WATER AND UNIFORMALY MIXED
C     K = 2 INFRARED OZONE.
C
      COMMON /TRFWFO/ TR(67),FW(67),FO(67)
      DIMENSION C(2),D(2),F(67,2)
      EQUIVALENCE (F(1,1),FW(1))
      DATA  C/0.007787,0.055194/,D /1.855595, 2.387853/
      TRANFN=1.
      IF(W.LT.1.0E-20.OR.ABB.LE.-5.) RETURN
      X=ALOG10(W)+ABB
      TRANFN=0.
      IF(X. GT. F(67,K) ) RETURN
      IF(X.LT.F(1,K))  TRANFN= 1. - C(K)*EXP(D(K)*X)
      IF(X.LT.F(1,K)) RETURN
      K1=2
      IF(X.GT.F(32,K)) K1=33
      DO 20 J1=K1,67
      J=J1
      IF(X .LE. F(J,K) ) GO TO 40
20    CONTINUE
40    TRANFN=TR(J) + (TR(J-1)-TR(J) )*(F(J,K)-X)/(F(J,K)-F(J-1,K))
      RETURN
      END
```

```
      SUBROUTINE SLF296(V1C,SH2OT0)
C     LOADS SELF CONTINUUM  296K
      COMMON /SH2O/ V1,V2,DV,NPT,S296(2001)
       CALL SINT(V1,V1C,DV,NPT,S296,SH2OT0)
      RETURN
      END
```

```
      SUBROUTINE SLF260(V1C,SH2OT1)
C     LOADS SELF CONTINUUM  260K
      COMMON /S260/ V1,V2,DV,NPT,S260(2001)
        CALL SINT(V1,V1C,DV,NPT,S260,SH2OT1)
      RETURN
      END
```

```
      SUBROUTINE FRN296(V1C,FH2O)
C     LOADS FOREIGN CONTINUUM  296K
      COMMON /FH2O/ V1,V2,DV,NPT,F296(2001)
       CALL SINT(V1,V1C,DV,NPT,F296,FH2O)
      RETURN
      END
```

```
        SUBROUTINE SINT(V1,V1C,DV,NPT,CONTI,CONTO)
C
C     INTERPOLATION  FOR CONTINUUM WITH LOWTRAN
C
      DIMENSION CONTI(2001)
      CONTO=0.
      I=(V1C-V1)/DV+1.00001
      IF(I.GE.NPT)GO TO 10
      CONTO=CONTI(I)
      IMOD=AMOD(V1C,10.)
      IF(IMOD.GT.0) CONTO=(CONTI(I)+CONTI(I+1))/2.
10    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE EXABIN
C
C      LOADS EXTINCTION AND ABSORPTION COEFFICIENTS FOR THE FOUR
C        AEROSOL ALTITUDE REGIONS
C
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON /CARD4/ V1,V2,DV
C
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON              WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX0(40)
      COMMON /EXTD  /  VX2(40),RUREXT(40,4),RURABS(40,4),URBEXT(40,4),
     1URBABS(40,4),OCNEXT(40,4),OCNABS(40,4),TROEXT(40,4),TROABS(40,4),
     2FG1EXT(40),FG1ABS(40),FG2EXT(40),FG2ABS(40)
     3,BSTEXT(40),BSTABS(40),AVOEXT(40),AVOABS(40),FVOEXT(40
     4),FVOABS(40),DMEEXT(40),DMEABS(40)
      DIMENSION RHZONE(4)
      DATA RHZONE/0.,70.,80.,99./
      DO 5 I=1,40
    5 VX0(I)=VX2(I)
      I1=1
      IF (IHAZE.EQ.7) I1=2
      IF(IHAZE.EQ.3) I1 = 2
      DO 85 M=I1,4
      ITA=ICH(M)
      ITC=ICH(M)-7
      WRH=W(15)
      IF (ICH(M).EQ.6.AND.M.NE.1) WRH=70.
C     THIS CODING  DOES NOT ALLOW TROP RH DEPENDENT  ABOVE EH(7,I)
C     DEFAULTS TO TROPOSPHERIC AT 70. PERCENT
      DO 10 I=2,4
      IF (WRH.LT.RHZONE(I)) GO TO 15
   10 CONTINUE
      I=4
   15 II=I-1
      IF(WRH.GT.0.0.AND.WRH.LT.99.)X=ALOG(100.0-WRH)
      X1=ALOG(100.0-RHZONE(II))
      X2=ALOG(100.0-RHZONE(I))
      IF (WRH.GE.99.0) X=X2
      IF (WRH.LE.0.0) X=X1
      DO 80 N=1,40
      ABSC(M,N)=0.
      EXTC(M,N)=0.
      IF(ITA.GT.6) GO TO 45
      IF(ITA.LE.0) GO TO 80
C     RH DEPENDENT AEROSOLS
      GO TO (20,20,25,25,30,35), ITA
   20 Y2=ALOG(RUREXT(N,I))
      Y1=ALOG(RUREXT(N,II))
      Z2=ALOG(RURABS(N,I))
      Z1=ALOG(RURABS(N,II))
      GO TO 40
   25 Y2=ALOG(OCNEXT(N,I))
      Y1=ALOG(OCNEXT(N,II))
      Z2=ALOG(OCNABS(N,I))
      Z1=ALOG(OCNABS(N,II))
```

```
      GO TO 40
   30 Y2=ALOG(URBEXT(N,I))
      Y1=ALOG(URBEXT(N,II))
      Z2=ALOG(URBABS(N,I))
      Z1=ALOG(URBABS(N,II))
      GO TO 40
   35 Y2=ALOG(TROEXT(N,I))
      Y1=ALOG(TROEXT(N,II))
      Z2=ALOG(TROABS(N,I))
      Z1=ALOG(TROABS(N,II))
   40 Y=Y1+(Y2-Y1)*(X-X1)/(X2-X1)
      ZK=Z1+(Z2-Z1)*(X-X1)/(X2-X1)
      ABSC(M,N)=EXP(ZK)
      EXTC(M,N)=EXP(Y)
      GO TO 80
   45 IF (ITA.GT.14) GO TO 75
      IF (ITC.LT.1) GO TO 80
      GO TO (50,55,60,65,70,65,70), ITC
   50 ABSC(M,N)=FG1ABS(N)
      EXTC(M,N)=FG1EXT(N)
      GO TO 80
   55 ABSC(M,N)=FG2ABS(N)
      EXTC(M,N)=FG2EXT(N)
      GO TO 80
   60 ABSC(M,N)=BSTABS(N)
      EXTC(M,N)=BSTEXT(N)
      GO TO 80
   65 ABSC(M,N)=AVOABS(N)
      EXTC(M,N)=AVOEXT(N)
      GO TO 80
   70 ABSC(M,N)=FVOABS(N)
      EXTC(M,N)=FVOEXT(N)
      GO TO 80
   75 ABSC(M,N)=DMEABS(N)
      EXTC(M,N)=DMEEXT(N)
   80 CONTINUE
   85 CONTINUE
      RETURN
C
      END
```

```
      SUBROUTINE AEREXT (V)
C
C     INTERPOLATES AEROSOL EXTINCTION AND ABSORPTION COEFFICIENT
C        FOR THE WAVENUMBER, V.
C
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON              WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /AER/ EXTV(4),ABSV(4)
      DO 5 I=1,4
      EXTV(I)=0.
      ABSV(I)=0.
    5 CONTINUE
      IF (IHAZE.EQ.0) RETURN
      ALAM=1.0E+4/V
      DO 10 N=1,40
      XD=ALAM-VX2(N)
      IF (XD) 15,10,10
   10 CONTINUE
      N=40
   15 VXD=VX2(N)-VX2(N-1)
      DO 20 I=1,4
      EXTV(I)=(EXTC(I,N)-EXTC(I,N-1))*XD/VXD+EXTC(I,N)
      ABSV(I)=(ABSC(I,N)-ABSC(I,N-1))*XD/VXD+ABSC(I,N)
   20 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE HNO3 (V,HABS)
C
C     HNO3  STATISTICAL BAND PARAMETERS
C
      DIMENSION H1(15), H2(16), H3(13)
C     ARRAY H1 CONTAINS HNO3 ABS. COEF(CM-1ATM-1) FROM  850 TO 920 CM-1
      DATA H1/2.197,3.911,6.154,8.150,9.217,9.461,11.58,11.10,11.17,12.4
     10,10.49,7.509,6.136,4.899,2.866/
C     ARRAY H2 CONTAINS HNO3 ABS. COEF(CM-1ATM-1) FROM 1275 TO1350 CM-1
      DATA H2/2.828,4.611,6.755,8.759,10.51,13.74,18.00,21.81,23.09,21.6
     18,21.32,18.82,18.42,17.87,14.86,8.716/
C     ARRAY H3 CONTAINS HNO3 ABS. COEF(CM-1ATM-1) FROM 1675 TO1735 CM-1
      DATA H3/5.003,8.803,14.12,19.83,23.31,23.58,23.22,21.09,28.89,35.8
     14,24.79,17.68,9.420/
      HABS=0.
      IF (V.GE.850.0.AND.V.LE.920.0) GO TO 5
      IF (V.GE.1275.0.AND.V.LE.1350.0) GO TO 10
      IF (V.GE.1675.0.AND.V.LE.1735.0) GO TO 15
      RETURN
    5 I=(V-845.)/5.
      HABS=H1(I)
      RETURN
   10 I=(V-1270.)/5.
      HABS=H2(I)
      RETURN
   15 I=(V-1670.)/5.
      HABS=H3(I)
      RETURN
      END
```

```
      SUBROUTINE SSGEO(IERROR,IPH,IPARM,PARM1,PARM2,PARM3,PARM4,PSIPO,G)
C
C     THIS ROUTINE DRIVES THE LOWTRAN GEOMETRY ROUTINES REPEATEDLY
C     TO OBTAIN THE ABSORBER AMOUNTS FROM THE SCATTERING POINTS ON
C     THE OPTICAL PATH TO THE EXTRATERRESTRIAL SOURCE, NECESSARY
C     TO DO THE LAYER BY LAYER SINGLE SCATTERING RADIANCE CALCULATION.
C
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /SOLS/ AH1(68),ARH(68),
     X   WPATHS(68,16),PA(68),PR(68),ATHETA(35),ADBETA(35),LJ(69),JTURN,
     X ANGSUN
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,REE,LEN
      COMMON /CARD4/ V1,V2,DV
      COMMON /CNTRL/ KMAX,MM,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /MODEL/ ZM(34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      COMMON /RFRPTH/ ZP(35),PP(35),TP(35),RFNDXP(35),SP(35),
     1    PPSUM(35),TPSUM(35),RHOPSM(35),DENP(16,35),AMTP(16,35)
      COMMON /USRDTA/ NANGLS,ANGF(50),F(4,50)
      DIMENSION WPDUM(68,16),TBDUM(68),LJD(68),AZ(35),RHD(35)
C     MOLECULAR AND HENYEY-GREENSTEIN PHASE FUNCTIONS
C     NOTE: UNITS ARE (STER-1), X=COS(SCATTERING ANGLE)
      PFMOL(X)=.06055+.05708*X**2
      PFHG(GG,X)=(1.0-GG**2)/(4.*PI*(1.0+GG**2-2.0*GG*X)**1.5)
      IKLO=1
      NPR = 1
      ISSGEO=1
C     SPECIFY THE GEOMETRICAL CONFIGURATION
      IF(IPARM.EQ.2) GO TO 1
      THETAO=PARM1
      PHIO=PARM2
      THETAS=PARM3
      PHIS=PARM4
      GO TO 2
    1 CONTINUE
      PSIO=PARM1
      DELO=PARM2
    2 IF(IPARM.NE.0) GO TO 5
      IF(ABS(THETAO).LT.89.5) GO TO 5
      IF(THETAO.GT.0.0) GO TO 4
C     OBSERVER IS AT OR NEAR THE SOUTH POLE, REMAP TO EQUATOR
      WRITE(IPR,960)
      PSIPO=PSIPO-PHIS
      THETAO=0.0
      PHIO=0.0
      THETAS=0.0
      PHIS=90.+THETAS
      GO TO 5
    4 CONTINUE
C     OBSERVER IS AT OR NEAR THE NORTH POLE, REMAP TO EQUATOR
      WRITE(IPR,961)
      PSIPO=PHIS-PSIPO
```

```
      THETAO=0.0
      PHIO=0.0
      THETAS=0.0
      PHIS=90.-THETAS
5     CONTINUE
      WRITE(IPR,900)
C
C     SAVE OPTICAL PATH PARAMETERS AND AMOUNTS
C
      JTURND=JTURN
      IKMAXD=IKMAX+1
      H1D=H1
      H2D=H2
      ANGD=ANGLE
      RNGD=RANGE
      BETD=BETA
      BETA=0.
      LEND=LEN
      ITD=ITYPE
      IMAX=ML
      DO 10 J=1,IMAX
      AZ(J)=ZP(J)
10    RHD(J)=RELHUM(J)
      DO 11 J=1,IKMAXD
      TBDUM(J)=TBBY(J)
      LJD(J)=LJ(J)
      IF(LJD(J).GT.IMAX)LJD(J)=IMAX
      DO 11 K=1,KMAX
11    WPDUM(J,K)=WPATH(J,K)
      IMAX=IMAX-1
C
C     ESTABLISH PSIO AND DELO
      IARBO=0
      IF(ANGLE.LT.0.01.OR.ANGLE.GT.179.99) IARBO=1
C
      IF(IPARM.NE.2)
     1CALL PSIDEL(THETAS,PHIS,THETAO,PHIO,PSIPO,PSIO,DELO,IARBO)
C     INITIAL CONDITIONS AT THE OBSERVER
      IARB=IARBO
      BETAST=0.0
      IF(IARBO.EQ.0) PSIST=PSIO
      ANGLO=DELO
C
C     LOOP OVER THE POINT TO SUN PATHS TO OBTAIN AMOUNTS
C
      WRITE(IPR,950)
      WRITE(IPR,952)
950   FORMAT(' SCTTR SCTTR SUBTENDED  SOLAR   PATH  RELATIVE  SCTTR   MO
     1LECULAR  ')
952   FORMAT(' POINT  ALT    ANGLE   ZENITH  ZENITH AZIMUTH   ANGLE   PH
     1ASE F    '/)
      DO 130 L=IK10,IKMAXD
      IF(LEND.EQ.1.OR.JTURND.NE.0) GO TO 20
C     SHORT PATH, UP
      H1=AZ(L)
      RELH=RHD(L)
      THTST=ATHETA(L)
      IF(L.GE.2) BETAST=BETAST+ADBETA(L-1)
      GO TO 30
```

```
20      CONTINUE
C       LONG PATH, OR SHORT PATH DOWN
        IF(L.GE.2) BETAST=BETAST+ADBETA(LJD(L-1))
        IF(L.GE.JTURND) GO TO 25
        LJP1=LJD(L)+1
        H1=AZ(LJP1)
        RELH=RHD(LJP1)
        THTST=180.-ATHETA(LJP1)
        GO TO 30
25      LJDL=LJD(L)
        H1=AZ(LJDL)
        RELH=RHD(LJDL)
        THTST=ATHETA(LJDL)
        IF(L.EQ.JTURND)THTST=180.-ATHETA(LJDL)
30      CONTINUE
        AH1(L)=H1
        ARH(L)=RELH
        IF(L.LT.2) GO TO 35
        PSIST=PSI(PSIO,DELO,BETAST,IARB,IARBO)
        ANGLO=DEL(PSIO,DELO,BETAST,IARB,IARBO)
35      CORR=0.0
C       RANGE=UNKNOWN
        ITYPE=3
        DO 90 JITER=1,4
        H2 = 0.0
        ANGLE=ANGLO-CORR
        LEN=0
        IF(ANGLE.LE.90.0) GO TO 40
        LEN=1
        WRITE(IPR,955) L
955     FORMAT('  SUN PATH ',I3,' PASSES THROUGH A TANGENT HEIGHT')
40      CONTINUE
        HTOP=ZMAX
        IF(H1.LT.HTOP.OR.LEN.EQ.1) GO TO 60
C       SCATTERING POINT IS AT OR ABOVE HTOP AND LEN=0.
C       SET W(K)=0.0 AND CONTINUE
        DO 50 K=1,KMAX
50      W(K)=0.0
        GO TO 100
C
60      CALL GEO(IERROR,BENDNG)
C
C       IERROR=-5 IF SCATTERING POINT IS IN THE SHADE, ALSO SET W(K)=-5.0
        IF(IERROR.NE.-5) GO TO 80
        WRITE(IPR,970) L
970     FORMAT('  SCATTERING POINT ',I3,' IS IN THE SHADE')
        DO 70 K=1,KMAX
70      W(K)=-5.0
        IERROR=0
        GO TO 100
  80    CONTINUE
C       SOLAR ZENITH BENDING CORRECTION
        IF(JITER.GT.1) WRITE(IPR,917) CORR
        IF(ABS(CORR-BENDNG).LT..1) GO TO 100
90      CORR=BENDNG
100     CONTINUE
        SANGLE=SCTANG(ANGLE,THTST,PSIST,IARB)
        COSANG=COS(CA*SANGLE)
C       LOAD MOLECULAR PHASE FUNCTION ARRAY
```

```
      PR(L)=PFMOL(COSANG)
C     LOAD AEROSOL PHASE FUNCTION ARRAY
C     HENYEY-GREENSTEIN
      IF(IPH.NE.0) GO TO 105
      PA(L)=PFHG(G,COSANG)
      GO TO 115
105   CONTINUE
      IF(IPH.NE.1) GO TO 110
C     USER SUPPLIED PHASE FUNCTION
C     DETERMINE ALTITUDE AND ANGLE INDICES
      M=4
      IF(H1.LE.30.) M=3
      IF(H1.LE.10.) M=2
      IF(H1.LE.2.) M=1
      DO 106 LL=1,NANGLS
      IF(ANGF(LL).EQ.SANGLE) GO TO 115
      IF(ANGF(LL).GT.SANGLE) GO TO 107
106   CONTINUE
107   LP1=LL
      LL=LL-1
      CALL INTERP(2,SANGLE,ANGF(LL),ANGF(LP1),PA(L),F(M,LL),F(M,LP1))
      GO TO 115
110   CONTINUE
C     V DEPENDENT MIE DATA BASE, SAVE SCATTERING ANGLE INSTEAD
      PA(L)=SANGLE
115   CONTINUE
C     LOAD AMOUNTS FROM W(K) INTO WPATHS(L,K)
      DO 120 K=1,KMAX
120   WPATHS(L,K)=W(K)
C     REVERSE SIGN CONVENTION (TO + E OF N) FOR PRINTED OUTPUT
      PSIST2=-PSIST
      WRITE(IPR,951)L,H1,BETAST,ANGLE,THTST,PSIST2,SANGLE,PR(L)
951   FORMAT(1X,I3,6(1X,F7.2). (1X,E10.3))
130   CONTINUE
C
C     RESTORE OPTICAL PATH AMOUNTS
C
      IKMAX=IKMAXD-1
      H1=H1D
      H2=H2D
      ANGSUN=ANGLE
      ANGLE=ANGD
      RANGE=RNGD
      BETA=BETD
      LEN=LEND
      ITYPE=ITD
      DO 160 J=1,IKMAXD
      TBBY(J)=TBDUM(J)
      LJ(J)=LJD(J)
      DO 160 K=1,KMAX
160   WPATH(J,K)=WPDUM(J,K)
      NPR = NOPRNT
C
C     FORMATS
C
900   FORMAT(2X,//,' SINGLE SCATTERING POINT TO SOURCE PATHS ')
917   FORMAT('  SOLAR ZENITH CORRECTION FOR BENDING = ',F10.3)
920   FORMAT(2X,'*** CUMMULATIVE POINT-TO-SOURCE AMOUNTS ***')
925   FORMAT(/,2X,'L                    WPATHS(L,K) K=1,7')
```

```
930   FORMAT(1X,I2,7(2X,E10.3))
931   FORMAT(8E10.3)
940   FORMAT(2X,'L                    WPATHS(L,K) K=8,15')
960   FORMAT(2X,'THETAO < 89.5, OBSERVER ASSUMED TO BE AT THE SOUTH
     1POLE, PROBLEM HAS BEEN REMAPPED TO THE EQUATOR')
961   FORMAT(2X,'THETAO > 89.5, OBSERVER ASSUMED TO BE AT THE NORTH
     1POLE, PROBLEM HAS BEEN REMAPPED TO THE EQUATOR')
      RETURN
      END
```

```
      SUBROUTINE PSIDEL(THETAS,PHIS,THETAO,PHIO,PSIPO2,PSIO,DELO,IARBO)
C
C     THIS ROUTINE CALCULATES PSIO (THE RELATIVE AZIMUTH BETWEEN THE
C     LINE OF SIGHT AND THE DIRECT SOLAR PATH, AT THE OBSERVER)
C     AND DELO (THE ANGLE SUBTENDED AT THE EARTH'S CENTER BY THE
C     OBSERVER AND THE SUBSOLAR POINT).
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      DATA  EPSILN/1.0E-5/
C
C     CHANGE CONVENTION FOR PSIPO FROM (EAST OF NORTH) TO (NORTH OF EAST
C     FOR COMPUTATIONAL PURPOSES. RANGE IS -180 TO +180.
      PSIPO=90.0-PSIPO2
      IF(PSIPO.GT.180.0) PSIPO=PSIPO-360.0
C
      DPHI=PHIS-PHIO
      DTHT=THETAS-THETAO
      THTS=THETAS/DEG
      THTO=THETAO/DEG
      DPH=DPHI/DEG
      STS=SIN(THTS)
      STO=SIN(THTO)
      CTS=COS(THTS)
      CTO=COS(THTO)
      SOPHI=SIN(DPH)
      COPHI=COS(DPH)
      TTS=TAN(THTS)
      TTO=TAN(THTO)
C
C     CALCULATE DELO,  CHECK FOR SPECIAL CASES%
      IF(ABS(DPHI).GT.EPSILN) GO TO 10
C     COLONGITUDE
      DELO=ABS(DTHT)
      GO TO 30
10    IF(ABS(DTHT).GT.EPSILN) GO TO 20
C     COLATITUDE
      DELO=ABS(DPHI)
      GO TO 30
C     GENERAL CASE
20    DELO=DEG*ACOS(CTS*CTO*COPHI+STS*STO)
30    IF(DELO.LE.EPSILN) DELO=0.0
C     CALCULATE PSIO (=PSISO-PSIPO)
C     CHECK FOR SPECIAL CASES WHERE EITHER PSISO OR PSIPO ARE ARBITRARY
C
C     VERTICAL OPTICAL PATH, PSIPO IS ARBITRARY, THIS CASE WAS FLAGGED
C     IN SSGEO BY SETTING IARBO=1
C
C     OBSERVER AND SUBSOLAR POINT COINCIDE, PSISO IS ARBITRARY
      IF(DELO.EQ.0.0) IARBO=IARBO+2
      IF(IARBO.EQ.0) GO TO 40
C     IARBO=0,1,2,3 FOR% PSIO DEFINITE, PSIPO ARBITRARY, PSISO ARBITRARY
C                        BOTH PSIPO AND PSISO ARBITRARY, RESPECTIVELY.
      RETURN
40    ANUMER=TTO*COPHI-TTS
      DENOM=(1.+TTO**2)*CTO*SOPHI
      IF(ABS(ANUMER).GT.EPSILN) GO TO 50
C     NUMERATOR=0.0, GREAT CIRCLE CONTAINING THE OBSERVER AND THE SUBSOL
C     POINT IS DUE EAST-WEST AT THE OBSERVER
      PSISO=0.0
```

```
      IF(DPHI.GT.0.0) PSISO=180.0
      GO TO 90
50    IF(ABS(DENOM).GT.EPSILN) GO TO 60
C     DENOMINATOR =0.0, ATAN(INFINITY)=+90 OR -90
      PSISO=90.0
      IF(DTHT.LT.0.0) PSISO=-90.0
      GO TO 90
C     GENERAL CASE
60    PSISO=DEG*ATAN(ANUMER/DENOM)
C     ATAN RETURNS ARGUMENTS BETWEEN -90 AND 90, MAY NEED TO CORRECT
C     NO CORRECTION NECESSARY
      IF(DPHI.LT.0.0) GO TO 90
C     CORRECTION NECESSARY
      IF(DPHI.GT.0.0) GO TO 70
C     DPHI=0.0
      PSISO=90.0
      IF(DTHT.LT.0.0) PSISO=-90.0
      GO TO 90
C     DPHI.GT.0.0
70    IF(PSISO.GT.0.0) GO TO 80
      PSISO=PSISO+180.0
      GO TO 90
80    PSISO=PSISO-180.0
90    CONTINUE
      PSIO=PSISO-PSIPO
C     RANGE OF PSIO IS -180.0 TO 180.0, CORRECT IF NECESSARY
      IF(PSIO.LT.-180.0) PSIO=PSIO+360.0
      IF(PSIO.GT. 180.0) PSIO=PSIO-360.0
C
      RETURN
      END
```

```
      FUNCTION SCTANG(ANGLST,THTST,PSIST,IARB)
C
C     FUNCTION SCTANG RETURNS THE SCATTERING ANGLE (THAT IS, THE
C     ANGLE BETWEEN THE SUN'S RAYS AND THE LINE OF SIGHT) AT ANY
C     POINT ALONG THE OPTICAL PATH.
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IRMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
C
      SUNZEN=ANGLST/DEG
      PTHZEN=THTST/DEG
      IF(IARB.EQ.0) GO TO 10
C     SPECIAL CASES IF PSI IS ARBITRARY
      SCTANG=DEG*ACOS(COS(SUNZEN)*COS(PTHZEN))
      RETURN
10    CONTINUE
      PSI=PSIST/DEG
C     GENERAL CASE
      X=SIN(SUNZEN)*SIN(PTHZEN)*COS(PSI)+COS(SUNZEN)*COS(PTHZEN)
      SCTANG=DEG*ACOS(X)
      RETURN
      END
```

```
      FUNCTION PSI(PSIO,DELO,BETA,IARB,IARBO)
C
C     FUNCTION PSI RETURNS THE VALUE OF SOLAR AZIMUTH RELATIVE TO
C     THE LINE OF SIGHT, AT THE CURRENT SCATTERING LOCATION
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      DATA  EPSILN/1.0E-5/
      DELOR=DELO/DEG
      BETAR=BETA/DEG
      IF(IARBO.EQ.0) GO TO 5
C     SPECIAL CASES WHEN PSIO IS ARBITRARY
      IARB=IARBO
      IF(IARBO.EQ.1.OR.IARBO.EQ.3) RETURN
      IF(BETA.LE.EPSILN) RETURN
C     PSI=180.0 (MOVED OUT FROM UNDER THE SUN)
      IARB=0
      PSI=180.0
      RETURN
5     CONTINUE
C     GENERAL CASE
      PSIOR=PSIO/DEG
      IARB=0
      ANUMER=SIN(DELOR)*SIN(PSIOR)
      DENOM=COS(BETAR)*SIN(DELOR)*COS(PSIOR)-SIN(BETAR)*COS(DELOR)
C     SPECIAL CASES
C     NUMERATOR GOES TO ZERO IN THE FOLLOWING 3 CASES
C 1)  DELO=0.0
      IF(DELO.GT.EPSILN) GO TO 20
      IF(BETA.GT.EPSILN) GO TO 10
      IARB=2
      RETURN
10    PSI=180.0
      RETURN
C 2)  PSIO=0.0
20    IF(ABS(PSIO).GT.EPSILN) GO TO 40
      IF(ABS(BETA-DELO).GE.EPSILN) GO TO 30
C     SCATTERING POINT IS DIRECTLY UNDER THE SUN
      IARB=2
      RETURN
30    IF(BETA.LT.DELO) PSI=0.0
      IF(BETA.GT.DELO) PSI=180.0
      RETURN
C 3)  PSIO=180.0
40    IF(ABS(PSIO).LT.(180.0-EPSILN)) GO TO 60
      PSI=180.0
      RETURN
60    CONTINUE
C     DENOMINATOR CAN GO TO ZERO FOR THE FOLLOWING 2 CASES
C 1)  BETA=DELO AND PSIO=0.0
C     THIS CASE WAS HANDLED EARLIER
C 2)  GENERAL CASE
      IF(ABS(DENOM).GT.EPSILN) GO TO 80
      IF(PSIO.LT.0.0) PSI=-90.0
      IF(PSIO.GT.0.0) PSI=90.0
      RETURN
80    CONTINUE
      PSI=DEG*ATAN(ANUMER/DENOM)
C     NOTE ATAN RETURNS ARGUMENTS BETWEEN -90 AND 90. PSI
C     AND PSIO SHOULD BE OF THE SAME SIGN.
      IF(PSIO.GT.0.0.AND.PSI.LT.0.0) PSI=PSI+180.
      IF(PSIO.LT.0.0.AND.PSI.GT.0.0) PSI=PSI-180.
      RETURN
      END
```

```
      FUNCTION DEL(PSIO,DELO,BETA,IARBO)
C
C     FUNCTION DEL RETURNS THE VALUE OF THE SUN'S ZENITH ANGLE
C     AT ANY POINT ALONG THE OPTICAL PATH BASED UPON STRAIGHT
C     LINE GEOMETRY (NO REFRACTION). THIS ANGLE IS USED TO SPECIFY
C     THE SCATTERING POINT TO SUN PATHS. THE BENDING DUE TO REFRACTION
C     ALONG THIS PATH IS DETERMINED BY THE GEO ROUTINES. IF THE BENDING
C     IS GREATER THAN ONE DEGREE THE ZENITH ANGLE IS CORRECTED ACCORDING
C     AND THE PATH CALCULATION IS REPEATED.
      COMMON /PARMTR/ RE,DELTAS,ZMAX,IMAX,IMOD,IBMAX,IPATH
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,BIGNUM,BIGEXP
      DATA  EPSILN/1.0E-5/
C
      IF(IARBO.EQ.0) GO TO 10
C     SPECIAL CASES IF PSIO IS ARBITRARY
      IF(IARBO.EQ.1) DEL=DELO
      IF(IARBO.EQ.2) DEL=BETA
      IF(IARBO.EQ.3) DEL=0.0
      RETURN
10    CONTINUE
      PSIOR=PSIO/DEG
      DELOR=DELO/DEG
      BETAR=BETA/DEG
C     GENERAL CASE
      X=COS(DELOR)*COS(BETAR)+SIN(DELOR)*SIN(BETAR)*COS(PSIOR)
      DEL=DEG*ACOS(X)
      RETURN
      END
```

```
      SUBROUTINE SSRAD(IPH,IK,ITZERO,IPATH,V,SUMSSR)
C
C     SUBROUTINE SSRAD PERFORMS THE LAYER BY LAYER SINGLE SCATTERING
C     RADIANCE SUM.
C
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON              WPATH(68,16),TBBY(68)
      COMMON ABSC(4,40),EXTC(4,40),VX2(40)
      COMMON /SOLS/ AH1(68),ARH(68),
     X   WPATHS(68,16),PA(68),PR(68),ATHETA(35),ADBETA(35),LJ(69),JTURN,
     X ANGSUN
      COMMON /SRAD/ TEB1,TEB2,TASP1,TASP2,TMSP1,TMSP2,TEB2SV
      IF(ITZERO.EQ.1) GO TO 60
      TX6=TX(6)
      TX7=TX(7)
      TX9=TX(9)
      TX10=TX(10)
      IF(IPATH-2) 10,20,30
10    CONTINUE
      ISKIP = 0
C     INITIAL CONDITIONS
C     SINGLE SCATTERING RADIANCE SUM
      SUMSSR=0.0
C     OPTICAL PATH TRANSMITTANCES
      TASP2=1.0
      TMSP2=1.0
C     L PATH TRANSMITTANCE
      TEB2=TX9
C     MOLECULAR AND AEROSOL PHASE FUNCTIONS
      PMOL2=PR(IK)
      PAER2=PA(IK)
      IF(IPH.EQ.2)
     1 CALL PHASEF(V,AH1(IK),PA(IK),ARH(IK),PAER2)
      RETURN
20    CONTINUE
C     CURRENT L PATH TRANSMITTANCE
      TEB1=TX9
C     CURRENT MOLECULAR AND AEROSOL PHASE FUNCTIONS
      PMOL1=PR(IK)
      PAER1=PA(IK)
      IF(IPH.EQ.2)
     1 CALL PHASEF(V,AH1(IK),PA(IK),ARH(IK),PAER1)
      RETURN
30    CONTINUE
C     CURRENT OPTICAL PATH TRANSMITTANCES
      TASP1=TX7/TX10
      TMSP1=TX6
C     SINGLE SCATTERING RADIANCE CALCULATION
      IF(TASP1.EQ.0.0 .OR. TMSP1.EQ.0.0 .OR.TMSP2.EQ.0.0 .OR.
     1    TASP2.EQ.0.0) GO TO 50
      XA1=PAER1*TEB1/TASP1
      XA2=PAER2*TEB2/TASP2
      XM1=PMOL1*TEB1/TMSP1
      XM2=PMOL2*TEB2/TMSP2
      DTASP=TASP2-TASP1
      DTMSP=TMSP2-TMSP1
C     COULD ADD A CHECK FOR SMALL DTMSP,DTASP AND BYPASS CALCULATION
      SUMSSR=SUMSSR+.5*(DTASP*(XA1+XA2)+DTMSP*(XM1+XM2))
C     RESET L AND OPTICAL PATH  TRANSMITTANCES
   50 CONTINUE
      TASP2=TASP1
      TEB2SV=TEB2
      TMSP2=TMSP1
      TEB2=TEB1
C     RESET PHASE FUNTION VALUES
      PAER2=PAER1
      PMOL2=PMOL1
60    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SOURCE(VV,ISOURC,IDAY,ANGLE,SS)                        SRC  100
      COMMON /ICLL/ ICALL,FPHS,FALB,FORBIT                              SRC *101
C     SUBROUITNE SOURCE CONTAINS THE SOLAR INTENSITY DATA AS A          SRC  110
C     FUNTION OF WAVELENGTH. THIS ROUTINE IS ALSO CAPABLE OF CALCULATINGSRC  115
C     LUNAR INTENSITY BASED ON THE PHASE ANGLE BETWEEN THE SUN, MOON ANDSRC  120
C     EARTH. CORRECTIONS ARE MADE FOR THE SUN'S ELLIPTIC ORBIT.         SRC  125
C                                                                       SRC  130
      DIMENSION NDAY(13),RAT(13),PHS(17),ALB(29),VSUN(210),ESUN(210)    SRC  135
      DATA NDAY/1,32,60,91,121,151,181,212,243,273,304,334,366/         SRC  140
      DATA RAT/1.034,1.030,1.019,1.001,.985,.972,.967,.971,.982,        SRC  145
     1    .998,1.015,1.029,1.034/                                       SRC  150
      DATA PHS/100.,73.2,57.8,42.3,32.0,23.3,16.7,12.4,8.7,6.7,         SRC  155
     1    4.7,3.6,2.4,1.2,0.9,0.4,.002/                                 SRC  160
      DATA ALB/.001,.01,.03,.075,.1,.13,.155,.17,.178,.185,.2,.211,     SRC  165
     1    .231,.25,.275,.289,.285,.287,.3,.29,.3,.31,.313,.319,.329     SRC  170
     1    ,.339,.345,.350,.5/                                           SRC  175
C     WAVELENGTH (MICROMETERS) AT WHICH SOLAR INTENSTY DATA IS STORED   SRC  180
C                                                                       SRC  185
      DATA VSUN/.115,.120,.125,.130,.140,.150,.160,                     SRC  190
     1 .170,.180,.190,.200,.210,.220,.225,.230,.235,.240,.245,.250,     SRC  195
     2 .255,.260,.265,.270,.275,.280,.285,.290,.295,.300,.305,.310,     SRC  200
     3 .315,.320,.325,.330,.335,.340,.345,.350,.355,.360,.365,.370,     SRC  205
     4 .375,.380,.385,.390,.395,.400,.405,.410,.415,.420,.425,.430,     SRC  210
     5 .435,.440,.445,.450,.455,.460,.465,.470,.475,.480,.485,.490,     SRC  215
     6 .495,.500,.505,.510,.515,.520,.525,.530,.535,.540,.545,.550,     SRC  220
     7 .555,.560,.565,.570,.575,.580,.585,.590,.595,.600,.605,.610,     SRC  225
     8 .620,.630,.640,.650,.660,.670,.680,.690,.700,.710,.720,.730,     SRC  230
     9 .740,.750,.760,.770,.780,.790,.800,.810,.820,.830,.840,.850,     SRC  235
     1 .860,.870,.880,.890,.900,.910,.920,.930,.940,.950,.960,.970,     SRC  240
     1 .980,.990,1.00,1.05,1.10,1.15,1.20,1.25,1.30,1.35,1.40,1.45,     SRC  245
     2 1,50,1.55,1.60,1.65,1.70,1.75,1.80,1.85,1.90,1.95,2.00,2.10,     SRC  250
     3 2.20,2.30,2.40,2.50,2.60,2.70,2.80,2.90,3.00,3.10,3.20,3.30,     SRC  255
     4 3.40,3.50,3.60,3.70,3.80,3.90,4.00,4.10,4.20,4.30,4.40,4.50,     SRC  260
     5 4.60,4.70,4.80,4.90,5.00,6.00,7.00,8.00,9.00,10.0,11.0,12.0,     SRC  265
     6 13.0,14.0,15.0,16.0,17.0,18.0,19.0,20.0,25.0,30.0,35.0,40.0,     SRC  270
     7 50.0,60.0,80.0,100.,120.,150.,200.,250.,300.,400.,1000./         SRC  275
C     SOLAR INTENSITY IN UNITS OF WATTS M-2 MICROMETER-1                SRC  280
C                                                                       SRC  285
      DATA ESUN/.007,.9,.007,.007,.030,.070,.230,.630,                  SRC  290
     1 1 25,2.71,10.7,22.9,57.5,64.9,66.7,59.3,63.0,72.3,70.4,104.,     SRC  295
     2 130.,185.,232.,204.,222.,315.,482.,584.,514.,603.,689.,764.,     SRC  300
     3 830.,975.,1059.,1081.,1074.,1069.,1093.,1083.,1068.,1132.,       SRC  305
     4 1181.,1157.,1120.,1098.,1098.,1189.,1429.,1644.,1751.,1774.,     SRC  310
     5 1747.,1693.,1639.,1663.,1810.,1922.,2006.,2057.,2066.,2048.,     SRC  315
     3 2033.,2044.,2074.,1976.,1950.,1960.,1942.,1920.,1882.,1833.,     SRC  320
     7 1833.,1852.,1842.,1818.,1783.,1754.,1725.,1720.,1695.,1705.,     SRC  325
     8 1712.,1719.,1715.,1712.,1700.,1682.,1668.,1647.,1635.,1602.,157  SRC  330
     9 0.,1544.,1511.,1486.,1456.,1427.,1402.,1396.,1344.,1314.,1290.,  SRC  335
     1 1260.,1235.,1211.,1185.,1159.,1134.,1109.,1085.,1060.,1036.,     SRC  340
     1 1013.,990.,968.,947.,926.,908.,891.,880.,869.,858.,847.,837.,    SRC  345
     2 820.,803.,785.,767.,748.,668.,593.,535.,485.,438.,397.,358.,     SRC  350
     3 337.,312.,288.,267.,245.,223.,202.,180.,159.,142.,126.,114.,     SRC  355
     4 103.,90.,79.,69.,62.,55.,48.,43.,39.,35.,31.,26.,22.6,19.2,      SRC  360
     5 16.6,14.6,13.5,12.3,11.1,10.3,9.5,8.7,7.8,7.1,6.5,5.92,5.35,     SRC  365
     6 4.86,4.47,4.11,3.79,1.82,.99,.585,.367,.241,.168,.117,.0851,     SRC  370
     7 .0634,.0481,.0371,.0291,.0231,.0186,.0152,6.17E-3,2.97E-3,       SRC  375
     8 1.60E-3,9.42E-4,3.91E-4,1.90E-4,6.16E-5,2.57E-5,1.26E-5,         SRC  380
     9 5.23E-6,1.69E-6,7.00E-7,3.40E-7,1.10E-7,0.0/                     SRC  385
      V=10000./VV                                                       SRC  390
```

```
      IF(ISOURC.NE.1) GO TO 50
      IF(ICALL.EQ.1) GO TO 20
C
C     MOON PHASE ANGLE FACTOR
C
      FPHS=0.0
      IF(ANGLE.GT.160.) GO TO 20
      IP=ANGLE/10.
      IF(FLOAT(IP*10).EQ.ANGLE) GO TO 10
      FPHS=PHS(IP+1)+(ANGLE-10.*IP)*(PHS(IP+2)-PHS(IP+1))/10.
      GO TO 20
10    FPHS=PHS(IP+1)
C
C     GEOMETRICAL ALBEDO OF THE MOON
C
20    FALB=0.4
      IF(V.GE.5.) GO TO 40
      IF(V.GT.2.8) GO TO 30
      I1=V*10
      FALB=ALB(I1)+(ALB(I1+1)-ALB(I1))*(V-I1*0.1)*10.
      GO TO 40
30    FALB=ALB(28)+(ALB(29)-ALB(28))*(V-2.8)/2.2
40    CONTINUE
C
C     SUN ELLIPTIC ORBIT FACTOR
C
50    IF(ICALL.EQ.1) GO TO 90
      FORBIT=0.0
      IF(IDAY.GT.0 .AND. IDAY.LT.367) GO TO 55
      FORBIT = 1.0
      GO TO 90
55    CONTINUE
      DO 60 I=1,13
      IF(NDAY(I).EQ.IDAY) GO TO 80
      IF(NDAY(I).GT.IDAY) GO TO 70
60    CONTINUE
70    FORBIT=RAT(I-1)+(IDAY-NDAY(I-1))*(RAT(I)-RAT(I-1))/(NDAY(I)
     1   -NDAY(I-1))
      GO TO 90
80    FORBIT=RAT(I)
90    CONTINUE
      ICALL=1
C
C     SOLAR INTENSITY
C
      SS=0.0
      IF(V.LT.VSUN(1).OR.V.GE.VSUN(210)) RETURN
      DO 100 I=1,210
      IF(VSUN(I).GE.V) GO TO 120
100   CONTINUE
120   IF(VSUN(I).EQ.V) GO TO 130
      SS=(ESUN(I)-ESUN(I-1))*(V-VSUN(I-1))/(VSUN(I)-VSUN(I-1))
     1    +ESUN(I-1)*FORBIT
      GO TO 140
130   SS=ESUN(I)*FORBIT
140   IF(ISOURC.EQ.1)  SS=SS*FPHS*FALB*2.04472E-7
C     CONVERT W/M-2-MICRON TO W/CM-2-MICRON
      SS=SS*.0001
      RETURN
      END
```

```
      SUBROUTINE SUBSOL(THETAS,PHIS,TIME,IDAY)
C
C     SUBROUTINE SUBSOL CALCULATES THE SUBSOLAR POINT ANGLES
C     THETAS AND PHIS BASED UPON IDAY AND TIME. SINCE EACH
C     YEAR IS 365.25 DAYS LONG THE EXACT VALUE OF THE DECLINATION
C     ANGLE CHANGES FROM YEAR TO YEAR.  FOR PRECISE VALUES CONSULT
C     ' THE AMERICAN EPHEMERIS AND NAUTICAL ALMANAC' PUBLISHED YEARLY
C     BY THE U.S. GOVT. PRINTING OFFICE.  ALSO, THE SOLAR POSITION
C     IS CHARACTERIZED BY 25 POINTS BELOW; THIS SHOULD PREDICT THE SUBSO
C     ANGLES WITHIN ONE DEGREE.  FOR INCREASED ACCURACY ADD MORE DATA
C     POINTS
C
C     THE EQUATION OF TIME, EQT, IS IN MINUTES
C     THE DECLINATION ANGLE, DEC IS IN DEGREES
C
      COMMON /MODEL/ ZM(34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      DIMENSION NDAY(25),EQT(25),DEC(25)
      DATA NDAY /1,9,21,32,44,60,91,121,141,152,160,172,182,
     1 190,202,213,244,274,305,309,325,335,343,355,366/
      DATA DEC /-23.07,-22.22,-20.08,-17.32,-13.62,-7.88,4.23,
     1 14.83, 20.03,21.95,22.87,23.45,23.17,22.47,20.63,18.23,8.68,
     2 -2.88,-14.18,-15.45,-19.75,-21.68,-22.75,-23.43,-23.07/
      DATA EQT /-3.23,-6.83,-11.17,-13.57,-14.33,-12.63,-4.2,
     1 2.83,3.57,2.45,1.10,-1.42,-3.52,-4.93,-6.25,-6.28,-0.25,
     2 10.02,16.35,16.38,14.3,11.27,8.02,2.32,-3.23/
      IF(IDAY.LT.1.OR.IDAY.GT.366)  GO TO 900
      IF(TIME.LT.0.0.OR.TIME.GT.24.0)  GO TO 910
      DO 10 I=1,25
      IF(NDAY(I).EQ.IDAY) GO TO 30
10    IF(NDAY(I).GT.IDAY) GO TO 20
20    I=I-1
      EQTIME=EQT(I)+(EQT(I+1)-EQT(I))*(IDAY-NDAY(I))/(NDAY(I+1)-NDAY(I))
      DECANG=DEC(I)+(DEC(I+1)-DEC(I))*(IDAY-NDAY(I))/(NDAY(I+1)-NDAY(I))
      GO TO 40
30    EQTIME=EQT(I)
      DECANG=DEC(I)
40    THETAS=DECANG
      EQTIME=EQTIME/60.0
      PHIS=15.0*(TIME+EQTIME)-180.0
      IF(PHIS.LT.0.0) PHIS=PHIS+360.0
      RETURN
900   WRITE(IPR,901) IDAY
901   FORMAT(' FROM SUBSOL - IDAY OUT OF RANGE, IDAY=',I6)
      STOP
910   WRITE(IPR,902) TIME
902   FORMAT(' FROM SUBSOL - TIME OUT OF RANGE, TIME=',E12.5)
      STOP
      END
```

```
      SUBROUTINE PHASEF(V,ALT,ANGLE,RH,PHFA)
C
C     RETURNS THE AEROSOL PHASE FUNCTION FROM THE STORED DATA BASE
C
C
C     THE TRUTH TABLE MNUM(27,26) STORED IN COMMON/MNMPHS/
C     IN SUBROUTINE PHSDTA IS QUERIED TO DETERMINE THE PROPER PHASE
C     FUNCTION NEEDED.
C     THE 27 POSITIONS REPRESENT THE 27 SPECIFIC FREQUENCIES SHOWN IN
C     DATA STATEMENT WAVE  .2-40 MICRONS.
C     THE NUMBERS STORED IN THESE 27 POSITIONS REPRESENT THE CORRECT
C     PHASE FUNCTIONS CHOSEN FROM THE DATA STATEMENT PHSFNC'S 1-70
C     POSSIBLE CHOICES.
C     THE 26 DATA STATEMENTS EACH HAVING 27 FREQUENCIES REPRESENT THE
C     FOLLOWING 26 MODELS;
C      1=RURAL      0%RH    2=RURAL      70%RH   3=RURAL      80%RH
C      4=RURAL     99%RH    5=MARITIME   0%RH    6=MARITIME  70%RH
C      7=MARITIME  80%RH    8=MARITIME  99%RH    9=URBAN       0%RH
C     10=URBAN     70%RH   11=URBAN     80%RH   12=URBAN      99%RH
C     13=OCEANIC    0%RH   14=OCEANIC   70%RH   15=OCEANIC    80%RH
C     16=OCEANIC   99%RH   17=TROPOSPH   0%RH   18=TROPOSPH  70%RH
C     19=TROPOSPH  80%RH   20=TROPOSPH  99%RH   21=STRATOSPHERIC
C     22=AGED VOLCANIC     23=FRESH VOLCANIC    24=RADIATION FOG
C     25=ADVECTIVE FOG     26=METEORIC DUST
C
C
C     IN THE PRESENT VERSION THE 4 OCEANIC MODELS 13-16
C     ARE NOT UTILIZED.
C
      COMMON /IFIL/ IRD,IPR,IPU,NPR
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON/MNMPHS/ MNUM(27,26),PHSFNC(34,70)
      DIMENSION RHPTS(4),WAVE(27),ANG(34)
      DATA ANG /0.,2.,4.,6.,8.,10.,12.,16.,20.,24.,28.,32.,36.,40.
     1,50.,60.,70.,80.,90.,100.,110.,120.,125.,130.,135.,140.,145.
     2,150.,155.,160.,165.,170.,175.,180./
      DATA WAVE /.2,.3,.55,.6943,1.06,1.536,2.0,2.5,2.7,3.,3.2,3.39
     1,5.,6.,7.2,7.9,8.7,9.2,10.0,10.59,12.5,15.0,17.2,18.5,21.3,30.
     2,40.0/
      DATA RHPTS /0.0,70.0,80.0,99.0/
C
      PHFA=0.0
      ALAM=1.0E4/V
      IF(ANGLE.LT.0.0.OR.ANGLE.GT.180.0) GO TO 900
      IF(ALAM.LT.WAVE(1).OR.ALAM.GT.WAVE(27)) GO TO 910
C     DETERMINE THE AEROSOL MODEL NUMBER
      IF(ALT.GT.2.0) GO TO 95
      IF(IHAZE.EQ.7) WRITE(IPR,999)
999   FORMAT(' IHAZE=7 INACTIVE, CONTINUING WITH PHFA=0.0')
      IF(IHAZE.EQ.0.OR.IHAZE.EQ.7) GO TO 400
      IF(IHAZE.GE.8) GO TO 90
C     0-2KM BOUNDARY LAYER MODELS, RH DEPENDENT
      DO 50 I1=1,4
      I=I1
      IF(RHPTS(I).EQ.RH) GO TO 70
      IF(RHPTS(I).GT.RH) GO TO 60
50    CONTINUE
```

```
60    IRHLO=I-1
      IRHHI=I
      GO TO 80
70    IRHLO=I
      IRHHI=I
80    CONTINUE
C     RURAL MODEL
      IF(IHAZE.EQ.1.OR.IHAZE.EQ.2) NNO=0
C     MARITIME MODEL
      IF(IHAZE.EQ.3.OR.IHAZE.EQ.4) NNO=4
C     URBAN MODEL
      IF(IHAZE.EQ.5) NNO=8
C     TROPOSPHERIC MODEL
      IF(IHAZE.EQ.6) NNO=16
      NN=NNO+IRHLO
      GO TO 130
C     0-2KM FOG MODELS, NO RH DEPENDENCE
90    IF(IHAZE.EQ.8) NN=24
      IF(IHAZE.EQ.9) NN=25
      GO TO 130
95    IF(ALT.GT.10.) GO TO 110
C     2-10KM TROPOSPHERIC MODEL
      NN=18
      GO TO 130
110   IF(ALT.GT.30.) GO TO 120
C     10-30KM STRATOSPHERIC MODELS
C     BACKGROUND MODEL
      IF(IVULCN.EQ.0.OR.IVULCN.EQ.1) NN=21
C     AGED VOLCANIC MODEL
      IF(IVULCN.EQ.2.OR.IVULCN.EQ.4) NN=22
C     FRESH VOLCANIC
      IF(IVULCN.EQ.3.OR.IVULCN.EQ.5) NN=23
      GO TO 130
C     30-100KM METEORIC MODEL
120   NN=26
130   IRH=0
C
C     DETERMINE THE BOUNDING ANGLE INDICES
140   DO 210 I1=1,34
      I=I1
      IF(ANG(I).EQ.ANGLE) GO TO 230
      IF(ANG(I).GT.ANGLE) GO TO 220
210   CONTINUE
220   IANG1=I-1
      IANG2=I
      GO TO 240
230   IANG1=I
      IANG2=I
240   CONTINUE
C
C     DETERMINE THE BOUNDING WAVELENGTH INDICES
      DO 250 I1=1,27
      I=I1
      IF(WAVE(I).EQ.ALAM) GO TO 270
      IF(WAVE(I).GT.ALAM) GO TO 260
250   CONTINUE
260   IWAV1=I-1
      IWAV2=I
      GO TO 280
```

```
270   IWAV1=I
      IWAV2=I
280   CONTINUE
C
C     FUNCTION PF CHOOSES DESIRED PHASE FUNCTION FROM LOOK UP TABLE
C     MNUM(IWAV,NN)  WHERE IWAV IS FREQ. AND NN IS MODEL NO.
C
C     WAVELENGTH INTERPOLATION ONLY USES PF11 AND PF21
C     ANGLE INTERPOLATION ONLY USES PF11 AND PF12
C     WAVELENGTH AND ANGLE INTERPOLATION USES PF11,PF21 AND PF12,PF22.
C
      PF11=PF(NN,IWAV1,IANG1)
      PF21=PF(NN,IWAV2,IANG1)
      PF12=PF(NN,IWAV1,IANG2)
      PF22=PF(NN,IWAV2,IANG2)
C     INTERPOLATE IN WAVELENGTH THEN ANGLE
      IF(IWAV1.EQ.IWAV2) GO TO 310
      IF(IANG1.EQ.IANG2) GO TO 290
C     BOTH INTERPOLATIONS ARE NECESSARY
      CALL INTERP(2,ALAM,WAVE(IWAV1),WAVE(IWAV2),YANG1,
     1PF11,PF21)
      CALL INTERP(2,ALAM,WAVE(IWAV1),WAVE(IWAV2),YANG2,
     1PF12,PF22)
      CALL INTERP(2,ANGLE,ANG(IANG1),ANG(IANG2),Y,YANG1,YANG2)
      GO TO 330
C     ONLY WAVELENGTH INTERPOLATION IS NECESSARY
290   CALL INTERP(2,ALAM,WAVE(IWAV1),WAVE(IWAV2),Y,PF11,
     1PF21)
      GO TO 330
310   IF(IANG1.EQ.IANG2) GO TO 320
C     ONLY ANGLE INTERPOLATION IS NECESSARY
      CALL INTERP(2,ANGLE,ANG(IANG1),ANG(IANG2),Y,PF11,
     1PF12)
      GO TO 330
C     NO INTERPOLATION IS NECESSARY
320   Y=PF(NN,IWAV1,IANG1)
330   CONTINUE
      PHFA=Y
C
C     HUMIDITY DEPENDENCE
      IF(ALT.GT.2.0.OR.NN.GE.17.OR.IRHLO.EQ.IRHHI) GO TO 400
      IF(IRH.EQ.1) GO TO 340
      NN=NNO+IRHHI
      PHFA1=PHFA
      IRH=1
      GO TO 280
340   CONTINUE
      PHFA2=PHFA
      CALL INTERP(1,RH,RHPTS(IRHLO),RHPTS(IRHHI),
     CPHFA,PHFA1,PHFA2)
400   CONTINUE
      RETURN
  900 WRITE(IPR,901) ANGLE
  901 FORMAT('0FROM PHASEF- SCATTERING ANGLE IS OUT OF RANGE, '
     1     ,'ANGLE = ',E12.5)
      STOP
  910 WRITE(IPR,911) ALAM
  911 FORMAT('0FROM PHASEF- ALAM IS OUT OF RANGE, ALAM = ',E12.5)
      STOP
      END
```

```
      FUNCTION PF(NN,I,J)
C     CALL THE APPROPRIATE PHASE FUNCTION
      COMMON/MNMPHS/ MNUM(27,26),PHSFNC(34,70)
      M=MNUM(I,NN)
      PF=PHSFNC(J,M)
      RETURN
      END
```

```
      SUBROUTINE INTERP(INTYPE,X,X1,X2,F,F1,F2)
C     SUBROUTINE INTERP INTERPOLATES TO DETERMINE THE VALUE OF F
C     AT X, GIVEN F1 AT X1 AND F2 AT X2.
C     INTYPE=1 FOR LINEAR INTERPOLATION
C     INTYPE=2 FOR LOGARITHMIC INTERPOLATION
      ITYPE=INTYPE
      IF(F1.LE.0.0.OR.F2.LE.0.0) ITYPE=1
      IF(ITYPE.EQ.2) GO TO 100
C     LINEAR INTERPOLATION
      F=F1+(X-X1)*(F2-F1)/(X2-X1)
      RETURN
100   CONTINUE
      A1=ALOG(F1)
      A2=ALOG(F2)
      A=A1+(X-X1)*(A2-A1)/(X2-X1)
      F=EXP(A)
      RETURN
      END
```

```
      FUNCTION TNRAIN(RR)
CCC
      COMMON /CNSTNS/ PI,CA,DEG.GCAIR,BIGNUM,BIGEXP
      COMMON /CARD3/ H1,H2,ANGLE,RANGE,BETA,RE,LEN
CCC   CALCULATES TRANSMISSION DUE TO RAIN AS A FUNCTION OF
CCC   RR=RAIN RATE IN MM/HR
CCC   RANGE=SLANT RANGE KM
CCC
CCC   ASSUMES A MARSHALL-PALMER RAIN DROP SIZE DISTRIBUTION
CCC   N(D)=NZERO*EXP(-A*D)
CCC   NZERO=8.E3 (MM-1)  (M-3)
CCC   A=41.*RR**(-0.21)
CCC   D=DROP DIAMETER (CM)
CCC
      REAL NZERO
      DATA NZERO /8000./
CCC
      A=41./RR**0.21
CCC
      IF(RR.LE.0)TNRAIN=1.
      IF(RR.LE.0)RETURN
CCC
      TNRAIN=EXP(-PI*NZERO*RANGE/A**3)
      RETURN
      END
```

```
      SUBROUTINE CIRRUS(CTHIK,CALT,ISEED,CPROB)
C*********************************************************************
C*   ROUTINE TO GENERATE ALTITUDE PROFILES OF CIRRUS DENSITY        **
C*   PROGRAMMED BY    M.J. POST                                     **
C*                    R.A. RICHTER          NOAA/WPL                **
C*                                          BOULDER, COLORADO       **
C*                                          01/27/1981              **
C*                                                                  **
C*   INPUTS!                                                        **
C*            CHTIK      -   CIRRUS THICKNESS (KM)                  **
C*                           0 = USE THICKNESS STATISTICS           **
C*                           .NE. 0 = USER DEFINES THICKNESS        **
C*                                                                  **
C*            CALT       -   CIRRUS BASE ALTITUDE (KM)              **
C*                           0 = USE CALCULATED VALUE               **
C*                           .NE. 0 = USER DEFINES BASE ALTITUDE    **
C*                                                                  **
C*            ICIR       -   CIRRUS PRESENCE FLAG                   **
C*                           0 = NO CIRRUS                          **
C*                           .NE. 0 = USE CIRRUS PROFILE            **
C*                                                                  **
C*            MODEL      -   ATMOSPHERIC MODEL                      **
C*                           1-5  AS IN MAIN PROGRAM                **
C*                           MODEL = 0,6,7 NOT USED SET TO 2        **
C*                                                                  **
C*            ISEED      -   RANDOM NUMBER INITIALIZATION FLAG.     **
C*                           0 = USE DEFAULT MEAN VALUES FOR CIRRUS **
C*                           .NE. 0 = INITIAL VALUE OF SEED FOR RANF**
C*                           FUNCTION. CHANGE SEED VALUE EACH RUN FOR**
C*                           DIFFERENT RANDOM NUMBER SEQUENCES. THIS**
C*                           PROVIDES FOR STATISTICAL DETERMINATION **
C*                           OF CIRRUS BASE ALTITUDE AND THICKNESS. **
C*                                                                  **
C*   OUTPUTS!                                                       **
C*         CTHIK          -  CIRRUS THICKNESS (KM)                  **
C*         CALT           -  CIRRUS BASE ALTITUDE (KM)              **
C*         DENSTY(16,I)   -  ARRAY, ALTITUDE PROFILE OF CIRRUS DENSITY**
C*         CPROB          -  CIRRUS PROBABILITY                     **
C*                                                                  **
C*********************************************************************
C
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1     RAINRT
      COMMON RELHUM(34),HSTOR(34),ICH(4),VH(16),TX(16),W(16)
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /CARD4/ V1,V2,DV
      COMMON /MODEL/ Z (34),PM(34),TM(34),RFNDX(34),DENSTY(16,34)
      DIMENSION CBASE(5,2),TSTAT(11),PTAB(5),CAMEAN(5)
      DIMENSION CBASE1(5),CBASE2(5)
      EQUIVALENCE (CBASE1(1),CBASE(1,1)),(CBASE2(1),CBASE(1,2))
C
      DATA  CAMEAN           / 11.0, 10.0, 8.0, 7.0, 8.0 /
      DATA  PTAB           / 0.8, 0.4, 0.5, 0.45, 0.4/
      DATA  CBASE1           / 7.5, 7.3, 4.5, 4.5, 2.5 /
      DATA  CBASE2           /16.5,13.5,14.0, 9.5,10.0 /
      DATA  TSTAT            / 0.0,.291,.509,.655,.764,.837,.892,
     + 0.928, 0.960, 0.982, 1.00 /
C
```

```
C  SET CIRRUS PROBABILITY AND PROFILE TO ALL ZEROES
C
      CPROB = 0.0
      MDL = MODEL
C
      DO 10 I=1,34
10    DENSTY(16,I)=0.
C
C  CHECK IF USER WANTS TO USE A THICKNESS VALUE HE PROVIDES, CALCULATE
C  A STATISTICAL THICKNESS, OR USE A MEAN THICKNESS (ISEED = 0).
C  DEFAULTED MEAN CIRRUS THICKNESS IS 1.0 KM.
C
      IF ( CTHIK .GT. 0.0 ) GO TO 25
      IF ( ISEED .NE. 0 ) GO TO 15
      CTHIK = 1.0
      GO TO 25
C
C  CALCULATE CLOUD THICKNESS USING LOWTRAN CIRRUS THICKNESS STATISTICS
C  NOTE - THIS ROUTINE USES A UNIFORM RANDOM NUMBER GENERATOR
C  FUNCTION (RANF) WHICH RETURNS A NUMBER BETWEEN 0 AND 1.
C  THIS FEATURE IS MACHINE DEPENDENT!!
C
 15   CALL RANSET(ISEED)
      URN = RANDOM(IDUM)
      DO 20 I = 1, 10
         IF (URN .GE. TSTAT(I) .AND. URN .LT. TSTAT(I+1)) CTHIK = I-1
   20 CONTINUE
      CTHIK = CTHIK / 2.0  +  RANDOM(IDUM) / 2.0
C
C  DENCIR IS CIRRUS DENSITY IN KM-1
C
   25 DENCIR = 0.07 * CTHIK
C
C  BASE HEIGHT CALCULATIONS
C
      IF ( MODEL .LT. 1  .OR.  MODEL .GT. 5 ) MDL = 2
      CPROB = 100.0 * PTAB(MDL)
C
      HMAX = CBASE(MDL,2) - CTHIK
      BRANGE = HMAX - CBASE(MDL,1)
      IF ( CALT .GT. 0.0 ) GO TO 27
      IF ( ISEED .NE. 0 ) GO TO 28
      CALT = CAMEAN(MDL)
      GO TO 27
   28 CALT = BRANGE * RANDOM(IDUM)+ CBASE(MDL,1)
C
C  PUT CIRRUS DENSITY IN CORRECT ALTITUDE BINS. IF MODEL = 7,
C  INTERPOLATE BH(16,I) FOR NON-STANDARD ALTITUDE BOUNDARIES.
C
  27  IF(MODEL .EQ. 7) GO TO 60
      IV1=INT(CALT )
      IV2=INT(CALT+CTHIK )
      DO 30 I = 2, 16
         IF(I .GE. IV1 .AND. I .LE. IV2) DENSTY(16,I+1) =  DENCIR
   30 CONTINUE
C
C  ADJUST FIRST AND LAST CIRRUS LEVEL IF CLOUD DOES NOT ENTIRELY
C  FILL EACH LEVEL.
C
```

```
      IHGT1 = INT( CALT )
      IHGT2 = INT( CALT + CTHIK)
      IF( IHGT1 . NE . IHGT2 ) GO TO 35
      DENSTY(16,IHGT1+1) = DENSTY( 16,IHGT1+1)*CTHIK
      RETURN
   35 PCT1  = 1.0 - ( CALT - IHGT1 )
      DENSTY(16,IHGT1+1) = DENSTY(16,IHGT1+1) * PCT1
      PCT2 =  ( CALT + CTHIK) - IHGT2
      DENSTY(16,IHGT2+1) = DENSTY(16,IHGT2+1) * PCT2
      RETURN
C
C  INTERPOLATE DENSTY(16,I) FOR USER SUPPLIED ALTITUDE BOUNDARIES
C
   60 TOP = CALT + CTHIK
      BOTTOM = CALT
      IF (TOP .LT. Z(1)) RETURN
      IF (BOTTOM .GT. Z(ML)) RETURN
      IML = ML - 1
      DO 70 I=1,IML
         ZMIN = Z(I)
         ZMAX = Z(I+1)
         DENOM = ZMAX - ZMIN
         IF(BOTTOM.LE.ZMIN .AND. TOP.GE.ZMAX) DENSTY(16,I) = DENCIR
         IF(BOTTOM.GE.ZMIN .AND. TOP.LT.ZMAX)
     +        DENSTY(16,I) = DENCIR * CTHIK/DENOM
         IF(BOTTOM.GE.ZMIN .AND. TOP.GE.ZMAX .AND. BOTTOM.LT.ZMAX)
     +        DENSTY(16,I) = DENCIR * (ZMAX - BOTTOM)/ DENOM
         IF(BOTTOM.LT.ZMIN .AND. TOP.LE.ZMAX .AND.TOP.GT.ZMIN)
     +        DENSTY(16,I) = DENCIR * (TOP - ZMIN) / DENOM
   70 CONTINUE
      RETURN
      END
```

```
      FUNCTION RANDOM(IDUM)
C*    RANF IS A UNIFORM RANDOM NUMBER GERERATOR WHICH RETURNS A
C*    NUMBER BETWEEN 0 AND 1.0.  RANF IS MACHINE DEPENDENT.
      RANDOM=RANF()
      RETURN
      END
```

```
      SUBROUTINE    MARINE(VIS,MODEL,WS,WH,ICSTL,BEXT,BABS,NL)
C
C         THIS SUBROUTINE DETERMINES AEROSOL EXT & ABS COEFFICIENTS
C           FOR THE NAVY MARITIME MODEL
C             CODED BY STU GATHMAN                      -  NRL
C
C         INPUTS-
C         WSS = CURRENT WIND SPEED (M/S)
C         WHH = 24 HOUR AVERAGE WIND SPEED (M/S)
C         RHH = RELATIVE HUMIDITY (PERCENTAGE)
C         VIS = METEOROLOGICAL RANGE (KM)
C         ICTL = AIR MASS CHARACTER  1 = OPEN OCEAN
C                     10 = STRONG CONTINENTAL INFLUENCE
C         MODEL = MODEL ATMOSPHERE
C
C         OUTPUTS-
C         BEXT = EXTINCTION COEFFICIENT (KM-1)
C         BABS = ABSORPTION COEFFICIENT (KM-1)
C
      COMMON /MART/ RHH
      COMMON /IFIL/IRD,IPR,IPU,NPR
      COMMON /CNSTNS/ PI,CA,DEG,GCAIR,DIGNUM,BIGEXP
      COMMON/A/T1QEXT(40,4),T2QEXT(40,4),T3QEXT(40,4),
     1T1QABS(40,4),T2QABS(40,4),T3QABS(40,4),ALAM(40),AREL(4)
      COMMON/AER/A1, A2, A3
      DIMENSION WSPD(8), BEXT(4,40), BABS(4,40)
      DIMENSION RHD(8)
      DATA WSPD/6.9, 4.1, 4.1, 10.29, 6.69, 12.35, 7.2, 6.9/
      DATA RHD/80., 75.63, 76.2, 77.13, 75.24, 80.53, 45.89, 80./
      PISC = PI/1000.0
      WRITE(IPR,890)
C
C     CHECK LIMITS OF MODEL VALIDITY
C
      RH = RHH
      IF(RHH.GT.0.) GO TO 10
      RH=RHD(MODEL+1)
10    IF(WS.GT.20.0) WS=20.
      IF(WH.GT.20.0) WH = 20.
      IF(RH.GT.98.0) RH = 98.
      IF(RH.LT.50.0.AND.RH.GE.0.0) RH = 50.
      IF(ICSTL.LT.1.OR.ICSTL.GT.10) ICSTL = 3
C
C     FIND SIZE DISTRIBUTION PARAMETERS FROM METEOROLOGY INPUT
C
      IF(WH.LE.0.) WRITE(IPR,920)
      IF(WH .LE. 0.0) WH = WSPD(MODEL + 1)
      IF(WS.LE.0.) WRITE(IPR,930)
      IF(WS.LE.0.0)WS=WH
      WRITE(IPR,910)WS,WH,RH,ICSTL
C
C        F IS A RELATIVE HUMIDITY DEPENDENT GROWTH CORRECTION
C        TO THE ATTENUATION COEFFICIENT.
C
      F=((2.-RH/100.)/(6.*(1.-RH/100.)))**0.33333
      A1=2000.0*ICSTL*ICSTL
      A2 = AMAX1(5.866*(WH-2.2), 0.5)
      A3 = AMAX1(0.01527*(WS-2.2), 1.14E-5)
C
```

```
C     FIND EXTINCTION AT 0.55 MICRONS AND NORMALIZE TO 1.
C
C     INTERPOLATE FOR RELATIVE HUMIDITY
C
      DO 40   J=2,4
      IF(RH.LE.AREL(J)) GO TO 42
 40   CONTINUE
 42   DELRH=AREL(J)-AREL(J-1)
      DELRHV=RH-AREL(J-1)
      RATIO=DELRHV/DELRH
      QE1=T1QEXT(4,J-1)+(T1QEXT(4,J)-T1QEXT(4,J-1))*RATIO
      QE2=T2QEXT(4,J-1)+(T2QEXT(4,J)-T2QEXT(4,J-1))*RATIO
      QE3=T3QEXT(4,J-1)+(T3QEXT(4,J)-T3QEXT(4,J-1))*RATIO
      TOTAL = A1*10.**QE1 + A2*10.**QE2 + A3*10.**QE3
      EXT55=PISC*TOTAL/F
C
C     IF METEOROLOLICAL RANGE NOT SPECIFIED,FIND FROM METEOR DATA
C
      IF(VIS.LE.0.) VIS=3.912/(EXT55+0.01159)
      C=(1./EXT55)*(PISC/F)
      A1=C*A1
      A2=C*A2
      A3=C*A3
C
C     CALCULATE NORMALIZED ATTENUATION COEFICIENTS
C
      DO 45   I=1,40
      T1XV = T1QEXT(I,J-1) + (T1QEXT(I,J) - T1QEXT(I,J-1))*RATIO
      T2XV = T2QEXT(I,J-1) + (T2QEXT(I,J) - T2QEXT(I,J-1))*RATIO
      T3XV = T3QEXT(I,J-1) + (T3QEXT(I,J) - T3QEXT(I,J-1))*RATIO
      T1AV = T1QABS(I,J-1) + (T1QABS(I,J) - T1QABS(I,J-1))*RATIO
      T2AV = T2QABS(I,J-1) + (T2QABS(I,J) - T2QABS(I,J-1))*RATIO
      T3AV = T3QABS(I,J-1) + (T3QABS(I,J) - T3QABS(I,J-1))*RATIO
      BEXT(NL,I)=A1*10**(T1XV)+A2*10**(T2XV)+A3*10**(T3XV)
      BABS(NL,I)=A1*10**(T1AV)+A2*10**(T2AV)+A3*10**(T3AV)
 45   CONTINUE
      WRITE(IPR,900) VIS
      RETURN
890   FORMAT('0MARINE AEROSOL MODEL USED')
900   FORMAT('0',T10,'VIS = ',F10.2,' KM')
910   FORMAT(T10,'WIND SPEED = ',F8.2,' M/SEC',/,T10,
     1 'WIND SPEED (24 HR AVERAGE) = ',F8.2,' M/SEC',/,
     2 T10,'RELATIVE HUMIDITY = ',F8.2,' PERCENT',/,
     3 T10,'AIRMASS CHARACTRR =' ,I3)
920   FORMAT('0  WS NOT SPECIFIED, A DEFAULT VALUE IS USED')
930   FORMAT('0  WH NOT SPECIFIED, A DEFAULT VALUE IS USED')
      END
```

```
      SUBROUTINE LAYVSA(K,TMP,DP,RH,AHAZE,VIS1,IHA1,ISEA1,IVUL1)
C     THIS SUBROUTINE RESTRUCTURES THE ATMOSPHERIC PROFILE
C     TO PROVICE FINER LAYERING NEAR THE GROUND FOR USE WITH
C     THE V.S.A. OPTION - IT RETURNS PRESSURE,TEMPERATURE,
C     AND AMOUNTS TO SUBROUTINE NSMDL
C     CODEING BEFORE 100 CONTINUE IS FOR STANDARD MODELS
C
C     CODEING AFTER 100 MERGES MODEL 7 WITH V.S.A.
C     MODEL=0 AND IVSA=1 NOT ALLOWED
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
      COMMON /MODEL/ Z(34)
      COMMON /CARD1/ MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRNT,TBOUND,SALB
      COMMON /CARD2/ IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,VIS,WSS,WHH,
     1    RAINRT
      COMMON /MDATA/ZM(34),P(34,7),T(34,7),WH(34,7),WO(34,7),
     X HMIX(34)
      COMMON /ZVSALY/ ZVSA(10),RHVSA(10),AHVSA(10),IHVSA(10)
      COMMON/NSINP/AINP(7,24)
      COMMON /IFIL/IRD,IPR,IPU,NPR
      DIMENSION TMPN(34),DPN(34),RHN(34),IHN(34),AHAN(34)
      DIMENSION ZNEW(24)
      DATA ZNEW/1.,2.,3.,4.,5.,6.,7.,8.,9.,10.,11.,12.,
     C 14.,16.,18.,20.,22.,25.,30.,35.,40.,50.,70.,100./
      HMXVSA=ZVSA(9)
      IF(MODEL.EQ.0.OR.MODEL.EQ.7) GO TO 100
      P(K,7)=0.
      TMP=0.
      DP=0.
      RH=0.
      WH(K,7)=0.
      WO(K,7)=0.
      AHAZE=0.
      VIS1=0.
      IHA1=0
      ISEA1=0
      IVUL1=0
      IF(K.GT.9) GO TO 10
      Z(K)=ZVSA(K)
      RH=RHVSA(K)
      AHAZE=AHVSA(K)
      IHA1=IHVSA(K)
      IF(M1.EQ.0)M1=MODEL
      IF(M2.EQ.0)M2=MODEL
      IF(M3.EQ.0)M3=MODEL
      RETURN
10    ZK1=HMXVSA+0.01
      IF(HMXVSA.LT.2.)ML=33
      IF(HMXVSA.LT.1.)ML=34
      IF(HMXVSA.EQ.2.)ML=32
      MDEL=34-ML
      IK=K-10-MDEL
      IF(IK.GE.1)Z(K)=ZNEW(IK)
      IF(K.EQ.10)Z(K)=ZK1
      RETURN
C
C     MODEL 7 CODEING
C     OLD LAYERS  AEROSOL RETURNED
C     NEW LAYERS P,T,DP,AEROSOL
100   CONTINUE
```

```
      ZVSA(10)=ZVSA(9)+0.01
      RHVSA(10)=0.
      AHVSA(10)=0.
      IHVSA(10)=0
      JML=ML
      IF(MODEL.EQ.0)WRITE (IPR,900)
      IF(MODEL.EQ.0)RETURN
      IF(K.GT.1) GO TO 200
      ML=ML+10
      IF(ML.GT.34)WRITE(IPR,910)
      IF(ML.GT.34)ML=34
      J=1
      KN=1
      L=1
110   IF(KN.GT.10)GO TO 140
      JL=J-1
      IF(JL.LT.1)JL=1
      JP=JL+1
      IF(ZVSA(KN).EQ.AINP(1,JL))GO TO 150
      IF(ZVSA(KN).EQ.AINP(1,JP))GO TO 150
      IF(ZVSA(KN).GT.AINP(1,JL).AND.ZVSA(KN).LT.AINP(1,JP))GO TO 115
      GO TO 140
115   Z(L)=ZVSA(KN)
      DIF=AINP(1,JP)-AINP(1,JL)
      DZ=ZVSA(KN)-AINP(1,JL)
      DLIN=DZ/DIF
      P(L,7)=(AINP(2,JP)-AINP(2,JL))*DLIN+AINP(2,JL)
      T(L,7)=0.
      TMPN(L)=(AINP(3,JP)-AINP(3,JL))*DLIN+AINP(3,JL)
      DPN(L)=(AINP(4,JP)-AINP(4,JL))*DLIN+AINP(4,JL)
      RHN(L)=(AINP(5,JP)-AINP(5,JL))*DLIN+AINP(5,JL)
      WH(L,7)=(AINP(6,JP)-AINP(6,JL))*DLIN+AINP(6,JL)
      WO(L,7)=(AINP(7,JP)-AINP(7,JL))*DLIN+AINP(7,JL)
      IHN(L)=IHVSA(KN)
      AHAN(L)=AHVSA(KN)
      FAC=(ZVSA(KN)-AINP(1,JL))/DIF
      IF(AINP(2,JP).LE.0.0.OR.AINP(2,JL).LE.0.) GO TO 122
      P(L,7)=AINP(2,JL)*(AINP(2,JP)/AINP(2,JL))**FAC
122   IF(AINP(3,JP).LE.0.0.OR.AINP(3,JL).LE.0.) GO TO 124
      TMPN(L)=AINP(3,JL)*(AINP(3,JP)/AINP(3,JL))**FAC
124   IF(AINP(4,JP).LE.0.0.OR.AINP(4,JL).LE.0.) GO TO 126
      DPN(L)=AINP(4,JL)*(AINP(4,JP)/AINP(4,JL))**FAC
126   IF(AINP(5,JP).LE.0.0.OR.AINP(5,JL).LE.0.) GO TO 128
      RHN(L)=AINP(5,JL)*(AINP(5,JP)/AINP(5,JL))**FAC
128   IF(AINP(6,JP).LE.0.0.OR.AINP(6,JL).LE.0.) GO TO 130
      WH(L,7)=AINP(6,JL)*(AINP(6,JP)/AINP(6,JL))**FAC
130   IF(AINP(JP,7).LE.0.0.OR.AINP(7,JL).LE.0.) GO TO 132
      WO(L,7)=AINP(7,JL)*(AINP(3,JP)/AINP(3,JL))**FAC
132   CONTINUE
      IF(L.EQ.ML) GO TO 200
      L=L+1
      KN=KN+1
      GO TO 110
140   Z(L)=AINP(1,J)
      P(L,7)=AINP(2,J)
      T(L,7)=0.
      TMPN(L)=AINP(3,J)
      DPN(L)=AINP(4,J)
      RHN(L)=AINP(5,J)
```

```
      WH(L,7)=AINP(6,J)
      WO(L,7)=AINP(7,J)
      IHN(L)=0
      IF(KN.LE.9) IHN(L)=IHVSA(KN)
      AHAN(L)=0.
      IF(KN.LE.9) GO TO 160
145   IF(J.EQ.JML)GO TO 200
      IF(L.EQ.ML)GO TO 200
      L=L+1
      J=J+1
      GO TO 110
150   ML=ML-1
      J=J+1
      GO TO 115
160   KL=KN-1
      IF(KL.LE.0)KL=1
      KP=KL+1
      DIF=ZVSA(KP)-ZVSA(KL)
      DZ=AINP(1,J)-ZVSA(KL)
      DLIN=DZ/DIF
      AHAN(L)=(AHVSA(KP)-AHVSA(KL))*DLIN+AHVSA(KL)
      GO TO 145
200   TMP=TMPN(K)
      VIS1=0.
      ISEA1=0
      IVUL1=0
      DP=DPN(K)
      RH=RHN(K)
      IHA1=IHN(K)
      AHAZE=AHAN(K)
      RETURN
900   FORMAT('   ERROR MODEL EQ 0 AND ARMY MODEL CANNOT MIX')
910   FORMAT('  ERROR ML GT 24 AND ARMY MODEL TOP LAYER TRUNCATED')
      END
```

```
      SUBROUTINE RDNSM(ML,IM)
C
C     THIS SUBROUTINE READS MODEL 7 DATA WHEN ISVA EQ 1
C
      COMMON/NSINP/AINP(7,24)
      COMMON /IFIL/IRD,IPR,IPU,NPR
      DO 20 I=1,ML
      READ(IRD,80)(AINP(J,I),J=1,7)
      WRITE(IPR,80)(AINP(J,I),J=1,7)
20    CONTINUE
      IM=0
80    FORMAT(3F10.3,2F5.1,2E10.3,E10.3,F7.3)
      RETURN
      END
```

```
      SUBROUTINE VSA(IHAZE,VIS,CEILHT,DEPTH,ZINVHT,Z,RH,AHAZE,IH)
C
C     VERTICAL STRUCTURE ALGORITHM
C
C     FROM ATMOSPHERIC SCIENCES LAB (U.S. ARMY)
C     WHITE SANDS N.M.
C
C     CREATES A PROFILE OF AEROSOL DENSITY NEAR THE GROUND,INCLUDING
C     CLOUDS AND FOG
C
C     THESE PROFILES ARE AT 9 HEIGHTS BETWEEN 0 KM AND 2 KM
C
C
C  ***VISIBILITY IS ASSUMED TO BE THE SURFACE VISIBILITY***
C
C     IHAZE  = THE TYPE OF AEROSOL
C     VIS    = VISIBILITY IN KM
C     CEILHT = THE CLOUD CEILING HEIGHT IN KM
C     DEPTH  = THE CLOUD/FOG DEPTH IN KM
C     ZINVHT = THE HEIGHT OF INVERSION OR BOUNDARY LAYER IN KM
C
C     VARIABLES USED IN VSA
C
C     ZC     = CLOUD CEILING HEIGHT IN M
C     ZT     = CLOUD DEPTH IN M
C     ZINV   = INVERSION HEIGHT IN M
C            SEE BELOW FOR MORE INFORMATION ABOUT ZC, ZT, AND ZINV
C     D      = INITIAL EXTINCTION AT THE SURFACE (D=3.912/VIS)
C     ZALGO  = THE DEPTH OF THE LAYER FOR THE ALGORITHM
C
C     OUTPUT FROM VSA:
C
C     Z      = HEIGHT IN KM
C     RH     = RELATIVE HUMIDITY AT HEIGHT Z IN PERCENT
C     AHAZE  = EXTINCTION AT HEIGHT Z IN KM**-1
C     IH     = AEROSAL TYPE FOR HEIGHT Z
C     HMAX   = MAXIMUM HEIGHT IN KM USED IN VSA, NOT NECESSARILY 2.0 KM
C
C
C     THE SLANT PATH CALCULATION USES THE FOLLOWING FUNCTION:
C
C                 EXT55=A*EXP(B*EXP(C*Z))
C
C     WHERE 'Z' IS THE HEIGHT IN KILOMETERS,
C           'A' IS A FUNCTION OF EXT55 AT Z=0.0 AND IS ALWAYS POSITIVE,
C           'B' AND 'C' ARE FUNCTIONS OF CLOUD CONDITIONS AND THE SURFAC
C               VISIBILITY (EITHER A OR B CAN BE POSITIVE OR NEGATIVE),
C           'EXT55' IS THE VISIBILE EXTINCTION COEFFICIENT IN KM**-1.
C
C     THEREFORE, THERE ARE 4 CASES DEPENDING ON THE SIGNS OF 'B' AND 'C'
C     CEILHT AND ZINVHT ARE USED AS SWITCHES TO DETERMINE WHICH CASE
C     TO USE.  THE SURFACE EXTINCTION 'D' IS CALCULATED FROM THE
C     VISIBILITY USING  D=3.912/VIS-0.012  THE FOUR CASES ARE AS FOLLOWS
C
C         CASE=1  FOG/CLOUD CONDITIONS
C                 'B' LT 0.0, 'C' LT 0.0
C                 'D' GE 7.064 KM**-1
C                 FOR A CLOUD 7.064 KM**-1 IS THE BOUNDARY VALUE AT
C                 THE CLOUD BASE AND 'Z' IS THE VERTICAL DISTANCE
```

```
C                   INTO THE CLOUD.
C                   VARIABLE USED:    DEPTH
C                   ** DEFAULT:  DEPTH OF FOG/CLOUD IS 0.2 KM WHEN
C                                'DEPTH' IS 0.0
C
C              =2  CLOUD CEILING PRESENT
C                  'B' GT 0.0, 'C' GT 0.0
C                  'D' GT 0.398 KM**-1 IS CASE 2 FOR HAZY/FOG
C                       SURFACE CONDITIONS
C                  'D' LE 0.398 KM**-1 IS CASE 2' FOR CLEAR/HAZY
C                       SURFACE CONDITIONS
C                  VARIABLE USED:    CEILHT (MUST BE GE 0.0)
C                  ** DEFAULTS:  CASE 2 - CEILHT IS CALCULATED FROM
C                                SURFACE EXTINCTION OR
C                                CASE 2' - CEILHT IS 1.8 KM WHEN
C                                'CEILHT' IS 0.0
C
C              =3  RADIATION FOG OR INVERSION OR BOUNDARY LAYER PRESENT
C                  'B' LT 0.0, 'C' GT 0.0
C                  VIS LE 2.0 KM DEFAULTS TO A RADIATION FOG AT THE
C                       GROUND AND OVERRIDES INPUT BOUNDARY AEROSOL TYPE
C                  VIS GT 2.0 KM FOR AN INVERSION OR BOUNDARY LAYER
C                       WITH INPUT BOUNDARY AEROSOL TYPE
C                  ** IHAZE=9 (RADIATION FOG) ALWAYS DEFAULTS TO A
C                     RADIATION FOG NO MATTER WHAT THE VISIBILITY IS.
C                  SWITCH VARIABLE: CEILHT (MUST BE LT 0.0)
C                  VARIABLE USED:    ZINVHT (MUST BE GE 0.0)
C                  ** CEILHT MUST BE LT 0.0 FOR ZINVHT TO BE USED **
C                     HOWEVER, IF DEPTH IS GT 0.0 AND ZINVHT IS EQ 0.0,
C                     THE PROGRAM WILL SUBSTITUTE DEPTH FOR ZINVHT.
C                  ** DEFAULT:  FOR A RADIATION FOG ZINVHT IS 0.2 KM
C                               FOR AN INVERSION LAYER ZINVHT IS 2.0 KM
C
C              =4  NO CLOUD CEILING, INVERSIUN LAYER, OR BOUNDARY
C                  LAYER PRESENT, I.E. CLEAR SKIES
C                  EXTINCTION PROFILE CONSTANT WITH HEIGHT
C
      COMMON /IFIL/IRD,IPR,IPU,NPR
      DIMENSION Z(10),RH(10),AHAZE(10),IH(10)
      DIMENSION AA(2),CC(2),EE(4),A(2),B(2),C(2),FAC1(9),FAC2(9)
      REAL KMTOM
      DATA AA/92.1,0.3981/,CC/-0.014,0.0125/,KMTOM/1000.0/
C     THE LAST 3 VALUES OF EE BELOW ARE EXTINCTIONS FOR VISIBILITIES
C     EQUAL TO 5.0, 23.0, AND 50.0 KM, RESPECTIVELY.
      DATA EE/7.044,0.7824,0.17009,0.07824/
      DATA FAC1/0.0,0.03,0.05,0.075,0.1,0.18,0.3,0.45,1.0/
      DATA FAC2/0.0,0.03,0.1,0.18,0.3,0.45,0.6,0.78,1.0/
      WRITE(IPR,599)
C
C     UPPER LIMIT ON VERTICAL DISTANCE = 2 KM
      ZHIGH=2000.
      HMAX=ZHIGH
      IF(VIS.GT.0.0)GO TO 5
C     DEFAULT FOR VISIBILITY DEPENDS ON THE VALUE OF IHAZE.
      IF(IHAZE.EQ.8)VIS=0.2
      IF(IHAZE.EQ.9)VIS=0.5
      IF(IHAZE.EQ.2.OR.IHAZE.EQ.5)VIS=5.0
      IF(IHAZE.EQ.1.OR.IHAZE.EQ.4.OR.IHAZE.EQ.7)VIS=23.0
      IF(IHAZE.EQ.6)VIS=50.0
```

```
C     IF(IHAZE.EQ.3)VIS=??????
    5 D=3.912/VIS-0.012
C
      ZC=CEILHT*KMTOM
      ZT=DEPTH*KMTOM
      ZINV=ZINVHT*KMTOM
C     IHAZE=9 (RADIATION FOG) IS ALWAYS CALCULATED AS A RADIATION FOG.
      IF(IHAZE.EQ.9)ZC=-1.0
C     ALSO, CHECK TO SEE IF THE FOG DEPTH FOR A RADIATION FOG
C     WAS INPUT TO DEPTH INSTEAD OF THE CORRECT VARIABLE ZINVHT.
      IF(IHAZE.EQ.9.AND.ZT.GT.0.0.AND.ZINV.EQ.0.0)ZINV=ZT
C
C     'IC' DEFINES WHICH CASE TO USE.
      IC=2
      IF(D.GE.EE(1).AND.ZC.GE.0.0)IC=1
C
      IF(ZC.LT.0.0.AND.IC.EQ.2)IC=3
      IF(ZINV.LT.0.0.AND.IC.EQ.3)IC=4
C     'ICC' IS FOR THE TWO CASES:  2 AND 2'.
      ICC=0
      IF(IC.EQ.2)ICC=1
      IF(D.LE.AA(2).AND.IC.EQ.2)ICC=2
      K=1
      IF(ICC.EQ.2)GO TO 30
      GO TO (10,20,40,60),IC
C
C     CASE 1:  DEPTH FOG/CLOUD: INCREASING EXTINCTION WITH HEIGHT FROM
C              CLOUD/FOG BASE TO CLOUD/FOG TOP.
   10 CONTINUE
      IF(ZC.LT.HMAX.AND.IC.EQ.2)K=2
C     IC=-1 WHEN A CLOUD IS PRESENT AND THE PATH GOES INTO IT.
C     USE CASE 2 OR 2' BELOW CLOUD AND CASE 1 INSIDE IT.
      IF(K.EQ.2)IC=(-1)
C     THE BASE OF THE CLOUD HAS AN EXTINCTION COEFFICIENT OF 7.064 KM-1.
      IF(K.EQ.2)D=EE(1)
      A(K)=AA(1)
C     IF THE SURFACE EXTINCTION IS GREATER THAN THE UPPER LIMIT OF 92.1
C     KM**-1, RUN THE ALGORITHM WITH AN UPPER LIMIT OF 'D+10'.
      IF(D.GE.AA(1))A(K)=D+10.0
      C(K)=CC(1)
      IF(ZT.LE.0.0)WRITE(IPR  ,603)
      IF(ZT.LE.0.0)WRITE(IPR  ,604)
      IF(ZT.GT.0.0)WRITE(IPR  ,611)ZT
C     IF THE DISTANCE FROM THE GROUND TO THE CLOUD/FOG TOP IS LESS
C     THAN 2.0 KM, VSA WILL ONLY CALCULATE UP TO THE CLOUD TOP.
      IF(ZT.LE.0.0)ZT=200.
      HMAX=AMIN1(ZT+ZC,HMAX)
      GO TO 60
C
C     CASE 2:  HAZY/LIGHTLY FOGGY; INCREASING EXTINCTION WITH HEIGHT
C              UP TO THE CLOUD BASE.
   20 A(K)=AA(2)
      E=EE(1)
      IF(ZC.EQ.0.0)WRITE(IPR  ,602)
      IF(ZC.EQ.0.0)CEIL=ALOG(ALOG(E/A(K))/(ALOG(D/A(K))))/CC(2)
      IF(ZC.EQ.0.0)WRITE(IPR  ,602)CEIL
      IF(ZC.GT.0.0)WRITE(IPR  ,610)ZC
      IF(ZC.EQ.0.0)ZC=CEIL
      GO TO 60
```

```
C
C      CASE 2':  CLEAR/HAZY; INCREASING EXTINCTION WITH HEIGHT, BUT LESS
C                SO THAN CASE 2, UP TO THE CLOUD BASE.
 30    A(K)=D*0.9
       E=EE(1)
       IF(ZC.EQ.0.0)WRITE(IPR  ,600)
       IF(ZC.EQ.0.0)WRITE(IPR  ,618)
       IF(ZC.GT.0.0)WRITE(IPR  ,610)ZC
       IF(ZC.EQ.0.0)ZC=1800.
       GO TO 60
C
C      CASE 3:  NO CLOUD CEILING BUT A RADIATION FOG OR AN INVERSION
C               OR BOUNDARY LAYER PRESENT; DECREASING EXTINCTION WITH
C               HEIGHT UP TO THE HEIGHT OF THE FOG OR LAYER.
 40    A(K)=D*1.1
       E=EE(3)
       IF(IHAZE.EQ.2.OR.IHAZE.EQ.5)E=EE(2)
       IF(IHAZE.EQ.6.OR.(VIS.GT.2.0.AND.IHAZE.NE.9))E=EE(4)
       IF(E.GT.D)E=D*0.99999
       IF(ZT.GT.0.0.AND.ZINV.EQ.0.0.AND.VIS.LE.2.0)ZINV=ZT
       IF(ZINV.EQ.0.0.AND.VIS.GT.2.0.AND.IHAZE.NE.9)WRITE(IPR  ,601)
       IF(ZINV.EQ.0.0.AND.(VIS.LE.2.0.OR.IHAZE.EQ.9))WRITE(IPR  ,605)
       IF(ZINV.EQ.0.0.AND.(VIS.LE.2.0.OR.IHAZE.EQ.9))WRITE(IPR  ,604)
       IF(ZINV.GT.0.0.AND.VIS.GT.2.0.AND.IHAZE.NE.9)WRITE(IPR  ,612)ZINV
       IF(ZINV.GT.0.0.AND.(VIS.LE.2.0.OR.IHAZE.EQ.9))WRITE(IPR  ,614)ZINV
       IF(ZINV.EQ.0.0.AND.VIS.GT.2.0.AND.IHAZE.NE.9)ZINV=2000
       IF(ZINV.EQ.0.0.AND.(VIS.LE.2.0.OR.IHAZE.EQ.9))ZINV=200
       HMAX=AMIN1(ZINV,HMAX)
       ZC=0.0
C
C      CASE 4:  NO CLOUD CEILING OR INVERSION LAYER; CONSTANT EXTINC-
C               TION WITH HEIGHT.
 60    IF(IC.NE.4)B(K)=ALOG(D/A(K))
       IF(IC.EQ.4)WRITE(IPR  ,613)
       IF(IC.EQ.2)C(K)=ALOG(ALOG(E/A(K))/B(K))/ZC
       IF(IC.EQ.3)C(K)=ALOG(ALOG(E/A(K))/B(K))/ZINV
       IF(ZC.LT.HMAX.AND.K.EQ.1.AND.IC.EQ.2)GO TO 10
       IF(IC.EQ.2)HMAX=AMIN1(ZC,HMAX)
       ZALGO=HMAX
       IF(IC.LT.0)ZALGO=ZC
       WRITE(IPR  ,619)
       IF(IC.LT.0)K=1
C
       DO 70 I=1,9
       IF(IC.LT.0.AND.I.EQ.5)K=2
       IF(IC.LT.0.AND.I.EQ.5)ZALGO=HMAX-ZC
       Z(I)=ZALGO*(1.0-FAC2(10-I))
       IF(IC.EQ.1)Z(I)=ZALGO*FAC1(I)
       IF(IC.EQ.4)Z(I)=ZALGO*FLOAT(I-1)/8.0
       IF(IC.LT.0.AND.I.LT.5)Z(I)=ZALGO*(1.0-FAC2(11-2*I))
       IF(IC.LT.0.AND.I.GE.5)Z(I)=ZALGO*FAC1(2*I-9)
C      IF(IC.LT.0.AND.(I.EQ.7.OR.I.EQ.8))Z(I)=ZALGO*FAC1(2*I-10)
       IF(IC.NE.4)AHAZE(I)=A(K)*EXP(B(K)*EXP(C(K)*Z(I)))
       IF(IC.EQ.4)AHAZE(I)=D
       IF(IC.LE.0.AND.I.GE.5)Z(I)=Z(I)+ZC
       Z(I)=Z(I)/KMTOM
       RH(I)=6.953*ALOG(AHAZE(I))+86.407
       IF(AHAZE(I).GE.EE(1))RH(I)=100.0
       VISIB=3.912/(AHAZE(I)+0.012)
```

```
      IH(I)=IHAZE
C     IF A RADIATION FOG IS PRESENT (I.E. VIS<=2.0 KM AND IC=3),
C     IH IS SET TO 9 FOR ALL LEVELS.
      IF(VISIB.LE.2.0.AND.IC.EQ.3)IH(I)=9
C     FOR A DEPTH FOG/CLOUD CASE, IH=8 DENOTING AN ADVECTION FOG.
      IF(IC.EQ.1.OR.(IC.LT.0.AND.I.GE.5))IH(I)=8
      WRITE(IPR  ,620)Z(I),RH(I),AHAZE(I),VISIB,IH(I)
   70 CONTINUE
      HMAX=HMAX/KMTOM
      RETURN
C
599   FORMAT('0 VERTICAL STRUCTURE ALGORITHM (VSA) USED')
600   FORMAT(1H ,50X,26HCLOUD CEILING HEIGHT UNKNOWN)
601   FORMAT(1H ,50X,42HINVERSION OR BOUNDARY LAYER HEIGHT UNKNOWN,/,
     1  1H ,50X,39HVSA WILL USE A DEFAULT OF 2000.0 METERS,/)
605   FORMAT(1H ,50X,27HRADIATION FOG DEPTH UNKNOWN)
618   FORMAT(1H ,50X,39HVSA WILL USE A DEFAULT OF 1800.0 METERS,/)
619   FORMAT(5X,10HHEIGHT(KM),5X,7HR.H.(%),5X,16HEXTINCTION(KM-1),
     1    5X,15HVIS(3.912/EXTN),5X,5HIHAZE,/)
620   FORMAT(7X,F7.4,7X,F5.1,8X,E12.4,11X,F7.4,10X,I2)
602   FORMAT(1H ,39X,35HVSA WILL USE A CALCULATED VALUE OF ,F7.1,
     1        7H METERS,/)
603   FORMAT(1H ,50X,19HCLOUD DEPTH UNKNOWN)
604   FORMAT(1H ,50X,30HVSA WILL USE A DEFAULT OF 200.0 METERS,/)
610   FORMAT(1H ,50X,24HCLOUD CEILING HEIGHT IS ,F9.1,7H METERS,/)
611   FORMAT(1H ,50X,15HCLOUD DEPTH IS ,F14.1,7H METERS,/)
612   FORMAT(1H ,50X,38HINVERSION OR BOUNDARY LAYER HEIGHT IS ,F7.1,
     1 7H METERS,/)
614   FORMAT(1H ,50X,26HDEPTH OF RADIATION FOG IS ,F7.1,7H METERS,/)
613   FORMAT(1H ,50X,43HTHERE IS NO INVERSION OR BOUNDARY LAYER OR ,
     1 13HCLOUD PRESENT,/)
      END
```

```
      BLOCK DATA MDTA
C*    BLOCK DATA
C
C     MODEL ATMOSPHERE DATA
C
      COMMON /CNTRL/ KMAX,M,IKMAX,NL,ML,IKLO,ISSGEO
C     NL IS NUMBER OF LAYERS IN PROFILES 1 TO 6
C     LAYER 34 (AT 99999KM) IS NO LONGER USED
C
C     COMMON /MDATA/ Z(34),P(34,7),T(34,7),WH(34,7),WO(34,7),
C    X HMIX(34)
      COMMON/MDATA/ZZ(34),P1(34),P2(34),P3(34),P4(34),P5(34),P6(34),
     X  P7(34),T1(34),T2(34),T3(34),T4(34),T5(34),T6(34),T7(34),
     X WH1(34),WH2(34),WH3(34),WH4(34),WH5(34),WH6(34),WH7(34),
     X WO1(34),WO2(34),WO3(34),WO4(34),WO5(34),WO6(34),WO7(34),
     X HMIX(34)
C?    DATA NL /33/
      DATA ZZ/
     1    0.,     1.,     2.,     3.,     4.,     5.,     6.,     7.,     8.,
     2    9.,    10.,    11.,    12.,    13.,    14.,    15.,    16.,    17.,
     3   18.,    19.,    20.,    21.,    22.,    23.,    24.,    25.,    30.,
     4   35.,    40.,    45.,    50.,    70.,   100.,99999./
      DATA P1/
     1 1.013E+03, 9.040E+02, 8.050E+02, 7.150E+02, 6.330E+02, 5.590E+02,
     2 4.920E+02, 4.320E+02, 3.780E+02, 3.290E+02, 2.860E+02, 2.470E+02,
     3 2.130E+02, 1.820E+02, 1.560E+02, 1.320E+02, 1.110E+02, 9.370E+01,
     4 7.890E+01, 6.660E+01, 5.650E+01, 4.800E+01, 4.090E+01, 3.500E+01,
     5 3.000E+01, 2.570E+01, 1.220E+01, 6.000E+00, 3.050E+00, 1.590E+00,
     6 8.540E-01, 5.790E-02, 3.000E-04, 0.          /
      DATA P2,
     1 1.013E+03, 9.020E+02, 8.020E+02, 7.100E+02, 6.280E+02, 5.540E+02,
     2 4.870E+02, 4.260E+02, 3.720E+02, 3.240E+02, 2.810E+02, 2.430E+02,
     3 2.090E+02, 1.799E+02, 1.530E+02, 1.300E+02, 1.110E+02, 9.500E+01,
     4 8.120E+01, 6.950E+01, 5.950E+01, 5.100E+01, 4.370E+01, 3.760E+01,
     5 3.220E+01, 2.770E+01, 1.320E+01, 6.520E+00, 3.330E+00, 1.760E+00,
     6 9.510E-01, 6.710E-02, 3.000E-04, 0.          /
      DATA P3/
     1 1.018E+03, 8.973E+02, 7.897E+02, 6.938E+02, 6.081E+02, 5.313E+02,
     2 4.627E+02, 4.016E+02, 3.473E+02, 2.993E+02, 2.568E+02, 2.199E+02,
     3 1.882E+02, 1.611E+02, 1.378E+02, 1.178E+02, 1.007E+02, 8.610E+01,
     4 7.360E+01, 6.280E+01, 5.370E+01, 4.580E+01, 3.910E+01, 3.340E+01,
     5 2.860E+01, 2.440E+01, 1.110E+01, 5.180E+00, 2.530E+00, 1.290E+00,
     6 6.830E-01, 4.870E-02, 3.000E-04, 0.          /
      DATA P4/
     1 1.010E+03, 8.960E+02, 7.929E+02, 7.000E+02, 6.160E+02, 5.410E+02,
     2 4.740E+02, 4.130E+02, 3.590E+02, 3.108E+02, 2.677E+02, 2.300E+02,
     3 1.977E+02, 1.700E+02, 1.460E+02, 1.260E+02, 1.080E+02, 9.280E+01,
     4 7.980E+01, 6.860E+01, 5.900E+01, 5.070E+01, 4.360E+01, 3.750E+01,
     5 3.220E+01, 2.780E+01, 1.340E+01, 6.610E+00, 3.400E+00, 1.820E+00,
     6 9.370E-01, 7.070E-02, 3.000E-04, 0.          /
      DATA P5/
     1 1.013E+03, 8.878E+02, 7.775E+02, 6.798E+02, 5.932E+02, 5.158E+02,
     2 4.467E+02, 3.853E+02, 3.308E+02, 2.829E+02, 2.418E+02, 2.067E+02,
     3 1.766E+02, 1.510E+02, 1.291E+02, 1.103E+02, 9.431E+01, 8.058E+01,
     4 6.882E+01, 5.875E+01, 5.014E+01, 4.277E+01, 3.647E+01, 3.109E+01,
     5 2.649E+01, 2.256E+01, 1.020E+01, 4.701E+00, 2.243E+00, 1.113E+00,
     6 5.719E-01, 4.016E-02, 3.000E-04, 0.          /
      DATA P6/
     1 1.013E+03, 8.988E+02, 7.950E+02, 7.012E+02, 6.166E+02, 5.405E+02,
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2 4.722E+02, 4.111E+02, 3.585E+02, 3.080E+02, 2.650E+02, 2.270E+02,MDT
3 1.940E+02, 1.658E+02, 1.417E+02, 1.211E+02, 1.035E+02, 8.850E+01,MDT
4 7.565E+01, 6.467E+01, 5.529E+01, 4.729E+01, 4.047E+01, 3.467E+01,MDT
5 2.972E+01, 2.549E+01, 1.197E+01, 5.746E+00, 2.871E+00, 1.491E+00,MDT
6 7.978E-01, 5.520E-02, 3.008E-04, 0.         /                   MDT
 DATA P7 /34*0. /                                                  MDT
 DATA T1/                                                          MDT
1 2.997E+02, 2.937E+02, 2.877E+02, 2.837E+02, 2.770E+02, 2.703E+02,MDT
2 2.636E+02, 2.570E+02, 2.503E+02, 2.436E+02, 2.370E+02, 2.301E+02,MDT
3 2.236E+02, 2.170E+02, 2.103E+02, 2.037E+02, 1.970E+02, 1.948E+02,MDT
4 1.988E+02, 2.027E+02, 2.067E+02, 2.107E+02, 2.146E+02, 2.170E+02,MDT
5 2.192E+02, 2.214E+02, 2.323E+02, 2.431E+02, 2.540E+02, 2.648E+02,MDT
6 2.702E+02, 2.189E+02, 2.100E+02, 2.100E+02/                      MDT
 DATA T2/                                                          MDT
1 2.942E+02, 2.897E+02, 2.852E+02, 2.792E+02, 2.732E+02, 2.672E+02,MDT
2 2.612E+02, 2.547E+02, 2.482E+02, 2.417E+02, 2.353E+02, 2.288E+02,MDT
3 2.223E+02, 2.158E+02, 2.157E+02, 2.157E+02, 2.157E+02, 2.157E+02,MDT
4 2.168E+02, 2.179E+02, 2.192E+02, 2.204E+02, 2.216E+02, 2.228E+02,MDT
5 2.239E+02, 2.251E+02, 2.337E+02, 2.452E+02, 2.575E+02, 2.699E+02,MDT
6 2.757E+02, 2.181E+02, 2.100E+02, 2.100E+02/                      MDT
 DATA T3/                                                          MDT
1 2.722E+02, 2.687E+02, 2.652E+02, 2.617E+02, 2.557E+02, 2.497E+02,MDT
2 2.437E+02, 2.377E+02, 2.317E+02, 2.257E+02, 2.197E+02, 2.192E+02,MDT
3 2.187E+02, 2.182E+02, 2.177E+02, 2.172E+02, 2.167E+02, 2.162E+02,MDT
4 2.157E+02, 2.152E+02, 2.152E+02, 2.152E+02, 2.152E+02, 2.152E+02,MDT
5 2.152E+02, 2.152E+02, 2.174E+02, 2.279E+02, 2.432E+02, 2.585E+02,MDT
6 2.657E+02, 2.307E+02, 2.102E+02, 2.100E+02/                      MDT
 DATA T4/                                                          MDT
1 2.872E+02, 2.817E+02, 2.763E+02, 2.709E+02, 2.655E+02, 2.601E+02,MDT
2 2.531E+02, 2.461E+02, 2.392E+02, 2.322E+02, 2.252E+02, 2.252E+02,MDT
3 2.252E+02, 2.252E+02, 2.252E+02, 2.252E+02, 2.252E+02, 2.252E+02,MDT
4 2.252E+02, 2.252E+02, 2.252E+02, 2.252E+02, 2.252E+02, 2.252E+02,MDT
5 2.266E+02, 2.281E+02, 2.351E+02, 2.472E+02, 2.621E+02, 2.736E+02,MDT
6 2.772E+02, 2.186E+02, 2.100E+02, 2.100E+02/                      MDT
 DATA T5/                                                          MDT
1 2.572E+02, 2.591E+02, 2.559E+02, 2.527E+02, 2.477E+02, 2.409E+02,MDT
2 2.341E+02, 2.273E+02, 2.206E+02, 2.172E+02, 2.172E+02, 2.172E+02,MDT
3 2.172E+02, 2.172E+02, 2.172E+02, 2.172E+02, 2.166E+02, 2.160E+02,MDT
4 2.154E+02, 2.148E+02, 2.142E+02, 2.136E+02, 2.130E+02, 2.124E+02,MDT
5 2.118E+02, 2.112E+02, 2.160E+02, 2.223E+02, 2.347E+02, 2.470E+02,MDT
6 2.593E+02, 2.457E+02, 2.100E+02, 2.100E+02/                      MDT
 DATA T6/                                                          MDT
1 2.882E+02, 2.817E+02, 2.752E+02, 2.687E+02, 2.622E+02, 2.557E+02,MDT
2 2.492E+02, 2.427E+02, 2.362E+02, 2.297E+02, 2.233E+02, 2.168E+02,MDT
3 2.167E+02, 2.167E+02, 2.167E+02, 2.167E+02, 2.167E+02, 2.167E+02,MDT
4 2.167E+02, 2.167E+02, 2.167E+02, 2.176E+02, 2.186E+02, 2.198E+02,MDT
5 2.208E+02, 2.216E+02, 2.265E+02, 2.385E+02, 2.504E+02, 2.642E+02,MDT
6 2.707E+02, 2.197E+02, 2.100E+02, 2.100E+02/                      MDT
 DATA T7 /34*0. /                                                  MDT
 DATA WH1/                                                         MDT
1 1.900E+01, 1.300E+01, 9.300E+00, 4.700E+00, 2.200E+00, 1.500E+00,MDT
2 8.500E-01, 4.700E-01, 2.500E-01, 1.200E-01, 5.000E-02, 1.700E-02,MDT
3 6.000E-03, 1.800E-03, 1.000E-03, 7.600E-04, 6.400E-04, 5.600E-04,MDT
4 5.000E-04, 4.900E-04, 4.500E-04, 5.100E-04, 5.100E-04, 6.400E-04,MDT
5 6.000E-04, 6.700E-04, 3.600E-04, 1.100E-04, 4.300E-05, 1.900E-05,MDT
6 6.300E-08, 1.400E-07, 1.000E-09, 0.         /                   MDT
 DATA WH2/                                                         MDT
1 1.400E+01, 9.330E+00, 5.930E+00, 3.300E+00, 1.900E+00, 1.000E+00,MDT
2 6.100E-01, 3.700E-01, 2.100E-01, 1.200E-01, 6.400E-02, 2.200E-02,MDT
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3 6.000E-03, 1.800E-03, 1.000E-03, 7.600E-04, 6.400E-04, 5.600E-04,
4 5.000E-04, 4.900E-04, 4.500E-04, 5.100E-04, 5.100E-04, 5.400E-04,
5 6.000E-04, 6.700E-04, 3.600E-04, 1.100E-04, 4.300E-05, 1.900E-05,
6 6.300E-06, 1.400E-07, 1.000E-09, 0.          /
 DATA WH3/
1 3.500E+00, 2.500E+00, 1.800E+00, 1.200E+00, 6.600E-01, 3.800E-01,
2 2.100E-01, 8.500E-02, 3.500E-02, 1.600E-02, 7.500E-03, 6.900E-03,
3 6.000E-03, 1.800E-03, 1.000E-03, 7.600E-04, 6.400E-04, 5.600E-04,
4 5.000E-04, 4.900E-04, 4.500E-04, 5.100E-04, 5.100E-04, 5.400E-04,
5 6.000E-04, 6.700E-04, 3.600E-04, 1.100E-04, 4.300E-05, 1.900E-05,
6 6.300E-06, 1.400E-07, 1.000E-09, 0.          /
 DATA WH4/
1 9.100E+00, 6.000E+00, 4.200E+00, 2.700E+00, 1.700E+00, 1.000E+00,
2 5.400E-01, 2.900E-01, 1.300E-01, 4.200E-02, 1.500E-02, 9.400E-03,
3 6.000E-03, 1.800E-03, 1.000E-03, 7.600E-04, 6.400E-04, 5.600E-04,
4 5.000E-04, 4.900E-04, 4.500E-04, 5.100E-04, 5.100E-04, 5.400E-04,
5 6.000E-04, 6.700E-04, 3.600E-04, 1.100E-04, 4.300E-05, 1.900E-05,
6 6.300E-06, 1.400E-07, 1.000E-09, 0.          /
 DATA WH5/
1 1.200E+00, 1.200E+00, 9.400E-01, 6.800E-01, 4.100E-01, 2.000E-01,
2 9.800E-02, 5.400E-02, 1.100E-02, 8.400E-03, 5.500E-03, 3.800E-03,
3 2.600E-03, 1.800E-03, 1.000E-03, 7.600E-04, 6.400E-04, 5.600E-04,
4 5.000E-04, 4.900E-04, 4.500E-04, 5.100E-04, 5.100E-04, 5.400E-04,
5 6.000E-04, 6.700E-04, 3.600E-04, 1.100E-04, 4.300E-05, 1.900E-05,
6 6.300E-06, 1.400E-07, 1.000E-09, 0.          /
 DATA WH6/
1 5.900E+00, 4.200E+00, 2.900E+00, 1.800E+00, 1.100E+00, 6.400E-01,
2 3.800E-01, 2.100E-01, 1.200E-01, 4.600E-02, 1.800E-02, 8.200E-03,
3 3.700E-03, 1.800E-03, 8.400E-04, 7.200E-04, 6.100E-04, 5.200E-04,
4 4.400E-04, 4.400E-04, 4.400E-04, 4.800E-04, 5.200E-04, 5.700E-04,
5 6.100E-04, 6.600E-04, 3.800E-04, 1.600E-04, 6.700E-05, 3.200E-05,
6 1.200E-05, 1.500E-07, 1.000E-09, 0.          /
 DATA WH7 /34*0. /
 DATA WO1/
1 5.600E-05, 5.600E-05, 5.400E-05, 5.100E-05, 4.700E-05, 4.500E-05,
2 4.300E-05, 4.100E-05, 3.900E-05, 3.900E-05, 3.900E-05, 4.100E-05,
3 4.300E-05, 4.500E-05, 4.500E-05, 4.700E-05, 4.700E-05, 6.900E-05,
4 9.000E-05, 1.400E-04, 1.900E-04, 2.400E-04, 2.800E-04, 3.200E-04,
5 3.400E-04, 3.400E-04, 2.400E-04, 9.200E-05, 4.100E-05, 1.300E-05,
6 4.300E-06, 8.600E-08, 4.300E-11, 0.          /
 DATA WO2/
1 6.000E-05, 6.000E-05, 6.000E-05, 6.200E-05, 6.400E-05, 6.600E-05,
2 6.900E-05, 7.500E-05, 7.900E-05, 8.600E-05, 9.000E-05, 1.100E-04,
3 1.200E-04, 1.500E-04, 1.800E-04, 1.900E-04, 2.100E-04, 2.400E-04,
4 2.800E-04, 3.200E-04, 3.400E-04, 3.600E-04, 3.600E-04, 3.400E-04,
5 3.200E-04, 3.000E-04, 2.000E-04, 9.200E-05, 4.100E-05, 1.300E-05,
6 4.300E-06, 8.600E-08, 4.300E-11, 0.          /
 DATA WO3/
1 6.000E-05, 5.400E-05, 4.900E-05, 4.900E-05, 4.900E-05, 5.800E-05,
2 6.400E-05, 7.700E-05, 9.000E-05, 1.200E-04, 1.600E-04, 2.100E-04,
3 2.600E-04, 3.000E-04, 3.200E-04, 3.400E-04, 3.600E-04, 3.900E-04,
4 4.100E-04, 4.300E-04, 4.500E-04, 4.300E-04, 4.300E-04, 3.900E-04,
5 3.600E-04, 3.400E-04, 1.900E-04, 9.200E-05, 4.100E-05, 1.300E-05,
6 4.300E-06, 8.600E-08, 4.300E-11, 0.          /
 DATA WO4/
1 4.900E-05, 5.400E-05, 5.600E-05, 5.800E-05, 6.000E-05, 6.400E-05,
2 7.100E-05, 7.500E-05, 7.900E-05, 1.100E-04, 1.300E-04, 1.800E-04,
3 2.100E-04, 2.600E-04, 2.800E-04, 3.200E-04, 3.400E-04, 3.900E-04,
4 4.100E-04, 4.100E-04, 3.900E-04, 3.600E-04, 3.200E-04, 3.000E-04,
5 2.800E-04, 2.600E-04, 1.400E-04, 9.200E-05, 4.100E-05, 1.300E-05,
6 4.300E-06, 8.600E-08, 4.300E-11, 0.          /
 DATA WO5/
1 4.100E-05, 4.100E-05, 4.100E-05, 4.300E-05, 4.500E-05, 4.700E-05,
2 4.900E-05, 7.100E-05, 9.000E-05, 1.600E-04, 2.100E-04, 3.200E-04,
3 4.300E-04, 4.700E-04, 4.900E-04, 5.600E-04, 6.200E-04, 6.200E-04,
4 6.200E-04, 6.000E-04, 5.600E-04, 5.100E-04, 4.700E-04, 4.300E-04,
5 3.600E-04, 3.200E-04, 1.500E-04, 9.200E-05, 4.100E-05, 1.300E-05,
6 4.300E-06, 8.600E-08, 4.300E-11, 0.          /
 DATA WO6/
1 5.400E-05, 5.400E-05, 5.400E-05, 5.000E-05, 4.600E-05, 4.600E-05,
2 4.500E-05, 4.900E-05, 5.200E-05, 7.100E-05, 9.000E-05, 1.300E-04,
3 1.600E-04, 1.700E-04, 1.900E-04, 2.100E-04, 2.400E-04, 2.800E-04,
4 3.200E-04, 3.500E-04, 3.800E-04, 3.800E-04, 3.900E-04, 3.800E-04,
5 3.600E-04, 3.400E-04, 2.000E-04, 1.100E-04, 4.900E-05, 1.700E-05,
6 4.000E-06, 8.600E-08, 4.300E-11, 0.          /
 DATA WO7 /34*0. /
C     HMIX(I)=HNO3 VOLUME MIXING RATIOS TIMES E+9 FROM EVANS  PROFILE
 DATA HMIX /8*0.,1.0E-30,
&             0.1,0.33,0.8,1.2,1.4,1.6,1.8,1.9,2.0,2.1,2.3,3.0,3.
17,4.2,5.2,6.0,3.8,2.6,0.22,1.0E-30,5*0.0/
 END
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      BLOCK DATA TITLE
C*    BLOCK DATA
C     TITLE INFORMATION
      COMMON /TITL/ HHAZE(5,15),HSEASN(5,2),HVULCN(5,5),BLANK,VSB(9),
     X HMET(5,2),HMODEL(5,8),HTRRAD(6,4)
      DATA VSB /23.,5.,0.,23.,5.,50.,23.,0.2,0.5/
      DATA BLANK/4H    /
      DATA HHAZE /
     1 4HRURA,4HL   ,4H    ,4H    ,4H    ,
     2 4HRURA,4HL   ,4H    ,4H    ,4H    ,
     3 4HNAVY,4H MAR,4HITIM,4HE   ,4H    ,
     4 4HMARI,4HTIME,4H    ,4H    ,4H    ,
     5 4HURBA,4HN   ,4H    ,4H    ,4H    ,
     6 4HTROP,4HOSPH,4HERIC,4H    ,4H    ,
     7 4HUSER,4H DEF,4HINED,4H    ,4H    ,
     8 4HFOG1,4H (AD,4HVECT,4HTION,4H)   ,
     9 4HFOG2,4H(RAD,4HIATI,4HON) ,4H    ,
     A 4HBACK,4HGROU,4HND S,4HTRAT,4HO   ,
     B 4HAGED,4H VOL,4HCANI,4HC   ,4H    ,
     C 4HFRES,4HH VO,4HLCAN,4HIC  ,4H    ,
     D 4HAGED,4H VOL,4HCANI,4HC   ,4H    ,
     E 4HFRES,4HH VO,4HCANI,4HC   ,4H    ,
     F 4HMETE,4HORIC,4H DUS,4HT   ,4H    /
      DATA HSEASN /
     1 4HSPRI,4HNG-S,4HUMME,4HR   ,4H    ,
     2 4HFALL,4H-WIN,4HTER ,4H    ,4H    /
      DATA HVULCN /
     1 4HBACK,4HGROU,4HND S,4HTRAT,4HO   ,
     2 4HAGED,4H VOL,4HCANI,4HC-MO,4HDERA,
     3 4HFRES,4HH VO,4HLCAN 4HIC-H,4HIH  ,
     4 4HAGED,4H VOL,4HCANI,4HC-HI,4HGH  ,
     5 4HFRES,4HH VO,4HCANI,4HC-MO,4HDE (A/
      DATA HMET/
     1 4HNORM,4HAL  ,4H    ,4H    ,4H    ,
     2 4HTRAN,4HSITI,4HON  ,4H    ,4H    /
      DATA HMODEL /
     1 4HTROP,4HICAL,4H MOD,4HEL  ,4H    ,
     2 4HMIDL,4HATIT,4HUDE ,4HSUMM,4HER  ,
     3 4HMIDL,4HATIT,4HUDE ,4HWINT,4HER  ,
     4 4HSUBA,4HARTI,4HC   ,4HSUMM,4HER  ,
     5 4HSUBA,4HARTI,4HC   ,4HWINT,4HER  ,
     6 4H1962,4H U S,4H STA,4HNDAR,4HD   ,
     7 4H    ,4H    ,4H    ,4H    ,4H    ,
     8 4HMODE,4HL =0,4HHORI,4HZONT,4HAL  /
      DATA HTRRAD/
     1 4HTRAN,4HSMIT,4HTANC,4HE   ,4H    ,4H    ,
     2 4HRADI,4HANCE,4H    ,4H    ,4H    ,4H    ,
     3 4HRADI,4HANCE,4H+SOL,4HAR S,4HCATT,4HERNG,
     4 4HTRAN,4HSMIT,4HTED ,4HSOLA,4HR IR,4HRAD./
      END
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      BLOCK DATA PRFDTA
C*    BLOCK DATA
C
C        AEROSOL PROFILE DATA
C
CCC         0-2KM
CCC           HZ2K=5 VIS PROFILES- 50KM,23KM,10KM,5KM,2KM
CCC         >2-9KM
CCC           FAWI50=FALL/WINTER    50KM VIS
CCC           FAWI23=FALL/WINTER     23KM VIS
CCC           SPSU50=SPRING/SUMMER  50KM VIS
CCC           SPSU23=SPRING/SUMMER  23KM VIS
CCC         >9-30KM
CCC           BASTFW=BACKGROUND STRATOSPHERIC   FALL/WINTER
CCC           VUMOFW=MODERATE VOLCANIC          FALL/WINTER
CCC           HIVUFW=HIGH VOLCANIC              FALL/WINTER
CCC           EXVUFW=EXTREME VOLCANIC           FALL/WINTER
CCC           BASTSS,VUMOSS,HIVUSS,EXVUSS=      SPRING/SUMMER
CCC         >30-100KM
CCC           UPNATM=NORMAL UPPER ATMOSPHERIC
CCC           VUTONO=TRANSITION FROM VOLCANIC TO NORMAL
CCC           VUTOEX=TRANSITION FROM VOLCANIC TO EXTREME
CCC           EXUPAT=EXTREME UPPER ATMOSPHERIC
      COMMON/PRFD  /ZHT(34),HZ2K(34,5),FAWI50(34),FAWI23(34),SPSU50(34),
     1SPSU23(34),BASTFW(34),VUMOFW(34),HIVUFW(34),EXVUFW(34),BASTSS(34),
     2VUMOSS(34),HIVUSS(34),EXVUSS(34),UPNATM(34),VUTONO(34),
     3VUTOEX(34),EXUPAT(34)
      DATA ZHT/
     *    0.,    1.,    2.,    3.,    4.,    5.,    6.,    7.,    8.,
     *    9.,   10.,   11.,   12.,   13.,   14.,   15.,   16.,   17.,
     *   18.,   19.,   20.,   21.,   22.,   23.,   24.,   25.,   30.,
     *   35.,   40.,   45.,   50.,   70.,  100.,99999./
       DATA HZ2K(1,1),HZ2K(1,2),HZ2K(1,3),HZ2K(1,4),HZ2K(1,5)/
     1 6.62E-02, 1.58E-01, 3.79E-01, 7.70E-01, 1.94E+00/
       DATA HZ2K(2,1),HZ2K(2,2),HZ2K(2,3),HZ2K(2,4),HZ2K(2,5)/
     1 4.15E-02, 9.91E-02, 3.79E-01, 7.70E-01, 1.94E+00/
       DATA HZ2K(3,1),HZ2K(3,2),HZ2K(3,3),HZ2K(3,4),HZ2K(3,5)/
     1 2.60E-02, 6.21E-02, 6.21E-02, 6.21E-02, 6.21E-02/
      DATA FAWI50  /3*0.,
     1 1.14E-02, 6.43E-03, 4.85E-03, 3.54E-03, 2.31E-03, 1.41E-03,
     2 9.80E-04,24*0./
      DATA FAWI23              /3*0.,
     1 2.72E-02, 1.20E-02, 4.85E-03, 3.54E-03, 2.31E-03, 1.41E-03,
     2 9.80E-04, 24*0./
      DATA  SPSU50              / 3*0.,
     1 1.46E-02, 1.02E-02, 9.31E-03, 7.71E-03, 6.23E-03, 3.37E-03,
     2 1.82E-03  ,24*0./
      DATA  SPSU23              / 3*0.,
     1 3.46E-02, 1.85E-02, 9.31E-03, 7.71E-03, 6.23E-03, 3.37E-03,
     2 1.82E-03  ,24*0./
      DATA BASTFW       /10*0.,
     1 7.07E-04, 7.14E-04, 6.64E-04, 6.23E-04, 6.45E-04, 6.43E-04,
     2 6.41E-04, 6.00E-04, 5.62E-04, 4.91E-04, 4.23E-04, 3.52E-04,
     3 2.85E-04, 2.42E-04, 1.92E-04, 1.50E-04, 3.32E-05 ,7*0./
      DATA    VUMOFW        /10*0.,
     1 1.99E-03, 1.73E-03, 2.31E-03, 2.75E-03, 2.69E-03, 2.92E-03,
     2 2.73E-03, 2.46E-03, 2.10E-03, 1.71E-03, 1.35E-03, 1.00E-03,
     3 8.60E-04, 5.60E-04, 3.15E-04, 4.09E-04, 7.60E-05 ,7*0./
      DATA    HIVUFW        /10*0.,
```

```
1 1.71E-03, 2.31E-03, 3.25E-03, 4.52E-03, 6.40E-03, 7.81E-03,
2 9.42E-03, 1.07E-02, 1.10E-02, 8.60E-03, 5.10E-03, 2.70E-03,
3 1.46E-03, 8.90E-04, 5.80E-04, 4.09E-04, 7.60E-05 ,7*0./
 DATA     EXVUFW         /10*0.,
1 1.71E-03, 2.31E-03, 3.25E-03, 4.52E-03, 6.40E-03, 1.01E-02,
2 2.35E-02, 6.10E-02, 1.00E-01, 4.00E-02, 9.15E-03, 3.13E-03,
3 1.46E-03, 8.90E-04, 5.80E-04, 4.09E-04, 7.60E-05 ,7*0./
 DATA     BASTSS         /10*0.,
1 1.14E-03, 7.99E-04, 6.41E-04, 5.17E-04, 4.[illegible]2E-04, 3.95E-04,
2 3.82E-04, 4.25E-04, 5.20E-04, 5.81E-04, 5.89E-04, 5.02E-04,
3 4.20E-04, 3.00E-04, 1.98E-04, 1.31E-04, 3.32E-05 ,7*0./
 DATA     VUMOSS         /10*0.,
1 1.85E-03, 2.12E-03, 2.45E-03, 2.80E-03, 2.89E-03, 2.92E-03,
2 2.73E-03, 2.46E-03, 2.10E-03, 1.71E-03, 1.35E-03, 1.09E-03,
3 8.60E-04, 6.60E-04, 5.15E-04, 4.09E-04, 7.60E-05 ,7*0./
 DATA     HIVUSS         /10*0.,
1 1.85E-03, 2.12E-03, 2.45E-03, 2.80E-03, 3.60E-03, 5.23E-03,
2 8.11E-03, 1.20E-02, 1.52E-02, 1.53E-02, 1.17E-02, 7.09E-03,
3 4.50E-03, 2.40E-03, 1.28E-03, 7.76E-04, 7.60E-05 ,7*0./
 DATA     EXVUSS         /10*0.,
1 1.85E-03, 2.12E-03, 2.45E-03, 2.80E-03, 3.60E-03, 5.23E-03,
2 8.11E-03, 1.27E-02, 2.32E-02, 4.85E-02, 1.00E-01, 5.50E-02,
3 6.10E-03, 2.40E-03, 1.28E-03, 7.76E-04, 7.60E-05 ,7*0./
 DATA UPNATM         /26*0.,
1 3.32E-05, 1.64E-05, 7.99E-06, 4.01E-06, 2.10E-06, 1.60E-07,
2 9.31E-10, 0.       /
 DATA VUTONO         /26*0.,
1 7.60E-05, 2.45E-05, 7.99E-06, 4.01E-06, 2.10E-06, 1.60E-07,
2 9.31E-10, 0.       /
 DATA VUTOEX         /26*0.,
1 7.60E-05, 7.20E-05, 6.95E-05, 6.60E-05, 5.04E-05, 1.03E-05,
2 4.50E-07, 0.       /
 DATA EXUPAT         /26*0.,
1 3.32E-05, 4.25E-05, 5.59E-05, 6.60E-05, 5.04E-05, 1.03E-05,
2 4.50E-07, 0.       /
 END
```

```
      BLOCK DATA EXTDTA
C*    BLOCK DATA
CCC
CCC   ALTITUDE REGIONS FOR AEROSOL EXTINCTION COEFFICIENTS
CCC
CCC
CCC        0-2KM
CCC          RUREXT=RURAL EXTINCTION   RURABS=RURAL ABSORPTION
CCC          URBEXT=URBAN EXTINCTION   URBABS=URBAN ABSORPTION
CCC          OCNEXT=MARITIME EXTINCTION  OCNABS=MARITIME ABSORPTION
CCC          TROEXT=TROPSPHER EXTINCTION  TROABS=TROPOSPHER ABSORPTION
CCC          FG1EXT=FOG1 .2KM VIS EXTINCTION  FG1ABS=FOG1 ABSORPTION
CCC          FG2EXT=FOG2 .5KM VIS EXTINCTION  FG2ABS=FOG2 ABSORPTION
CCC        >2-9KM
CCC          TROEXT=TROPOSPHER EXTINCTION  TROABS=TROPOSPHER ABSORPTION
CCC        >9-30KM
CCC          BSTEXT=BACKGROUND STRATOSPHERIC EXTINCTION
CCC          BSTABS=BACKGROUND STRATOSPHERIC ABSORPTION
CCC          AVOEXT=AGED VOLCANIC EXTINCTION
CCC          AVOABS=AGED VOLCANIC ABSORPTION
CCC          FVOEXT=FRESH VOLCANIC EXTINCTION
CCC          FVOABS=FRESH VOLCANIC ABSORPTION
CCC        >30-100KM
CCC          DMEEXT=METEORIC DUST EXTINCTION
CCC          DMEABS=METEORIC DUST ABSORPTION
C
C     AEROSOL EXTINCTION AND ABSORPTION DATA
C
C     COMMON /EXTD  /VX2(40),RUREXT(40,4),RURABS(40,4),URBEXT(40,4),
C    1URBABS(40,4),OCNEXT(40,4),OCNABS(40,4),TROEXT(40,4),TROABS(40,4),
C    2FG1EXT(40),FG1ABS(40),FG2EXT(40),FG2ABS(40),
C    3   BSTEXT(40),BSTABS(40),AVOEXT(40),AVOABS(40),FVOEXT(40)
C    4),FVOABS(40),DMEEXT(40),DMEABS(40)
      COMMON /EXTD  / VX2(40),RURE1(40),RURE2(40),RURE3(40),RURE4(40),
     X RURA1(40),RURA2(40),RURA3(40),RURA4(40),
     X URBE1(40),URBE2(40),URBE3(40),URBE4(40),
     X URBA1(40),URBA2(40),URBA3(40),URBA4(40),
     X OCNE1(40),OCNE2(40),OCNE3(40),OCNE4(40),
     X OCNA1(40),OCNA2(40),OCNA3(40),OCNA4(40),
     X TROE1(40),TROE2(40),TROE3(40),TROE4(40),
     X TROA1(40),TROA2(40),TROA3(40),TROA4(40),
     2FG1EXT(40),FG1ABS(40),FG2EXT(40),FG2ABS(40),
     3   BSTEXT(40),BSTABS(40),AVOEXT(40),AVOABS(40),FVOEXT(40),
     4  FVOABS(40),DMEEXT(40),DMEABS(40)
      DATA VX2 /
     *    .2000,    .3000,    .3371,    .5500,    .6943,   1.0600,   1.5360,
     *   2.0000,   2.2500,   2.5000,   2.7000,   3.0000,   3.3923,   3.7500,
     *   4.5000,   5.0000,   5.5000,   6.0000,   6.2000,   6.5000,   7.2000,
     *   7.9000,   8.2000,   8.7000,   9.0000,   9.2000,  10.0000,  10.5910,
     *  11.0000,  11.5000,  12.5000,  14.8000,  15.0000,  16.4000,  17.2000,
     *  18.5000,  21.3000,  25.0000,  30.0000,  40.0000/
      DATA RURE1 /
     1 2.09201, 1.74582, 1.60500, 1.00000,  .75203,  .41943,  .24070,
     2  .14709,  .13304,  .12234,  .13247,  .11196,  .10437,  .09956,
     3  .09190,  .08449,  .07061,  .07025,  .07089,  .07196,  .07791,
     4  .04481,  .04339,  .12184,  .12650,  .12829,  .09152,  .08076,
     5  .07436,  .06030,  .06032,  .04949,  .05654,  .06000,  .06962,
     6  .05722,  .06051,  .05177,  .04589,  .04304/
      DATA RURE2 /
```

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1 2.09544, 1.74165, 1.59981, 1.00000,  .75316,  .42171,  .24323,   EXT
2  .15108,  .13608,  .12430,  .13222,  .13823,  .11076,  .10323,   EXT
3  .09475,  .08728,  .08076,  .07639,  .07797,  .07576,  .07943,   EXT
4  .04899,  .04525,  .12165,  .12741,  .12778,  .09032,  .07962,   EXT
5  .07380,  .06880,  .06329,  .05791,  .06646,  .06639,  .07443,   EXT
6  .06304,  .06443,  .05538,  .04867,  .04519/                     EXT
  DATA RURE3 /                                                     EXT
1 2.07082, 1.71456, 1.57962, 1.00000,  .76095,  .43228,  .25348,   EXT
2  .16456,  .14677,  .13234,  .13405,  .20316,  .12873,  .11506,   EXT
3  .10481,  .09709,  .08918,  .09380,  .09709,  .08791,  .08601,   EXT
4  .06247,  .05601,  .11905,  .12595,  .12348,  .08741,  .07703,   EXT
5  .07266,  .07044,  .07443,  .08146,  .08810,  .08563,  .08962,   EXT
6  .08051,  .07677,  .06658,  .05747,  .05184/                     EXT
  DATA RURE4 /                                                     EXT
1 1.66076, 1.47886, 1.40139, 1.00000,  .80652,  .50595,  .32259,   EXT
2  .23468,  .20772,  .18532,  .17348,  .35114,  .20006,  .17386,   EXT
3  .16139,  .15424,  .14557,  .16215,  .16786,  .14994,  .14032,   EXT
4  .12968,  .12601,  .13551,  .13582,  .13228,  .11070,  .09994,   EXT
5  .09873,  .10418,  .13241,  .15924,  .16139,  .15949,  .15778,   EXT
6  .15184,  .13848,  .12563,  .11076,  .09801/                     EXT
  DATA RURA1 /                                                     EXT
1  .67198,  .11937,  .08506,  .05930,  .05152,  .05816,  .05006,   EXT
2  .01968,  .02070,  .02101,  .05652,  .02785,  .01316,  .00867,   EXT
3  .01462,  .01310,  .01627,  .02013,  .02165,  .02367,  .03538,   EXT
4  .02823,  .03962,  .06778,  .07285,  .08120,  .04032,  .03177,   EXT
5  .02557,  .02342,  .02177,  .02627,  .03943,  .03114,  .03696,   EXT
6  .02956,  .03500,  .03241,  .03297,  .03380/                     EXT
  DATA RURA2 /                                                     EXT
1  .62968,  .10816,  .07671,  .05380,  .04684,  .05335,  .04614,   EXT
2  .01829,  .01899,  .01962,  .05525,  .06816,  .01552,  .00867,   EXT
3  .01542,  .01373,  .01327,  .02832,  .02829,  .02532,  .03487,   EXT
4  .02835,  .03854,  .06684,  .07272,  .08036,  .03987,  .03247,   EXT
5  .02816,  .02816,  .03101,  .03741,  .04829,  .04032,  .04399,   EXT
6  .03734,  .03956,  .03601,  .03525,  .03563/                     EXT
  DATA RURA3 /                                                     EXT
1  .51899,  .08278,  .05816,  .04092,  .03570,  .04158,  .03620,   EXT
2  .01513,  .01481,  .01633,  .05278,  .13890,  .02494,  .00888,   EXT
3  .01804,  .01882,  .01677,  .04816,  .04367,  .03013,  .03443,   EXT
4  .02930,  .01677,  .06209,  .06911,  .07475,  .03892,  .03494,   EXT
5  .03513,  .03958,  .05152,  .06241,  .06537,  .06203,  .06215,   EXT
3  .05614,  .05209,  .04608,  .04196,  .04095/                     EXT
  DATA RURA4 /                                                     EXT
1  .21943,  .02848,  .01943,  .01342,  .01171,  .01437,  .01323,   EXT
2  .01152,  .00696,  .01329,  .06108,  .24690,  .05323,   01430,   EXT
3  .03361,  .02949,  .02652,  .09437,  .08506,  .05548,  .04627,   EXT
4  .04380,  .04557,  .05380,  .05715,  .05899,  .04881,  .05253,   EXT
5  .08171,  .07437,  .10152,  .13019,  .12190,  .11734,  .11411,   EXT
6  .10766,  .09487,  .08430,  .07348,  .06861/                     EXT
  DATA URBE1 /                                                     EXT
1 1.98816, 1.63316, 1.51807, 1.00000,  .77785,  .47095,  .30006,   EXT
2  .21392,  .19405,  .17866,  .18127,  .18133,  .14765,  .14000,   EXT
3  .12715,  .11000,  .11234,  .10801,  .10500,  .10381,  .10342,   EXT
4  .08760,  .08652,  .11937,  .12139,  .12297,  .09797,  .09057,   EXT
5  .08595,  .08198,  .07563,  .06690,  .07209,  .06842,  .07177,   EXT
6  .06354,  .06177,  .05373,  .04728,  .04081/                     EXT
  DATA URBE2 /                                                     EXT
1 1.95502, 1.64994, 1.53070, 1.00000,  .77614,  .46639,  .29487,   EXT
2  .21051,  .18943,  .17205,  .17209,  .21418,  .15354,  .14081,   EXT
3  .13728,  .11681,  .11080,  .11329,  .11323,  .10563,  .10247,   EXT
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4 .08696,  .06361,  .12013,  .12418,  .12304,  .09614,  .08842,
5 .08487,  08285,   .08361,  .08430,  .08880,  .08449,  .08601,
6 .07825,  .07323,  .06367,  .05500,  .04747/
 DATA URBE3 /
1 1.96430, 1.64032, 1.52392, 1.00000, .77709,  .46253,  .28690,
2 .20310,  .17981,  .16101,  .15614,  .26475,  .15456,  .13563,
3 .12215,  .11361,  .10500,  .11715,  .11753,  .10392,  .09766,
4 .08443,  .08057,  .10943,  .11342,  .11063,  .08703,  .08025,
5 .07888,  .08032,  .09101,  .10070,  .10386,  .09943,  .09886,
6 .09152,  .08247,  .07152,  .06089,  .05253/
 DATA URBE4 /
1 1.41266, 1.33816, 1.29114, 1.00000, .83646,  .55025,  .35342,
2 .25285,  .21576,  .18310,  .16215,  .37854,  .20494,  .16665,
3 .14778,  .13892,  .12943,  .15525,  .15709,  .13513,  .12481,
4 .11759,  .11494,  .11487,  .11329,  .11108,  .09911,  .09209,
5 .00342,  .10120,  .13177,  .15696,  .15766,  .15513,  .15203,
6 .14532,  .13038,  .11785,  .10411,  .09101/
 DATA URBA1 /
1 .78407,  .58975,  .54285,  .36184,  .29222,  .20886,  .15658,
2 .12329,  .11462,  .10747,  .11797,  .10025,  .08759,  .08184,
3 .07506,  .07006,  .06741,  .06601,  .06544,  .06449,  .06665,
4 .06278,  .06949,  .07316,  .07462,  .08101,  .05753,  .05272,
5 .04899,  .04734,  .04494,  .04443,  .05133,  .04348,  .04443,
6 .03994,  .03981,  .03633,  .03468,  .03146/
 DATA URBA2 /
1 .69032,  .49367,  .45165,  .29741,  .24070,  .17399,  .13146,
2 .10354,  .09589,  .09025,  .10411,  .15101,  .07880,  .06949,
3 .06570,  .06095,  .05829,  .07171,  .06797,  .05975,  .06013,
4 .05589,  .06051,  .07139,  .07494,  .07956,  .05525,  .05184,
5 .05089,  .05291,  .05866,  .06380,  .06880,  .06127,  .06019,
6 .05525,  .05070,  .04500,  .04076,  .03741/
 DATA URBA3 /
1 .54848,  .37101,  .33734,  .21949,  .17785,  .12968,  .09654,
2 .07804,  .07165,  .06791,  .08563,  .19639,  .06722,  .05316,
3 .05316,  .04886,  .04620,  .07570,  .06899,  .05291,  .05101,
4 .04734,  .05025,  .00171,  .06570,  .06854,  .04892,  .04797,
5 .05057,  .05655,  .07127,  .08095,  .08411,  .07728,  .07475,
6 .06886,  .060.9,  .05222,  .04538,  .04171/
 DATA URBA4 /
1 .15975,  .10000,  .09013,  .05785,  .04671,  .03424,  .02633,
2 .02525,  .01975,  .02354,  .06241,  .26690,  .05810,  .02285,
3 .03810,  .03386,  .03044,  .09627,  .08557,  .05405,  .04576,
4 .04392,  .04424,  .04671,  .04791,  .04861,  .04684,  .05177,
5 .06158,  .07475,  .10342,  .12146,  .12177,  .11734,  .11335,
6 .10608,  .09 1,   .08063,  .06969,  .06475/
 DATA OCNE1 /
1 1.4.578, 1.32614, 1.26171, 1.00000, .88133,  .70207,  .58487,
2 .46008,  .42044,  .38310,  .35076,  .42268,  .32278,  .28810,
3 .24905,  .21184,  .16734,  .14791,  .21032,  .15076,  .12067,
4 .10038,  .10703,  .15070,  .15665,  .14639,  .10228,  .08367,
5 .07373,  .06829,  .08044,  .04573,  .04962,  .06158,  .07703,
6 .07234,  .06297,  .05431,  .05329,  .03741/
 DATA OCNE2 /
1 1.38924, 1.25443, 1.20835, 1.00000, .91367,  .77086,  .64997,
2 .64886,  .50247,  .45038,  .38209,  .50589,  .43766,  .38076,
3 .31658,  .27478,  .22215,  .21019,  .27570,  .21057,  .16948,
4 .14209,  .14215,  .16956,  .17082,  .16025,  .11665,  .09759,
5 .09215,  .09373,  .10532,  .12070,  .13000,  .13633,  .14291,
6 .13506,  .11476,  .09658,  .08291,  .10348/
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      DATA OCNE3 /
     1 1.22259, 1.14627, 1.11842, 1.00000,  .94766,  .87538,  .80418,
     2  .72930,  .68582,  .62165,  .49962,  .67949,  .66468,  .59253,
     3  .49551,  .44671,  .37886,  .35924,  .43367,  .37019,  .30842,
     4  .26437,  .25228,  .24905,  .23975,  .22766,  .17804,  .15316,
     5  .15373,  .16791,  .22361,  .28348,  .28677,  .29082,  .29038,
     6  .27810,  .23867,  .20209,  .16430,  .14943/
      DATA OCNE4 /
     1 1.09133, 1.06601, 1.05620, 1.00000,  .97506,  .94791,  .94203,
     2  .93671,  .92867,  .90411,  .80253,  .89222,  .94462,  .92146,
     3  .85797,  .82595,  .76747,  .88646,  .78209,  .75266,  .68658,
     4  .62722,  .60228,  .56335,  .53728,  .51861,  .43449,  .37196,
     5  .35899,  .37316,  .46854,  .58234,  .58690,  .60348,  .60563,
     6  .60000,  .55392,  .50367,  .43576,  .35949/
      DATA OCNA1 /
     1  .30987,  .04354,  .02880,  .01797,  .01468,  .01766,  .01582,
     2  .00816,  .01146,  .01677,  .03310,  .03380,  .00715,  .00443,
     3  .00500,  .00601,  .00753,  .01595,  .02943,  .00994,  .01367,
     4  .01671,  .02538,  .03481,  .03405,  .03601,  .01608,  .01310,
     5  .01152,  .01082,  .01070,  .01563,  .02063,  .03171,  .03810,
     6  .03741,  .03804,  .03759,  .04209,  .07892/
      DATA OCNA2 /
     1  .23367,  .03127,  .02070,  .01297,  .01063,  .01285,  .01190,
     2  .00937,  .00911,  .01576,  .05576,  .23487,  .03949,  .00905,
     3  .02057,  .01816,  .01665,  .08025,  .08044,  .03677,  .03139,
     4  .03190,  .03766,  .04532,  .04544,  .04715,  .03405,  .03614,
     5  .04329,  .05424,  .07823,  .09728,  .10057,  .10247,  .10222,
     6  .09551,  .08241,  .07158,  .06506,  .09203/
      DATA OCNA3 /
     1  .13025,  .01557,  .01013,  .00646,  .00532,  .00665,  .00722,
     2  .01335,  .00728,  .01810,  .09835,  .37329,  .09703,  .01968,
     3  .05114,  .04342,  .03709,  .17456,  .16468,  .08785,  .06880,
     4  .06589,  .06791,  .07247,  .07329,  .07449,  .07025,  .07962,
     5  .09899,  .12481,  .17867,  .32019,  .22228,  .22051,  .21595,
     6  .20335,  .17278,  .14677,  .12171,  .12430/
      DATA OCNA4 /
     1  .03506,  .00323,  .00215,  .00139,  .00114,  .00171,  .00532,
     2  .03082,  .01101,  .03741,  .20101,  .47608,  .21165,  .05234,
     3  .12886,  .11215,  .09684,  .33810,  .31778,  .20513,  .16658,
     4  .15956,  .15842,  .15905,  .15968,  .16051,  .16506,  .18323,
     5  .21709,  .25652,  .33222,  .39639,  .39854,  .40297,  .40025,
     6  .39025,  .35468,  .32006,  .27715,  .25348/
      DATA TROE1 /
     1 2.21222, 1.82753, 1.67032, 1.00000,  .72424,  .35272,  .15234,
     2  .05165,  .03801,  .02994,  .04671,  .02462,  .01538,  .01146,
     3  .01032,  .00816,  .00861,  .00994,  .01057,  .01139,  .01747,
     4  .01494,  .02418,  .03165,  .03386,  .04247,  .01601,  .01215,
     5  .00937,  .00861,  .00823,  .01139,  .01924,  .01234,  .01348,
     6  .01114,  .01297,  .01266,  .01418,  .01487/
      DATA TROE2 /
     1 2.21519, 1.82260, 1.66557, 1.00000,  .72525,  .35481,  .15449,
     2  .05475,  .04044,  .03082,  .04620,  .05272,  .01867,  .01266,
     3  .01127,  .00886,  .00886,  .01449,  .01399,  .01228,  .01728,
     4  .01475,  .02285,  .03215,  .03494,  .04285,  .01652,  .01304,
     5  .01101,  .01120,  .01297,  .01753,  .02468,  .01741,  .01766,
     6  .01513,  .01557,  .01456,  .01532,  .01582/
      DATA TROE3 /
     1 2.19082, 1.79462, 1.64456, 1.00000,  .73297,  .36443,  .16278,
     2  .06468,  .04850,  .03399,  .04538,  .11692,  .02835,  .01046,
```

```
3  .01386,  .01076,  .00968,  .02551,  .02222,  .01468,  .01690,   EXT 1280
4  .01437,  .01994,  .03127,  .03513,  .04076,  .01722,  .01513,   EXT 1285
5  .01519,  .01791,  .02538,  .03272,  .03816,  .03038,  .02886,   EXT 1290
6 '.02551,  .02228,  .91937,  .01804,  .01791/                     EXT 1295
 DATA TROE4 /                                                       EXT 1300
1 1.75696, 1.54829, 1.45962, 1.00000,  .77816,  .43139,  .21778,   EXT 1305
2  .11329,  .08101,  .05506,  .04943,  .25291,  .06816,  .03703,   EXT 1310
3  .02601,  .01968,  .01468,  .04962,  .04247,  .02234,  .01797,   EXT 1315
4  .01532,  .01633,  .02259,  .02487,  .02595,  .01728,  .01892,   EXT 1320
5  .02399,  .03247,  .05285,  .06462,  .06608,  .05930,  .05525,   EXT 1325
6  .04861,  .03753,  .02968,  .02348,  .02165/                     EXT 1330
 DATA TROA1 /                                                       EXT 1335
1  .69671,  .09905,  .06563,  .04101,  .03354,  .03627,  .02810,   EXT 1340
2  .00873,  .00918,  .00930,  .03215,  .01285,  .00513,  .00316,   EXT 1345
3  .00557,  .00494,  .00646,  .00867,  .00937,  .01025,  .01646,   EXT 1350
4  .01481,  .02418,  .02886,  .03070,  .04032,  .01494,  .01139,   EXT 1355
5  .00873,  .00816,  .00797,  .01133,  .01911,  .01215,  .01329,   EXT 1360
6  .01101,  .01291,  .01266,  .01418,  .01487/                     EXT 1365
 DATA TROA2 /                                                       EXT 1370
1  .65000,  .08791,  .05816,  .03652,  .02994,  .03278,  .02557,   EXT 1375
2  .00810,  .00842,  .00867,  .03139,  .03949,  .00646,  .00316,   EXT 1380
3  .00595,  .00519,  .00646,  .01304,  .01247,  .01095,  .01620,   EXT 1385
4  .01449,  .02278,  .02930,  .03184,  .04063,  .01544,  .01234,   EXT 1390
5  .01044,  .01076,  .01272,  .01741,  .02462,  .01722,  .01747,   EXT 1395
6  .01506,  .01551,  .01456,  .01532,  .01582/                     EXT 1400
 DATA TROA3 /                                                       EXT 1405
1  .52804,  .06367,  .04158,  .02633,  .02184,  .02443,  .01937,   EXT 1410
2  .00658,  .00646,  .00709,  .02949,  .10013,  .00968,  .00310,   EXT 1415
3  .00677,  .00582,  .00646,  .02361,  .01994,  .01266,  .01544,   EXT 1420
4  .01386,  .01968,  .02848,  .03203,  .03854,  .01620,  .01449,   EXT 1425
5  .01462,  .01747,  .02513,  .03253,  .03797,  .03019,  .02861,   EXT 1430
6  .02538,  .02215,  .01930,  .01797,  .01791/                     EXT 1435
 DATA TROA4 /                                                       EXT 1440
1  .19829,  .01842,  .01215,  .00791,  .00665,  .00778,  .00652,   EXT 1445
2  .00361,  .00253,  .00399,  .02570,  .20690,  .01715,  .00318,   EXT 1450
3  .00873,  .00728,  .00658,  .04481,  .03525,  .01646,  .01405,   EXT 1455
4  .01310,  .01468,  .01956,  .02184,  .02387,  .01608,  .01816,   EXT 1460
5  .02342,  .03203,  .05234,  .06399,  .06538,  .05867,  .05456,   EXT 1465
6  .04810,  .03715,  .02949,  .02335,  .02158/                     EXT 1470
 DATA FO1EXT /                                                      EXT 1475
1  .98519,  .99158,  .99089, 1.00000, 1.00576, 1.01747, 1.03177,   EXT 1480
2 1.04146, 1.04696, 1.05323, 1.05886, 1.04899, 1.06823, 1.07604,   EXT 1485
3 1.09272, 1.10367, 1.11684, 1.10430, 1.11387, 1.12899, 1.14987,   EXT 1490
4 1.17209, 1.18378, 1.20133, 1.21266, 1.21949, 1.22677, 1.15589,   EXT 1495
5 1.05684,  .98291, 1.01120, 1.10911, 1.11462, 1.14871, 1.16247,   EXT 1500
6 1.18544, 1.21582, 1.24614, 1.26842, 1.20500/                     EXT 1505
 DATA FO1ABS /                                                      EXT 1510
1  .00013, 0.00000, 0.00000, 0.00000, 0.00000,  .00095,  .01513,   EXT 1515
2  .10861,  .03892,  .13272,  .47133,  .49696,  .45785,  .17918,   EXT 1520
3  .37373,  .34601,  .31867,  .55190,  .55025,  .49987,  .46342,   EXT 1525
4  .45943,  .45918,  .46089,  .46241,  .46388,  .47193,  .40905,   EXT 1530
5  .51468,  .53101,  .55266,  .58665,  .58899,  .60367,  .61158,   EXT 1535
6  .62335,  .64120,  .65627,  .66278,  .66392/                     EXT 1540
 DATA FO2EXT /                                                      EXT 1545
1  .94791,  .96215,  .97063, 1.00000, 1.00937, 1.05177, 1.12519,   EXT 1550
2 1.29570, 1.39203, 1.41120, 1.04715, 1.10816, 1.43285, 1.45272,   EXT 1555
3 1.18709, 1.04307,  .82354,  .71747,  .92405,  .79342,  .60286,   EXT 1560
4  .47677,  .43171,  .30734,  .33259,  .31184,  .24:38,  .21601,   EXT 1565
5  .24006,  .28818,  .42671,  .58861,  .57206,  .58089,  .57185,   EXT 1570
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6 .54247, .43981, .34475, .24905, .19291/
 DATA FG2ABS /
1 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, .00013, .00247,
2 .01987, .00620, .02323, .17209, .57930, .19810, .03475,
3 .09639, .08000, .06582, .34589, .32703, .17025, .12633,
4 .11816, .11627, .11519, .11538, .11601, .12329, .14468,
5 .18633, .24057, .35411, .44886, .45095, .45215, .44278,
6 .41778, .34430, .27823, .21063, .17867/
 DATA BSTEXT /
1 1.48671, 1.55462, 1.51506, 1.00000, .70633, .28867, .09994,
2 .04184, .02728, .01848, .01335, .06513, .08930, .66532,
3 .04766, .04278, .05810, .05367, .04392, .03342, .04456,
4 .11867, .14709, .12734, .09291, .08778, .05019, .04070,
5 .05734, .03576, .01975, .01892, .01956, .03665, .04152,
6 .01715, .01620, .00835, .00633, .00589/
 DATA BSTABS /
1 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, .00019,
2 .00127, .00158, .00291, .00405, .05880, .08297, .06019,
3 .04519, .04133, .05703, .05266, .04304, .03285, .04437,
4 .11816, .14633, .12639, .09215, .08722, .04968, .04044,
5 .05709, .03551, .01962, .01892, .01949, .03665, .04146,
3 .01709, .01620, .00835, .00633, .00589/
 DATA AVOEXT /
1 1.14880, 1.19171, 1.18013, 1.00000, .84873, .53019, .27968,
2 .14551, .11070, .08633, .07184, .06076, .04506, .03399,
3 .02095, .01538, .01266, .01019, .00994, .01044, .01361,
4 .01791, .02278, .02918, .03108, .03234, .03456, .03184,
5 .02772, .02475, .01715, .01563, .01665, .01646, .01734,
6 .01772, .01076, .01051, .01133, .01329/
 DATA AVOABS /
1 .44816, .11259, .08500, .05272, .04082, .02449, .01487,
2 .01019, .00867, .00842, .00842, .00949, .00741, .00487,
3 .00316, .00335, .00399, .00449, .00525, .00665, .01114,
4 .01652, .02177, .02437, .02506, .02658, .03006, .02861,
5 .02513, .02285, .01620, .01532, .01633, .01620, .01709,
6 .01741, .01057, .01038, .01127, .01329/
 DATA FVOEXT /
1 .88715, .92532, .94013, 1.00000, 1.03013, 1.05975, 1.01171,
2 .88677, .82538, .76361, .71563, .67424, .60589, .55057,
3 .45222, .37646, .32316, .25519, .22728, .20525, .17810,
4 .14481, .14152, .37639, .44551, .44405, .42222, .36462,
5 .32551, .27519, .16728, .10627, .10861, .10886, .11665,
6 .13127, .10108, .08557, .06411, .05741/
 DATA FVOABS /
1 .41582, .22892, .19108, .14468, .12475, .09158, .06601,
2 .04943, .04367, .04342, .04399, .05076, .04133, .02629,
3 .01924, .01981, .02297, .02475, .02778, .03411, .05335,
4 .07133, .08816, .15342, .18506, .19384, .20791, .18449,
5 .16101, .13759, .00466, .06886, .07278, .07367, .07958,
6 .08785, .06032, .05747, .05133, .05323/
 DATA DMEEXT /
1 1.05019, 1.05880, 1.05259, 1.00000, .94949, .81456, .66051,
2 .54360, .49133, .44677, .41671, .39083, .34779, .32804,
3 .29722, .27506, .25082, .22620, .21652, .20253, .17266,
4 .14905, .14234, .14082, .15057, .16399, .23608, .24481,
5 .27791, .25076, .15272, .09601, .09456, .14676, .12373,
6 .18348, .12190, .12924, .08538, .04108/
 DATA DMEABS /
1 .00063, .00152, .00184, .00506, .00791, .01629, .03728,
2 .06158, .07538, .08943, .10051, .11614, .13310, .14348,
3 .14633, .13728, .12462, .11184, .10709, .10078, .09008,
4 .08734, .09000, .10304, .11605, .13437, .19551, .20095,
5 .22494, .18418, .09285, .06605, .06823, .12329, .10551,
6 .16184, .09635, .10582, .08769, .03247/
 END
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      BLOCK DATA SF296
C*    BLOCK DATA
C
C     WATER VAPOR CONTINUUM - SELF BROADENED ABSORPTION COEFFICIENTS 296
C
C     COMMON /SH2O/ V1,V2,DV,NPT,S296(2001)
      COMMON /SH2O/ V1,V2,DV,NPT,S0001(50),S0051(50),S0101(50),S0151(50)
     1,S0201(50),S0251(50),S0301(50),S0351(50),S0401(50),S0451(50)
     2,S0501(50),S0551(50),S0601(50),S0651(50),S0701(50),S0751(50)
     3,S0801(50),S0851(50),S0901(50),S0951(50)
     4,S1001(50),S1051(50),S1101(50),S1151(50),S1201(50),S1251(50)
     5,S1301(50),S1351(50),S1401(50),S1451(50)
     6,S1501(50),S1551(50),S1601(50),S1651(50),S1701(50),S1751(50)
     7,S1801(50),S1851(50),S1901(50),S1951(50),S2001(1)
C
      DIMENSION S296(2001)
      EQUIVALENCE(S296(1),S0001(1))
C
       DATA V1,V2,DV,NPT /
     1        0.0,     20000.0,        10.0,  2001/
C
C
      DATA S0001/
     C 1.0162E-21, 1.0573E-21, 1.1109E-21, 1.2574E-21, 1.3499E-21,
     C 1.4327E-21, 1.5065E-21, 1.5164E-21, 1.5022E-21, 1.3677E-21,
     C 1.3115E-21, 1.2253E-21, 1.1271E-21, 1.0070E-21, 8.7495E-22,
     C 8.0118E-22, 6.9940E-22, 6.2034E-22, 5.6051E-22, 4.7663E-22,
     C 4.2450E-22, 3.6690E-22, 3.3441E-22, 3.0711E-22, 2.5205E-22,
     C 2.2113E-22, 1.8880E-22, 1.6653E-22, 1.4626E-22, 1.2065E-22,
     C 1.0709E-22, 9.1783E-23, 7.7274E-23, 6.7302E-23, 5.6164E-23,
     C 4.9089E-23, 4.1497E-23, 3.5823E-23, 3.1124E-23, 2.6414E-23,
     C 2.3107E-23, 2.0156E-23, 1.7829E-23, 1.5666E-23, 1.3928E-23,
     C 1.2338E-23, 1.0932E-23, 9.7939E-24, 8.8241E-24, 7.9173E-24/
      DATA S0051/
     C 7.1296E-24, 6.4179E-24, 5.8031E-24, 5.2647E-24, 4.7762E-24,
     C 4.3349E-24, 3.9355E-24, 3.5887E-24, 3.2723E-24, 2.9919E-24,
     C 2.7363E-24, 2.5013E-24, 2.2876E-24, 2.0924E-24, 1.9193E-24,
     C 1.7618E-24, 1.6188E-24, 1.4891E-24, 1.3717E-24, 1.2647E-24,
     C 1.1671E-24, 1.0786E-24, 9.9785E-25, 9.2350E-25, 8.5539E-25,
     C 7.9377E-25, 7.3701E-25, 6.8677E-25, 6.3993E-25, 5.9705E-25,
     C 5.5788E-25, 5.2196E-25, 4.8899E-25, 4.5865E-25, 4.3079E-25,
     C 4.0526E-25, 3.8182E-25, 3.6025E-25, 3.4038E-25, 3.2203E-25,
     C 3.0511E-25, 2.8949E-25, 2.7505E-25, 2.6170E-25, 2.4933E-25,
     C 2.3786E-20, 2.2722E-25, 2.1736E-25, 2.0819E-25, 1.9968E-25/
      DATA S0101/
     C 1.9178E-25, 1.8442E-25, 1.7760E-25, 1.7127E-25, 1.6541E-25,
     C 1.5997E-25, 1.5495E-25, 1.5034E-25, 1.4614E-25, 1.4230E-25,
     C 1.3883E-25, 1.3578E-25, 1.3304E-25, 1.3069E-25, 1.2876E-25,
     C 1.2733E-25, 1.2626E-25, 1.2558E-25, 1.2544E-25, 1.2604E-25,
     C 1.2719E-25, 1.2883E-25, 1.3164E-25, 1.3581E-25, 1.4187E-25,
     C 1.4866E-25, 1.5669E-25, 1.6717E-25, 1.8148E-25, 2.0268E-25,
     C 2.2456E-25, 2.5502E-25, 2.9183E-25, 3.3612E-25, 3.9996E-25,
     C 4.6929E-25, 5.5055E-25, 6.5897E-25, 7.5360E-25, 8.7213E-25,
     C 1.0046E-24, 1.1496E-24, 1.2943E-24, 1.5049E-24, 1.6973E-24,
     C 1.8711E-24, 2.0286E-24, 2.2823E-24, 2.6780E-24, 2.8766E-24/
      DATA S0151/
     C 3.1164E-24, 3.3540E-24, 3.6884E-24, 3.9159E-24, 3.8712E-24,
     C 3.7433E-24, 3.4503E-24, 3.1003E-24, 2.8027E-24, 2.5253E-24,
     C 2.3408E-24, 2.2036E-24, 2.4442E-24, 2.7521E-24, 2.9048E-24,
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C 3.0489E-24, 3.2646E-24, 3.3880E-24, 3.3492E-24, 3.0987E-24,        BSF  395
C 2.9482E-24, 2.8711E-24, 2.6068E-24, 2.2683E-24, 1.9996E-24,        BSF  400
C 1.7788E-24, 1.6101E-24, 1.3911E-24, 1.2013E-24, 1.0544E-24,        BSF  405
C 9.4224E-25, 8.1256E-25, 7.3667E-25, 6.2233E-25, 5.5906E-25,        BSF  410
C 5.1619E-25, 4.5140E-25, 4.0273E-25, 3.3268E-25, 3.0258E-25,        BSF  415
C 2.6440E-25, 2.3102E-25, 2.0749E-25, 1.8258E-25, 1.6459E-25,        BSF  420
C 1.4097E-25, 1.2052E-25, 1.0759E-25, 9.1400E-26, 8.1432E-26/        BSF  425
 DATA S0201/                                                         BSF  430
C 7.1460E-26, 6.4006E-26, 5.6995E-26, 4.9372E-26, 4.4455E-26,        BSF  435
C 3.9033E-26, 3.4740E-26, 3.1269E-26, 2.8059E-26, 2.5558E-26,        BSF  440
C 2.2919E-26, 2.0846E-26, 1.8983E-26, 1.7329E-26, 1.5929E-26,        BSF  445
C 1.4631E-26, 1.3513E-26, 1.2461E-26, 1.1519E-26, 1.0682E-26,        BSF  450
C 9.9256E-27, 9.2505E-27, 8.6367E-27, 8.0857E-27, 7.5674E-27,        BSF  455
C 7.0904E-27, 6.6580E-27, 6.2580E-27, 5.8853E-27, 5.5333E-27,        BSF  460
C 5.2143E-27, 4.9169E-27, 4.6431E-27, 4.3898E-27, 4.1564E-27,        BSF  465
C 3.9405E-27, 3.7403E-27, 3.5544E-27, 3.3819E-27, 3.2212E-27,        BSF  470
C 3.0714E-27, 2.9313E-27, 2.8003E-27, 2.6777E-27, 2.5628E-27,        BSF  475
C 2.4551E-27, 2.3540E-27, 2.2591E-27, 2.1701E-27, 2.0866E-27/        BSF  480
 DATA S0251/                                                         BSF  485
C 2.0082E-27, 1.9349E-27, 1.8665E-27, 1.8027E-27, 1.7439E-27,        BSF  490
C 1.6894E-27, 1.6400E-27, 1.5953E-27, 1.5557E-27, 1.5195E-27,        BSF  495
C 1.4808E-27, 1.4603E-27, 1.4337E-27, 1.4093E-27, 1.3828E-27,        BSF  500
C 1.3569E-27, 1.3270E-27, 1.2984E-27, 1.2714E-27, 1.2541E-27,        BSF  505
C 1.2399E=27, 1.2102E-27, 1.1878E-27, 1.1728E-27, 1.1644E-27,        BSF  510
C 1.1491E-27, 1.1305E-27, 1.1235E-27, 1.1228E-27, 1.1224E-27,        BSF  515
C 1.1191E-27, 1.1151E-27, 1.1098E-27, 1.1068E-27, 1.1109E-27,        BSF  520
C 1.1213E-27, 1.1431E-27, 1.1826E-27, 1.2322E-27, 1.3025E-27,        BSF  525
C 1.4066E-27, 1.5657E-27, 1.7214E-27, 1.9449E-27, 2.2662E-27,        BSF  530
C 2.6953E-27, 3.1723E-27, 3.7028E-27, 4.4482E-27, 5.3852E-27/        BSF  535
 DATA S0301/                                                         BSF  540
C 6.2639E-27, 7.2175E-27, 7.7626E-27, 8.7248E-27, 9.6759E-27,        BSF  545
C 1.0102E-26, 1.0620E-26, 1.1201E-26, 1.2107E-26, 1.2998E-26,        BSF  550
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C 1.0120E-26, 9.4795E-27, 9.2858E-27, 9.8060E-27, 1.0999E-26,        BSF  560
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C 2.1795E-29, 1.7880E-29, 1.4309E-29, 1.1256E-29, 9.1903E-30,
C 7.6833E-30, 6.3949E-30, 5.6496E-30, 4.9581E-30, 4.5722E-30,
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C 4.3898E-30, 4.3505E-30, 4.3671E-30, 4.5329E-30, 4.6827E-30,
C 4.9334E-30, 5.1122E-30, 5.1649E-30, 5.0965E-30, 4.9551E-30/
 DATA S1251/
C 4.8928E-30, 4.7947E-30, 4.7989E-30, 4.9071E-30, 4.8867E-30,
C 4.7260E-30, 4.5756E-30, 4.5400E-30, 4.5993E-30, 4.4042E-30,
C 4.3309E-30, 4.4182E-30, 4.6735E-30, 5.0378E-30, 5.2204E-30,
C 5.0166E-30, 4.6799E-30, 4.3119E-30, 3.8803E-30, 3.3291E-30,
C 2.6289E-30, 2.1029E-30, 1.7011E-30, 1.3345E-30, 1.0224E-30,
C 7.8207E-31, 6.2451E-31, 5.0481E-31, 4.1507E-31, 3.5419E-31,
C 3.0582E-31, 2.6900E-31, 2.3778E-31, 2.1343E-31, 1.9182E-31,
C 1.7162E-31, 1.5391E-31, 1.3877E-31, 1.2619E-31, 1.1450E-31,
C 1.0461E-31, 9.6578E-32, 8.9579E-32, 8.3463E-32, 7.8127E-32,
C 7.3322E-32, 6.9414E-32, 6.6037E-32, 6.3285E-32, 6.1095E-32/
 DATA S1301/
C 5.9387E-32, 5.8118E-32, 5.7260E-32, 5.6794E-32, 5.6711E-32,
C 5.7003E-32, 5.7670E-32, 5.8717E-32, 6.0151E-32, 6.1984E-32,
C 6.4232E-32, 6.6918E-32, 7.0065E-32, 7.3705E-32, 7.7873E-32,
C 8.2612E-32, 8.7972E-32, 9.4009E-32, 1.0079E-31, 1.0840E-31,
C 1.1692E-31, 1.2648E-31, 1.3723E-31, 1.4935E-31, 1.6313E-31,
C 1.7905E-31, 1.9740E-31, 2.1898E-31, 2.4419E-31, 2.7426E-31,
C 3.0083E-31, 3.4235E-31, 3.7841E-31, 4.1929E-31, 4.6776E-31,
C 5.2123E-31, 5.8497E-31, 6.5294E-31, 7.4038E-31, 8.4793E-31,
C 9.6453E-31, 1.1223E-30, 1.2786E-30, 1.4882E-30, 1.7799E-30,
C 2.0766E-30, 2.4523E-30, 2.8591E-30, 3.3380E-30, 4.0531E-30/
 DATA S1351/
C 4.7663E-30, 5.4858E-30, 6.3377E-30, 7.1688E-30, 8.4184E-30,
C 9.5144E-30, 1.0481E-29, 1.1356E-29, 1.2339E-29, 1.3396E-29,
C 1.4375E-29, 1.5831E-29, 1.7323E-29, 1.9671E-29, 2.2976E-29,
C 2.6679E-29, 3.0777E-29, 3.4321E-29, 3.8192E-29, 4.2711E-29,
C 4.4903E-29, 4.8931E-29, 5.2253E-29, 5.4040E-29, 5.6387E-29,
C 5.6704E-29, 6.0345E-29, 6.1079E-29, 6.2576E-29, 6.4039E-29,
C 6.3776E-29, 6.1878E-29, 5.8616E-29, 5.7036E-29, 5.5840E-29,
C 5.6905E-29, 5.8931E-29, 6.2478E-29, 6.8291E-29, 7.4528E-29,
C 7.6078E-29, 7.3098E-29, 6.7573E-29, 5.9827E-29, 5.0927E-29,
C 4.0099E-29, 3.1933E-29, 2.4296E-29, 1.8485E-29, 1.4595E-29/
 DATA S1401/
C 1.2017E-29, 1.0164E-29, 8.7433E-30, 7.7108E-30, 7.0048E-30,
C 6.5291E-30, 6.1477E-30, 5.9254E-30, 5.8150E-30, 5.7591E-30,
C 5.8490E-30, 5.8587E-30, 5.9636E-30, 6.2408E-30, 6.5478E-30,
C 7.0400E-30, 7.2313E-30, 7.5524E-30, 8.0863E-30, 8.3386E-30,
C 9.2342E-30, 9.6754E-30, 1.0203E-29, 1.0895E-29, 1.1330E-29,
C 1.2210E-29, 1.2413E-29, 1.2613E-29, 1.2671E-29, 1.2225E-29,
C 1.1609E-29, 1.0991E-29, 1.0000E-29, 1.0570E-29, 1.0818E-29,
C 1.1421E-29, 1.2270E-29, 1.3370E-29, 1.4742E-29, 1.4948E-29,
C 1.4322E-29, 1.3210E-29, 1.1749E-29, 1.0051E-29, 7.0387E-30,
C 6.1844E-30, 4.6288E-30, 3.4164E-30, 2.5412E-30, 1.9857E-30/
 DATA S1451/
C 1.5876E-30, 1.2966E-30, 1.0920E-30, 9.4811E-31, 8.3733E-31,
C 7.3908E-31, 6.7259E-31, 6.1146E-31, 5.7119E-31, 5.3548E-31,
C 4.8835E-31, 4.4749E-31, 4.1089E-31, 3.7825E-31, 3.4465E-31,
C 3.1018E-31, 2.8109E-31, 2.5610E-31, 2.2858E-31, 2.0490E-31,
C 1.8133E-31, 1.5839E-31, 1.3949E-31, 1.2295E-31, 1.0799E-31,
C 9.6544E-32, 8.7597E-32, 7.9990E-32, 7.3973E-32, 6.9039E-32,
C 6.4935E-32, 6.1195E-32, 5.8235E-32, 5.5926E-32, 5.4191E-32,
C 5.2993E-32, 5.2330E-32, 5.2272E-32, 5.2923E-32, 5.4352E-32,
C 5.6523E-32, 5.9433E-32, 6.3197E-32, 6.8016E-32, 7.5016E-32,
C 8.2885E-32, 9.4050E-32, 1.0605E-31, 1.2257E-31, 1.3822E-31/
 DATA S1501/
C 1.5353E-31, 1.7543E-31, 1.9806E-31, 2.2197E-31, 2.4066E-31,
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C 2.6777E-31, 2.9751E-31, 3.2543E-31, 3.5536E-31, 3.9942E-31,        BSF 1870
C 4.6283E-31, 5.4556E-31, 6.5490E-31, 7.6803E-31, 9.0053E-31,        BSF 1875
C 1.0852E-30, 1.2946E-30, 1.4916E-30, 1.7748E-30, 2.0073E-30,        BSF 1880
C 2.2485E-30, 2.5114E-30, 2.7715E-30, 3.1319E-30, 3.3305E-30,        BSF 1885
C 3.5059E-30, 3.5746E-30, 3.6311E-30, 3.7344E-30, 3.6574E-30,        BSF 1890
C 3.7539E-30, 3.9434E-30, 4.3510E-30, 4.3340E-30, 4.2588E-30,        BSF 1895
C 4.3977E-30, 4.6062E-30, 4.7687E-30, 4.6457E-30, 4.8578E-30,        BSF 1900
C 5.2344E-30, 5.6752E-30, 5.8702E-30, 5.6603E-30, 5.3784E-30,        BSF 1905
C 4.9181E-30, 4.3272E-30, 3.5681E-30, 2.8814E-30, 2.3320E-30/        BSF 1910
  DATA S1551/                                                        BSF 1915
C 1.8631E-30, 1.4587E-30, 1.1782E-30, 9.8132E-31, 8.2528E-31,        BSF 1920
C 6.9174E-31, 6.1056E-31, 5.3459E-31, 4.7116E-31, 4.1878E-31,        BSF 1925
C 3.8125E-31, 3.6347E-31, 3.5071E-31, 3.3897E-31, 3.3541E-31,        BSF 1930
C 3.3563E-31, 3.5469E-31, 3.8111E-31, 3.8675E-31, 4.1333E-31,        BSF 1935
C 4.3475E-31, 4.6476E-31, 4.9761E-31, 5.1380E-31, 5.4135E-31,        BSF 1940
C 5.3802E-31, 5.5158E-31, 5.6864E-31, 5.9311E-31, 6.3827E-31,        BSF 1945
C 6.7893E-31, 6.8230E-31, 6.6694E-31, 6.6018E-31, 6.4863E-31,        BSF 1950
C 6.5893E-31, 6.3813E-31, 6.4741E-31, 6.8630E-31, 7.0255E-31,        BSF 1955
C 7.0667E-31, 6.8810E-31, 6.4104E-31, 5.8130E-31, 4.7242E-31,        BSF 1960
C 3.7625E-31, 3.1742E-31, 2.5581E-31, 1.8824E-31, 1.3303E-31/        BSF 1965
  DATA S1601/                                                        BSF 1970
C 9.6919E-32, 7.5353E-32, 6.0986E-32, 5.0742E-32, 4.3094E-32,        BSF 1975
C 3.7190E-32, 3.2520E-32, 2.8756E-32, 2.5680E-32, 2.3139E-32,        BSF 1980
C 2.1025E-32, 1.9257E-32, 1.7777E-32, 1.6539E-32, 1.5508E-32,        BSF 1985
C 1.4657E-32, 1.3966E-32, 1.3417E-32, 1.2998E-32, 1.2700E-32,        BSF 1990
C 1.2514E-32, 1.2437E-32, 1.2483E-32, 1.2592E-32, 1.2823E-32,        BSF 1995
C 1.3157E-32, 1.3596E-32, 1.4144E-32, 1.4806E-32, 1.5588E-32,        BSF 2000
C 1.6497E-32, 1.7544E-32, 1.8738E-32, 2.0094E-32, 2.1626E-32,        BSF 2005
C 2.3354E-32, 2.5297E-32, 2.7483E-32, 2.9941E-32, 3.2708E-32,        BSF 2010
C 3.5833E-32, 3.9374E-32, 4.3415E-32, 4.8079E-32, 5.3602E-32,        BSF 2015
C 5.9916E-32, 6.7436E-32, 7.6368E-32, 8.6812E-32, 9.8747E-32/        BSF 2020
  DATA S1651/                                                        BSF 2025
C 1.1350E-31, 1.3181E-31, 1.5406E-31, 1.7868E-31, 2.0651E-31,        BSF 2030
C 2.4504E-31, 2.9184E-31, 3.4159E-31, 3.9979E-31, 4.8704E-31,        BSF 2035
C 5.7856E-31, 6.7576E-31, 7.9103E-31, 9.4370E-31, 1.1224E-30,        BSF 2040
C 1.3112E-30, 1.5674E-30, 1.8206E-30, 2.0576E-30, 2.3187E-30,        BSF 2045
C 2.7005E-30, 3.0055E-30, 3.3423E-30, 3.6958E-30, 3.8737E-30,        BSF 2050
C 4.2630E-30, 4.5154E-30, 4.8383E-30, 5.3982E-30, 5.8109E-30,        BSF 2055
C 6.3741E-30, 6.3874E-30, 6.3870E-30, 6.5918E-30, 6.5056E-30,        BSF 2060
C 6.5291E-30, 6.3159E-30, 6.3984E-30, 6.4549E-30, 6.5444E-30,        BSF 2065
C 6.7035E-30, 6.7665E-30, 6.9124E-30, 6.8451E-30, 6.9255E-30,        BSF 2070
C 6.9923E-30, 7.0398E-30, 6.7715E-30, 6.0371E-30, 5.3774E-30/        BSF 2075
  DATA S1701/                                                        BSF 2080
C 4.6043E-30, 3.7635E-30, 2.9484E-30, 2.2965E-30, 1.8185E-30,        BSF 2085
C 1.4191E-30, 1.1471E-30, 9.4790E-31, 7.9613E-31, 6.7989E-31,        BSF 2090
C 5.9391E-31, 5.2810E-31, 4.7136E-31, 4.2618E-31, 3.8313E-31,        BSF 2095
C 3.4686E-31, 3.1609E-31, 2.9110E-31, 2.6871E-31, 2.5074E-31,        BSF 2100
C 2.4308E-31, 2.3925E-31, 2.4087E-31, 2.4339E-31, 2.4704E-31,        BSF 2105
C 2.5873E-31, 2.7177E-31, 2.9237E-31, 3.1593E-31, 3.5730E-31,        BSF 2110
C 4.0221E-31, 4.3994E-31, 4.8448E-31, 5.3191E-31, 5.8552E-31,        BSF 2115
C 6.3458E-31, 6.6335E-31, 7.2457E-31, 7.9091E-31, 8.2234E-31,        BSF 2120
C 8.7068E-31, 8.7851E-31, 9.2852E-31, 9.6157E-31, 9.5928E-31,        BSF 2125
C 1.0120E-30, 1.0115E-30, 9.8577E-31, 9.6633E-31, 9.2391E-31/        BSF 2130
  DATA S1751/                                                        BSF 2135
C 9.3315E-31, 9.8598E-31, 1.0064E-30, 1.0509E-30, 1.1455E-30,        BSF 2140
C 1.2443E-30, 1.2962E-30, 1.2632E-30, 1.1308E-30, 1.0185E-30,        BSF 2145
C 8.5892E-31, 6.7863E-31, 5.1521E-31, 3.7760E-31, 2.8842E-31,        BSF 2150
C 2.2052E-31, 1.7402E-31, 1.4406E-31, 1.1634E-31, 1.0223E-31,        BSF 2155
C 8.9544E-32, 7.8088E-32, 7.0078E-32, 6.2228E-32, 5.6051E-32,        BSF 2160
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C 5.0502E-32, 4.5578E-32, 4.2630E-32, 3.9461E-32, 3.7599E-32,
C 3.5215E-32, 3.2467E-32, 3.0018E-32, 2.6558E-32, 2.3928E-32,
C 2.0707E-32, 1.7575E-32, 1.5114E-32, 1.2941E-32, 1.1004E-32,
C 9.5175E-33, 8.2894E-33, 7.3253E-33, 6.5551E-33, 5.9098E-33,
C 5.3548E-33, 4.8697E-33, 4.4413E-33, 4.0600E-33, 3.7188E-33/
 DATA S1801/
C 3.4121E-33, 3.1356E-33, 2.8856E-33, 2.6590E-33, 2.4533E-33,
C 2.2663E-33, 2.0960E-33, 1.9407E-33, 1.7990E-33, 1.6695E-33,
C 1.5512E-33, 1.4429E-33, 1.3437E-33, 1.2527E-33, 1.1693E-33,
C 1.0927E-33, 1.0224E-33, 9.5767E-34, 8.9818E-34, 8.4335E-34,
C 7.9285E-34, 7.4626E-34, 7.0325E-34, 6.6352E-34, 6.2676E-34,
C 5.9274E-34, 5.6121E-34, 5.3195E-34, 5.0479E-34, 4.7953E-34,
C 4.5602E-34, 4.3411E-34, 4.1367E-34, 3.9456E-34, 3.7670E-34,
C 3.5996E-34, 3.4427E-34, 3.2952E-34, 3.1566E-34, 3.0261E-34,
C 2.9030E-34, 2.7868E-34, 2.6770E-34, 2.5730E-34, 2.4745E-34,
C 2.3809E-34, 2.2921E-34, 2.2076E-34, 2.1271E-34, 2.0504E-34/
 DATA S1851/
C 1.9772E-34, 1.9073E-34, 1.8404E-34, 1.7764E-34, 1.7151E-34,
C 1.6564E-34, 1.6000E-34, 1.5459E-34, 1.4939E-34, 1.4439E-34,
C 1.3958E-34, 1.3495E-34, 1.3049E-34, 1.2620E-34, 1.2206E-34,
C 1.1807E-34, 1.1422E-34, 1.1050E-34, 1.0691E-34, 1.0345E-34,
C 1.0010E-34, 9.6870E-35, 9.3747E-35, 9.0727E-35, 8.7808E-35,
C 8.4986E-35, 8.2257E-35, 7.9617E-35, 7.7064E-35, 7.4594E-35,
C 7.2204E-35, 6.9891E-35, 6.7653E-35, 6.5488E-35, 6.3392E-35,
C 6.1363E-35, 5.9399E-35, 5.7499E-35, 5.5659E-35, 5.3878E-35,
C 5.2153E-35, 5.0494E-35, 4.8868E-35, 4.7303E-35, 4.5788E-35,
C 4.4322E-35, 4.2902E-35, 4.1527E-35, 4.0196E-35, 3.8907E-35/
 DATA S1901/
C 3.7659E-35, 3.6451E-35, 3.5281E-35, 3.4149E-35, 3.3052E-35,
C 3.1991E-35, 3.0963E-35, 2.9967E-35, 2.9004E-35, 2.8071E-35,
C 2.7167E-35, 2.6293E-35, 2.5446E-35, 2.4626E-35, 2.3833E-35,
C 2.3064E-35, 2.2320E-35, 2.1600E-35, 2.0903E-35, 2.0228E-35,
C 1.9574E-35, 1.8942E-35, 1.8329E-35, 1.7736E-35, 1.7163E-35,
C 1.6607E-35, 1.6069E-35, 1.5548E-35, 1.5044E-35, 1.4557E-35,
C 1.4084E-35, 1.3627E-35, 1.3185E-35, 1.2757E-35, 1.2342E-35,
C 1.1941E-35, 1.1552E-35, 1.1177E-35, 1.0813E-35, 1.0461E-35,
C 1.0120E-35, 9.7900E-36, 9.4707E-36, 9.1618E-36, 8.8628E-36,
C 8.5734E-36, 8.2933E-36, 8.0223E-36, 7.7600E-36, 7.5062E-36/
 DATA S1951/
C 7.2606E-36, 7.0229E-36, 6.7929E-36, 6.5703E-36, 6.3550E-36,
C 6.1466E-36, 5.9449E-36, 5.7498E-36, 5.5610E-36, 5.3783E-36,
C 5.2015E-36, 5.0305E-36, 4.8650E-36, 4.7049E-36, 4.5500E-36,
C 4.4002E-36, 4.2552E-36, 4.1149E-36, 3.9792E-36, 3.8479E-36,
C 3.7209E-36, 3.5981E-36, 3.4792E-36, 3.3642E-36, 3.2530E-36,
C 3.1454E-36, 3.0413E-36, 2.9406E-36, 2.8432E-36, 2.7490E-36,
C 2.6579E-36, 2.5697E-36, 2.4845E-36, 2.4020E-36, 2.3223E-36,
C 2.2451E-36, 2.1705E-36, 2.0984E-36, 2.0286E-36, 1.9611E-36,
C 1.8958E-36, 1.8327E-36, 1.7716E-36, 1.7126E-36, 1.6555E-36,
C 1.6003E-36, 1.5469E-36, 1.4952E-36, 1.4453E-36, 1.3970E-36/
 DATA S2001/
C 1.3503E-36/
C
 END
```

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      BLOCK DATA SF260
C*    BLOCK DATA
C
C     WATER VAPOR CONTINUUM - SELF BROADENED ABSORPTION COEFFICIENTS 260
C
C     COMMON /S260/ V1,V2,DV,NPT,S260(2001)
      COMMON /S260/ V1,V2,DV,NPT,S0001(50),S0051(50),S0101(50),S0151(50)
     1,S0201(50),S0251(50),S0301(50),S0351(50),S0401(50),S0451(50)
     2,S0501(50),S0551(50),S0601(50),S0651(50),S0701(50),S0751(50)
     3,S0801(50),S0851(50),S0901(50),S0951(50)
     4,S1001(50),S1051(50),S1101(50),S1151(50),S1201(50),S1251(50)
     5,S1301(50),S1351(50),S1401(50),S1451(50)
     6,S1501(50),S1551(50),S1601(50),S1651(50),S1701(50),S1751(50)
     7,S1801(50),S1851(50),S1901(50),S1951(50),S2001(1)
C
C
      DIMENSION S260(1)
      EQUIVALENCE (S260(1),S0001(1))
       DATA V1,V2,DV,NPT /
     1        0.0,     20000.0,       10.0,  2001/
C
C
       DATA S0001/
     C 1.6457E-21, 1.7045E-21, 1.7750E-21, 2.0036E-21, 2.1347E-21,
     C 2.2454E-21, 2.3428E-21, 2.3399E-21, 2.3022E-21, 2.0724E-21,
     C 1.9712E-21, 1.8317E-21, 1.6724E-21, 1.4780E-21, 1.2757E-21,
     C 1.1626E-21, 1.0098E-21, 8.9033E-22, 7.9770E-22, 6.7416E-22,
     C 5.9588E-22, 5.1117E-22, 4.6218E-22, 4.2179E-22, 3.4372E-22,
     C 2.9863E-22, 2.5252E-22, 2.2075E-22, 1.9209E-22, 1.5816E-22,
     C 1.3932E-22, 1.1843E-22, 1.0079E-22, 8.7667E-23, 7.4094E-23,
     C 6.4967E-23, 5.5711E-23, 4.8444E-23, 4.2552E-23, 3.6953E-23,
     C 3.2824E-23, 2.9124E-23, 2.6102E-23, 2.3370E-23, 2.1100E-23,
     C 1.9308E-23, 1.7145E-23, 1.5573E-23, 1.4206E-23, 1.2931E-23/
       DATA S0051/
     C 1.1803E-23, 1.0774E-23, 9.8616E-24, 9.0496E-24, 8.3071E-24,
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     C 6.0260E-35, 5.8533E-35, 5.6856E-35, 5.5226E-35, 5.3642E-35,
     C 5.2104E-35, 5.0610E-35, 4.9158E-35, 4.7748E-35, 4.6378E-35,
     C 4.5047E-35, 4.3753E-35, 4.2497E-35, 4.1277E-35, 4.0091E-35,
     C 3.8939E-35, 3.7820E-35, 3.6733E-35, 3.5677E-35, 3.4651E-35,
     C 3.3655E-35, 3.2686E-35, 3.1746E-35, 3.0832E-35, 2.9944E-35,
     C 2.9082E-35, 2.8244E-35, 2.7431E-35, 2.6640E-35, 2.5872E-35,
     C 2.5126E-35, 2.4401E-35, 2.3697E-35, 2.3014E-35, 2.2349E-35/
      DATA S1951/
     C 2.1704E-35, 2.1077E-35, 2.0468E-35, 1.9877E-35, 1.9302E-35,
     C 1.8744E-35, 1.8202E-35, 1.7675E-35, 1.7164E-35, 1.6667E-35,
     C 1.6184E-35, 1.5716E-35, 1.5260E-35, 1.4818E-35, 1.4389E-35,
     C 1.3971E-35, 1.3566E-35, 1.3172E-35, 1.2790E-35, 1.2419E-35,
     C 1.2058E-35, 1.1708E-35, 1.1368E-35, 1.1037E-35, 1.0716E-35,
     C 1.0405E-35, 1.0102E-35, 9.8079E-36, 9.5224E-36, 9.2451E-36,
     C 8.9758E-36, 8.7142E-36, 8.4602E-36, 8.2136E-36, 7.9740E-36,
     C 7.7414E-36, 7.5154E-36, 7.2961E-36, 7.0830E-36, 6.8761E-36,
     C 6.6752E-36, 6.4801E-36, 6.2906E-36, 6.1066E-36, 5.9280E-36,
     C 5.7545E-36, 5.5860E-36, 5.4224E-36, 5.2636E-36, 5.1094E-36/
      DATA S2001/
     C 4.9596E-36/
C
      END
```

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      BLOCK DATA BFH20
C*    BLOCK DATA
C
C     WATER VAPOR CONTINUUM - FOREIGN BROADENED ABSORPTION COEFFICIENTS
C
C     COMMON /FH2O/ V1,V2,DV,NPT,F296(2001)
      COMMON /FH2O/ V1,V2,DV,NPT,F0001(50),F0051(50),F0101(50),F0151(50)
     1,F0201(50),F0251(50),F0301(50),F0351(50),F0401(50),F0451(50)
     2,F0501(50),F0551(50),F0601(50),F0651(50),F0701(50),F0751(50)
     3,F0801(50),F0851(50),F0901(50),F0951(50)
     4,F1001(50),F1051(50),F1101(50),F1151(50),F1201(50),F1251(50)
     5,F1301(50),F1351(50),F1401(50),F1451(50)
     6,F1501(50),F1551(50),F1601(50),F1651(50),F1701(50),F1751(50)
     7,F1801(50),F1851(50),F1901(50),F1951(50),F2001(1)
      COMMON /FRND/IENTER
C
C
      DIMENSION F296(1)
      EQUIVALENCE (F296(1),F0001(1))
       DATA V1,V2,DV,NPT /
     1        0.0,      20000.0,         10.0,  2001/
C
C
      DATA F0001/
     C 1.1036E-22, 1.1715E-22, 1.2859E-22, 1.5326E-22, 1.6999E-22,
     C 1.8321E-22, 1.9402E-22, 1.9570E-22, 1.9432E-22, 1.7572E-22,
     C 1.6760E-22, 1.5480E-22, 1.3984E-22, 1.2266E-22, 1.0467E-22,
     C 9.4526E-23, 8.0485E-23, 6.9484E-23, 6.1416E-23, 5.0941E-23,
     C 4.4836E-23, 3.8133E-23, 3.4608E-23, 3.1487E-23, 2.4555E-23,
     C 2.0977E-23, 1.7266E-23, 1.4920E-23, 1.2709E-23, 9.8081E-24,
     C 8.5063E-24, 6.8822E-24, 5.3809E-24, 4.4679E-24, 3.3774E-24,
     C 2.7979E-24, 2.1047E-24, 1.6511E-24, 1.2993E-24, 9.3033E-25,
     C 7.4360E-25, 5.6428E-25, 4.5442E-25, 3.4575E-25, 2.7903E-25,
     C 2.1374E-25, 1.6075E-25, 1.3022E-25, 1.0962E-25, 8.5959E-26/
      DATA F0051/
     C 6.9135E-26, 5.3808E-26, 4.3586E-26, 3.6394E-26, 2.9552E-26,
     C 2.3547E-26, 1.8463E-26, 1.6036E-26, 1.3483E-26, 1.1968E-26,
     C 1.0333E-26, 8.4484E-27, 6.7195E-27, 5.0947E-27, 4.2343E-27,
     C 3.4453E-27, 2.7830E-27, 2.3063E-27, 1.9951E-27, 1.7087E-27,
     C 1.4393E-27, 1.2575E-27, 1.0750E-27, 8.2325E-28, 5.7524E-28,
     C 4.4482E-28, 3.8106E-28, 3.4315E-28, 2.9422E-28, 2.5069E-28,
     C 2.2402E-28, 1.9349E-28, 1.6152E-28, 1.2208E-28, 8.9630E-29,
     C 7.1322E-29, 6.1028E-29, 5.2938E-29, 4.5350E-29, 3.4977E-29,
     C 2.9511E-29, 2.4734E-29, 2.0508E-29, 1.8507E-29, 1.6373E-29,
     C 1.5171E-29, 1.3071E-29, 1.2462E-29, 1.2148E-29, 1.2590E-29/
      DATA F0101/
     C 1.3153E-29, 1.3301E-29, 1.4483E-29, 1.6944E-29, 2.0559E-29,
     C 2.2954E-29, 2.6221E-29, 3.2606E-29, 4.2392E-29, 5.2171E-29,
     C 6.2553E-29, 8.2548E-29, 9.5842E-29, 1.1280E-28, 1.3628E-28,
     C 1.7635E-28, 2.1576E-28, 2.4835E-28, 3.0014E-28, 3.8485E-28,
     C 4.7440E-28, 5.5202E-28, 7.0897E-28, 9.6578E-28, 1.3976E-27,
     C 1.8391E-27, 2.3207E-27, 2.9960E-27, 4.0408E-27, 5.9260E-27,
     C 7.8487E-27, 1.0047E-26, 1.4676E-26, 1.9325E-26, 2.6587E-26,
     C 3.4534E-26, 4.4376E-26, 5.8061E-26, 7.0141E-26, 8.4937E-26,
     C 1.0186E-25, 1.2034E-25, 1.3837E-25, 1.6595E-25, 1.9259E-25,
     C 2.1620E-25, 2.3081E-25, 2.7064E-25, 3.2510E-25, 3.5460E-25/
      DATA F0151/
     C 3.9109E-25, 4.2891E-25, 4.7757E-25, 5.0981E-25, 5.0527E-25,
     C 4.8618E-25, 4.4001E-25, 3.7982E-25, 3.2667E-25, 2.7794E-25,
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C 2.4910E-25, 2.4375E-25, 2.7316E-25, 3.2579E-25, 3.5499E-25,      BFH
C 3.8010E-25, 4.1353E-25, 4.3323E-25, 4.3004E-25, 3.9790E-25,      BFH
C 3.7718E-25, 3.6360E-25, 3.2386E-25, 2.7409E-25, 2.3626E-25,      BFH
C 2.0631E-25, 1.8371E-25, 1.5445E-25, 1.2989E-25, 1.1098E-25,      BFH
C 9.6552E-26, 8.0649E-26, 7.2365E-26, 5.9137E-26, 5.2759E-26,      BFH
C 4.8860E-26, 4.1321E-26, 3.5918E-26, 2.7640E-26, 2.4892E-26,      BFH
C 2.1018E-26, 1.7848E-26, 1.5855E-26, 1.3569E-26, 1.1986E-26,      BFH
C 9.4693E-27, 7.4097E-27, 6.3443E-27, 4.8131E-27, 4.0942E-27/      BFH
 DATA F0201/                                                       BFH
C 3.3316E-27, 2.8488E-27, 2.3461E-27, 1.7397E-27, 1.4684E-27,      BFH
C 1.0953E-27, 8.5396E-28, 6.9261E-28, 5.4001E-28, 4.5430E-28,      BFH
C 3.2791E-28, 2.5995E-28, 2.0225E-28, 1.5710E-28, 1.3027E-28,      BFH
C 1.0229E-28, 8.5277E-29, 6.5249E-29, 5.0117E-29, 3.9906E-29,      BFH
C 3.2332E-29, 2.7847E-29, 2.4570E-29, 2.3359E-29, 2.0599E-29,      BFH
C 1.8436E-29, 1.6559E-29, 1.4910E-29, 1.2794E-29, 9.8229E-30,      BFH
C 8.0054E-30, 6.0769E-30, 4.5648E-30, 3.3111E-30, 2.4428E-30,      BFH
C 1.8007E-30, 1.3291E-30, 9.7974E-31, 7.8271E-31, 6.3833E-31,      BFH
C 5.4425E-31, 4.6471E-31, 4.0209E-31, 3.5227E-31, 3.1212E-31,      BFH
C 2.8840E-31, 2.7762E-31, 2.7935E-31, 3.2012E-31, 3.9525E-[illegible]/      BFH
 DATA F0251/                                                       BFH
C 5.0303E-31, 6.8027E-31, 9.3954E-31, 1.2986E-30, 1.8478E-30,      BFH
C 2.5331E-30, 3.4827E-30, 4.6968E-30, 6.2380E-30, 7.9106E-30,      BFH
C 1.0026E-29, 1.2102E-29, 1.4146E-29, 1.6154E-29, 1.7510E-29,      BFH
C 1.8575E-29, 1.8742E-29, 1.8700E-29, 1.8582E-29, 1.9657E-29,      BFH
C 2.1204E-29, 2.0381E-29, 2.0122E-29, 2.0436E-29, 2.1213E-29,      BFH
C 2.0742E-29, 1.9870E-29, 2.0465E-29, 2.1556E-29, 2.2222E-29,      BFH
C 2.1977E-29, 2.1047E-29, 1.9334E-29, 1.7357E-29, 1.5754E-29,      BFH
C 1.4398E-29, 1.4018E-29, 1.5459E-29, 1.7576E-29, 2.1645E-29,      BFH
C 2.9480E-29, 4.4439E-29, 5.8341E-29, 8.0757E-29, 1.1658E-28,      BFH
C 1.6793E-28, 2.2694E-28, 2.9468E-28, 3.9278E-28, 5.2145E-28/      BFH
 DATA F0301/                                                       BFH
C 6.4378E-28, 7.7947E-28, 8.5321E-28, 9.7848E-28, 1.0999E-27,      BFH
C 1.1489E-27, 1.2082E-27, 1.2822E-27, 1.4053E-27, 1.5238E-27,      BFH
C 1.5454E-27, 1.5018E-27, 1.4048E-27, 1.2359E-27, 1.0858E-27,      BFH
C 9.3486E-28, 8.1638E-28, 7.7690E-28, 8.4625E-28, 1.0114E-27,      BFH
C 1.1430E-27, 1.2263E-27, 1.3084E-27, 1.3380E-27, 1.3573E-27,      BFH
C 1.3441E-27, 1.2962E-27, 1.2638E-27, 1.1934E-27, 1.1371E-27,      BFH
C 1.0871E-27, 9.8843E-28, 9.1877E-28, 9.1050E-28, 9.3213E-28,      BFH
C 9.2929E-28, 1.0155E-27, 1.1263E-27, 1.2370E-27, 1.3636E-27,      BFH
C 1.5400E-27, 1.7656E-27, 2.1329E-27, 2.3045E-27, 2.5811E-27,      BFH
C 2.9261E-27, 3.4259E-27, 4.0770E-27, 4.8771E-27, 5.8081E-27/      BFH
 DATA F0351/                                                       BFH
C 7.2895E-27, 8.7482E-27, 1.0795E-26, 1.3384E-26, 1.7208E-26,      BFH
C 2.0677E-26, 2.5294E-26, 3.1123E-26, 3.7900E-26, 4.7752E-26,      BFH
C 5.6891E-26, 6.6261E-26, 7.6246E-26, 8.7730E-26, 9.6672E-26,      BFH
C 1.0980E-25, 1.1287E-25, 1.1670E-25, 1.1635E-25, 1.1768E-25,      BFH
C 1.2039E-25, 1.2253E-25, 1.3294E-25, 1.4005E-25, 1.3854E-25,      BFH
C 1.3420E-25, 1.3003E-25, 1.2645E-25, 1.1715E-25, 1.1258E-25,      BFH
C 1.1516E-25, 1.2494E-25, 1.3655E-25, 1.4931E-25, 1.4649E-25,      BFH
C 1.3857E-25, 1.3120E-25, 1.1791E-25, 1.0637E-25, 8.2760E-26,      BFH
C 6.5821E-26, 5.1959E-26, 4.0158E-26, 3.0131E-26, 2.0482E-26,      BFH
C 1.4853E-26, 1.0365E-26, 7.3938E-27, 4.9752E-27, 3.4148E-27/      BFH
 DATA F0401/                                                       BFH
C 2.4902E-27, 1.8363E-27, 1.4591E-27, 1.1380E-27, 9.0588E-28,      BFH
C 7.3697E-28, 6.0252E-28, 5.1868E-28, 4.2600E-28, 3.8183E-28,      BFH
C 3.2512E-28, 2.9258E-28, 2.42[illegible]8E-28, 2.1209E-28, 1.6362E-28,      BFH
C 1.3871E-28, 1.2356E-28, 9.6940E-29, 7.7735E-29, 6.2278E-29,      BFH
C 5.2282E-29, 4.3799E-29, 3.5545E-29, 2.7527E-29, 2.0950E-29,      BFH
C 1.6344E-29, 1.2689E-29, 1.0403E-29, 8.4860E-30, 6.3461E-30,      BFH
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C 4.7657E-30, 3.5220E-30, 2.7879E-30, 2.3021E-30, 1.6167E-30,        BFH
C 1.1732E-30, 8.9206E-31, 7.0596E-31, 5.8310E-31, 4.4084E-31,        BFH
C 3.1534E-31, 2.5068E-31, 2.2088E-31, 2.2579E-31, 2.2637E-31,        BFH
C 2.5705E-31, 3.2415E-31, 4.6116E-31, 6.5346E-31, 9.4842E-31/        BFH
  DATA F0451/                                                        BFH
C 1.2809E-30, 1.8211E-30, 2.4052E-30, 3.0270E-30, 3.5531E-30,        BFH
C 4.2402E-30, 4.6730E-30, 4.7942E-30, 4.8813E-30, 4.5997E-30,        BFH
C 4.5788E-30, 4.0311E-30, 3.7367E-30, 3.3149E-30, 2.9281E-30,        BFH
C 2.5231E-30, 2.1152E-30, 1.9799E-30, 1.8636E-30, 1.9085E-30,        BFH
C 2.0786E-30, 2.2464E-30, 2.3785E-30, 2.5684E-30, 2.7499E-30,        BFH
C 2.6962E-30, 2.6378E-30, 2.8297E-30, 2.6903E-30, 2.7035E-30,        BFH
C 2.5394E-30, 2.5655E-30, 2.7184E-30, 2.9013E-30, 3.0565E-30,        BFH
C 3.0791E-30, 3.1667E-30, 3.4343E-30, 3.7365E-30, 4.0269E-30,        BFH
C 4.7260E-30, 5.6584E-30, 6.9791E-30, 8.6569E-30, 1.0393E-29,        BFH
C 1.2067E-29, 1.5047E-29, 1.8583E-29, 2.2357E-29, 2.6498E-29/        BFH
  DATA F0501/                                                        BFH
C 3.2483E-29, 3.9927E-29, 4.6618E-29, 5.5555E-29, 6.6609E-29,        BFH
C 8.2139E-29, 1.0285E-28, 1.3919E-28, 1.8786E-28, 2.5150E-28,        BFH
C 3.3130E-28, 4.5442E-28, 6.3370E-28, 9.0628E-28, 1.2118E-27,        BFH
C 1.5927E-27, 2.1358E-27, 2.7825E-27, 3.7671E-27, 4.4894E-27,        BFH
C 5.4442E-27, 6.2240E-27, 7.3004E-27, 8.3384E-27, 8.7933E-27,        BFH
C 8.8080E-27, 8.6939E-27, 8.6541E-27, 8.2055E-27, 7.7278E-27,        BFH
C 7.5989E-27, 8.6909E-27, 9.7945E-27, 1.0394E-26, 1.0646E-26,        BFH
C 1.1509E-26, 1.2017E-26, 1.1915E-26, 1.1259E-26, 1.1549E-26,        BFH
C 1.1938E-26, 1.2356E-26, 1.2404E-26, 1.1716E-26, 1.1149E-26,        BFH
C 1.0073E-26, 8.9845E-27, 7.6639E-27, 6.1517E-27, 5.0887E-27/        BFH
  DATA F0551/                                                        BFH
C 4.1269E-27, 3.2474E-27, 2.5698E-27, 1.8893E-27, 1.4009E-27,        BFH
C 1.0340E-27, 7.7724E-28, 5.7302E-28, 4.2178E-28, 2.9603E-28,        BFH
C 2.1945E-28, 1.6301E-28, 1.2806E-28, 1.0048E-28, 7.8970E-29,        BFH
C 6.1133E-29, 4.9034E-29, 4.1985E-29, 3.6944E-29, 3.2586E-29,        BFH
C 2.7362E-29, 2.3647E-29, 2.1249E-29, 1.8172E-29, 1.6224E-29,        BFH
C 1.5158E-29, 1.2361E-29, 1.0682E-29, 9.2312E-30, 7.9220E-30,        BFH
C 6.8174E-30, 5.6147E-30, 4.8268E-30, 4.1534E-30, 3.3106E-30,        BFH
C 2.8275E-30, 2.4584E-30, 2.0742E-30, 1.7840E-30, 1.4664E-30,        BFH
C 1.2390E-30, 1.0497E-30, 8.5038E-31, 6.7008E-31, 5.6355E-31,        BFH
C 4.3323E-31, 3.6914E-31, 3.2262E-31, 3.0749E-31, 3.0318E-31/        BFH
  DATA F0601/                                                        BFH
C 2.9447E-31, 2.9918E-31, 3.0668E-31, 3.1315E-31, 3.0329E-31,        BFH
C 2.8259E-31, 2.6065E-31, 2.3578E-31, 2.0469E-31, 1.6908E-31,        BFH
C 1.4912E-31, 1.1867E-31, 9.9730E-32, 8.1014E-32, 6.7528E-32,        BFH
C 6.3133E-32, 5.8599E-32, 6.0145E-32, 6.5105E-32, 7.0537E-32,        BFH
C 7.4073E-32, 7.8519E-32, 8.5039E-32, 9.1995E-32, 1.0694E-31,        BFH
C 1.1659E-31, 1.2685E-31, 1.3087E-31, 1.3222E-31, 1.2634E-31,        BFH
C 1.1077E-31, 9.6259E-32, 8.3202E-32, 7.4857E-32, 6.8069E-32,        BFH
C 6.7496E-32, 7.3116E-32, 8.0171E-32, 8.6394E-32, 9.2659E-32,        BFH
C 1.0040E-31, 1.0941E-31, 1.2226E-31, 1.3058E-31, 1.5193E-31,        BFH
C 1.8923E-31, 2.3334E-31, 2.8707E-31, 3.8693E-31, 4.8295E-31/        BFH
  DATA F0651/                                                        BFH
C 6.4260E-31, 8.8269E-31, 1.1865E-30, 1.5961E-30, 2.0605E-30,        BFH
C 2.7349E-30, 3.7193E-30, 4.8216E-30, 6.1966E-30, 7.7150E-30,        BFH
C 1.0195E-29, 1.2659E-29, 1.6535E-29, 2.0316E-29, 2.3913E-29,        BFH
C 3.0114E-29, 3.7495E-29, 4.6504E-29, 5.9145E-29, 7.6840E-29,        BFH
C 1.0304E-28, 1.3010E-28, 1.6441E-28, 2.1476E-28, 2.5892E-28,        BFH
C 2.9780E-28, 3.3820E-28, 4.0007E-28, 4.4886E-28, 4.5765E-28,        BFH
C 4.6131E-28, 4.6239E-28, 4.4849E-28, 4.0729E-28, 3.6856E-28,        BFH
C 3.6184E-28, 3.7608E-28, 4.1457E-28, 4.3750E-28, 5.1150E-28,        BFH
C 5.6054E-28, 6.1580E-28, 6.4521E-28, 6.8494E-28, 6.9024E-28,        BFH
C 6.8853E-28, 7.0001E-28, 6.9760E-28, 7.1485E-28, 7.0740E-28/        BFH
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      DATA F07C1/
     C 7.3764E-28, 7.6618E-28, 8.4182E-28, 9.3838E-28, 1.0761E-27,
     C 1.2851E-27, 1.4748E-27, 1.8407E-27, 2.2109E-27, 2.6392E-27,
     C 2.9887E-27, 3.4493E-27, 4.0336E-27, 4.3551E-27, 4.9231E-27,
     C 5.0720E-27, 5.3781E-27, 5.3285E-27, 5.4496E-27, 5.5707E-27,
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     C 4.3835E-39, 1.6587E-39, 6.3044E-40, 2.9014E-40, 2.7146E-40,       BFH 2000
     C 5.1708E-40, 1.1957E-39, 2.7853E-39, 6.3427E-39, 1.4070E-38,       BFH 2005
     C 3.0405E-38, 6.4059E-38, 1.3169E-37, 2.6443E-37, 5.1917E-37,       BFH 2010
     C 9.9785E-37, 1.8802E-36, 3.4788E-36, 6.3328E-36, 1.1370E-35,       BFH 2015
     C 2.0198E-35, 3.5665E-35, 6.3053E-35, 1.1309E-34, 2.1206E-34,       BFH 2020
     C 3.2858E-34, 5.5165E-34, 8.6231E-34, 1.2776E-33, 1.7780E-33/       BFH 2025
      DATA F1651/                                                        BFH 2030
     C 2.5266E-33, 3.6254E-33, 5.1398E-33, 6.8289E-33, 8.7481E-33,       BFH 2035
     C 1.1914E-32, 1.6086E-32, 2.0469E-32, 2.5761E-32, 3.4964E-32,       BFH 2040
     C 4.4980E-32, 5.5358E-32, 6.7963E-32, 8.5720E-32, 1.0700E-31,       BFH 2045
     C 1.2983E-31, 1.6270E-31, 1.9609E-31, 2.2668E-31, 2.5953E-31,       BFH 2050
     C 3.0918E-31, 3.4930E-31, 3.9330E-31, 4.4208E-31, 4.6431E-31,       BFH 2055
     C 5.1141E-31, 5.4108E-31, 5.8077E-31, 6.5050E-31, 7.2126E-31,       BFH 2060
     C 8.1064E-31, 8.1973E-31, 8.1694E-31, 8.3081E-31, 8.0240E-31,       BFH 2065
     C 7.9225E-31, 7.6256E-31, 7.8468E-31, 8.0041E-31, 8.1585E-31,       BFH 2070
     C 8.3405E-31, 8.3774E-31, 8.5870E-31, 8.6104E-31, 8.8516E-31,       BFH 2075
     C 9.0014E-31, 9.2522E-31, 8.8913E-31, 7.8381E-31, 6.8568E-31/       BFH 2080
      DATA F1701/                                                        BFH 2085
     C 5.6797E-31, 4.4163E-31, 3.2369E-31, 2.3259E-31, 1.6835E-31,       BFH 2090
     C 1.1733E-31, 8.5273E-32, 6.3805E-32, 4.8983E-32, 3.8831E-32,       BFH 2095
     C 3.2610E-32, 2.8577E-32, 2.5210E-32, 2.2913E-32, 2.0341E-32,       BFH 2100
     C 1.8107E-32, 1.6395E-32, 1.4890E-32, 1.3616E-32, 1.2542E-32,       BFH 2105
     C 1.2910E-32, 1.3471E-32, 1.4689E-32, 1.5889E-32, 1.6989E-32,       BFH 2110
     C 1.8843E-32, 2.0602E-32, 2.3874E-32, 2.7294E-32, 3.3353E-32,       BFH 2115
     C 4.0188E-32, 4.5868E-32, 5.2212E-32, 5.8856E-32, 6.5991E-32,       BFH 2120
     C 7.2505E-32, 7.8637E-32, 8.5113E-32, 9.4832E-32, 9.9678E-32,       BFH 2125
     C 1.0723E-31, 1.0749E-31, 1.1380E-31, 1.1774E-31, 1.1743E-31,       BFH 2130
     C 1.2493E-31, 1.2569E-31, 1.2332E-31, 1.1782E-31, 1.1086E-31/       BFH 2135
      DATA F1751/                                                        BFH 2140
     C 1.0949E-31, 1.1178E-31, 1.2083E-31, 1.3037E-31, 1.4730E-31,       BFH 2145
     C 1.6480E-31, 1.7403E-31, 1.7004E-31, 1.5117E-31, 1.3339E-31,       BFH 2150
     C 1.0844E-31, 8.0916E-32, 5.6615E-32, 3.7198E-32, 2.5194E-32,       BFH 2155
     C 1.6569E-32, 1.1201E-32, 8.2335E-33, 6.0270E-33, 4.8205E-33,       BFH 2160
```

```
C 4.1313E-33, 3.6243E-33, 3.2575E-33, 2.7730E-33, 2.5292E-33,
C 2.3062E-33, 2.1126E-33, 2.1556E-33, 2.1213E-33, 2.2103E-33,
C 2.1927E-33, 2.0794E-33, 1.9533E-33, 1.6592E-33, 1.4521E-33,
C 1.1393E-33, 8.3772E-34, 6.2077E-34, 4.3337E-34, 2.7165E-34,
C 1.6821E-34, 9.5407E-35, 5.3093E-35, 3.0320E-35, 1.7429E-35,
C 9.9828E-36, 5.6622E-36, 3.1672E-36, 1.7419E-36, 9.3985E-37/
 DATA F1801/
C 4.9656E-37, 2.5652E-37, 1.2942E-37, 6.3695E-38, 3.0554E-38,
C 1.4273E-38, 6.4890E-39, 2.8691E-39, 1.2331E-39, 5.1485E-40,
C 2.0875E-40, 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        /
 DATA F1851/
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        /
 DATA F1901/
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        /
 DATA F1951/
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        ,
C 0.        , 0.        , 0.        , 0.        , 0.        /
 DATA F2001/
C 0.        /
C
 END
```

```
      BLOCK DATA TRFN
C*    BLOCK DATA
C     LOWTRAN TRANSMITTANCE FUNCTIONS
      COMMON /TRFWFO/ TR(67),FW(67),FO(67)
      DATA TR/
     1 .9988,  .9980,  .9960,  .9940,  .9920,  .9900,  .9800,  .9700,
     2 .9600,  .9500,  .9400,  .9300,  .9200,  .9100,  .9000,  .8800,
     3 .8600,  .8400,  .8200,  .8000,  .7800,  .7600,  .7400,  .7200,
     4 .7000,  .6800,  .6600,  .6400,  .6200,  .6000,  .5800,  .5600,
     5 .5400,  .5200,  .5000,  .4800,  .4600,  .4400,  .4200,  .4000,
     6 .3800,  .3600,  .3400,  .3200,  .3000,  .2800,  .2600,  .2400,
     7 .2200,  .2000,  .1800,  .1600,  .1400,  .1200,  .1000,  .0800,
     8 .0600,  .0400,  .0300,  .0200,  .0150,  .0100,  .0080,  .0060,
     9 .0040,  .0020,  .0010/
C     FW WATER VAPOR AND UNIFORMALY MIXED TRANSMITTANCE TABLE
      DATA FW/
     1-2.3468,-2.0362,-1.6990,-1.4815,-1.3279,-1.2007, -.7825, -.5229,
     2 -.3468, -.1938, -.0655,  .0414,  .1553,  .2430,  .3324,  .4838,
     3  .6128,  .7243,  .8261,  .9191, 1.0000, 1.0792, 1.1461, 1.2122,
     4 1.2672, 1.3284, 1.3892, 1.4409, 1.4955, 1.5441, 1.5966, 1.6435,
     5 1.6857, 1.7340, 1.7782, 1.8261, 1.8692, 1.9191, 1.9638, 2.0086,
     6 2.0607, 2.1038, 2.1461, 2.1875, 2.2304, 2.2788, 2.3263, 2.3717,
     7 2.4183, 2.4698, 2.5159, 2.5740, 2.6284, 2.6902, 2.7559, 2.8261,
     8 2.9031, 3.0000, 3.0607, 3.1461, 3.2041, 3.2718, 3.3054, 3.3444,
     9 3.3979, 3.4914, 3.5682/
C     F INFRARED O  OZONE TRANSMITTANCE TABLE
      DATA FO/
     1-1.6778,-1.3980,-1.1192, -.9508, -.8239, -.7258, -.4318, -.2366,
     2 -.1074, 0.0000,  .0969,  .1761,  .2304,  .3010,  .3522,  .4624,
     3  .5563,  .6435,  .7243,  .7924,  .8573,  .9191,  .9731, 1.0253,
     4 1.0719, 1.1173, 1.1614, 1.2095, 1.2480, 1.2900, 1.3263, 1.3617,
     5 1.3979, 1.4393, 1.4698, 1.4983, 1.5314, 1.5682, 1.6021, 1.6335,
     6 1.6721, 1.7076, 1.7482, 1.7924, 1.8325, 1.8865, 1.9395, 2.0000,
     7 2.0607, 2.1206, 2.1903, 2.2652, 2.3385, 2.4313, 2.5185, 2.6435,
     8 2.7853, 2.9777, 3.1072, 3.2553, 3.3617, 3.4771, 3.5563, 3.6233,
     9 3.7076, 3.8325, 3.9345/
      END
```

```
      BLOCK DATA C1D
C*    BLOCK DATA
C        WATER VAPOR BAND MODEL ABSORPTION COEFFICIENTS
C     C1 LOCATION  1     V =  350  CM-1
C     C1 LOCATION  1770 V =  9195  CM-1
C     C1 LOCATION  1771 V =  9875  CM-1
C     C1 LOCATION  2355 V =  12795  CM-1
C     C1 LOCATION  2356 V =  13400  CM-1
C     C1 LOCATION  2580 V =  14520  CM-1
C     COMMON /C1/C1(2580)
      COMMON /C1/ C01(190),C191(190),C381(190),C571(190),C761(190),
     X C951(190),C1141(190),C1331(190),C1521(190),C1711(190),
     X C1901(190),C2091(190),C2281(190),C2471(110)
       DATA C01/
     1 3.93, 3.72, 3.54, 3.42, 3.37, 3.37, 3.36, 3.33, 3.25, 3.13,
     2 3.02, 2.96, 2.97, 3.00, 3.08, 3.12, 3.08, 3.03, 3.00, 3.01,
     3 3.03, 3.07, 3.05, 3.01, 2.94, 2.83, 2.71, 2.62, 2.58, 2.57,
     4 2.62, 2.67, 2.72, 2.71, 2.60, 2.46, 2.35, 2.26, 2.22, 2.23,
     5 2.19, 2.17, 2.17, 2.20, 2.28, 2.34, 2.42, 2.39, 2.20, 2.01,
     6 1.92, 1.83, 1.78, 1.79, 1.81, 1.84, 1.83, 1.80, 1.71, 1.51,
     7 1.39, 1.30, 1.25, 1.18, 1.19, 1.18, 1.21, 1.33, 1.47, 1.53,
     8 1.54, 1.36, 1.12,  .89,  .69,  .49,  .60,  .71,  .79,  .99,
     9  .86,  .73,  .53,  .43,  .51,  .52,  .67,  .73,  .80,  .83,
     $  .80,  .63,  .47,  .32, -.08, -.21, -.29, -.21, -.01,  .08,
     $  .16,  .09, -.03, -.21, -.37, -.35, -.30, -.31, -.37, -.42,
     $ -.48, -.42, -.40, -.39, -.43, -.77, -.83, -.88, -.79, -.60,
     $ -.50, -.42, -.39, -.38, -.37, -.40, -.51, -.67, -.82, -.58,
     $ -.40, -.32, -.21, -.09, -.18, -.16, -.19, -.28, -.33, -.35,
     $ -.28, -.22, -.10, -.05, -.11, -.13, -.27, -.27, -.18, -.06,
     $  .11,  .23,  .26,  .19,  .11, 0.00, -.09,  .02,  .08,  .12,
     $  .22,  .28,  .39,  .54,  .68,  .75,  .79,  .79,  .71,  .69,
     $  .76,  .88, 1.01, 1.16, 1.18, 1.14, 1.05, 1.02, 1.11, 1.23,
     $ 1.41, 1.75, 1.83, 1.99, 2.05, 2.03, 2.00, 1.96, 1.90, 1.86/
       DATA C191/
     1 1.91, 2.08, 2.24, 2.41, 2.63, 2.68, 2.67, 2.73, 2.79, 2.81,
     2 2.91, 2.93, 3.02, 3.16, 3.23, 3.30, 3.34, 3.43, 3.57, 3.59,
     3 3.59, 3.58, 3.57, 3.61, 3.71, 3.71, 3.69, 3.64, 3.60, 3.68,
     4 3.80, 3.95, 4.05, 4.05, 4.02, 3.99, 3.96, 4.01, 4.13, 4.22,
     5 4.35, 4.49, 4.58, 4.62, 4.63, 4.61, 4.57, 4.56, 4.56, 4.53,
     6 4.49, 4.46, 4.40, 4.28, 4.14, 3.92, 3.63, 3.35, 3.16, 3.10,
     7 3.24, 3.47, 3.66, 3.80, 3.93, 4.00, 4.04, 4.15, 4.23, 4.31,
     8 4.35, 4.31, 4.23, 4.20, 4.24, 4.28, 4.35, 4.42, 4.42, 4.44,
     9 4.46, 4.40, 4.30, 4.22, 4.13, 4.07, 4.12, 4.19, 4.22, 4.23,
     $ 4.16, 4.04, 3.99, 3.94, 3.93, 3.91, 3.86, 3.83, 3.80, 3.78,
     $ 3.70, 3.54, 3.40, 3.30, 3.31, 3.42, 3.52, 3.52, 3.49, 3.41,
     $ 3.21, 3.14, 3.10, 3.08, 3.11, 2.98, 2.88, 2.78, 2.74, 2.76,
     $ 2.72, 2.76, 2.82, 2.85, 2.86, 2.75, 2.64, 2.60, 2.61, 2.64,
     $ 2.56, 2.49, 2.37, 2.25, 2.14, 2.08, 2.11, 2.20, 2.31, 2.28,
     $ 2.15, 2.08, 1.98, 2.03, 2.05, 1.96, 1.84, 1.72, 1.64, 1.69,
     $ 1.57, 1.57, 1.60, 1.63, 1.61, 1.38, 1.07,  .91,  .87,  .92,
     $ 1.04, 1.01,  .92,  .84,  .92,  .87, 1.01, 1.06, 1.10, 1.06,
     $ 1.01,  .91,  .79,  .65,  .47,  .41,  .39,  .38,  .34,  .33,
     $  .30,  .43,  .48,  .45,  .38,  .27,  .21,  .22,  .29,  .37/
       DATA C381/
     1  .38,  .37,  .29,  .19,  .13,  .11,  .03, -.05, -.12, -.24,
     2 -.31, -.39, -.43, -.50, -.59, -.68, -.73, -.80, -.92,-1.06,
     3-1.14,-1.22,-1.27,-1.28,-1.33,-1.32,-1.43,-1.51,-1.63,-1.74,
     4-1.82,-1.98,-2.09,-2.21,-2.21,-2.24,-2.27,-2.36,-2.51,-2.66,
     5-2.70,-2.63,-2.57,-2.56,-2.59,-2.67,-2.69,-2.67,-2.68,-2.62,
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6-2.52,-2.42,-2.29,-2.14,-2.00,-1.87,-1.71,-1.51,-1.39,-1.27,
7-1.12,-1.01, -.89, -.75, -.68, -.57, -.47, -.42, -.32, -.27,
8 -.26, -.19, -.13, -.11, -.01,  .05,  .08,  .17,  .25,  .31,
9  .41,  .43,  .44,  .43,  .36,  .35,  .31,  .25,  .25,  .22,
$  .21,  .33,  .49,  .65,  .76,  .71,  .51,  .30,  .13,  .10,
$  .17,  .24,  .31,  .38,  .45,  .51,  .56,  .60,  .63,  .62,
$  .63,  .64,  .66,  .69,  .76,  .75,  .74,  .70,  .62,  .53,
$  .46,  .39,  .38,  .37,  .38,  .42,  .47,  .50,  .58,  .69,
$  .67,  .62,  .64,  .68,  .76,  .90, 1.11, 1.13, 1.10,  .97,
$  .98, 1.17, 1.38, 1.52, 1.70, 1.76, 1.84, 1.92, 1.90, 1.87,
$ 1.91, 2.02, 2.13, 2.10, 2.18, 2.22, 2.25, 2.03, 2.01, 1.77,
$ 1.93, 2.19, 2.28, 2.14, 2.15, 2.22, 2.01, 2.14, 2.26, 2.36,
$ 2.51, 2.66, 2.73, 2.68, 2.69, 2.64, 2.22, 1.95, 1.61, 1.11,
$  .88,  .83,  .89, 1.20, 1.62, 1.82, 1.99, 2.01, 2.14, 2.16/
  DATA C571/
1 2.21, 2.30, 2.33, 2.42, 2.50, 2.51, 2.49, 2.46, 2.42, 2.37,
2 2.37, 2.33, 2.31, 2.43, 2.56, 2.61, 2.63, 2.60, 2.50, 2.38,
3 2.41, 2.34, 2.31, 2.32, 2.40, 2.27, 2.32, 2.22, 2.09, 2.08,
4 2.17, 2.41, 2.77, 2.68, 2.49, 2.29, 2.23, 2.42, 2.61, 2.58,
5 2.49, 2.40, 2.39, 2.51, 2.60, 2.68, 2.68, 2.70, 2.82, 2.83,
6 2.82, 2.81, 2.84, 2.86, 2.91, 2.96, 3.03, 3.08, 3.21, 3.30,
7 3.40, 3.52, 3.49, 3.46, 3.51, 3.54, 3.56, 3.55, 3.57, 3.61,
8 3.71, 3.80, 3.92, 3.99, 4.06, 4.02, 4.06, 4.12, 4.28, 4.30,
9 4.22, 4.32, 4.42, 4.53, 4.64, 4.55, 4.40, 4.28, 4.32, 4.38,
$ 4.37, 4.24, 4.13, 4.14, 4.20, 4.25, 4.32, 4.35, 4.31, 4.27,
$ 4.25, 4.27, 4.31, 4.36, 4.41, 4.52, 4.59, 4.71, 4.79, 4.81,
$ 4.73, 4.61, 4.42, 4.28, 4.08, 4.00, 3.88, 3.86, 3.92, 3.98,
$ 4.12, 4.18, 4.31, 4.37, 4.42, 4.50, 4.53, 4.58, 4.59, 4.61,
$ 4.61, 4.59, 4.53, 4.49, 4.44, 4.41, 4.40, 4.34, 4.30, 4.26,
$ 4.09, 3.98, 3.87, 3.78, 3.77, 3.79, 3.75, 3.72, 3.62, 3.56,
$ 3.51, 3.48, 3.32, 3.18, 3.07, 2.96, 2.87, 2.80, 2.68, 2.58,
$ 2.59, 2.51, 2.59, 2.57, 2.50, 2.42, 2.32, 2.20, 2.12, 2.00,
$ 1.92, 1.79, 1.63, 1.60, 1.69, 1.78, 2.04, 2.00, 1.81, 1.70,
$ 1.63, 1.61, 1.60, 1.49, 1.14, 1.35, 1.64, 1.69, 1.70, 1.59/
  DATA C761/
1 1.45, 1.29, 1.19, 1.08, 1.02, 1.04, 1.10, 1.16, 1.20, 1.23,
2 1.22, 1.08, 1.08, 1.06,  .89,  .93,  .73,  .58,  .54,  .77,
3  .81,  .74,  .71,  .57,  .49,  .43,  .38,  .12,  .10,  .20,
4  .41,  .37,  .31,  .11, -.13, -.21, -.32, -.36, -.39, -.33,
5 -.39, -.45, -.50, -.56, -.62, -.68, -.77, -.84, -.91,-1.00,
6-1.11,-1.19,-1.28,-1.31,-1.39,-1.43,-1.48,-1.52,-1.57,-1.60,
7-1.61,-1.60,-1.58,-1.51,-1.42,-1.32,-1.26,-1.16,-1.00, -.83,
8 -.71, -.61, -.52, -.43, -.36, -.30, -.21, -.19, -.17, -.15,
9 -.13, -.17, -.19, -.12, -.06, -.01, 0.00, -.11, -.23, -.32,
$ -.44, -.51, -.48, -.47, -.42, -.40, -.40, -.39, -.37, -.35,
$ -.48, -.75,-1.13,-1.58,-1.80,-1.66,-1.52,-1.35,-1.19,-1.02,
$ -.88, -.66, -.65, -.63, -.62, -.66, -.73, -.79, -.88, -.84,
$ -.70, -.59, -.43, -.39, -.50, -.61, -.74, -.79, -.76, -.69,
$ -.62, -.59, -.52, -.48, -.48, -.42, -.39, -.38, -.33, -.29,
$ -.26, -.23, -.22, -.28, -.37, -.50, -.60, -.60, -.51, -.46,
$ -.42, -.43, -.45, -.35, -.24, -.14, -.08, -.08, 0.00,  .11,
$  .32,  .43,  .42,  .32,  .23,  .22,  .28,  .45,  .55,  .62,
$  .65,  .71,  .75,  .80,  .83,  .85,  .87,  .90,  .93, 1.00,
$ 1.04, 1.15, 1.22, 1.32, 1.31, 1.32, 1.33, 1.48, 1.78, 1.87/
  DATA C951/
1 2.01, 1.92, 1.86, 1.89, 1.92, 1.98, 2.03, 2.39, 2.31, 2.48,
2 2.70, 2.71, 2.76, 2.78, 2.70, 2.77, 3.08, 2.94, 3.05, 2.94,
3 3.23, 3.20, 3.19, 3.32, 3.11, 3.41, 3.31, 3.36, 3.46, 3.36,
4 3.39, 3.50, 3.41, 3.22, 3.19, 2.98, 2.78, 2.98, 3.02, 2.82,
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5 2.98, 2.86, 2.92, 2.92, 3.05, 3.22, 3.60, 3.78, 3.81, 3.96,
6 3.76, 3.62, 3.34, 3.08, 3.31, 3.16, 3.37, 3.41, 3.30, 3.33,
7 3.33, 3.51, 3.48, 3.43, 3.52, 3.31, 3.40, 3.58, 3.61, 3.49,
8 3.46, 3.42, 3.19, 3.18, 3.30, 3.00, 2.99, 3.21, 3.11, 3.14,
9 3.10, 2.72, 2.81, 2.95, 2.69, 2.73, 2.72, 2.47, 2.51, 2.60,
$ 2.42, 2.37, 2.73, 1.91, 1.87, 1.81, 1.78, 1.53, 1.51, 1.62,
$ 1.59, 1.50, 1.42, 1.32, 1.22, 1.12, 1.08, 1.02,  .97,  .92,
$  .90,  .87,  .84,  .82,  .79,  .78,  .76,  .75,  .72,  .71,
$  .71,  .70,  .69,  .67,  .61,  .59,  .52,  .48,  .41,  .39,
$  .38,  .33,  .32,  .30,  .30,  .30,  .29,  .28,  .27,  .26,
$  .25,  .23,  .22,  .21,  .20,  .18,  .14,  .13,  .06,  .01,
$ -.03, -.07, -.11, -.16, -.21, -.24, -.29, -.32, -.38, -.41,
$ -.45, -.50, -.54, -.61, -.69, -.76, -.84, -.90, -.97,-1.01,
$-1.10,-1.13,-1.19,-1.22,-1.28,-1.30,-1.33,-1.36,-1.39,-1.43,
$-1.48,-1.50,-1.52,-1.57,-1.61,-1.66,-1.70,-1.72,-1.78,-1.81/
  DATA C1141/
1-1.89,-1.92,-2.00,-2.08,-2.16,-2.24,-2.31,-2.40,-2.48,-2.54,
2-2.61,-2.71,-2.83,-2.95,-3.10,-5.00,-5.00,-5.00,-5.00,-5.00,
3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
8-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
9-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-3.78,-3.33,-3.01,-2.82,-2.68,-2.49,-2.30,-2.13,-2.00,-1.81,
$-1.60,-1.41,-1.13, -.90, -.79, -.63, -.48, -.36, -.28, -.16,
$ -.06,  .08,  .20,  .28,  .41,  .54,  .69,  .80,  .92, 1.04,
$ 1.19, 1.19, 1.01,  .98, 1.02, 1.19, 1.29, 1.30, 1.29, 1.38,
$ 1.19, 1.39, 1.42, 1.43, 1.70, 1.62, 1.54, 1.41, 1.53, 1.86,
$ 1.96, 1.97, 2.02, 2.01, 1.94, 1.94, 1.83, 2.03, 2.21, 2.42,
$ 2.30, 2.16, 2.02, 2.02, 2.02, 2.13, 1.90, 1.71, 2.01, 1.56,
$ 1.56, 1.51, 1.30, 1.63, 1.64, 1.67, 1.70, 2.22, 2.39, 2.38,
$ 2.30, 1.93, 2.39, 2.49, 2.52, 2.57, 2.21, 2.18, 2.40, 2.41,
$ 2.45, 2.51, 2.23, 2.49, 2.30, 2.61, 2.72, 2.52, 2.63, 2.56/
  DATA C1331/
1 2.51, 2.70, 2.62, 2.62, 2.80, 2.74, 2.79, 2.74, 2.70, 2.88,
2 2.81, 2.72, 2.76, 2.84, 2.92, 2.98, 2.88, 2.88, 3.02, 3.08,
3 3.26, 3.03, 3.14, 3.28, 3.03, 3.11, 3.15, 3.30, 3.31, 3.22,
4 3.00, 3.08, 3.34, 3.40, 3.37, 3.32, 3.08, 3.09, 3.09, 3.01,
5 3.07, 3.07, 3.31, 3.21, 3.31, 3.67, 3.58, 3.79, 3.70, 3.49,
6 3.39, 3.11, 3.13, 3.01, 3.10, 3.01, 3.18, 3.32, 3.43, 3.35,
7 3.40, 3.39, 3.39, 3.51, 3.54, 3.42, 3.50, 3.67, 3.59, 3.63,
8 3.66, 3.48, 3.39, 3.29, 3.31, 3.41, 3.23, 3.32, 3.12, 2.91,
9 2.91, 2.75, 2.78, 2.72, 2.62, 2.58, 2.32, 2.22, 2.00, 1.97,
$ 1.68, 1.62, 1.64, 1.53, 1.56, 1.51, 1.52, 1.48, 1.42, 1.42,
$ 1.40, 1.41, 1.43, 1.56, 1.52, 1.51, 1.52, 1.39, 1.39, 1.30,
$ 1.09, 1.16, 1.21, 1.20, 1.22, 1.20, 1.18, 1.20, 1.19, 1.17,
$ 1.10, 1.10, 1.09, 1.10, 1.11, 1.04,  .98,  .90,  .88,  .90,
$  .90,  .90,  .86,  .71,  .79,  .70,  .71,  .67,  .62,  .53,
$  .42,  .31,  .20,  .01, -.08, -.17, -.26, -.35, -.44, -.53,
$ -.63, -.73, -.83, -.93,-1.04,-1.14,-1.24,-1.34,-1.44,-1.54,
$-1.64,-1.74,-1.84,-1.94,-2.04,-2.14,-2.24,-2.34,-2.44,-2.54,
$-2.64,-2.74,-2.84,-2.94,-3.04,-3.14,-3.24,-3.34,-3.44,-3.54,
$-3.64,-3.74,-3.84,-3.94,-4.04,-5.00,-5.00,-5.00,-5.00,-5.00/
  DATA C1521/
1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
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4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
8-4.15,-4.06,-3.97,-3.88,-3.79,-3.70,-3.61,-3.52,-3.43,-3.34,
9-3.25,-3.16,-3.07,-2.98,-2.89,-2.80,-2.71,-2.62,-2.53,-2.44,
$-2.35,-2.26,-2.18,-2.09,-2.00,-1.91,-1.82,-1.73,-1.64,-1.55,
$-1.46,-1.37,-1.28,-1.19,-1.10,-1.01, -.92, -.83, -.74, -.65,
$ -.56, -.47, -.38, -.29, -.20, -.14, -.09, -.02,  .03,  .10,
$  .17,  .22,  .30,  .35,  .41,  .45,  .42,  .40,  .43,  .46,
$  .50,  .59,  .71,  .84,  .93, 1.01, 1.06, 1.07, 1.02, 1.01,
$ 1.12, 1.23, 1.24, 1.28, 1.34, 1.43, 1.52, 1.56, 1.59, 1.56,
$ 1.51, 1.61, 1.50, 1.70, 1.82, 1.92, 1.94, 1.89, 1.81, 1.45,
$ 1.30, 1.28, 1.43, 1.50, 1.49, 1.55, 1.48, 1.32, 1.39, 1.53,
$ 1.82, 2.23, 2.61, 2.51, 2.20, 1.86, 1.61, 1.19, 1.32, 1.52,
$ 1.70, 1.90, 2.01, 1.92, 1.91, 2.12, 2.10, 2.01, 2.18, 1.99/
  DATA C1711/
1 2.11, 2.28, 2.21, 2.13, 2.00, 1.91, 1.92, 1.97, 1.88, 1.91,
2 1.91, 1.92, 1.93, 1.74, 1.61, 1.58, 1.27, 1.20, 1.18, 1.11,
3  .99,  .86,  .71,  .60,  .44,  .31,  .19,  .03, -.07, -.21,
4 -.35, -.49, -.64, -.79, -.94,-1.11,-1.24,-1.41,-1.57,-1.73,
5-1.91,-2.09,-2.27,-2.45,-2.63,-2.81,-2.99,-3.18,-3.37,-3.56,
6-3.75,-3.94,-4.13,-4.31,-4.49,-4.66,-4.83,-4.99,-5.14,-5.28,
7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.68,-4.26,
8-3.89,-3.57,-3.32,-3.11,-2.91,-2.89,-2.79,-2.74,-2.63,-2.47,
9-2.29,-2.20,-2.17,-2.23,-2.27,-2.32,-2.12,-2.08,-2.07,-2.07,
$-2.07,-1.98,-1.77,-1.70,-1.63,-1.60,-1.59,-1.43,-1.21,-1.15,
$-1.09,-1.13,-1.29,-1.19, -.98, -.93, -.87, -.91, -.88, -.71,
$ -.62, -.59, -.58, -.63, -.58, -.39, -.22, -.14, -.06, -.01,
$ -.01, -.08, -.20, -.16, -.02,  .18,  .32,  .42,  .37,  .23,
$  .12,  .15,  .28,  .43,  .59,  .56,  .53,  .44,  .39,  .38,
$  .35,  .23,  .26,  .19,  .08,  .10,  .18,  .27,  .38,  .43,
$  .32,  .37,  .58,  .64,  .87,  .98, 1.00, 1.02, 1.13, 1.08,
$ 1.08, 1.16, 1.16, 1.30, 1.41, 1.40, 1.32, 1.32, 1.37, 1.42,
$ 1.50, 1.42, 1.38, 1.36, 1.38, 1.49, 1.63, 1.62, 1.62, 1.70,
$ 1.68, 1.60, 1.56, 1.56, 1.63, 1.64, 1.56, 1.49, 1.49, 1.52/
  DATA C1901/
1 1.58, 1.62, 1.62, 1.61, 1.61, 1.62, 1.63, 1.71, 1.72, 1.70,
2 1.70, 1.67, 1.62, 1.66, 1.70, 1.67, 1.56, 1.49, 1.42, 1.38,
3 1.25, 1.20, 1.13, 1.14, 1.19, 1.29, 1.50, 1.72, 1.86, 1.78,
4 1.82, 1.88, 1.82, 1.89, 1.99, 2.00, 2.14, 2.04, 2.02, 2.02,
5 1.98, 1.90, 1.83, 1.81, 1.72, 1.69, 1.59, 1.50, 1.36, 1.20,
6  .98,  .63,  .43,  .29,  .16,  .05,  .02,  .03,  .03,  .01,
7 -.08, -.18, -.20, -.11, -.06, -.03, -.14, -.21, -.08, -.06,
8  .10,  .18,  .11,  .32,  .42,  .44,  .38,  .28,  .42,  .43,
9  .41,  .33,  .32,  .41,  .50,  .46,  .31,  .18,  .08,  .20,
$  .21,  .34,  .36,  .28,  .35,  .39,  .42,  .38,  .32,  .30,
$  .16, -.01, -.23, -.41, -.52, -.48, -.58, -.61, -.48, -.23,
$ -.03,  .21,  .36,  .39,  .47,  .44,  .40,  .51,  .59,  .53,
$  .69,  .57,  .48,  .52,  .62,  .59,  .55,  .50,  .32,  .26,
$  .11, -.08, -.10, -.16, -.43, -.62, -.88,-1.09,-1.16,-1.31,
$-1.45,-1.49,-1.78,-1.91,-2.01,-1.97,-1.97,-1.97,-1.97,-2.26,
$-2.20,-2.01,-1.99,-2.00,-2.04,-2.37,-2.49,-2.44,-2.36,-2.32,
$-2.19,-2.10,-2.25,-2.16,-2.36,-2.44,-2.40,-2.49,-2.48,-2.43,
$-2.40,-2.36,-2.40,-2.49,-2.59,-2.68,-2.89,-3.28,-3.61,-3.74,
$-3.97,-4.20,-4.43,-4.66,-4.89,-5.00,-5.00,-5.00,-5.00,-5.00/
  DATA C2091/
1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
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3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,      DC1 1280
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,      DC1 1285
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,      DC1 1290
6-5.00,-5.00,-5.00,-5.00,-5.00,-3.71,-3.56,-3.40,-3.21,-3.06,      DC1 1295
7-2.90,-2.74,-2.60,-2.46,-2.32,-2.17,-2.03,-1.87,-1.79,-1.74,      DC1 1300
8-1.83,-1.82,-1.71,-1.59,-1.49,-1.46,-1.46,-1.49,-1.49,-1.25,      DC1 1305
9-1.24,-1.08, -.90,-1.06, -.91, -.91,-1.01, -.99, -.87, -.92,      DC1 1310
$ -.79, -.42, -.54, -.38, -.42, -.48, -.34, -.27, -.17, -.28,      DC1 1315
$ -.38, -.22, -.30, -.08, -.01, -.20,  .06,  .10,  .06,  .14,      DC1 1320
$ -.12, -.02, -.02, -.13, -.11, -.10, -.06, -.05, -.04, -.10,      DC1 1325
$ -.04, -.06, -.21, -.38, -.61, -.40, -.31, -.42, -.58, -.57,      DC1 1330
$ -.54, -.24,  .11,  .51,  .81,  .79,  .62,  .26, -.31, -.67,      DC1 1335
$ -.80, -.88, -.50, -.39, -.10,  .09,  .06,  .08,  .16,  .21,      DC1 1340
$  .13,  .32,  .35,  .51,  .60,  .61,  .51,  .40,  .40,  .43,      DC1 1345
$  .42,  .33,  .43,  .34,  .22,  .13, -.11, -.31, -.31, -.41,      DC1 1350
$ -.41, -.39, -.53, -.69, -.84, -.88,-1.01,-1.10,-1.19,-1.29,      DC1 1355
$-1.45,-1.49,-1.67,-1.87,-1.51,-1.66,-1.60,-1.69,-1.83,-1.51/      DC1 1360
  DATA C2201/                                                      DC1 1365
1-1.42,-1.40,-1.24,-1.38,-1.31,-1.30,-1.30,-1.28,-1.39,-1.33,      DC1 1370
2-1.40,-1.35,-1.37,-1.39,-1.41,-1.49,-1.48,-1.56,-1.47,-1.46,      DC1 1375
3-1.41,-1.42,-1.48,-1.41,-1.31,-1.15,-1.13,-1.20,-1.41,-1.88,      DC1 1380
4-2.08,-2.08,-2.22,-2.35,-2.35,-1.98,-1.92,-1.78,-1.57,-1.69,      DC1 1385
5-1.70,-1.70,-1.66,-1.84,-1.50,-1.56,-1.42,-1.29,-1.38,-1.28,      DC1 1390
6-1.48,-1.58,-1.44,-1.53,-1.48,-1.48,-1.58,-1.58,-1.69,-1.79,      DC1 1395
7-2.00,-2.16,-1.99,-2.23,-2.04,-2.04,-2.39,-2.74,-3.09,-3.44,      DC1 1400
8-3.79,-4.14,-4.49,-4.84,-5.19,-2.46,-2.26,-1.99,-2.01,-2.14,      DC1 1405
9-2.31,-2.15,-2.01,-1.99,-2.14,-2.41,-2.12,-1.99,-1.84,-1.79,      DC1 1410
$-1.71,-1.78,-1.72,-1.68,-1.78,-1.52,-1.38,-1.29,-1.22, -.91,      DC1 1415
$ -.90,-1.01, -.76, -.90, -.90, -.90,-1.19,-1.00, -.79, -.68,      DC1 1420
$ -.68, -.73, -.85, -.85, -.61, -.61, -.48, -.51, -.92, -.83,      DC1 1425
$ -.61, -.41, -.29, -.29, -.61, -.74, -.19, -.18, 0.00,  .19,      DC1 1430
$ -.10,  .20,  .20,  .02,  .20, -.01,  .18,  .20,  .11, 0.00,      DC1 1435
$ -.37, -.10,  .02,  .16,  .20, 0.00,  .09,  .09,  .09,  .07,      DC1 1440
$  .22,  .11,  .11,  .21,  .09,  .21,  .20,  .37,  .28,  .07,      DC1 1445
$  .09, -.29, -.69, -.69, -.74, -.88,-1.01, -.86, -.54, -.19,      DC1 1450
$  .19,  .23,  .21,  .29,  .28,  .29,  .52,  .54,  .51,  .60,      DC1 1455
$  .40,  .49,  .48,  .46,  .49,  .27,  .06, -.33, -.81,-1.17/      DC1 1460
  DATA C2471/                                                      DC1 1465
1-1.11,-1.37,-1.52,-1.54,-1.94,-2.06,-2.06,-2.14,-1.96,-2.00,      DC1 1470
2-2.00,-2.08,-2.23,-2.31,-2.31,-2.53,-2.31,-2.31,-2.31,-2.28,      DC1 1475
3-2.34,-2.34,-1.91,-1.82,-1.69,-1.56,-1.84,-1.91,-1.75,-1.83,      DC1 1480
4-1.76,-1.54,-1.98,-1.60,-1.68,-1.69,-1.56,-1.60,-1.71,-1.36,      DC1 1485
5-1.36,-1.44,-1.48,-1.40,-1.48,-1.36,-1.45,-1.49,-1.85,-1.39,      DC1 1490
6-1.23,-1.18,-1.18,-1.34,-1.36,-1.23,-1.23,-1.37,-1.30,-1.40,      DC1 1495
7-1.28,-1.27,-1.37,-1.32,-1.32,-1.22,-1.28,-1.38,-1.69,-2.07,      DC1 1500
8-2.42,-2.59,-2.58,-3.80,-2.58,-2.43,-1.88,-1.60,-1.26,-1.16,      DC1 1505
9-1.23,-1.10,-1.23,-1.10, -.83, -.80, -.80, -.80, -.98, -.97,      DC1 1510
$ -.97, -.91, -.92,-1.13,-1.24,-1.50,-1.89,-2.18,-2.32,-2.63,      DC1 1515
$-3.91,-4.20,-4.49,-4.78,-5.07,-5.07,-5.07,-5.07,-5.07,-5.07/      DC1 1520
 END                                                               DC1 1525
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      BLOCK DATA C2D
C@    BLOCK DATA
C        UNIFORMLY MIXED GASES BAND MODEL ABSORPTION COEFFICIENTS
C     INCLUDING CO2,CO,N2O,CH4
C     C2 LOCATION  1     V =  500     CM-1
C     C2 LOCATION  1515 V =  8070     CM-1
C     C2 LOCATION  1516 V =  12950     CM-1
C     C2 LOCATION  1575 V =  13245  CM-1
C     COMMON/C2/ C2(1575)
      COMMON /C2/C001(190),C191(190),C381(190),C571(190),C761(190),
     X C951(190),C1141(190),C1331(190),C1521(55)
      DATA C001 /
     1-4.25,-3.70,-3.20,-2.75,-1.90,-1.73,-1.51,-1.29,-1.11, -.91,
     2 -.71, -.51, -.30, -.06,  .22,  .49,  .76, 1.08, 1.29, 1.56,
     3 1.76, 1.91, 2.08, 2.23, 2.36, 2.51, 2.72, 2.90, 3.12, 3.37,
     4 3.56, 3.69, 3.79, 3.86, 3.88, 3.86, 3.73, 3.58, 3.38, 3.17,
     5 2.86, 2.73, 2.52, 2.31, 2.17, 2.01, 1.89, 1.77, 1.63, 1.47,
     6 1.21,  .92,  .53,  .23, -.17, -.53, -.74, -.81, -.84, -.88,
     7-1.00,-1.18,-1.42,-1.61,-1.86,-2.10,-2.29,-2.51,-2.72,-2.91,
     8-3.14,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     9-5.00,-2.68,-2.47,-2.19,-1.97,-1.71,-1.50,-1.32,-1.21,-1.13,
     $-1.09,-1.11,-1.10,-1.09,-1.01,-1.01,-1.11,-1.33,-1.66,-2.13,
     $-2.51,-2.83,-2.71,-2.39,-2.09,-1.78,-1.59,-1.33,-1.18,-1.01,
     $ -.96, -.91, -.90, -.87, -.80, -.79, -.86,-1.07,-1.28,-1.69,
     $-2.11,-2.74,-3.09,-3.50,-3.03,-2.58,-2.23,-1.89,-1.54,-1.28,
     $-1.13,-1.11,-1.16,-1.20,-1.23,-1.21,-1.17,-1.12,-1.15,-1.19,
     $-1.20,-1.17,-1.02, -.89, -.68, -.42, -.24, -.01,  .18,  .40,
     $  .57,  .77,  .96, 1.07, 1.13, 1.11, 1.08, 1.15, 1.27, 1.33,
     $ 1.44, 1.40, 1.13,  .89,  .63,  .54,  .65,  .78,  .81,  .86,
     $  .82,  .68,  .47,  .14, -.12, -.48, -.92,-1.43,-1.89,-2.32,
     $-2.81,-5.00,-5.00,-5.00,-3.14,-2.47,-2.00,-1.71,-1.59,-1.61/
      DATA C191 /
     1-1.69,-1.82,-1.87,-1.90,-1.94,-2.04,-2.10,-2.23,-2.32,-2.48,
     2-2.71,-2.88,-3.09,-2.99,-2.43,-2.00,-1.69,-1.42,-1.38,-1.49,
     3-1.70,-2.01,-2.41,-2.64,-2.63,-2.49,-2.38,-2.27,-2.16,-2.05,
     4-1.94,-1.83,-1.76,-1.71,-1.70,-1.72,-1.81,-1.92,-2.03,-2.27,
     5-2.61,-3.21,-4.01,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     8-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.30,-3.42,-3.17,-2.98,
     9-2.83,-2.71,-2.67,-2.67,-2.68,-2.58,-2.33,-2.01,-1.64,-1.32,
     $ -.97, -.76, -.63, -.59, -.60, -.63, -.69, -.87,-1.08,-1.26,
     $-1.53,-1.87,-1.91,-1.93,-2.02,-2.21,-2.48,-2.80,-3.08,-3.11,
     $-3.09,-2.93,-2.76,-2.39,-2.01,-1.69,-1.36, -.99, -.63, -.28,
     $ 0.00,  .08,  .11,  .12,  .12,  .07,  .01, -.08, -.23, -.40,
     $ -.51, -.53, -.57, -.60, -.61, -.73, -.81, -.95,-1.05,-1.02,
     $ -.91, -.68, -.41, -.09,  .18,  .41,  .76, 1.00, 1.18, 1.39,
     $ 1.51, 1.58, 1.68, 1.71, 1.80, 1.91, 2.03, 2.18, 2.32, 2.50,
     $ 2.61, 2.69, 2.81, 2.89, 2.96, 3.04, 3.14, 3.27, 3.41, 3.55,
     $ 3.72, 3.90, 4.03, 4.22, 4.42, 4.61, 4.71, 4.73, 4.65, 4.63,
     $ 4.72, 4.78, 4.79, 4.50, 3.62, 3.28, 2.79, 2.30, 1.86, 1.35/
      DATA C381 /
     1  .52, -.24,-1.09,-2.18,-2.01,-1.79,-1.53,-1.32,-1.20,-1.15,
     2-1.12,-1.18,-1.25,-1.26,-1.20,-1.17,-1.20,-1.32,-1.54,-1.84,
     3-2.16,-2.30,-2.26,-2.01,-1.71,-1.36,-1.06, -.81, -.61, -.49,
     4 -.45, -.47, -.49, -.46, -.37, -.31, -.34, -.49, -.75,-1.11,
     5-1.43,-2.01,-2.60,-2.88,-2.87,-2.74,-2.51,-2.42,-2.38,-2.39,
     6-2.42,-2.46,-2.48,-2.49,-2.43,-2.43,-2.46,-2.53,-2.68,-2.74,
     7-2.82,-2.87,-2.83,-2.82,-2.79,-2.71,-2.66,-2.49,-2.40,-2.32,
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8-2.26,-2.23,-2.20,-2.09,-2.02,-1.96,-1.88,-1.84,-1.86,-1.86,
9-1.87,-1.83,-1.79,-1.73,-1.68,-1.64,-1.69,-1.74,-1.79,-1.87,
$-1.78,-1.63,-1.50,-1.37,-1.21,-1.00, -.83, -.69, -.53, -.41,
$ -.30, -.19, -.09, -.04,  .02,  .10,  .16,  .18,  .23,  .26,
$  .27,  .26,  .24,  .22,  .17,  .12,  .07, -.01, -.07, -.09,
$  .32,  .72,  .91, 1.12, 1.03,  .67,  .18, -.11, -.38, -.29,
$ -.17, -.08, 0.00,  .09,  .13,  .18,  .24,  .27,  .29,  .30,
$  .29,  .26,  .23,  .21,  .13,  .09,  .02, -.04, -.18, -.32,
$ -.51, -.72, -.98,-1.18,-1.50,-1.62,-1.81,-2.04,-2.29,-2.49,
$-2.62,-2.87,-3.03,-3.21,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.01,-3.38,-3.01,-2.63,
$-2.32,-2.09,-1.98,-1.94,-2.00,-2.14,-2.26,-2.20,-2.02,-1.82/
 DATA C571 /
1-1.59,-1.43,-1.38,-1.46,-1.64,-1.90,-2.09,-2.54,-2.91,-3.28,
2-3.61,-3.72,-3.64,-3.50,-3.41,-3.37,-3.30,-3.16,-3.01,-2.76,
3-2.51,-2.20,-1.80,-1.49,-1.22, -.97, -.72, -.49, -.20,  .03,
4  .20,  .36,  .51,  .61,  .67,  .83, 1.00, 1.22, 1.38, 1.56,
5 1.70, 1.86, 2.01, 2.20, 2.31, 2.47, 2.61, 2.76, 2.92, 3.01,
6 3.05, 3.02, 2.98, 2.98, 3.01, 3.03, 2.97, 2.78, 2.44, 2.13,
7 1.83, 1.59, 1.49, 1.50, 1.67, 1.94, 2.22, 2.50, 2.71, 2.93,
8 3.12, 3.18, 3.17, 3.15, 3.21, 3.26, 3.19, 2.98, 2.59, 2.14,
9 1.70, 1.22,  .55, -.27,-1.09,-2.54,-3.00,-2.94,-2.78,-2.68,
$-2.61,-2.60,-2.63,-2.60,-2.57,-2.53,-2.57,-2.64,-2.77,-3.04,
$-3.38,-3.98,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-4.00,-3.73,-3.62,-3.59,-3.53,-3.56,-3.57,-3.53,-3.51,
$-3.45,-3.37,-3.26,-3.21,-3.18,-3.27,-3.36,-3.60,-3.96,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-4.62,-4.07,-3.89,-3.76,-3.67,-3.56,
$-3.42,-3.35,-3.20,-3.10,-3.14,-3.11,-3.09,-3.10,-3.12,-3.23,
$-3.30,-3.38,-3.37,-3.29,-3.14,-3.08,-3.00,-2.93,-2.89,-2.91/
 DATA C751 /
1-3.00,-3.08,-3.16,-3.31,-3.48,-3.71,-3.98,-5.00,-5.00,-5.00,
2-5.00,-4.52,-3.98,-3.69,-3.42,-3.18,-2.95,-2.77,-2.61,-2.48,
3-2.41,-2.41,-2.40,-2.38,-2.34,-2.27,-2.21,-2.31,-2.48,-2.73,
4-3.21,-4.13,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-5.00,-5.00,-4.13,-4.02,-3.99,-3.96,-3.87,-3.73,-3.51,-3.29,
7-3.13,-2.99,-2.84,-2.73,-2.69,-2.68,-2.69,-2.65,-2.62,-2.59,
8-2.57,-2.62,-2.81,-3.04,-3.21,-3.39,-3.42,-3.36,-3.21,-3.03,
9-2.93,-2.80,-2.64,-2.52,-2.37,-2.28,-2.20,-2.13,-2.07,-2.02,
$-1.96,-1.88,-1.78,-1.63,-1.44,-1.31,-1.20,-1.08, -.98, -.94,
$ -.86, -.76, -.52, -.31, -.08,  .13,  .30,  .37,  .36,  .36,
$  .35,  .35,  .39,  .46,  .48,  .41,  .23, -.08, -.38, -.67,
$ -.88, -.96, -.98, -.87, -.67, -.36, -.12,  .14,  .44,  .68,
$  .90, 1.11, 1.19, 1.24, 1.25, 1.26, 1.27, 1.51, 1.59, 1.50,
$ 1.28,  .71,  .11, -.28, -.67,-1.32,-1.61,-1.58,-1.42,-1.18,
$ -.91, -.59, -.27, -.00,  .29,  .57,  .73,  .92,  .81,  .73,
$  .79,  .91, 1.01, 1.03,  .88,  .72,  .63,  .38,  .12, -.21,
$ -.47, -.67,-1.23,-1.67,-2.31,-2.76,-3.24,-3.49,-3.51,-3.47,
$-3.39,-3.37,-3.43,-3.53,-3.60,-3.36,-3.18,-3.07,-2.96,-3.08/
 DATA C951 /
1-3.14,-3.12,-3.23,-3.07,-2.83,-2.47,-2.23,-2.07,-1.91,-1.78,
2-1.63,-1.46,-1.27,-1.23,-1.26,-1.40,-1.57,-1.98,-2.28,-2.87,
3-3.74,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
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7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
8-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
9-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-4.91,-4.79,-4.61,-4.45,-4.40,-4.29,-4.17,-3.90,
$-3.73,-3.59,-3.62,-3.72,-3.73,-3.69,-3.31,-3.12,-2.91,-2.63,
$-2.41,-2.27,-2.16,-2.11,-2.28,-2.29,-2.21,-2.06,-1.91,-1.99,
$-2.27,-2.59,-2.98,-3.35,-3.69,-3.79,-3.68,-3.53,-3.46,-3.39,
$-3.31,-3.16,-2.97,-2.69,-2.39,-2.11,-1.83,-1.58,-1.49,-1.22/
 DATA C1141 /
1-1.08, -.89, -.68, -.54, -.71, -.79, -.78, -.66, -.49, -.54,
2 -.86,-1.37,-2.08,-2.44,-3.46,-3.72,-3.74,-3.59,-3.22,-2.98,
3-2.52,-2.21,-1.64,-1.34,-1.08, -.86, -.72, -.61, -.70, -.72,
4 -.67, -.57, -.38, -.51, -.97,-1.36,-1.89,-2.74,-3.18,-4.21,
5-4.57,-4.62,-4.78,-4.87,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-4.93,-4.46,-3.99,-3.45,-2.99,-2.63,-2.30,-2.09,-2.02,-2.12,
7-2.18,-2.13,-2.04,-1.78,-1.83,-2.08,-2.28,-2.51,-3.01,-3.15,
8-3.22,-3.29,-3.58,-3.89,-4.46,-4.88,-5.00,-5.00,-5.00,-5.00,
9-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
$-4.81,-4.52,-4.11,-3.69,-3.09,-2.99,-2.91,-2.89,-3.19,-3.20,
$-3.38,-3.62,-3.89,-3.92,-3.73,-3.53,-3.37,-3.19,-3.02,-2.79,
$-2.52,-2.36,-2.24,-2.19,-2.32,-2.41,-2.29,-2.06,-2.00,-2.18,
$-2.47,-2.91,-3.57,-4.69,-5.00,-5.00,-5.00,-5.00,-5.00,-4.61,
$-4.18,-3.89,-3.57,-3.30,-3.02,-2.74,-2.51,-2.20,-1.98,-1.73,
$-1.57,-1.38,-1.21,-1.11, -.98, -.87, -.78, -.60, -.37, -.18,
$ -.04, -.04, -.06, -.15, -.18, -.19, -.23, -.45,-1.02,-1.97,
$-2.70,-3.71,-4.01,-4.20,-4.35,-4.58,-4.73,-4.81,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00;-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00/
 DATA C1331 /
1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-5.00,-5.00,-5.00,-4.71,-4.31,-3.99,-3.68,-3.50,-3.34,-3.22,
7-3.23,-3.25,-3.24,-3.18,-3.10,-3.07,-3.18,-3.41,-3.67,-4.12,
8-4.68,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.51,-4.18,
9-3.73,-3.48,-3.17,-2.96,-2.73,-2.63,-2.58,-2.59,-2.57,-2.49,
$-2.42,-2.38,-2.48,-2.62,-3.02,-3.49,-4.16,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00-5.00,-5.00,-4.87,-4.50,
$-4.21,-3.90,-3.66,-3.56,-3.51,-3.51,-3.51,-3.49,-3.41,-3.34,
$-3.34,-3.47,-3.60,-3.87,-4.23,-4.59,-5.00,-5.00,-5.00,-5.00,
$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.92,
$-4.51,-4.10,-3.78,-3.32,-3.03,-2.74,-2.43,-2.08,-1.83,-1.59,
$-1.29,-1.02, -.81, -.70, -.73, -.90,-1.08,-1 19,-1.35,-1.47,
$-1.57,-1.66,-1.80,-1.91,-2.04,-2.18,-2.33,-2.47,-2.61,-2.78,
$-2.97,-3.10,-3.28,-3.44,-3.63,-3.81,-3.98,-4.15,-4.32,-4.61,
$-4.71,-4.80,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.32/
 DATA C1521 /
1-3.24,-2.59,-2.12,-1.82,-1.57,-1.34,-1.16,-1.02, -.82, -.64,
2 -.48, -.33, -.14, -.06,  .08,  .21,  .39,  .52,  .61,  .72,
3  .85,  .96, 1.02, 1.12, 1.16, 1.21, 1.17, 1.08,  .98,  .90,
4  .97, 1.13, 1.37, 1.58, 1.74, 1.70, 1.48, 1.13,  .73,  .22,
5 -.51,-1.67,-3.48,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
6-5.00,-5.00,-5.00,-5.00,-5.00/
 END
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      BLOCK DATA C3D
C*    BLOCK DATA
C        OZONE BAND MODEL ABSORPTION COEFFICIENTS
C     C3 LOCATION  1    V =  575   CM-1
C     C3 LOCATION  510  V =  3270 CM-1
C     COMMON /C3/ C3(540)
      COMMON  /C3/ C001(190),C191(190),C381(160)
      DATA C001 /
     1-4.15,-3.51,-3.00,-2.54,-2.12,-1.76,-1.50,-1.21, -.86, -.49,
     2 -.29, -.10,  .02,  .12,  .24,  .32,  .43,  .52,  .58,  .65,
     3  .72,  .79,  .76,  .72,  .68,  .64,  .68,  .79,  .82,  .83,
     4  .80,  .78,  .68,  .56,  .49,  .42,  .34,  .26,  .14,  .02,
     5 -.14, -.35, -.51, -.74, -.88,-1.17,-1.40,-1.58,-2.11,-2.47,
     6-2.83,-3.24,-3.59,-3.94,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     7-5.00,-5.00,-5.00,-5.00,-5.00,-4.46,-4.00,-3.50,-3.14,-2.78,
     8-2.41,-2.10,-1.78,-1.49,-1.20, -.20,  .15,  .35,  .57,  .78,
     9  .95, 1.20, 1.40, 1.65, 1.80, 1.97, 2.10, 2.21, 2.31, 2.38,
     $ 2.40, 2.42, 2.58, 2.52, 2.20, 2.48, 2.54, 2.45, 2.30, 2.00,
     $ 1.20,  .95,  .92,  .90,  .90,  .89,  .90,  .92,  .94,  .95,
     $  .96,  .95,  .90,  .80,  .68,  .55,  .40,  .30,  .16,  .08,
     $ -.02, -.11, -.22, -.41, -.56, -.71, -.89,-1.03,-1.18,-1.33,
     $-1.60,-1.76,-1.90,-2.02,-2.21,-2.40,-2.59,-2.79,-3.00,-3.22,
     $-3.61,-4.16,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00/
      DATA C191 /
     1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     2-5.00,-5.00,-5.00,-5.00,-4.16,-3.91,-3.66,-3.41,-3.05,-2.69,
     3-2.44,-2.19,-2.03,-1.86,-1.71,-1.56,-1.48,-1.39,-1.26,-1.13,
     4 -.97, -.81, -.65, -.48, -.35, -.22, -.14, -.06, -.02, -.09,
     5 -.18, -.14,  .06,  .26, -.02, -.42, -.80, -.82, -.80, -.74,
     6 -.74, -.79, -.84, -.89, -.85, -.81, -.76, -.70, -.68, -.64,
     7 -.65, -.66, -.72, -.78, -.84, -.90,-1.02,-1.16,-1.24,-1.33,
     8-1.47,-1.61,-1.77,-1.92,-1.98,-2.04,-2.08,-2.09,-2.06,-2.03,
     9-1.98,-1.93,-1.87,-1.82,-1.76,-1.71,-1.65,-1.59,-1.51,-1.44,
     $-1.36,-1.28,-1.18,-1.08, -.98, -.89, -.78, -.69, -.59, -.49,
     $ -.37, -.25, -.18, -.10, 0.00,  .16,  .27,  .38,  .57,  .75,
     $  .93, 1.11, 1.20, 1.33, 1.44, 1.46, 1.48, 1.48, 1.64, 1.58,
     $ 1.49, 1.23,  .66,  .38, -.33, -.71, -.66, -.58, -.49, -.44,
     $ -.40, -.40, -.46, -.53, -.64, -.76, -.89,-1.01,-1.14,-1.26,
     $-1.40,-1.55,-1.69,-1.83,-1.98,-2.13,-2.28,-2.43,-2.64,-2.86,
     $-3.07,-3.28,-3.50,-3.72,-3.94,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     $-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00/
      DATA C381 /
     1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,
     4-5.00,-5.00,-5.00,-4.16,-3.97,-3.77,-3.58,-3.36,-3.07,-2.75,
     5-2.44,-2.12,-1.85,-1.57,-1.30,-1.07, -.95, -.94, -.89, -.85,
     6 -.81, -.77, -.72, -.68, -.63, -.58, -.53, -.48, -.41, -.34,
     7 -.28, -.19, -.17, -.18, -.19, -.46, -.79,-1.12,-1.45,-1.75,
     8-2.38,-2.97,-3.57,-4.16,-5.00,-5.00,-5.00,-4.16,-3.80,-3.83,
     9-3.37,-3.10,-2.79,-2.47,-2.15,-1.84,-1.73,-1.63,-1.52,-1.41,
     $-1.33,-1.25,-1.17,-1.09,-1.02, -.96, -.89, -.82, -.73, -.68,
     $ -.54, -.42, -.27, -.13,  .03,  .16,  .25,  .31,  .38,  .47,
     $  .48,  .49,  .50,  .50,  .48,  .48,  .23,  .01, -.11, -.33,
     $ -.55, -.77, -.03, -.88, -.94, -.92, -.91, -.90, -.83, -.80,
     $ -.78, -.71, -.69, -.67, -.66, -.65, -.65, -.66, -.67, -.68,
     $ -.70, -.72, -.82, -.93,-1.03,-1.14,-1.24,-1.34,-1.51,-1.68,
     $-2.13,-2.57,-2.92,-3.28,-3.71,-4.16,-5.00,-5.00,-5.00,-5.00/
      END
```

```
      BLOCK DATA C4D
C8    BLOCK DATA
      COMMON /C4C8/ C401(114),C4115(19),C8(102)
C         N2 CONTINUUM ABSORPTION COEFFICIENTS
C     C4 LOCATION  1    V =  2080 CM-1
C     C4 LOCATION  133  V =  2740 CM-1
      DATA C401 /
     1 2.93E-04, 3.86E-04, 5.09E-04, 6.56E-04, 8.85E-04, 1.08E-03,
     2 1.31E-03, 1.73E-03, 2.27E-03, 2.73E-03, 3.36E-03, 3.95E-03,
     3 5.46E-03, 7.19E-03, 9.00E-03, 1.13E-02, 1.36E-02, 1.66E-02,
     4 1.96E-02, 2.16E-02, 2.36E-02, 2.63E-02, 2.90E-02, 3.15E-02,
     5 3.40E-02, 3.66E-02, 3.92E-02, 4.26E-02, 4.60E-02, 4.95E-02,
     6 5.30E-02, 5.65E-02, 6.00E-02, 6.30E-02, 6.60E-02, 6.89E-02,
     7 7.18E-02, 7.39E-02, 7.60E-02, 7.84E-02, 8.08E-02, 8.39E-02,
     8 8.70E-02, 9.13E-02, 9.56E-02, 1.08E-01, 1.20E-01, 1.36E-01,
     9 1.52E-01, 1.60E-01, 1.69E-01, 1.60E-01, 1.51E-01, 1.37E-01,
     $ 1.23E-01, 1.19E-01, 1.16E-01, 1.14E-01, 1.12E-01, 1.12E-01,
     $ 1.11E-01, 1.11E-01, 1.12E-01, 1.14E-01, 1.13E-01, 1.12E-01,
     $ 1.09E-01, 1.07E-01, 1.02E-01, 9.90E-02, 9.50E-02, 9.00E-02,
     $ 8.65E-02, 8.20E-02, 7.65E-02, 7.05E-02, 6.50E-02, 6.10E-02,
     $ 5.50E-02, 4.95E-02, 4.50E-02, 4.00E-02, 3.75E-02, 3.50E-02,
     $ 3.10E-02, 2.65E-02, 2.50E-02, 2.20E-02, 1.95E-02, 1.75E-02,
     $ 1.60E-02, 1.40E-02, 1.20E-02, 1.05E-02, 9.50E-03, 9.00E-03,
     $ 8.00E-03, 7.00E-03, 6.50E-03, 6.00E-03, 5.50E-03, 4.75E-03,
     $ 4.00E-03, 3.75E-03, 3.50E-03, 3.00E-03, 2.50E-03, 2.25E-03,
     $ 2.00E-03, 1.85E-03, 1.70E-03, 1.60E-03, 1.50E-03, 1.50E-03/
      DATA C4115 /
     1 1.54E-03, 1.50E-03, 1.47E-03, 1.34E-03, 1.25E-03, 1.08E-03,
     2 9.06E-04, 7.53E-04, 6.41E-04, 5.09E-04, 4.04E-04, 3.36E-04,
     3 2.86E-04, 2.32E-04, 1.94E-04, 1.57E-04, 1.31E-04, 1.02E-04,
     4 8.07E-05/
C         4N  H2O CONTINUUM
C         OZONE U.V. + VISIBLE BAND MODEL ABSORPTION COEFF
C     C8 LOCATION  1    V =  13000  CM-1
C     C8 LOCATION  56   V =  24200  CM-1
C         DV = 200  CM-1
C     C8 LOCATION  57   V =  27500  CM-1
C     C8 LOCATION  102  V =  50000  CM-1
C         DV = 500  CM-1
      DATA C8 /
     1 4.50E-03, 8.00E-03, 1.07E-02, 1.10E-02, 1.27E-02, 1.71E-02,
     2 2.00E-02, 2.45E-02, 3.07E-02, 3.84E-02, 4.78E-02, 5.67E-02,
     3 6.54E-02, 7.62E-02, 9.15E-02, 1.00E-01, 1.09E-01, 1.20E-01,
     4 1.28E-01, 1.12E-01, 1.11E-01, 1.16E-01, 1.19E-01, 1.13E-01,
     5 1.03E-01, 9.24E-02, 8.28E-02, 7.57E-02, 7.07E-02, 6.58E-02,
     6 5.56E-02, 4.77E-02, 4.06E-02, 3.87E-02, 3.02E-02, 2.84E-02,
     7 2.09E-02, 1.60E-02, 1.91E-02, 1.66E-02, 1.17E-02, 7.70E-03,
     8 6.10E-03, 8.50E-03, 6.10E-03, 3.70E-03, 3.20E-03, 3.10E-03,
     9 2.55E-03, 1.98E-03, 1.40E-03, 8.25E-04, 2.50E-04, 0.       ,
     $ 0.       , 0.       , 5.65E-04, 2.04E-03, 7.35E-03, 2.03E-02,
     $ 4.98E-02, 1.18E-01, 2.46E-01, 5.16E-01, 1.02E+00, 1.95E+00,
     $ 3.79E+00, 6.65E+00, 1.24E+01, 2.20E+01, 3.67E+01, 5.95E+01,
     $ 8.50E+01, 1.26E+02, 1.68E+02, 2.06E+02, 2.42E+02, 2.71E+02,
     $ 2.91E+02, 3.02E+02, 3.03E+02, 2.94E+02, 2.77E+02, 2.64E+02,
     $ 2.28E+02, 1.98E+02, 1.68E+02, 1.44E+02, 1.17E+02, 9.78E+01,
     $ 7.65E+01, 6.04E+01, 4.42E+01, 3.46E+01, 2.52E+01, 2.00E+01,
     $ 1.57E+01, 1.20E+01, 1.00E+01, 8.80E+00, 8.30E+00, 8.60E+00/
      END
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      BLOCK DATA MARDTA
C*    BLOCK DATA
C
C     MARINE AEROSOL EXTINCTION AND ABSORPTION DATA
C            CODED BY STU GATHMAN                         -  NRL
C
      COMMON/A/T1QEXT(40,4),T2QEXT(40,4),T3QEXT(40,4),
     1T1QABS(40,4),T2QABS(40,4),T3QABS(40,4),ALAM(40),AREL(4)
      DIMENSION A1(40),A2(40),A3(40),A4(40)
      DIMENSION B1(40),B2(40),B3(40),B4(40)
      DIMENSION C1(40),C2(40),C3(40),C4(40)
      DIMENSION D1(40),D2(40),D3(40),D4(40)
      DIMENSION E1(40),E2(40),E3(40),E4(40)
      DIMENSION F1(40),F2(40),F3(40),F4(40)
      EQUIVALENCE (A1(1), T1QEXT(1,1)), (A2(1), T1QEXT(1,2)),
     +            (A3(1), T1QEXT(1,3)), (A4(1), T1QEXT(1,4))
      EQUIVALENCE (B1(1), T2QEXT(1,1)), (B2(1), T2QEXT(1,2)),
     +            (B3(1), T2QEXT(1,3)), (B4(1), T2QEXT(1,4))
      EQUIVALENCE (C1(1), T3QEXT(1,1)), (C2(1), T3QEXT(1,2)),
     +            (C3(1), T3QEXT(1,3)), (C4(1), T3QEXT(1,4))
      EQUIVALENCE (D1(1), T1QABS(1,1)), (D2(1), T1QABS(1,2)),
     +            (D3(1), T1QABS(1,3)), (D4(1), T1QABS(1,4))
      EQUIVALENCE (E1(1), T2QABS(1,1)), (E2(1), T2QABS(1,2)),
     +            (E3(1), T2QABS(1,3)), (E4(1), T2QABS(1,4))
      EQUIVALENCE (F1(1), T3QABS(1,1)), (F2(1), T3QABS(1,2)),
     +            (F3(1), T3QABS(1,3)), (F4(1), T3QABS(1,4))
      DATA ALAM/
     *   .2000,    .3000,    .3371,    .5500,    .6943,   1.0000,   1.5380,
     *  2.0000,   2.2500,   2.5000,   2.7000,   3.0000,   3.3923,   3.7500,
     *  4.5000,   5.0000,   5.5000,   6.0000,   6.2000,   6.5000,   7.2000,
     *  7.9000,   8.2000,   8.7000,   9.0000,   9.2000,  10.0000,  10.5910,
     * 11.0000,  11.5000,  12.5000,  14.8000,  15.0000,  16.4000,  17.2000,
     * 18.5000,  21.3000,  25.0000,  30.0000,  40.0000/
      DATA AREL/50.,85.,95.,98./
      DATA A1/
     * -3.3075, -3.4388, -3.4998, -3.8225, -4.0134, -4.4214, -4.8412,
     * -5.1635, -5.3158, -5.4223, -5.0061, -4.5105, -5.3517, -5.7325,
     * -5.7705, -5.8315, -5.8432, -5.1790, -5.2918, -5.5851, -5.6307,
     * -5.6737, -5.6064, -5.5378, -5.6314, -5.5150, -5.6582, -5.6047,
     * -5.5235, -5.3876, -5.1767, -5.0918, -5.0916, -5.1300, -5.1459,
     * -5.1980, -5.3116, -5.4009, -5.4889, -5.4794/
      DATA A2/
     * -2.8367, -2.9363, -2.9800, -3.2310, -3.3906, -3.7440, -4.1271,
     * -4.4371, -4.6037, -4.7610, -4.3752, -3.8438, -4.6259, -4.9386,
     * -5.0863, -5.1774, -5.2542, -4.5523, -4.6578, -4.9749, -5.0864,
     * -5.1210, -5 0976, -5.0614, -5.0535, -5.0398, -5.0783, -4.0779,
     * -4.8738, -4.7253, -4.5080, -4.4250, -4.4269, -4.4640, -4.4902,
     * -4.5466, -4.6661, -4.7701, -4.8804, -4.9063/
      DATA A3/
     * -2.3685, -2.4287, -2.4534, -2.6258, -2.7481, -3.0376, -3.3752,
     * -3.6604, -3.8213, -3.9963, -3.7279, -3.2000, -3.8573, -4.1858,
     * -4.3378, -4.4459, -4.5631, -3.9208, -4.0099, -4.3220, -4.4654,
     * -4.5059, -4.5055, -4.4942, -4.4890, -4.4811, -4.4716, -4.3569,
     * -4.2468, -4.0955, -3.8765, -3.7923, -3.7948, -3.8304, -3.8590,
     * -3.9176, -4.0397, -4.1491, -4.2678, -4.3079/
      DATA A4/
     * -1.6952, -1.6992, -1.7007, -1.7688, -1.8314, -2.0198, -2.2794,
     * -2.5113, -2.6490, -2.8160, -2.7278, -2.2526, -2.6939, -3.0477,
     * -3.1498, -3.2625, -3.4079, -2.9515, -2.9968, -3.2674, -3.4312,
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     * -3.4956, -3.5142, -3.5311, -3.5369, -3.5377, -3.5240, -3.4172,
     * -3.3106, -3.1626, -2.9455, -2.8564, -2.8588, -2.8915, -2.9211,
     * -2.9782, -3.1016, -3.2146, -3.3390, -3.3886/
      DATA B1/
     * -0.5741, -0.5495, -0.5407, -0.5337, -0.5059, -0.5367, -0.6309,
     * -0.7237, -0.7859, -0.8664, -0.9424, -0.7780, -0.8613, -0.9565,
     * -1.0927, -1.1616, -1.2559, -1.2119, -1.1776, -1.2870, -1.4164,
     * -1.4649, -1.5231, -1.4562, -1.4176, -1.4141, -1.5730, -1.6324,
     * -1.6417, -1.5982, -1.4677, -1.3923, -1.3911, -1.4067, -1.4207,
     * -1.4667, -1.5804, -1.6833, -1.7932, -1.8237/
      DATA B2/
     * -0.1808, -0.1611, -0.1540, -0.1458, -0.1069, -0.1254, -0.1608,
     * -0.2204, -0.2730, -0.3485, -0.4413, -0.2715, -0.3017, -0.3917,
     * -0.5277, -0.5937, -0.6966, -0.6662, -0.6037, -0.7099, -0.8351,
     * -0.9055, -0.9551, -0.9551, -0.9511, -0.9598, -1.0824, -1.1186,
     * -1.1017, -1.0291, -0.8689, -0.7683, -0.7673, -0.7772, -0.7922,
     * -0.8307, -0.9352, -1.0393, -1.1631, -1.2354/
      DATA B3/
     *  0.2478,  0.2556,  0.2585,  0.2629,  0.3062,  0.3021,  0.3207,
     *  0.2935,  0.2573,  0.2006,  0.1027,  0.2291,  0.2511,  0.1858,
     *  0.0701,  0.0141, -0.0792, -0.0844, -0.0062, -0.0893, -0.1273,
     * -0.2739, -0.3153, -0.3508, -0.3700, -0.3873, -0.4950, -0.5325,
     * -0.5142, -0.4411, -0.2820, -0.1710, -0.1693, -0.1716, -0.1827,
     * -0.2117, -0.3013, -0.3962, -0.5177, -0.6123/
      DATA B4/
     *  0.9239,  0.9234,  0.9233,  0.9221,  0.9536,  0.9578,  1.0162,
     *  1.0193,  1.0076,  0.9877,  0.9061,  0.9596,  1.0192,  0.9964,
     *  0.9306,  0.8965,  0.8359,  0.7859,  0.8642,  0.8244,  0.7549,
     *  0.6907,  0.6597,  0.6125,  0.5825,  0.5612,  0.4575,  0.3987,
     *  0.3974,  0.4483,  0.5830,  0.6954,  0.6983,  0.7068,  0.7036,
     *  0.6899,  0.6286,  0.5576,  0.4580,  0.3481/
      DATA C1/
     *  2.1467,  2.1504,  2.1518,  2.1518,  2.1601,  2.1671,  2.1870,
     *  2.1925,  2.2131,  2.2110,  2.2005,  2.1968,  2.2282,  2.2326,
     *  2.2514,  2.2518,  2.2426,  2.2225,  2.2388,  2.2431,  2.2464,
     *  2.2500,  2.2349,  2.2426,  2.2489,  2.2491,  2.2426,  2.2065,
     *  2.1734,  2.1401,  2.1221,  2.1400,  2.1514,  2.1749,  2.1771,
     *  2.1776,  2.1613,  2.1333,  2.0841,  2.0095/
      DATA C2/
     *  2.5481,  2.5503,  2.5511,  2.5446,  2.5522,  2.5752,  2.5831,
     *  2.5795,  2.5987,  2.6060,  2.5956,  2.5878,  2.6117,  2.6242,
     *  2.6334,  2.6345,  2.6273,  2.6104,  2.6289,  2.6391,  2.6620,
     *  2.6606,  3.6452,  2.6438,  2.6460,  2.6415,  2.6010,  2.5591,
     *  2.5268,  2.4991,  2.5098,  2.5641,  2.5671,  2.5662,  2.5918,
     *  2.5979,  2.5925,  2.5793,  2.5493,  2.4884/
      DATA C3/
     *  2.9792,  2.9801,  2.9805,  2.9768,  2.9837,  2.9969,  3.0095,
     *  3.0130,  3.0119,  3.0248,  3.0201,  3.0125,  3.0290,  3.0428,
     *  3.0476,  3.0449,  3.0468,  3.0416,  3.0480,  3.0620,  3.0903,
     *  3.0036,  3.0733,  3.0640,  3.0592,  3.0548,  3.0320,  2.9982,
     *  2.9670,  2.9424,  2.9601,  3.0119,  3.0146,  3.0301,  3.0362,
     *  3.0439,  3.0459,  3.0435,  3.0304,  2.9884/
      DATA C4/
     *  3.6516,  3.6528,  3.6533,  3.6540,  3.6574,  3.6607,  3.6752,
     *  3.6806,  3.6728,  3.6614,  3.6873,  3.6771,  3.6873,  3.6962,
     *  3.6997,  3.6944,  3.6980,  3.6998,  3.7009,  3.7121,  3.7340,
     *  3.7261,  3.7210,  3.7155,  3.7142,  3.7157,  3.7187,  3.6988,
     *  3.6737,  3.6511,  3.6603,  3.6958,  3.6977,  3.7068,  3.7138,
     *  3.7209,  3.7202,  3.7346,  3.7387,  3.7230/
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      DATA D1/                                                          DMA  690
     * -7.7608, -7.8138, -7.8353, -7.8363, -7.7777, -7.5148, -6.9697,   DMA  695
     * -6.3960, -6.3271, -6.0085, -5.0856, -4.5455, -5.6074, -6.2374,   DMA  700
     * -5.9767, -5.9873, -5.9406, -5.1920, -5.3128, -5.6178, -5.6515,   DMA  705
     * -5.6911, -5.6171, -5.5477, -5.5451, -5.5248, -5.6661, -5.6094,   DMA  710
     * -5.5265, -5.3892, -5.1776, -5.0924, -5.0922, -5.1306, -5.1465,   DMA  715
     * -5.1965, -5.3120, -5.4012, -5.4891, -5.4795/                     DMA  720
      DATA D2/                                                          DMA  725
     * -7.5897, -7.6463, -7.6693, -7.6720, -7.6085, -7.2880, -6.6040,   DMA  730
     * -5.9094, -6.0402, -5.6344, -4.4682, -3.8933, -4.9853, -5.7235,   DMA  735
     * -5.3670, -5.4040, -5.4134, -4.5697, -4.6896, -5.0266, -5.1251,   DMA  740
     * -5.1500, -5.1188, -5.0787, -5.0697, -5.0543, -5.0873, -4.9824,   DMA  745
     * -4.8765, -4.7268, -4.5091, -4.4260, -4.4280, -4.4651, -4.4912,   DMA  750
     * -4.5475, -4.6669, -4.7706, -4.8807, -4.9065/                     DMA  755
      DATA D3/                                                          DMA  760
     * -7.3839, -7.4591, -7.4907, -7.5015, -7.4267, -6.9782, -6.1115,   DMA  765
     * -5.3320, -5.6308, -5.1375, -3.8595, -3.2737, -4.3476, -5.1330,   DMA  770
     * -4.7424, -4.7905, -4.8257, -3.9497, -4.0652, -4.4132, -4.5402,   DMA  775
     * -4.5603, -4.5492, -4.5280, -4.5184, -4.5071, -4.4858, -4.3636,   DMA  780
     * -4.2507, -4.0979, -3.8786, -3.7946, -3.7972, -3.8328, -3.8622,   DMA  785
     * -3.9198, -4.0415, -4.1504, -4.2687, -4.3082/                     DMA  790
      DATA D4/                                                          DMA  795
     * -6.9467, -7.0906, -7.1590, -7.2396, -7.1295, -6.3047, -5.2250,   DMA  800
     * -4.3913, -4.8138, -4.2512, -2.9555, -2.3736, -3.3713, -4.1797,   DMA  805
     * -3.7845, -3.8391, -3.8898, -3.0159, -3.1187, -3.4677, -3.6117,   DMA  810
     * -3.6326, -3.6324, -3.6235, -3.6153, -3.6070, -3.5613, -3.4345,   DMA  815
     * -3.3208, -3.1692, -2.9518, -2.8642, -2.8666, -2.8995, -2.9291,   DMA  820
     * -2.9861, -3.1082, -3.2197, -3.3425, -3.3900/                     DMA  825
      DATA E1/                                                          DMA  830
     * -4.1705, -4.1963, -4.2063, -4.1266, -4.0441, -3.7452, -3.1712,   DMA  835
     * -2.5963, -2.5294, -2.2355, -1.4984, -1.0273, -1.7948, -2.4098,   DMA  840
     * -2.1791, -2.1972, -2.1647, -1.5024, -1.5747, -1.8526, -1.9156,   DMA  845
     * -1.957, -1.9055, -1.8233, -1.8050, -1.7853, -1.9447, -1.9098,    DMA  850
     * -1.8439, -1.7270, -1.5405, -1.4544, -1.4532, -1.4763, -1.4894,   DMA  855
     * -1.5359, -1.6463, -1.7393, -1.8354, -1.8422/                     DMA  860
      DATA E2/                                                          DMA  865
     * -4.0384, -4.0927, -4.0729, -4.0213, -3.9061, -3.5498, -2.8358,   DMA  870
     * -2.1337, -2.2627, -1.8818, -0.9846, -0.5156, -1.2001, -1.8993,   DMA  875
     * -1.5831, -1.6215, -1.6451, -0.9323, -0.9859, -1.2771, -1.3921,   DMA  880
     * -1.4241, -1.4077, -1.3685, -1.3568, -1.3446, -1.3974, -1.3197,   DMA  885
     * -1.2354, -1.1127, -0.9288, -0.8348, -0.8343, -0.8503, -0.8670,   DMA  890
     * -0.9084, -1.0118, -1.1094, -1.2214, -1.2647/                     DMA  895
      DATA E3/                                                          DMA  900
     * -3.8575, -3.9117, -3.9336, -3.8643, -3.7519, -3.2484, -2.3765,   DMA  905
     * -1.5840, -1.8758, -1.4045, -0.4651, -0.0282, -0.6085, -1.3211,   DMA  910
     * -0.9739, -1.0177, -1.0654, -0.3653, -0.4032, -0.6817, -0.8120,   DMA  915
     * -0.8409, -0.8395, -0.8254, -0.8193, -0.8125, -0.8151, -0.7274,   DMA  920
     * -0.6426, -0.5262, -0.3544, -0.2571, -0.2563, -0.2648, -0.2788,   DMA  925
     * -0.3124, -0.4027, -0.4930, -0.6036, -0.6605/                     DMA  930
      DATA E4/                                                          DMA  935
     * -3.4282, -3.8621, -3.0245, -3.6194, -3.5032, -2.6505, -1.5096,   DMA  940
     * -0.6912, -1.0979, -0.5564,  0.3125,  0.6827,  0.2590, -0.4128,   DMA  945
     * -0.0613, -0.1030, -0.1598,  0.4690,  0.4489,  0.2105,  0.0870,   DMA  950
     *  0.0612,  0.0563,  0.0507,  0.0567,  0.0620,  0.0792,  0.1597,   DMA  955
     *  0.2339,  0.3320,  0.4751,  0.5677,  0.5695,  0.5709,  0.5638,   DMA  960
     *  0.5435,  0.4786,  0.4093,  0.3163,  0.2577/                     DMA  965
      DATA F1/                                                          DMA  970
     * -0.5499, -0.5783, -0.5894, -0.5104, -0.4212, -0.0960,  0.4863,   DMA  975
     *  1.0328,  1.0997,  1.3537,  1.7043,  1.8943,  1.6604,  1.2620,   DMA  980
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     * 1.4563,  1.4532,  1.4784,  1.8461,  1.8293,  1.7005,  1.6725,
     * 1.6570,  1.6811,  1.7406,  1.7614,  1.7751,  1.6857,  1.6983,
     * 1.7261,  1.7763,  1.8497,  1.8987,  1.9012,  1.9135,  1.9154,
     * 1.9104,  1.8848,  1.8572,  1.8166,  1.8043/
      DATA F2/
     * -0.4215, -0.4483, -0.4587, -0.4073, -0.3085,  0.0696,  0.7952,
     * 1.4548,  1.3737,  1.6960,  2.0995,  2.2816,  2.1301,  1.6978,
     * 1.9564,  1.9399,  1.9290,  2.2741,  2.2680,  2.1606,  2.1128,
     * 2.1004,  2.1074,  2.1348,  2.1447,  2.1515,  2.1204,  2.1504,
     * 2.1811,  2.2215,  2.2777,  2.3246,  2.3268,  2.3387,  2.3420,
     * 2.3435,  2.3329,  2.3179,  2.2891,  2.2719/
      DATA F3/
     * -0.2341, -0.2834, -0.3033, -0.2717, -0.0633,  0.3368,  1.2184,
     * 1.9791,  1.7218,  2.1368,  2.5364,  2.6979,  2.6050,  2.2107,
     * 2.4693,  2.4531,  2.4300,  2.7168,  2.7144,  2.6374,  2.5939,
     * 2.5855,  2.5871,  2.5971,  2.6015,  2.6044,  2.6010,  2.6295,
     * 2.6533,  2.6812,  2.7190,  2.7572,  2.7592,  2.7705,  2.7749,
     * 2.7799,  2.7802,  2.7767,  2.7627,  2.7525/
      DATA F4/
     * 0.1750,  0.0418, -0.0203, -0.0789,  0.0501,  0.9248,  2.0179,
     * 2.7921,  2.4415,  2.9025,  3.2424,  3.3513,  3.3148,  3.0046,
     * 3.2303,  3.2194,  3.2001,  3.3884,  3.3859,  3.3494,  3.3241,
     * 3.3215,  3.3223,  3.3260,  3.3279,  3.3303,  3.3384,  3.3547,
     * 3.3666,  3.3776,  3.3917,  3.4141,  3.4155,  3.4248,  3.4294,
     * 3.4362,  3.4458,  3.4537,  3.4572,  3.4608/
      END
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      BLOCK DATA PHSDTA
C*    BLOCK DATA
CCC
CCC   ROUTINE TO STORE TABLE TO CALL UP PROPER PHASE FUNCTION
CCC   AND 70 AVERAGE PHASE FUNCTIONS
CCC
C     COMMON/MNMPHS/ MNUM(27,26),PHSFNC(34,70)
      COMMON/MNMPHS/MUM1(27),MUM2(27),MUM3(27),MUM4(27),MUM5(27),
     1MUM6(27),MUM7(27),MUM8(27),MUM9(27),MUM10(27),MUM11(27),MUM12(27),
     2MUM13(27),MUM14(27),MUM15(27),MUM16(27),MUM17(27),MUM18(27),
     3MUM19(27),MUM20(27),MUM21(27),MUM22(27),MUM23(27),MUM24(27),
     4MUM25(27),MUM26(27),PHSF1(34),PHSF2(34),PHSF3(34),PHSF4(34),
     5PHSF5(34),PHSF6(34),PHSF7(34),PHSF8(34),PHSF9(34),
     6PHSF10(34),PHSF11(34),PHSF12(34),PHSF13(34),PHSF14(34),PHSF15(34),
     7PHSF16(34),PHSF17(34),PHSF18(34),PHSF19(34),PHSR20(34),PHSF21(34),
     8PHSF22(34),PHSF23(34),PHSF24(34),PHSF25(34),PHSF26(34),PHSF27(34),
     9PHSF28(34),PHSF29(34),PHSF30(34),PHSF31(34),PHSF32(34),PHSF33(34),
     9PHSF34(34),PHSF35(34),PHSF36(34),PHSF37(34),PHSF38(34),PHSF39(34),
     1PHSF40(34),PHSF41(34),PHSF42(34),PHSF43(34),PHSF44(34),PHSF45(34),
     2PHSF46(34),PHSF47(34),PHSF48(34),PHSF49(34),PHSF50(34),PHSF51(34),
     3PHSF52(34),PHSF53(34),PHSF54(34),PHSF55(34),PHSF56(34),PHSF57(34),
     4PHSF58(34),PHSF59(34),PHSF60(34),PHSF61(34),PHSF62(34),PHSF63(34),
     5PHSF64(34),PHSF65(34),PHSF66(34),PHSF67(34),PHSF68(34),PHSF69(34),
     6PHSF70(34)
      DATA MUM1/ 3, 5, 4, 4, 4, 6, 8,22,21,22,26,26,
     C26,27,29, 1,34,34,34,34,33,33,36,36,38,36,23/
      DATA MUM2/ 3, 5, 4, 4, 4, 6, 8,22,21,21,22,26,
     C26,27,29, 1,34,33,33,33,46,46,34,34,36,36,23/
      DATA MUM3/ 3, 5, 5, 5,19, 6, 8,21, 7,21,22, 8,
     C26, 1,27, 1,46,46,46,29,29,46,34,34,34,36,23/
      DATA MUM4/58,58,62,62,62,63,63,63,60,64,64,64,
     C21,70,65,65,65,65,66,66,65,27,29,29,46,33,34/
      DATA MUM5/59,11,11,11,20,20,20,28,28,16,16,16,
     C16,37,37,37,32,36,32,32,32,36,23,23,23,38,25/
      DATA MUM6/ 9,59,11,13,13,26,26,26,27,29,46,28,
     C28,29,28,28,37,37,37,37,34,36,36,36,23,23,38/
      DATA MUM7/ 9, 9,14,14,14,15,15,15,66,65,27,26,
     C29,27,29,29,29,29,29,28,46,34,36,36,36,23,23/
      DATA MUM8/57,57,69,69,69,68,68,68,61,70,60,21,
     C 7,66, 1, 1, 1, 1,66,66, 1,29,46,46,33,34,38/
      DATA MUM9/ 2,18,18,19,19, 6,22,22,22,22,22,22,
     C29,29,46,29,34,34,34,34,34,34,36,36,36,23,23/
      DATA MUM10/ 2, 3,18,18,19, 6,22,22,21,22,22,22,
     C27,27,29,27,33,33,46,46,46,33,34,34,36,36,23/
      DATA MUM11/ 2, 3,18,18,19, 6,22,21, 7,22,22,22,
     C27,27,27,27,46,29,29,29,29,46,33,34,34,36,36/
      DATA MUM12/58,58,62,62,62,62,63,63,60,64,64,64,
     C21,60, 7,65,65,65,66,67,65, 7,27,27,29,46,33/
      DATA MUM13/10,59,11,11,13,20,20,28,28,16,16,16,
     C16,37,37,37,32,36,32,32,32,36,23,23,23,38,25/
      DATA MUM14/10,10,14,14,13,13,26,26,27,29,29,28,
     C28,29,28,28,37,37,37,37,33,32,36,36,23,23,38/
      DATA MUM15/10,69,14,14,14,15,15, 7,66,65,27,26,
     C29, 1,29,29,29,29,29,29,46,34,36,36,36,23,23/
      DATA MUM16/47,57,69,60,69,68,68,68,61,70,60,21,
     C 7,66, 1, 1, 1, 1,66,66, 1,29,46,46,33,34,36/
      DATA MUM17/29,16,32,32,36,36,23,23,23,38,38,38,
     C25,25,25,25,25,25,25,25,35,35,35,35,35,40,39/
      DATA MUM18/29,10,32,32,32,38,23,23,23,38,38,38,
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C38,25,25,25,25,25,25,25,35,35,35,35,35,40,39/                        PHD
 DATA MUM19/29,28,37,37,32,36,36,23,23,23,23,23,                       PHD
C38,25,25,25,25,25,25,25,35,35,35,35,35,40,40/                        PHD
 DATA MUM20/15,26,28,28,37,37,32,32,32,23,23,23,                       PHD
C23,38,38,38,38,25,25,25,25,35,35,35,35,35,40/                        PHD
 DATA MUM21/20,20,37,37,24,23,38,25,25,35,35,35,                       PHD
C40,40,39,39,39,39,39,39,39,39,39,39,39,39,39/                        PHD
 DATA MUM22/ 7,20,16,37,32,32,24,23,23,23,38,38,                       PHD
C25,25,35,35,35,25,35,35,40,40,40,40,40,39,39/                        PHD
 DATA MUM23/17,51,13,13,20,20,28,28,37,37,37,37,                       PHD
C32,32,24,24,23,23,38,38,38,38,38,38,38,25,35/                        PHD
 DATA MUM24/47,30,55,55,55,13,15,12,42,12, 1,26,                       PHD
C44,52,44,44,45,45,45,45,24,23,38,38,38,25,35/                        PHD
 DATA MUM25/48,53,31,31,31,41,41,41,49,17,17,17,                       PHD
C56,50,43,43,67,61,42,54,42,12,12,12,12, 1,44/                        PHD
 DATA MUM26/59,59,11,11,20,20,28,28,46,46,46,46,                       PHD
C33,33,34,34,34,34,36,36,36,36,23,23,23,38,38/                        PHD
 DATA PHSF1/                                                           PHD
C      4.81387,      4.26047,      3.42600,      2.74953,      2.21493, PHD
C      1.78847,      1.44553,       .94765,       .62704,       .42183, PHD
C       .28987,       .20375,       .14632,       .10720,       .05307, PHD
C       .02882,       .01703,       .01093,       .00764,       .00582, PHD
C       .00482,       .00431,       .00418,       .00411,       .00409, PHD
C       .00412,       .00419,       .00428,       .00436,       .00442, PHD
C       .00443,       .00433,       .00421,       .00435/               PHD
 DATA PHSF2/                                                           PHD
C    100.88000,      4.36700,      2.73667,      2.10567,      1.68067, PHD
C      1.36333,      1.11900,       .77513,       .55317,       .40393, PHD
C       .30047,       .22690,       .17367,       .13437,       .07407, PHD
C       .04350,       .02714,       .01795,       .01266,       .00958, PHD
C       .00780,       .00683,       .00656,       .00639,       .00633, PHD
C       .00636,       .00649,       .00669,       .00682,       .00671, PHD
C       .00626,       .00582,       .00606,       .00646/               PHD
 DATA PHSF3/                                                           PHD
C     75.07600,      3.77580,      2.33100,      1.82620,      1.49120, PHD
C      1.23720,      1.03680,       .74470,       .54766,       .41000, PHD
C       .31120,       .23880,       .18506,       .14476,       .08148, PHD
C       .04851,       .03047,       .02022,       .01431,       .01086, PHD
C       .00886,       .00785,       .00763,       .00756,       .00762, PHD
C       .00780,       .00809,       .00843,       .00868,       .00861, PHD
C       .00813,       .00790,       .00871,       .00948/               PHD
 DATA PHSF4/                                                           PHD
C     14.11167,      3.29400,      1.58300,      1.07677,       .85635, PHD
C       .73207,       .64758,       .52827,       .43880,       .36565, PHD
C       .30452,       .25337,       .21070,       .17523,       .11108, PHD
C       .07169,       .04755,       .03263,       .02388,       .01855, PHD
C       .01557,       .01420,       .01398,       .01397,       .01424, PHD
C       .01473,       .01545,       .01641,       .01758,       .01894, PHD
C       .01999,       .02139,       .02376,       .02512/               PHD
 DATA PHSF5/                                                           PHD
C     31.33400,      3.01280,      1.63600,      1.27280,      1.08020, PHD
C       .94204,       .83026,       .65320,       .51698,       .40994, PHD
C       .32558,       .25926,       .20702,       .16590,       .09733, PHD
C       .05921,       .03764,       .02534,       .01809,       .01382, PHD
C       .01155,       .01059,       .01051,       .01070,       .01116, PHD
C       .01192,       .01303,       .01447,       .01610,       .01727, PHD
C       .01780,       .01838,       .02091,       .02259/               PHD
 DATA PHSF6/                                                           PHD
C     13.83333,      5.76067,      2.88717,      1.73500,      1.19267, PHD
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C       .89500,       .71377,       .50818,       .39290,       .31612,
C       .25947,       .21512,       .17950,       .15035,       .09782,
C       .06489,       .04418,       .03126,       .02336,       .01872,
C       .01625,       .01521,       .01510,       .01520,       .01550,
C       .01600,       .01670,       .01758,       .01860,       .01958,
C       .02003,       .01962,       .01969,       .02072/
 DATA PHSF7/
C     10.69213,      7.32563,      4.66850,      3.15175,      2.23700,
C      1.85050,      1.25550,       .77671,       .51168,       .35194,
C       .24998,       .18219,       .13565,       .10291,       .05530,
C       .03232,       .02036,       .01381,       .01015,       .00813,
C       .00711,       .00672,       .00671,       .00680,       .00698,
C       .00723,       .00753,       .00783,       .00813,       .00841,
C       .00864,       .00843,       .00793,       .00865/
 DATA PHSF8/
C     10.29225,      5.75700,      3.34100,      2.19450,      1.56850,
C      1.18950,       .94123,       .64033,       .46530,       .35098,
C       .27068,       .21203,       .16803,       .13445,       .07989,
C       .04975,       .03251,       .02247,       .01667,       .01344,
C       .01188,       .01148,       .01166,       .01210,       .01285,
C       .01392,       .01522,       .01656,       .01776,       .01897,
C       .02003,       .01932,       .01776,       .02043/
 DATA PHSF9/
C    232.30000,     13.73667,      3.92300,      1.97167,      1.29767,
C       .97050,       .77753,       .55393,       .41583,       .31763,
C       .24957,       .19523,       .15503,       .12260,       .06875,
C       .04015,       .02414,       .01485,       .01040,       .00803,
C       .00674,       .00569,       .00549,       .00550,       .00615,
C       .00775,       .01205,       .01820,       .02141,       .02076,
C       .02123,       .02409,       .03397,       .05439/
 DATA PHSF10/
C    286.85000,     20.19500,      5.34175,      2.25050,      1.24273,
C       .81960,       .60855,       .40505,       .30698,       .24148,
C       .19903,       .16210,       .13158,       .10705,       .06313,
C       .03807,       .02275,       .01373,       .00983,       .00704,
C       .00512,       .00400,       .00412,       .00401,       .00456,
C       .00580,       .00954,       .01947,       .03101,       .03784,
C       .04018,       .04524,       .06312,       .08295/
 DATA PHSF11/
C     15.36571,      6.08614,      3.15543,      1.98500,      1.39671,
C      1.05749,       .84297,       .58904,       .44120,       .34216,
C       .27140,       .21837,       .17669,       .14371,       .08723,
C       .05498,       .03568,       .02444,       .01753,       .01339,
C       .01087,       .00986,       .00983,       .01019,       .01094,
C       .01243,       .01473,       .01871,       .02423,       .03204,
C       .03592,       .03792,       .04492,       .05004/
 DATA PHSF12/
C      5.64100,      5.44440,      4.90680,      4.15680,      3.34180,
C      2.57840,      1.93040,      1.03104,       .54702,       .30330,
C       .18026,       .11514,       .07816,       .05557,       .02729,
C       .01547,       .00986,       .00697,       .00542,       .00457,
C       .00413,       .00392,       .00387,       .00385,       .00385,
C       .00385,       .00385,       .00388,       .00391,       .00401,
C       .00400,       .00368,       .00352,       .00365/
 DATA PHSF13/
C      8.90311,      6.06467,      3.93056,      2.63178,      1.82878,
C      1.32733,      1.00856,       .65342,       .46637,       .34863,
C       .26062,       .20709,       .16222,       .12811,       .07347,
C       .04425,       .02794,       .01667,       .01336,       .01033,
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C       .00874,        .00818,        .00837,        .00894,        .01001,
C       .01171,        .01423,        .01759,        .02129,        .02494,
C       .02767,        .02690,        .02658,        .03550/
 DATA PHSF14/
C     41.20875,      11.84363,       5.00750,       2.73850,       1.74425,
C      1.23475,        .93516,        .60986,        .43641,        .32733,
C       .24819,        .19145,        .14831,        .11555,        .06356,
C       .03649,        .02176,        .01390,        .00974,        .00759,
C       .00657,        .00643,        .00671,        .00741,        .00806,
C       .01210,        .01618,        .01839,        .01979,        .02104,
C       .02356,        .02652,        .02694,        .04004/
 DATA PHSF15/
C      7.98100,       5.58389,       3.81067,       2.75011,       2.05900,
C      1.58178,       1.24011,        .80424,        .55144,        .39021,
C       .28203,        .20701,        .15369,        .11570,        .05985,
C       .03329,        .01999,        .01295,        .00920,        .00726,
C       .00645,        .00646,        .00683,        .00743,        .00833,
C       .00942,        .01038,        .01112,        .01187,        .01290,
C       .01451,        .01415,        .01176,        .01646/
 DATA PHSF16/
C      1.52473,       1.44645,       1.30800,       1.16736,       1.03716,
C       .92088,        .81802,        .64725,        .51405,        .40964,
C       .32742,        .26255,        .21129,        .17075,        .10236,
C       .06361,        .04130,        .02819,        .02041,        .01583,
C       .01330,        .01222,        .01213,        .01235,        .01288,
C       .01373,        .01491,        .01635,        .01784,        .01906,
C       .02003,        .02225,        .02715,        .03082/
 DATA PHSF17/
C    143.02500,      55.03750,      11.00250,       3.10675,       1.29675,
C       .67675,        .40423,        .18580,        .10582,        .06884,
C       .04883,        .03665,        .02858,        .02291,        .01418,
C       .00942,        .00664,        .00497,        .00397,        .00337,
C       .00302,        .00283,        .00277,        .00273,        .00272,
C       .00275,        .00283,        .00298,        .00314,        .00324,
C       .00332,        .00347,        .00373,        .00359/
 DATA PHSF18/
C     26.74167,       3.70000,       1.73800,       1.24150,       1.02157,
C       .88398,        .78022,        .62040,        .49727,        .39937,
C       .32113,        .25863,        .20880,        .16910,        .10153,
C       .06289,        .04050,        .02733,        .01952,        .01491,
C       .01225,        .01083,        .01046,        .01025,        .01017,
C       .01020,        .01030,        .01043,        .01053,        .01059,
C       .01061,        .01071,        .01107,        .01136/
 DATA PHSF19/
C     16.76800,       4.67840,       2.10000,       1.29420,        .94964,
C       .76794,        .65496,        .51386,        .41986,        .34756,
C       .28898,        .24060,        .20054,        .16730,        .10712,
C       .06978,        .04668,        .03245,        .02379,        .01863,
C       .01572,        .01429,        .01397,        .01384,        .01389,
C       .01407,        .01438,        .01481,        .01529,        .01572,
C       .01603,        .01613,        .01637,        .01668/
 DATA PHSF20/
C      3.35750,       2.77033,       2.20467,       1.77208,       1.43950,
C      1.10167,        .98083,        .69731,        .51368,        .38864,
C       .29989,        .23472,        .18552,        .14785,        .08680,
C       .05339,        .03443,        .02340,        .01889,        .01308,
C       .01097,        .01015,        .01022,        .01082,        .01145,
C       .01289,        .01512,        .01829,        .02228,        .02580,
C       .02615,        .02523,        .02990,        .03817/
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 DATA PHSF21/
C     13.35245,      7.86691,      4.51555,      2.89018,      1.99645,
C      1.45664,      1.10655,       .69522,       .47093,       .33483,
C       .24620,       .18557,       .14266,       .11148,       .06369,
C       .03890,       .02523,       .01742,       .01294,       .01044,
C       .00921,       .00861,       .00886,       .00906,       .00940,
C       .00985,       .01039,       .01098,       .01163,       .01232,
C       .01277,       .01220,       .01131,       .01247/
 DATA PHSF22/
C      9.49578,      6.01133,      3.71372,      2.49106,      1.77633,
C      1.32572,      1.02483,       .66094,       .45784,       .33285,
C       .25044,       .19334,       .15224,       .12179,       .07358,
C       .04717,       .03185,       .02271,       .01730,       .01421,
C       .01264,       .01208,       .01207,       .01220,       .01245,
C       .01280,       .01321,       .01365,       .01405,       .01436,
C       .01447,       .01422,       .01407,       .01456/
 DATA PHSF23/
C       .45555,       .45332,       .44686,       .43683,       .42405,
C       .40929,       .39319,       .35887,       .32388,       .28985,
C       .25771,       .22804,       .20101,       .17671,       .12722,
C       .09162,       .06691,       .05037,       .03979,       .03345,
C       .03009,       .02875,       .02860,       .02871,       .02902,
C       .02946,       .03000,       .03059,       .03120,       .03179,
C       .03232,       .03276,       .03305,       .03315/
 DATA PHSF24/
C       .51072,       .50922,       .50476,       .49744,       .48752,
C       .47514,       .46072,       .42698,       .38890,       .34888,
C       .30902,       .27072,       .23504,       .20254,       .13652,
C       .09070,       .06070,       .04186,       .03042,       .02372,
C       .02000,       .01816,       .01773,       .01753,       .01753,
C       .01767,       .01792,       .01826,       .01866,       .01907,
C       .01948,       .01984,       .02009,       .02019/
 DATA PHSF25/
C       .21327,       .21298,       .21208,       .21060,       .20856,
C       .20606,       .20305,       .19588,       .18741,       .17798,
C       .16793,       .15754,       .14702,       .13659,       .11191,
C       .09060,       .07368,       .06147,       .05381,       .05020,
C       .04990,       .05207,       .05380,       .05581,       .05801,
C       .06028,       .06253,       .06468,       .06664,       .06834,
C       .06973,       .07077,       .07140,       .07161/
 DATA PHSF26/
C      4.10720,      3.38127,      2.61113,      2.06147,      1.66320,
C      1.36400,      1.13140,       .79725,       .57362,       .41947,
C       .31103,       .23368,       .17766,       .13669,       .07413,
C       .04288,       .02647,       .01753,       .01255,       .00978,
C       .00837,       .00791,       .00800,       .00831,       .00888,
C       .00974,       .01087,       .01219,       .01347,       .01448,
C       .01468,       .01320,       .01237,       .01467/
 DATA PHSF27/
C      4.37885,      3.78265,      2.97685,      2.33720,      1.85900,
C      1.49815,      1.22035,       .83140,       .58200,       .41624,
C       .30308,       .22426,       .16839,       .12816,       .06844,
C       .03932,       .02424,       .01607,       .01161,       .00894,
C       .00753,       .00684,       .00668,       .00661,       .00661,
C       .00668,       .00679,       .00692,       .00706,       .00715,
C       .00715,       .00705,       .00703,       .00721/
 DATA PHSF28/
C      1.99262,      1.84586,      1.62814,      1.42588,      1.24733,
C      1.09157,       .95572,       .73438,       .56567,       .43699,
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C       .33874,       .26371,       .20635,       .16235,       .09181,
C       .05440,       .03397,       .02253,       .01601,       .01230,
C       .01031,       .00946,       .00938,       .00951,       .00985,
C       .01043,       .01123,       .01222,       .01328,       .01405,
C       .01405,       .01340,       .01391,       .01521/
 DATA PHSF29/
C      2.72707,      2.52017,      2.15725,      1.81463,      1.52555,
C      1.28665,      1.08932,       .78963,       .58023,       .43161,
C       .32473,       .24695,       .18977,       .14727,       .08150,
C       .04783,       .02980,       .01981,       .01414,       .01091,
C       .00911,       .00819,       .00796,       .00784,       .00781,
C       .00787,       .00798,       .00812,       .00825,       .00831,
C       .00830,       .00829,       .00847,       .00868/
 DATA PHSF30/
C    183.60000,     32.48000,      3.18400,      1.30100,       .85020,
C       .63540,       .54470,       .41140,       .33110,       .26080,
C       .20850,       .16570,       .12700,       .09546,       .04755,
C       .02460,       .01160,       .00650,       .00370,       .00264,
C       .00234,       .00355,       .00326,       .00308,       .00528,
C       .01403,       .02285,       .01565,       .01398,       .01362,
C       .01240,       .01544,       .02607,       .04655/
 DATA PHSF31/
C   1565.50000,      9.96867,      1.73233,       .92547,       .70240,
C       .59477,       .52513,       .42173,       .33793,       .26700,
C       .20973,       .16157,       .11973,       .09043,       .04400,
C       .01947,       .00793,       .00346,       .00177,       .00138,
C       .00166,       .00254,       .00438,       .00358,       .00653,
C       .02986,       .01362,       .01200,       .00992,       .00867,
C       .00765,       .00818,       .00986,       .05756/
 DATA PHSF32/
C       .79503,       .78714,       .76605,       .73601,       .70017,
C       .66092,       .61994,       .53736,       .45896,       .38796,
C       .32563,       .27208,       .22676,       .18879,       .11979,
C       .07727,       .05125,       .03541,       .02586,       .02025,
C       .01717,       .01576,       .01552,       .01551,       .01571,
C       .01607,       .01656,       .01710,       .01764,       .01814,
C       .01872,       .01965,       .02093,       .02164/
 DATA PHSF33/
C      1.56125,      1.49306,      1.34900,      1.19444,      1.05048,
C       .92302,       .81176,       .83177,       .49621,       .39304,
C       .31378,       .25238,       .20435,       .16659,       .10271,
C       .06594,       .04424,       .03123,       .02338,       .01868,
C       .01692,       .01439,       .01392,       .01360,       .01339,
C       .01325,       .01315,       .01310,       .01308,       .01314,
C       .01330,       .01355,       .01381,       .01392/
 DATA PHSF34/
C      1.22457,      1.18085,      1.08010,       .98058,       .87944,
C       .78708,       .70433,       .58565,       .45677,       .37107,
C       .30321,       .24916,       .20585,       .17099,       .11000,
C       .07323,       .05066,       .03866,       .02794,       .02253,
C       .01924,       .01727,       .01663,       .01614,       .01577,
C       .01550,       .01532,       .01522,       .01523,       .01538,
C       .01582,       .01596,       .01827,       .01640/
 DATA PHSF35/
C       .15944,       .15931,       .15893,       .15825,       .15734,
C       .15620,       .15479,       .15131,       .14701,       .14199,
C       .13638,       .13030,       .12389,       .11727,       .10065,
C       .08527,       .07250,       .06322,       .05702,       .05621,
C       .05792,       .06222,       .06505,       .06017,       .07146,
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C       .07479,      .07805,      .08112,      .08390,      .08631,
C       .08826,      .08970,      .09058,      .09088/
 DATA PHSF36/
C       .72999,      .72086,      .69632,      .66227,      .62369,
C       .58366,      .54390,      .46850,      .40091,      .34178,
C       .29081,      .24724,      .21025,      .17893,      .12047,
C       .08253,      .05810,      .04253,      .03278,      .02688,
C       .02352,      .02183,      .02142,      .02122,      .02118,
C       .02127,      .02146,      .02171,      .02202,      .02235,
C       .02273,      .02314,      .02351,      .02367/
 DATA PHSF37/
C      1.15457,     1.13481,     1.08637,     1.02208,      .95035,
C       .87581,      .80158,      .66139,      .53812,      .43402,
C       .34834,      .27905,      .22360,      .17950,      .10538,
C       .06398,      .04056,      .02712,      .01935,      .01490,
C       .01250,      .01143,      .01126,      .01130,      .01153,
C       .01191,      .01242,      .01301,      .01357,      .01399,
C       .01422,      .01450,      .01526,      .01585/
 DATA PHSF38/
C       .31056,      .30982,      .30766,      .30415,      .29944,
C       .29365,      .28698,      .27149,      .25411,      .23575,
C       .21708,      .19865,      .18081,      .16385,      .12623,
C       .09621,      .07365,      .05766,      .04714,      .04092,
C       .03792,      .03722,      .03748,      .03804,      .03881,
C       .03972,      .04071,      .04172,      .04270,      .04358,
C       .04433,      .04490,      .04526,      .04539/
 DATA PHSF39/
C       .12377,      .12369,      .12346,      .12308,      .12254,
C       .12185,      .12102,      .11893,      .11632,      .11324,
C       .10974,      .10592,      .10181,      .09752,      .08650,
C       .07613,      .06762,      .06192,      .05964,      .06097,
C       .06565,      .07304,      .07747,      .08219,      .08708,
C       .09196,      .09670,      .10114,      .10516,      .10862,
C       .11144,      .11349,      .11477,      .11519/
 DATA PHSF40/
C       .13400,      .13391,      .13367,      .13321,      .13259,
C       .13180,      .13085,      .12842,      .12541,      .12185,
C       .11785,      .11344,      .10872,      .10383,      .09125,
C       .07940,      .06955,      .06267,      .05932,      .05961,
C       .06323,      .06951,      .07336,      .07751,      .08181,
C       .08613,      .09032,      .09428,      .09782,      .10091,
C       .10339,      .10522,      .10634,      .10673/
 DATA PHSF41/
C    227.93333,    32.03000,     4.13167,     1.54367,      .95123,
C       .71613,      .59840,      .43330,      .33043,      .25093,
C       .18920,      .14303,      .10800,      .08045,      .03915,
C       .01854,      .00866,      .00431,      .00239,      .00168,
C       .00157,      .00266,      .00434,      .00724,      .01132,
C       .01476,      .00983,      .00835,      .00785,      .00711,
C       .00717,      .00803,      .01265,      .02951/
 DATA PHSF42/
C     10.12167,     9.39467,     7.81833,     5.59200,     3.87533,
C      2.62733,     1.78200,      .85247,      .43620,      .23983,
C       .14137,      .08952,      .05950,      .04118,      .01854,
C       .00958,      .00552,      .00354,      .00251,      .00195,
C       .00163,      .00145,      .00139,      .00134,      .00129,
C       .00125,      .00122,      .00120,      .00120,      .00120,
C       .00120,      .00115,      .00105,      .00108/
 DATA PHSF43/
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C     23.70500,     19.81000,     12.14500,     6.16400,      2.96850, PHD 2165
C      1.51300,     .[illegible]15,       .39850,      .24525,       .17225, PHD 2170
C       .12825,     .0[illegible]9,       .07598,      .05932,       .03272, PHD 2175
C       .01871,     .01[illegible],       .00710,      .00485,       .00363, PHD 2180
C       .00303,       .0028 ,       .00290,      .00302,       .00318, PHD 2185
C       .00334,       .00345,       .00349,      .00354,       .00388, PHD 2190
C       .00510,       .00600,       .00344,      .00472/               PHD 2195
 DATA PHSF44/                                                          PHD 2200
C      1.13310,      1.12586,      1.10518,     1.07182,      1.02708, PHD 2205
C       .97348,       .91266,       .77952,      .64406,       .51826, PHD 2210
C       .40884,       .31800,       .24506,      .18784,       .09626, PHD 2215
C       .05060,       .02813,       .01701,      .01126,       .00818, PHD 2220
C       .00651,       .00563,       .00539,      .00526,       .00522, PHD 2225
C       .00525,       .00536,       .00551,      .00571,       .00595, PHD 2230
C       .00624,       .00656,       .00681,      .00692/               PHD 2235
 DATA PHSF45/                                                          PHD 2240
C       .61443,       .61273,       .60783,      .59967,       .58847, PHD 2245
C       .57447,       .55783,       .51803,      .47153,       .42127, PHD 2250
C       .36970,       .31913,       .27140,      .22780,       .14030, PHD 2255
C       .08293,       .04868,       .02942,      .01892,       .01327, PHD 2260
C       .01027,       .00875,       .00834,      .00811,       .00800, PHD 2265
C       .00801,       .00810,       .00824,      .00842,       .00861, PHD 2270
C       .00879,       .00893,       .00903,      .00906/               PHD 2275
 DATA PHSF46/                                                          PHD 2280
C      2.06615,      1.93640,      1.69345,     1.45610,      1.24945, PHD 2285
C      1.07421,       .92677,       .69739,      .53175,       .41021, PHD 2290
C       .31969,       .25144,       .19943,      .15944,       .09421, PHD 2295
C       .05837,       .03804,       .02624,      .01931,       .01523, PHD 2300
C       .01288,       .01160,       .01123,      .01099,       .01084, PHD 2305
C       .01077,       .01073,       .01072,      .01070,       .01068, PHD 2310
C       .01069,       .01078,       .01095,      .01105/               PHD 2315
 DATA PHSF47/                                                          PHD 2320
C  1888.10000,     16.32500,      2.35900,     1,00950,       .67300, PHD 2325
C       .53970,       .46415,       .37245,      .30310,       .24865, PHD 2330
C       .20715,       .15820,       .13160,      .10710,       .05669, PHD 2335
C       .02778,       .01325,       .00679,      .00344,       .00306, PHD 2340
C       .00420,       .00189,       .00154,      .00137,       .00145, PHD 2345
C       .00265,       .01227,       .03321,      .02025,       .01971, PHD 2350
C       .01869,       .02153,       .03166,      .09376/               PHD 2355
 DATA PHSF48/                                                          PHD 2360
C 18500.00000,      2.83400,       .85070,      .58200,       .49050, PHD 2365
C       .44240,       .40380,       .35560,      .31400,       .25730, PHD 2370
C       .19510,       .17010,       .12770,      .10750,       .05190, PHD 2375
C       .02554,       .01105,       .00365,      .00203,       .00200, PHD 2380
C       .00370,       .00118,       .00112,      .00112,       .00113, PHD 2385
C       .00113,       .00649,       .02603,      .02019,       .01751, PHD 2390
C       .01439,       .01308,       .01407,      .10720/               PHD 2395
 DATA PHSF49/                                                          PHD 2400
C   190.90000,     60.01000,      8.56500,     2.26800,       .98870, PHD 2405
C       .55520,       .36100,       .19580,      .12640,       .08822, PHD 2410
C       .06382,       .04693,       .03478,      .02590,       .01284, PHD 2415
C       .00642,       .00348,       .00208,      .00143,       .00120, PHD 2420
C       .00124,       .00131,       .00123,      .00108,       .00097, PHD 2425
C       .00092,       .00090,       .00089,      .00091,       .00098, PHD 2430
C       .00107,       .00136,       .00251,      .00246/               PHD 2435
 DATA PHSF50/                                                          PHD 2440
C     44.01000,     33.47000,     16.38000,     6.54800,      2.88800, PHD 2445
C      1.24800,       .66020,       .27930,      .14870,       .08818, PHD 2450
C       .05760,       .03977,       .02850,      .02111,       .01087, PHD 2455
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     C      .00620,      .00387,      .00265,      .00198,      .00161, PHD 2460
     C      .00141,      .00129,      .00125,      .00122,      .00120, PHD 2465
     C      .00119,      .00118,      .00117,      .00117,      .00117, PHD 2470
     C      .00118,      .00118,      .00113,      .00113/              PHD 2475
      DATA PHSF51/                                                     PHD 2480
     C    45.72000,    22.68000,     8.45200,     3.68600,     1.88400, PHD 2485
     C     1.11400,      .72990,      .39640,      .26220,      .19430, PHD 2490
     C      .15350,      .12410,      .10220,      .08533,      .05455, PHD 2495
     C      .03546,      .02333,      .01580,      .01103,      .00801, PHD 2500
     C      .00615,      .00530,      .00517,      .00509,      .00547, PHD 2505
     C      .00614,      .00763,      .01038,      .01534,      .02235, PHD 2510
     C      .02692,      .02902,      .03071,      .03320/              PHD 2515
      DATA PHSF52/                                                     PHD 2520
     C     1.35800,     1.34900,     1.32400,     1.28300,     1.22900, PHD 2525
     C     1.16200,     1.08700,      .91840,      .74460,      .58190, PHD 2530
     C      .44060,      .32530,      .23580,      .16900,      .07319, PHD 2535
     C      .03392,      .01766,      .01037,      .00676,      .00484, PHD 2540
     C      .00377,      .00317,      .00298,      .00284,      .00274, PHD 2545
     C      .00269,      .00267,      .00268,      .00274,      .00283, PHD 2550
     C      .00294,      .00306,      .00314,      .00317/              PHD 2555
      DATA PHSF53/                                                     PHD 2560
     C  8232.00000,     3.82700,      .95120,      .65890,      .52640, PHD 2565
     C      .49710,      .52530,      .38980,      .33700,      .25360, PHD 2570
     C      .21110,      .16430,      .12260,      .09209,      .04939, PHD 2575
     C      .01954,      .00754,      .00272,      .00161,      .00134, PHD 2580
     C      .00166,      .00334,      .00383,      .00124,      .00127, PHD 2585
     C      .01906,      .01831,      .01420,      .01077,      .00904, PHD 2590
     C      .00782,      .00667,      .00690,      .04228/              PHD 2595
      DATA PHSF54/                                                     PHD 2600
     C    13.90000,    12.72000,     9.87700,     6.74400,     4.24600, PHD 2605
     C     2.58600,     1.58500,      .68190,      .32580,      .18150, PHD 2610
     C      .10950,      .06977,      .04630,      .03174,      .01380, PHD 2615
     C      .00682,      .00376,      .00228,      .00153,      .00111, PHD 2620
     C      .00086,      .00073,      .00068,      .00064,      .00061, PHD 2625
     C      .00059,      .00057,      .00056,      .00055,      .00055, PHD 2630
     C      .00056,      .00054,      .00050,      .00050/              PHD 2635
      DATA PHSF55/                                                     PHD 2640
     C    36.42000,    23.44333,     8.32800,     3.11067,     1.49100, PHD 2645
     C      .91783,      .67807,      .46263,      .34257,      .26417, PHD 2650
     C      .20257,      .15540,      .12417,      .09463,      .05233, PHD 2655
     C      .02703,      .01629,      .00959,      .00563,      .00472, PHD 2660
     C      .00438,      .00459,      .00534,      .00777,      .01141, PHD 2665
     C      .01545,      .01058,      .01080,      .01607,      .01686, PHD 2670
     C      .01907,      .03025,      .03881,      .05215/              PHD 2675
      DATA PHSF56/                                                     PHD 2680
     C    45.49000,    31.63000,    12.30000,     4.19500,     1.72400, PHD 2685
     C      .91960,      .59500,      .34070,      .23500,      .17450, PHD 2690
     C      .13450,      .10490,      .08291,      .06559,      .03717, PHD 2695
     C      .02135,      .01252,      .00762,      .00490,      .00346, PHD 2700
     C      .00283,      .00279,      .00305,      .00366,      .00484, PHD 2705
     C      .00584,      .00670,      .00603,      .00640,      .00651, PHD 2710
     C      .00840,      .01245,      .01103,      .01440/              PHD 2715
      DATA PHSF57/                                                     PHD 2720
     C  1696.00000,    15.47000,     3.11967,     1.46900,      .97603, PHD 2725
     C      .76003,      .62317,      .46853,      .38270,      .28193, PHD 2730
     C      .22163,      .17297       .13357,      .10470,      .05409, PHD 2735
     C      .02789,      .01270,      .00794,      .00479,      .00390, PHD 2740
     C      .00409,      .00407,      .00363,      .00324,      .00464, PHD 2745
     C      .01000,      .01626,      .01957,      .01599,      .01547, PHD 2750
```

```
C      .01597,        .01678,        .02321,        .05917/
 DATA PHSF58/
C   525.35000,       5.54850,       3.39200,       2.40225,       1.79275,
C     1.38725,       1.10400,        .74203,        .52213,        .37803,
C      .27970,        .20945,        .15915,        .12258,        .06615,
C      .03783,        .02289,        .01510,        .01074,        .00837,
C      .00717,        .00653,        .00661,        .00699,        .00781,
C      .00922,        .01127,        .01364,        .01588,        .01743,
C      .01838,        .01583,        .01491,        .02015/
 DATA PHSF59/
C    56.57000,      10.86983,       4.30450,       2.32817,       1.48817,
C     1.05608,        .80615,        .53590,        .39175,        .30123,
C      .23833,        .19167,        .15528,        .12653,        .07717,
C      .04870,        .03126,        .02128,        .01493,        .01091,
C      .00856,        .00765         .00767,        .00787,        .00840,
C      .00973,        .01199,        .01623,        .02446,        .03802,
C      .04421,        .04801,        .05991,        .06067/
 DATA PHSF60/
C    37.27000,      14.69200,       6.78420,       3.81000,       2.39800,
C     1.62640,       1.16200,        .86076,        .41350,        .27594,
C      .19292,        .13976,        .10406,        .07926,        .04328,
C      .02568,        .01635,        .01116,        .00822,        .00657,
C      .00569,        .00527,        .00516,        .00510,        .00508,
C      .00511,        .00518,        .00528,        .00537,        .00537,
C      .00527,        .00528,        .00536,        .00549/
 DATA PHSF61/
C    24.80333,      14.28000,       8.35167,       5.06833,       3.14833,
C     2.03700,       1.38367,        .72373,        .42163,        .26167,
C      .16947,        .11343,        .07807,        .05503,        .02512,
C      .01283,        .00726,        .00455,        .00317,        .00247,
C      .00214,        .00196,        .00187,        .00177,        .00168,
C      .00159,        .00153,        .00150,        .00151,        .00161,
C      .00185,        .00209,        .00168,        .00168/
 DATA PHSF62/
C   101.15288,       5.39657,       2.28843,       1.62671,       1.32757,
C     1.13054,        .97698,        .73870,        .56023,        .42529,
C      .32310,        .24639,        .18874,        .14550,        .07827,
C      .04428,        .02552,        .01699,        .01182,        .00901,
C      .00763,        .00715,        .00718,        .00742,        .00797,
C      .00901,        .01007,        .01036,        .01076,        .01129,
C      .01176,        .01204,        .01243,        .01444/
 DATA PHSF63/
C    48.02600,      10.67620,       3.98180,       2.14360,       1.42080,
C     1.08302,        .85178,        .60524,        .45450,        .34880,
C      .26996,        .21070,        .16526,        .13048,        .07418,
C      .04380,        .02714,        .01784,        .01271,        .00998,
C      .00877,        .00871,        .00917,        .00990,        .01086,
C      .01174,        .01200,        .01185,        .01202,        .01250,
C      .01377,        .01588,        .01523,        .01809/
 DATA PHSF64/
C    34.21033,      12.98500,       4.94933,       2.57983,       1.56550,
C     1.05095,        .77238,        .48407,        .34588,        .28490,
C      .21097,        .17168,        .14155,        .11773,        .07509,
C      .05058,        .03467,        .02483,        .01884,        .01536,
C      .01352,        .01278,        .01287,        .01373,        .01293,
C      .01328,        .01371,        .01437,        .01491,        .01553,
C      .01582,        .01535,        .01513,        .01573/
 DATA PHSF65/
C     8.58757,       8.79429,       4.60071,       3.23487,       2.36214,
```

```
C      1.77586,      1.36529,      .84849,      .55343,      .37399, PHD 3050
C       .25995,       .18501,      .13442,      .09951,      .05039, PHD 3055
C       .02794,       .01684,      .01103,      .00787,      .00614, PHD 3060
C       .00521,       .00476,      .00465,      .00460,      .00460, PHD 3065
C       .00464,       .00470,      .00479,      .00490,      .00502, PHD 3070
C       .00509,       .00498,      .00479,      .00491/              PHD 3075
 DATA PHSF66/                                                        PHD 3080
C      7.73378,      6.31989,     4.61211,     3.41189,     2.56922, PHD 3085
C      1.96389,      1.51900,      .93560,      .59521,      .38946, PHD 3090
C       .26146,       .17967,      .12618,      .09038,      .04241, PHD 3095
C       .02194,       .01241,      .00766,      .00519,      .00386, PHD 3100
C       .00314,       .00278,      .00267,      .00259,      .00254, PHD 3105
C       .00251,       .00251,      .00252,      .00256,      .00261, PHD 3110
C       .00268,       .00274,      .00268,      .00273/              PHD 3115
 DATA PHSF67/                                                        PHD 3120
C     13.24333,     11.06100,     7.42300,     4.70567,     3.98533, PHD 3125
C      1.97200,      1.37267,      .75370,      .45857,      .29573, PHD 3130
C       .19823,       .13693,      .09689,      .07004,      .03369, PHD 3135
C       .01789,       .01040,      .00660,      .00460,      .00353, PHD 3140
C       .00298,       .00273,      .00268,      .00266,      .00265, PHD 3145
C       .00265,       .00265,      .00266,      .00270,      .00282, PHD 3150
C       .00308,       .00319,      .00262,      .00275/              PHD 3155
 DATA PHSF68/                                                        PHD 3160
C     37.10000,     12.65667,     5.63100,     3.16800,     2.05233, PHD 3165
C      1.45750,      1.09982,      .69772,      .47462,      .33515, PHD 3170
C       .24170,       .17635,      .13072,      .09747,      .04922, PHD 3175
C       .02644,       .01502,      .00935,      .00640,      .00503, PHD 3180
C       .00468,       .00549,      .00635,      .00767,      .00953, PHD 3185
C       .01124,       .01140,      .01090,      .01055,      .01125, PHD 3190
C       .01355,       .01701,      .01486,      .02554/              PHD 3195
 DATA PHSF69/                                                        PHD 3200
C    256.51429,     19.73571,     5.24714,     2.30771,     1.36100, PHD 3205
C       .94431,       .72756,      .50319,      .37583,      .28504, PHD 3210
C       .22174,       .17010,      .13151,      .10155,      .05367, PHD 3215
C       .02848,       .01561,      .00902,      .00592,      .00443, PHD 3220
C       .00434,       .00493,      .00535,      .00629,      .00897, PHD 3225
C       .01636,       .01849,      .01647,      .01539,      .01496, PHD 3230
C       .01673,       .02178,      .02754,      .05075/              PHD 3235
 DATA PHSF70/                                                        PHD 3240
C     27.44667,     14.67667,     7.63033,     4.46200,     2.82633, PHD 3245
C      1.89500,      1.32600,      .71323,      .41983,      .26377, PHD 3250
C       .17420,       .11977,      .08514,      .06224,      .03144, PHD 3255
C       .01785,       .01118,      .00766,      .00573,      .00466, PHD 3260
C       .00407,       .00377,      .00368,      .00363,      .00360, PHD 3265
C       .00359,       .00360,      .00361,      .00363,      .00365, PHD 3270
C       .00366,       .00367,      .00367,      .00369/              PHD 3275
 END                                                                 PHD 3280
```

Table 7. Descriptions of Plot Program Subroutines

		Page No.
LOWPLT	MAIN DRIVER PROGRAM. READS 4 CONTROL CARDS.	166
AXISL	PLOTS A LABELED LINEAR AXIS.	174
AXLOG	PLOTS A LABELED LOGARITHMIC AXIS.	177
PLTDTA	READS LOWTRAN DATA FROM TAPE 7. DETERMINES WHICH VARIABLE TO PLOT.	173
DRAW	SETS UP DATA TO BE PLOTTED. DETERMINES WHICH TYPE OF LINE TO PLOT.	180
DASH2	PLOTS A DASHED LINE.	184
DOT	PLOTS A DOTTED LINE.	181
DSHDOT	PLOTS A LINE WITH ALTERNATING DASHES AND DOTS.	183
DSHDT2	PLOTS A LINE WITH ALTERNATING DASH AND TWO DOTS.	182

Table 8. Listing of LOWTRAN 6 Plot Code

Pages 165 to 184

```
      PROGRAM LOWPLT(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7,
     1TAPE39)
CCC
CCC
CCC   *******  LOWTRAN SIX PLOT PROGRAM  **********************
CCC
CCC   PROGRAM WRITTEN BY
CCC                         FRANCIS X. KNEIZYS      OPI/AFGL
CCC                         JAMES H. CHETWYND JR.  OPI/AFGL
CCC                         LEONARD W. ABREU       OPI/AFGL
CCC                         ERIC P. SHETTLE        OPA/AFGL
CCC
CCC
CCC   THE PLOT PROGRAM WILL PLOT SEVERAL FILES OF OUTPUT DATA FROM
CCC   TAPE 7 AS OUTPUT FROM STANDARD LOWTRAN SIX RUNS.
CCC   TO INITIATE PROGRAM AN IDENTIFICATION CARD OF 30 HOLERITH
CCC   CHARACTERS IS READ IN FOLLOWED BY TWO CARDS DEFINING THE
CCC   AXIS,WAVELENGTHS,DELTA,LENGTH OF X AXIS AND Y AXIS AND
CCC   TYPE OF PLOT DESIRED.
CCC   THE FOURTH INPUT CARD IS READ IN SUBROUTINE PLTDTA
CCC   AND IT CONTROLS THE PLOTTING OF THE VARIOUS VARIABLES
CCC   OUTPUT BY LOWTRAN SIX
CCC   THE FIFTH INPUT CARD IS READ AFTER PLOTTING AND
CCC   IT DETERMINES WHETHER PLOTTING ON THE SAME PLOT IS DESIRED
CCC   AND ALSO DETERMINES WHETHER TO REWIND AND PLOT THE SAME FILE
CCC
CCC   TO PLOT MULTIPLE FILES FROM TAPE 7;
CCC   THE FOUR INPUT CARDS MUST BE INPUT FOR EACH FILE TO BE PLOTTED
CCC
CCC   TO END PLOTS;
CCC   SET XSIZE=NEGATIVE ON LAST INPUT CARD.
CCC
CCC   **********************************************************
CCC
CCC
      COMMON /DXDY/ DX,ADY,PFRBEG,YRMIN,IXAXIS,IYAXIS,PFREND,YRMAX,
     C ITYP,IYPWR,IEMSCT
      DIMENSION PROGID(3)
      DIMENSION ACRD1(8),ACRD2(8),ACRD2A(8),ACRD2B(8),ACRD2C(8)
      DIMENSION ACRD3(8),ACRD30(8),ACD3A1(8),ACD3A2(8),ACRD4(8)
      DIMENSION DUMMY(8)
      DIMENSION RADC(4),RADM(4),RADCLG(3),RADMLG(3),WAVL(2)
      DIMENSION WAVN(2),TRAN(2)
      DIMENSION CARD1(5),CARD2(6),CARD2A(2),CARD2B(2),CARD3(3)
      DIMENSION CARD3U(3),CRD3A1(5),CRD3A2(5)
      DATA RADC/10HRADIANCE(1,10H0   WATTS/,10HCM2-STER-C,4HM-1)/
      DATA RADM/10HRADIANCE(1,10H0   WATTS/,10HCM2-STER-M,4HICR)/
      DATA RADCLG/10HRADIANCE(W,10HATTS/CM2-S,9HTER-CM-1)/
      DATA RADMLG/10HRADIANCE(W,10HATTS/CM2-S,9HTER-MICR)/
      DATA WAVL/10HWAVELENGTH,10H (MICRON) /
      DATA WAVN/10HWAVENUMBER,10H  (CM-1)  /
      DATA TRAN/10HTRANSMITTA,3HNCE/
      DATA CARD1/10HMODEL,ITYP,10HE,IEMSCT,M,10H1,M2,M3,IM,
     110H,NOPRT,TBO,8HUNO,SALB/
      DATA CARD2/10HIHAZE,ISEA,10HSN,IVULCN,,10HICSTL,ICIR,
     110H,IVSA,VIS,,10HWSS,WHH,RA,4HINRT/
      DATA CARD2A/10HCTHIK,CALT,6H,ISEED/
      DATA CARD2B/10HZCVSA,ZTVS,8HA,ZINVSA/
      DATA CARD3/10HH1,H2,ANGL,10HE,RANGE,BE,9HTA,RO,LEN/
```

```
      DATA CARD3O/10HH1,P,T,DP,,10HRH,WH,WO,R,4HANGE/
      DATA CRD3A1/10HIPARM,IPH,,10HIDAY,ISOUR,2HC /
      DATA CRD3A2/10HPARM1,PARM,10H2,PARM3,PA,10HRM4,TIME,P,
     110HSIPO,ANGLE,3HM,G/
CCC
CCC   ITYP=0      RADIANCE PER MICRON VS MICRONS
CCC   ITYP=1      RADIANCE PER CM-1 VS CM-1
CCC   ITYP=2      TRANSMITTANCE VS MICRONS
CCC   ITYP=3      TRANSMITTANCE VS CM-1
CCC
CCC   IXAXIS=0      X-AXIS WILL BE LINEAR
CCC   IXAXIS=1      X-AXIS WILL BE LOG10
CCC   IYAXIS=0      Y-AXIS WILL BE LINEAR
CCC   IYAXIS=1      Y-AXIS WILL BE LOG10
CCC
      IEOF=0
      ISAMPT=0
      IRPT=1
      READ (5,80) (PROGID(I),I=1,3),SCALE
      WRITE (6,85) (PROGID(I),I=1,3),SCALE
      CALL PLTID3(PROGID,900.0,11.0,SCALE,4)
       CALL PLOT(1.0,1.0,-3)
CCC
CCC   XSIZE=LENGTH OF X-AXIS IN INCHES
CCC   PFRBEG=BEGINNING FREQUENCY ON PLOT IN CM-1 OR MICRONS
CCC   PFREND=ENDING FREQUENCY ON PLOT IN CM-1 OR MICRONS
CCC   DX=(PFREND-PFRBEG)/XSIZE
CCC   ADV=NO. OF DIVISIONS IN TEN INCHES OF PAPER
CCC    YRMIN AND YRMAX ARE LOGARITHMS BASE 10 OF MINIMUM AND MAXIMUM
CCC   RADIATION VALUES WHICH CAN BE PLOTTED
CCC   IN PLOTTING TRANSMITTANCE OR RADIANCE LINEARLY
CCC   YRMIN AND YRMAX BECOME THE LIMITING VALUES OF THE YAXIS.
CCC   NMYDEC SPECIFIES THE NUMBER OF DECIMAL PLACES ON A LINEAR YAXIS
CCC
        REWIND 7
5     READ (5,88) XSIZE,PFRBEG,PFREND,DELTAX,ITYP,IXAXIS,NUMFIL
      IF(XSIZE.LE.0.) GO TO 999
      WRITE (6,90) XSIZE,PFRBEG,PFREND,DELTAX,ITYP,IXAXIS,NUMFIL
      DX=(PFREND-PFRBEG)/XSIZE
      ANUMX=(PFREND-PFRBEG)/DELTAX
       NUMX=ANUMX+.5
      DIVLX=XSIZE/ANUMX
       READ (5,89) YSIZE,YRMIN,YRMAX,DELTAY,ICRV,IYAXIS,NMYDEC
      IF(DELTAY .LE. 0.0) DELTAY=1.0
      ADY =(YRMAX-YRMIN)/YSIZE
      ANUMY=(YRMAX-YRMIN)/DELTAY
       NUMY=ANUMY+.5
      DIVLY=YSIZE/ANUMY
      WRITE (6,92) YSIZE,YRMIN,YRMAX,DELTAY,ICRV,IYAXIS,NMYDEC
CCC
CCC   NUMFIL CONTROLS SPECIFIC FILE NO. OF LOWTRAN TAPE 7 DATA
CCC   TO BE PLOTTED.
CCC
CCC   IF NUMFIL=0       IT WILL PLOT THE NEXT AVAILABLE FILE OF DATA.
CCC   IF NUMFIL>0 IT WILL PLOT FROM THE NUMBERED FILE
CCC   SPECIFIED BY NUMFIL.
CCC
      IF(NUMFIL.GT.0) IEOF=NUMFIL-1
      IF(NUMFIL.LT.1) GO TO 12
```

```
      REWIND 7
      NNF=1
      IF(NUMFIL.EQ.NNF) GO TO 12
8     DO 9 I=1,10
      READ (7,101) DUMMY
9     CONTINUE
11    READ (7,99) DUM
      IF(DUM.NE.-9999.) GO TO 11
      NNF=NNF+1
      IF(NUMFIL.EQ.NNF) GO TO 12
      GO TO 8
12    CONTINUE
CCC
CCC   THE LOWTRAN SIX PLOT PROGRAM EXPECTS TEN INPUT CARDS ON TAPE 7
CCC   WHICH WAS GENERATED FROM A LOWTRAN RUN.
CCC   THERE CAN BE SEVERAL SETS OF DATA AND INPUT CARDS SEPERATED BY
CCC   AN END OF FILE, WHICH IS CODED -9999. IN COL. 1-6
CCC   THE INPUT CARDS ARE AS LISTED IN THE LOWTRAN INSTRUCTIONS
CCC   THE MANDATORY CARDS OUTPUT TO TAPE 7 ARE
CCC   CARD1,CARD2,CARD2A,CARD2B,CARD2C,CARD3, OR OPTIONAL CARD3
CCC   (MODEL=0), CARD3A1,CARD3A2,CARD4 AND CARD5.
CCC   IN A GIVEN RUN SEVERAL OF THESE CARDS MAY NOT BE UTILIZED
CCC   IN THAT EVENT THEIR VARIABLES WILL BE REPRESENTED BY -99
CCC
CCC   IN THE OUTPUT DATA ON TAPE 7 DURING A NORMAL EMISSION RUN FOR
CCC   EXAMPLE SEVERAL OF THE VARIABLES ARE NOT UTILIZED IN THIS CASE
CCC   THEIR VARIABLES WILL BE REPRESENTED BY -99 ALSO.
CCC
CCC
CCC   READING AND WRITING INPUT CARDS TO THE PLOT
CCC
CCC
      IF(ISAMPT.GT.0) GO TO 13
      READ (7,100) MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRT,TBOUND,SALB
      BACKSPACE 7
      READ (7,101) ACRD1
      IF(IEMSCT.EQ.0) WRITE (6,102)
      IF(IEMSCT.EQ.1) WRITE (6,103)
      IF(IEMSCT.EQ.2) WRITE (6,104)
      IF(IEMSCT.EQ.3) WRITE (6,105)
      WRITE (6,100) MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRT,TBOUND,SALB
      YT=7.0
      XT=1.
      CALL SYMBOL(XT,YT,0.12,CARD1,0.0,48)
      YT=YT-0.2
      CALL SYMBOL(XT ,YT,0.12,ACRD1,0.0,80)
      READ (7,101 ) ACRD2
      WRITE (6,101) ACRD2
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,CARD2,0.0,64)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACRD2,0.0,80)
      READ (7,101 ) ACRD2A
      WRITE (6,101) ACRD2A
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,CARD2A,0.0,16)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACRD2A,0.0,80)
      READ (7,101 ) ACRD2B
```

```
      WRITE (6,101) ACRD2B
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,CARD2B,0.0,18)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACRD2B,0.0,80)
      READ (7,101 ) ACRD2C
      WRITE (6,101) ACRD2C
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,8HML,TITLE,0.0,8)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACRD2C,0.0,80)
      IF(MODEL.NE.0) READ (7,101 ) ACRD3
      IF(MODEL.NE.0) WRITE (6,101) ACRD3
      IF(MODEL.EQ.0) READ (7,101 ) ACRD30
      IF(MODEL.EQ.0) WRITE (6,101) ACRD30
      YT=YT-0.4
      IF(MODEL.NE.0) CALL SYMBOL(XT,YT,0.12,CARD3,0.0,29)
      IF(MODEL.EQ.0) CALL SYMBOL(XT,YT,0.12,CARD30,0.0,24)
      YT=YT-0.2
      IF(MODEL.NE.0) CALL SYMBOL(XT,YT,0.12,ACRD3,0.0,80)
      IF(MODEL.EQ.0) CALL SYMBOL(XT,YT,0.12,ACRD30,0.0,80)
      READ (7,101 ) ACD3A1
      WRITE (6,101) ACD3A1
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,CRD3A1,0.0,21)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACD3A1,0.0,80)
      READ (7,101 ) ACD3A2
      WRITE (6,101) ACD3A2
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,CRD3A2,0.0,43)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACD3A2,0.0,80)
      READ (7,101 ) ACRD4
      WRITE (6,101) ACRD4
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,8HV1,V2,DV,0.0,8)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACRD4,0.0,80)
      READ (7,500 ) IRPT
      BACKSPACE 7
      READ (7,501 ) ACRD5
      WRITE (6,601) ACRD5
      YT=YT-0.4
      CALL SYMBOL(XT,YT,0.12,4HIRPT,0.0,4)
      YT=YT-0.2
      CALL SYMBOL(XT,YT,0.12,ACRD5,0.0,5)
CCC
CCC   SET UP TO PLOT
CCC
      CALL PLOT(18.0,0.0,-3)
      CALL PLOT(0.0,YSIZE,3)
      CALL PLOT(XSIZE,YSIZE,2)
      CALL PLOT(XSIZE,0.0,2)
      CALL PLOT(0.,0.,2)
      CALL PLOT(0.,YSIZE,2)
      CALL PLOT(0.,YSIZE,3)
CCC
CCC   SET UP TO DRAW AXIS
```

```
CCC
      IYPWR=ALOG10(DELTAY)
      IF((ITYP.EQ.0.OR.ITYP.EQ.1) .AND. IYAXIS.EQ.0) SFY=10.**(-IYPWR)
      NUMCX=PFREND-PFRBEG
      CYCLX=XSIZE/FLOAT(NUMCX)
      NUMCY=YRMAX-YRMIN
      CYCLY=YSIZE/FLOAT(NUMCY)
      IF((ITYP.EQ.0.OR.ITYP.EQ.2) .AND. IXAXIS.EQ.0)
     XCALL AXISL (0.0,0.0,WAVL,-20,NUMX,DIVLX,1,
     X PFRBEG,DELTAX,1,0.,.125,1,0,0,0,0)
      IF((ITYP.EQ.0.OR.ITYP.EQ.2) .AND. IXAXIS.EQ.1)
     XCALL AXLOG(0.0,0.0,WAVL,-20,NUMCX,CYCLX,
     X PFRBEG,0.0,0.125,1,0,0,0,0)
      IF((ITYP.EQ.1.OR.ITYP.EQ.3) .AND. IXAXIS.EQ.0)
     XCALL AXISL(0.0,0.0,WAVN,-20,NUMX,DIVLX,1,
     X PFRBEG,DELTAX,-1,0.,.125,1,0,0,0,0)
      IF((ITYP.EQ.1.OR.ITYP.EQ.3) .AND. IXAXIS.EQ.1)
     XCALL AXLOG(0.0,0.0,WAVN,-20,NUMCX,CYCLX,
     X PFRBEG,0.0,0.125,1,0,0,0,0)
      IF(ITYP.EQ.0 .AND. IYAXIS.EQ.0)
     XCALL AXISL(0.,0.,RADM,34,NUMY,
     XDIVLY,  3,YRMIN*SFY,DELTAY*SFY,NMYDEC,90.,0.15,1,1,0,0,0)
      IF(ITYP.EQ.0 .AND. IYAXIS.EQ.1)
     XCALL AXLOG(0.,0.,RADMLG,29,NUMCY,CYCLY,
     X            YRMIN,90.,0.15,1,1,2,0,0)
      IF(ITYP.EQ.1 .AND. IYAXIS.EQ.0)
     XCALL AXISL(0.,0.,RADC,34,NUMY,
     XDIVLY,  3,YRMIN*SFY,DELTAY*SFY,NMYDEC,90.,0.15,1,1,0,0,0)
      IF(ITYP .EQ.1 .AND. IYAXIS.EQ.1)
     XCALL AXLOG(0.,0.,RADCLG,29,NUMCY,CYCLY,
     X            YRMIN,90.,.15,1,1,2,0,0)
      IF((ITYP .EQ.2.OR.ITYP .EQ.3) .AND. IYAXIS.EQ.0)
     X  CALL AXISL(0.,0.,TRAN,13,NUMY,DIVLY,2,YRMIN,DELTAY,
     XNMYDEC,90.0,.125,1,1,2,0,0)
      IF((ITYP .EQ.2.OR.ITYP .EQ.3) .AND. IYAXIS.EQ.1)
     X  CALL AXLOG(0.,0.,TRAN,13,NUMCY,CYCLY,YRMIN,
     X 90.0,.125,1,1,0,0,0)
      IF(ITYP .EQ.0 .AND. IYAXIS.EQ.0)
     XCALL AXISL(XSIZE,0.,RADM,-34,
     XNUMY, DIVLY,3,YRMIN*SFY,DELTAY*SFY,NMYDEC,90.,.15,1,1,0,0,0)
      IF(ITYP .EQ.0 .AND. IYAXIS.EQ.1)
     XCALL AXLOG(XSIZE,0.,RADMLG,-29,NUMCY,
     X  CYCLY,YRMIN,90.,.15,1,1,2,0,0)
      IF(ITYP .EQ.1 .AND. IYAXIS.EQ.0)
     XCALL AXISL(XSIZE,0.,RADC,-34,
     XNUMY, DIVLY,3,YRMIN*SFY,DELTAY*SFY,NMYDEC,90.,.15,1,1,0,0,0)
      IF(ITYP .EQ.1 .AND. IYAXIS.EQ.1)
     XCALL AXLOG(XSIZE,0.,RADCLG,-29,NUMCY,
     X  CYCLY,YRMIN,90.,.15,1,1,2,0,0)
      IF((ITYP .EQ.2.OR.ITYP .EQ.3) .AND. IYAXIS.EQ.0)
     X  CALL AXISL(XSIZE,0.,TRAN,-13,NUMY,DIVLY,2,YRMIN,
     XDELTAY,NMYDEC,90.0,.125,1,1,2,0,0)
      IF((ITYP .EQ.2.OR.ITYP .EQ.3) .AND. IYAXIS.EQ.1)
     X  CALL AXLOG(XSIZE,0.,TRAN,-13,NUMCY,CYCLY,YRMIN,
     X 90.0,.125,1,1,0,0,0)
      GO TO 10
CCC
CCC   READ AROUND HEADER RECORDS AS FILE IS PLOTTED ON SAME PLOT
CCC
```

```
13    DO 14 I=1,10
      READ (7,101) DUMMY
      WRITE (6,101) DUMMY
14    CONTINUE
16    CONTINUE
CCC
CCC   READ IN DATA TO BE PLOTTED
CCC
CCC   ITRP CONTROLS THE PLOT OF TRANSMISSION VARIABLES
CCC   ITRP=0  PLOTS TOTAL TRANSMISSION
CCC   ITRP=1-7 PLOTS H2O,CO2,OZONE,N2CONT,H2OCONT,MOLSCT,AERTRN
CCC
       XT=0.
CCC
CCC   SUBROUTINE PLTDTA IS CALLED  TO IMPLEMENT THE READING
CCC   IN AND PLOTTING OF TRANSMISSION AND OR EMISSION VALUES
CCC   FROM TAPE7.
CCC
      CALL PLTDTA(ICRV,IEOF)
CCC
CCC   ISAMFL=0  NORMAL ADVANCE TO NEXT FILE
CCC   ISAMFL=1  REWIND AND GO TO SAME FILE
CCC
CCC   ISAMPT=0  NORMAL ADVANCE TO NEXT PLOT
CCC   ISAMPT=1  PLOT ON SAME PLOT
CCC
CCC   ISAMFL AND ISAMPT ARE SET TO HANDLE THE NEXT FILE OF DATA
CCC   TO BE PLOTTED.
CCC
      READ (5,94) ISAMFL,ISAMPT
      WRITE (6,94) ISAMFL,ISAMPT
      IF(ISAMFL.GT.0) GO TO 63
61    IF(ISAMPT.GT.0) GO TO 62
      XT=XSIZE+2.0
      CALL PLOT(XT,0.0,-3)
62    CONTINUE
CCC
CCC   RECYCYCLE TO PLOT THE NEXT FILE OF DATA
CCC
      GO TO 5
63    CONTINUE
      IF(IEOF.NE.1) GO TO 64
      REWIND 7
      GO TO 61
64    NEOF=1
      REWIND 7
65    DO 66 I=1,10
      READ (7,101) DUMMY
66    CONTINUE
67    READ (7,99) DUM
      IF(DUM.NE.-9999.) GO TO 67
      NEOF=NEOF+1
      IF(IEOF.EQ.NEOF) GO TO 69
      GO TO 65
69    IEOF=IEOF-1
      GO TO 61
CCC
CCC   PLOTTING OVER GO TO END
CCC
```

```
999   CONTINUE
      CALL PLOT(XT,0.0,-3)
CCC
CCC
80    FORMAT(3A10,F10.4)
85    FORMAT(1H1,5X,3A10,F10.4//)
88    FORMAT(4F10.4,3I5)
89    FORMAT(F10.4,3E10.2,3I5)
90    FORMAT(//4F10.4,3I5)
92    FORMAT(F10.4,3E10.2,3I5//)
94    FORMAT(2I5)
99    FORMAT(F7.0)
100   FORMAT(8I5,2F10.3)
101   FORMAT(8A10)
102   FORMAT(10X,14H TRANSMISSION //)
103   FORMAT(10X,10H RADIANCE //)
104   FORMAT(10X,32H RADIANCE WITH SOLAR SCATTERING //)
105   FORMAT(10X,25H DIRECT SOLAR IRRADIANCE //)
500   FORMAT(I5)
501   FORMAT(A5)
      CALL ENDPLT
      STOP
      END
```

```
      SUBROUTINE PLTDTA(ICRV,IEOF)
CCC
CCC   ROUTINE TO READ TAPE7 EMISSIONS AND TRANSMISSIONS
CCC   AND PLOT VARIOUS VALUES.
CCC   ITRP=0 PLOTS TOTAL TRANSMISSION
CCC   ITRP=1-7 PLOTS H2O,CO2,OZONE,N2CONT,H2OCONT,MOLSCT,AERTRN
CCC   ITRP=8-10 PLOTS HNO3,AERABS OR INTEG. ABS
CCC
      COMMON /DXDY/ DX,ADY,PFRBEG,YRMIN,IXAXIS,IYAXIS,PFREND,YRMAX,
     C ITYP,IYPWR,IEMSCT
      DIMENSION RAD(400),V(400),TRM(10),RADVAL(9)
CCC
CCC   IRAD AND ITRP=0 PLOTS TOTAL TRANSMITTANCE
CCC
CCC   IF IEMSCT=1
CCC   IRAD=1  PLOTS ATMOSPHERIC RADIANCE PER CM-1 VS CM-1
CCC   IRAD=2  PLOTS ATMOSPHERIC RADIANCE PER MICRONS VS MICRONS
CCC
CCC   IF IEMSCT=2
CCC   IRAD=1 TO 8  PLOTS ATMOSPHERIC,SCATTERED,REFLECTED AND TOTAL
CCC   RADIANCE PER CM-1 VS CM-1 AND MICRONS VS MICRONS RESPECTIVELY
CCC
CCC   IF IEMSCT=3
CCC   IRAD=1 TO 4  PLOTS TRANSMITTED SOLAR IRRADIANCE AND INCIDENT
CCC   SOLAR IRRADIANCE PER CM-1 VS CM-1 AND MICRONS VS MICRONS
CCC   RESPECTIVELY
CCC
CCC
      TRANS=0.
      READ (5,94) IRAD,ITRP
      WRITE (6,94) IRAD,ITRP
       J=1
      READ (7,900) RAIN,CIRRUS
      WRITE (6,900) RAIN,CIRRUS
20    IF(IEMSCT.GT.0) READ (7,1000) FREQ,ALAM,(RADVAL(K),K=1,9),
     1TRANS
      IF(IEMSCT.EQ.0) READ (7,1100) FREQ,ALAM,TRANS,(TRM(I),I=1,10)
      IF(FREQ.EQ.-9999.) GO TO 50
      CONTINUE
       JWT=J
      JFNU=J
      V(J)=ALAM
      IF(ITRP .EQ. 0) RAD(J)=TRANS
      IF(ITRP .GT. 0) RAD(J)=TRM(ITRP)
      IF(ITYP.EQ.1.OR.ITYP.EQ.3) V(J)=FREQ
      IF(V(J).LT.PFRBEG) GO TO 20
      IF(V(J).GT.PFREND) GO TO 20
      IF(IEMSCT.GT.0 .AND. IRAD.GT.0) RAD(J)=RADVAL(IRAD)
      IF(J.GE.399) GO TO 40
      J=J+1
       GO TO 20
CCC
CCC   PLOT DATA
CCC
CCC   TYPE OF LINE PLOTTED IS CONTROLLED BY THE VALUE OF ICRV
CCC   SUBROUTINE DRAW EXPLAINS THE USE OF ICRV IN OBTAINING
CCC   VARIOUS TYPES OF PLOTTED LINES
CCC
40    CALL DRAW(V,RAD,JFNU,ICRV)
```

```
      WRITE (6,2000) V(1),RAD(1),V(JFNU),RAD(JFNU)
      IF(J.LT.399) GO TO 60
      V(1)=V(399)
      RAD(1)=RAD(399)
      J=2
      GO TO 20
50    CONTINUE
      IEOF=IEOF+1
       JWT=J-1
       JFNU=J-1
      IF(JWT.LE.1) GO TO 60
      GO TO 40
60    CONTINUE
94    FORMAT(5I5)
900   FORMAT(2F9.4)
1000  FORMAT(F7.0,F8.3,9E9.2,F8.4)
1100  FORMAT(F7.0,F8.3,10F8.4,F12.4)
2000  FORMAT(2(F10.3,E10.3))
      RETURN
      END


      SUBROUTINE AXISL(X, Y, BCD, N, NUMDIV, DIVLEN, NUMSUB, BEGNUM,
     1  DELNUM, NUMDEC, THETA, HEIGHT, NRPT,NTURN , NOEND, LSUPR, LTURN)
C
C    MODIFIED VERSION OF AXISL
C
C    WRITTEN BY RICHARD L. TAYLOR    RADC/ET    EEC    NOVEMBER 1980
C
C    ROUTINE TO PLOT A LABELLED LINEAR AXIS
C
C
C    X AND Y ARE THE STARTING COORDINATES OF THE AXIS RELATIVE TO THE
C
C         CURRENT ORIGIN
C
C    BCD IS THE LABEL OF THE AXIS EXPRESSED AS A HOLLERITH CONSTANT
C
C    N IS THE NUMBER OF CHARACTERS IN THE LABEL
C
C         NEGATIVE N PLACES THE LABEL ON THE CLOCKWISE SIDE OF THE AXIS
C
C         POSITIVE N PLACES THE LABEL ON THE COUNTERCLOCKWISE SIDE
C
C    NUMDIV IS THE NUMBER OF MAJOR DIVISIONS
C
C    DIVLEN IS THE LENGTH IN INCHES OF A MAJOR DIVISION
C
C    NUMSUB IS THE NUMBER OF MINOR DIVISIONS PER MAJOR DIVISION
C
C         1 GIVES NO SUBDIVISION TICS, 2 GIVES ONE SUBDIVISION TIC, ETC.
C
C    BEGNUM IS THE NUMBER FOR THE BEGINNING OF THE AXIS
C
C    DELNUM IS THE DELTA NUMBER FOR A MAJOR DIVISION
C
C    NUMDEC IS THE NUMBER OF DECIMAL PLACES DESIRED
C
C         NUMDEC EQUAL TO -1 SUPPRESSES THE DECIMAL POINT
C
C    THETA IS THE ANGLE OF THE AXIS IN DEGREES  (0.0 FOR X, 90.0 FOR Y)
C
C    HEIGHT IS THE HEIGHT OF THE NUMBERS IN INCHES
C
C    NRPT IS THE REPEAT FACTOR FOR THE SCALE NUMBERS (USUALLY INTEGER 1)
C
C         WHEN NRPT IS ZERO THE SCALE NUMBERS WILL BE SUPPRESSED;
C
C         WHEN NRPT = 2, EVERY 2ND SCALE NUMBER WILL BE PRODUCED; ETC.
C
C    NTURN EQUAL TO 1 TURNS THE AXIS NUMBERS BY 90 DEGREES CLOCKWISE,
C         -1 TURNS NUMBERS BY 90 DEGREES COUNTERCLOCKWISE, 0 FOR NO TURN
C
C    NOEND EQUAL TO 1 SUPPRESSES THE NUMBERS AT EITHER END OF THE AXIS.
C
C         2 SUPPRESSES THE BEGINNING NUMBER, 3 THE ENDING NUMBER
C
C    LSUPR EQUAL TO 1 SUPPRESSES THE LABEL
C     LTURN NOT USED
C
      COMMON/TITLOC/XPOS, YPOS
```

```
      COMMON /DXDY/ DX,ADY,PFRBEG,YRMIN,IXAXIS,IYAXIS,PFREND,YRMAX,
     C ITYP,IYPWR,IEMSCT
      DIMENSION  BCD(1)
      THETA1=THETA-90.*NTURN
      PI = 2. * ASIN(1.)
      ANGLE = (PI/180.) * THETA
      SINANG = SIN(ANGLE)
      COSANG = COS(ANGLE)
      SIGNAX = FLOAT(ISIGN(1,N))
      SIZMAJ = 0.25 * HEIGHT + 0.05
      OFFST=HEIGHT*1.5
      DXMAJ = -SIZMAJ * SINANG * SIGNAX
      DYMAJ =  SIZMAJ * COSANG * SIGNAX
      DXMIN = 0.5 * DXMAJ
      DYMIN = 0.5 * DYMAJ
      NSUB = NUMSUB
      IF(NUMSUB .LT. 1)  NSUB = 1
      SUBDIV = DIVLEN / FLOAT(NSUB)
      BCDSIZ = 1.25 * HEIGHT
      YBIAS = (-0.50 + SIGN(1.25, SIGNAX)) * HEIGHT + DYMAJ
      NABS = IABS(N)
      BCDLEN = (FLOAT(NABS) - 0.4) * BCDSIZ
      S = DIVLEN * FLOAT(NUMDIV)
      DIVCOS = DIVLEN * COSANG
      DIVSIN = DIVLEN * SINANG
      SIZMAX = HEIGHT
C
C
C   DRAW DIVISION NUMBERS
C
C
      NDIV = 0
   10 DIGITS = 0.0
      XTIC = X + DIVCOS*FLOAT(NDIV)
      YTIC = Y + DIVSIN*FLOAT(NDIV)
      IF(NRPT .EQ. 0)  GO TO 20
      NSUPR = NDIV - (NDIV/NRPT)*NRPT
      IF(NSUPR .NE. 0)  GO TO 20
      IF((NOEND .EQ. 1  .OR.  NOEND .EQ. 2)  .AND.  NDIV .EQ. 0)
     1      GO TO 20
      IF((NOEND .EQ. 1  .OR.  NOEND .EQ. 3)  .AND.  NDIV .EQ. NUMDIV)
     1      GO TO 20
      DIVNUM = BEGNUM + DELNUM*FLOAT(NDIV)
      IF(ABS(DIVNUM) .GE. 10.0)  DIGITS = ALOG10(ABS(DIVNUM))
      DIGITS = AINT(DIGITS + 1.0E-12)
      IF(DIVNUM .LT. 0.0)  DIGITS = DIGITS + 1.0
      SIZNUM = (DIGITS + FLOAT(NUMDEC) + 1.5)*HEIGHT
      XBIAS = -0.5*SIZNUM
      XBIAS1=0.
      YBIAS1=0.
      IF(NTURN.EQ.0) GO TO 15
      YBIAS1=YBIAS-SIZNUM-OFFST
      IF(N.LT.0)YBIAS1=YBIAS+OFFST
      XBIAS1=XBIAS+HEIGHT*0.5
   15 XPOS = XTIC - YBIAS*SINANG + XBIAS*COSANG
     C +YBIAS1*SINANG+XBIAS1*COSANG
      YPOS = YTIC + YBIAS*COSANG  + XBIAS*SINANG
     C -XBIAS1*SINANG-YBIAS1*COSANG
      CALL NUMBER(XPOS, YPOS, HEIGHT, DIVNUM, THETA1,NUMDEC)
```

```
      IF(SIZMAX .LT. SIZNUM)  SIZMAX = SIZNUM
   20 CONTINUE
C
C
C   DRAW TIC MARKS
C
C
      CALL PLOT(XTIC       , YTIC       , 3)
      CALL PLOT(XTIC+DXMAJ, YTIC+DYMAJ, 2)
      IF(NDIV .EQ. NUMDIV)  GO TO 50
      IF(NUMSUB .LE. 1)  GO TO 40
      DO 30  J=2,NUMSUB
      SUBLEN = SUBDIV*FLOAT(J-1)
      XSTIC = XTIC + SUBLEN * COSANG
      YSTIC = YTIC + SUBLEN * SINANG
      CALL PLOT(XSTIC+DXMIN, YSTIC+DYMIN, 3)
      CALL PLOT(XSTIC, YSTIC, 2)
   30 CONTINUE
   40 NDIV = NDIV + 1
      GO TO 10
C
C
C   DRAW AXIS
C
C
   50 CALL PLOT(XTIC, YTIC, 3)
      CALL PLOT(X, Y, 2)
C
C
C   DRAW LABEL
C
C
      IF(ISUPR .EQ. 1  .OR.  NABS .EQ. 0)  RETURN
      XBIAS1=0
      YBIAS1=-SIZNUM-OFFST
      IF(N.LT.0)YBIAS1=-YBIAS1
      IF(NTURN.EQ.0) YBIAS1=0
      XBIAS = 0.5*(S - BCOLFN)
      YBIAS = (-0.50 + SIGN(3.25, SIGMAX)) * BCOSIZ
      XPOS = X - YBIAS*SINANG + XBIAS*COSANG
     C +YBIAS1*SINANG-XBIAS1*COSANG
      YPOS = Y + YBIAS*COSANG + XBIAS*SINANG
     C -XBIAS1*SINANG-YBIAS1*COSANG
      IF(IEMSCT.NE.3 .OR. ITYP.GT.1) GO TO 55
      IF(THETA.EQ.0.0) GO TO 55
      YPOS=YPOS-0.375
      CALL SYMBOL(XPOS,YPOS,BCOSIZ,2HIR,THETA,2)
      YPOS=YPOS+0.375
   55 CONTINUE
      CALL SYMBOL(XPOS, YPOS, BCOSIZ, BCO, THETA, NABS)
      IF(THETA.NE.90.) GO TO 60
      IF(ITYP.GT.1 .OR. IVAXIS.NE.0) GO TO 60
      AMAX=IVPWR
      YPOS=YPOS+2.063
      XPOS=XPOS-0.10
      CALL NUMBER(XPOS,YPOS,0.135,AMAX,THETA,-1)
   60 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE AXLOG(X, Y, BCD, N, NUMCYC, CYCLEN, BEGEXP,
     1     THETA, HEIGHT, NRPT, NTURN, NOEND, LSUPR, LTURN)
C
C
C    WRITTEN BY RICHARD L. TAYLOR   RADC/ET   EEC   NOVEMBER 1980
C
C
C
C    ROUTINE TO PLOT A LABELLED LOGARITHMIC AXIS
C
C
C
C
C    X AND Y ARE THE STARTING COORDINATES OF THE AXIS RELATIVE TO THE
C
C         CURRENT ORIGIN
C
C    BCD IS THE LABEL OF THE AXIS EXPRESSED AS A HOLLERITH CONSTANT
C
C    N IS THE NUMBER OF CHARACTERS IN THE LABEL
C
C         NEGATIVE N PLACES THE LABEL ON THE CLOCKWISE SIDE OF THE AXIS
C
C         POSITIVE N PLACES THE LABEL ON THE COUNTERCLOCKWISE SIDE
C
C    NUMCYC IS THE NUMBER OF CYCLES DESIRED
C
C    CYCLEN IS THE LENGTH OF ONE CYCLE IN INCHES
C
C    BEGEXP IS THE EXPONENT FOR THE BEGINNING OF THE AXIS
C
C    THETA IS THE ANGLE OF THE AXIS IN DEGREES  (0.0 FOR X, 90.0 FOR Y)
C
C    HEIGHT IS THE HEIGHT IN INCHES OF THE TENS
C
C    NRPT IS THE REPEAT FACTOR FOR THE SCALE NUMBERS (USUALLY INTEGER 1)
C
C         WHEN NRPT IS ZERO THE SCALE NUMBERS WILL BE SUPPRESSED;
C
C         WHEN NRPT = 2, EVERY 2ND SCALE NUMBER WILL BE PRODUCED;
C
C         WHEN NRPT = 3, EVERY 3RD SCALE NUMBER WILL BE PRODUCED; ETC.
C
C     NTURN EQUAL TO 1 TURNS THE AXIS NUMBERS BY 90 DEGREES CLOCKWISE,
C          -1 TURNS NUMBERS BY 90 DEGREES COUNTERCLOCKWISE, 0 FOR NO TURN
C
C    NOEND EQUAL TO 1 SUPPRESSES THE NUMBERS AT EITHER END OF THE AXIS,
C
C         NOEND EQUAL TO 2 SUPPRESSES ONLY THE STARTING NUMBER, AND NOEND
C
C         EQUAL TO 3 SUPPRESSES ONLY THE ENDING NUMBER
C
C    LSUPR EQUAL TO 1 SUPPRESSES THE LABEL
C
C     LTURN EQUAL TO 1 TURNS THE LABEL BY 90 DEGREES CLOCKWISE,
C          -1 TURNS LABEL BY 90 DEGREES COUNTERCLOCKWISE, 0 FOR NO TURN
C
C
      COMMON/TITLOC/XPOS, YPOS
```

```
      COMMON /DXDY/ DX,ADY,PFRBEG,YRMIN,IXAXIS,IYAXIS,PFREND,YRMAX,
     C ITYP,IYPWR,IEMSCT
      DIMENSION  BCD(1), SUBDIV(10), DIVLOG(8)
      DATA   DIVLOG / 0.301029995664, 0.477121254720, 0.602059991328,
     1               0.698970004336, 0.778151250384, 0.845098040014,
     2               0.903089986992, 0.954242509439/
      THETA1=THETA-90.*NTURN
      PI = 2. * ASIN(1.)
      ANGLE = (PI/180.) * THETA
      SINANG = SIN(ANGLE)
      COSANG = COS(ANGLE)
      SIGNAX = FLOAT(ISIGN(1, N))
      SIZMAJ = 0.25 * HEIGHT + 0.05
      OFFST=HEIGHT*1.5
      DXMAJ = -SIZMAJ * SINANG * SIGNAX
      DYMAJ =  SIZMAJ * COSANG * SIGNAX
      DXMIN = 0.5 * DXMAJ
      DYMIN = 0.5 * DYMAJ
      BCDSIZ = 1.25 * HEIGHT
      ENLARG=1.5
      EXPSIZ = 0.60 * HEIGHT *ENLARG
      NABS = IABS(N)
      BCDLEN = (FLOAT(NABS) - 0.4) * BCDSIZ
      S = CYCLEN * FLOAT(NUMCYC)
      NUMTIC = 2 - MIN1(1.0, CYCLEN)
      NUMLOG = 8 / NUMTIC
      XBIAS = 1.85*HEIGHT *ENLARG
      YBIAS = 0.70*HEIGHT *ENLARG
      EXPBX = -YBIAS*SINANG + XBIAS*COSANG
      EXPBY =  YBIAS*COSANG + XBIAS*SINANG
      IF (NTURN .EQ. 0) GO TO 5
      EXPBX = XBIAS * SINANG + YBIAS * COSANG
      EXPBY = YBIAS * SINANG - XBIAS * COSANG
    5 DO 10  I=2,8
      SUBDIV(I) = DIVLOG(I-1)*CYCLEN
   10 CONTINUE
      NNUMB = NUMCYC + 1
      SIZMAX = EXPSIZ
      EXP = BEGEXP
      DO 20  I=1,NNUMB
      DIGITS = 0.0
      IF(ABS(EXP) .GE. 10.0)  DIGITS = ALOG10( ABS(EXP) )
      DIGITS = AINT(DIGITS + 1.0E-12) + 0.7
      IF(EXP .LT. 0.0)  DIGITS = DIGITS + 1.0
      SIZNUM = DIGITS * EXPSIZ
      IF(SIZMAX .LT. SIZNUM)  SIZMAX = SIZNUM
   20 EXP = EXP + 1.0
      SIZNUM = SIZMAX + 2.0*HEIGHT
C
C
C     DRAW CYCLE NUMBERS AND EXPONENTS
C
C
      NCYCLE = 0
      EXP = BEGEXP
      XBIAS = -0.7*HEIGHT
      YBIAS = (-0.50 + SIGN(1.25, SIGNAX)) * HEIGHT
      XBIAS1=0.
      YBIAS1=0.
```

```
      IF(NTURN.EQ.0) GO TO 25
      XBIAS1=XBIAS+HEIGHT*0.5
      YBIAS1=YBIAS1-OFFST-SIZNUM
      IF(N.LT.0) YBIAS1 = YBIAS+OFFST
25    TENBX = -YBIAS*SINANG + XBIAS*COSANG
     C +YBIAS1*SINANG - XBIAS1*COSANG
      TENBY =  YBIAS*COSANG + XBIAS*SINANG
     C -YBIAS1*COSANG -XBIAS1*SINANG
   30 XTIC = X + FLOAT(NCYCLE)*CYCLEN*COSANG
      YTIC = Y + FLOAT(NCYCLE)*CYCLEN*SINANG
      IF(NRPT .EQ. 0)  GO TO 40
      NSUPR = NCYCLE - (NCYCLE/NRPT)*NRPT
      IF(NSUPR .NE. 0)  GO TO 40
      IF((NOEND .EQ. 1  .OR.  NOEND .EQ. 2)  .AND.  NCYCLE .EQ. 0)
     1      GO TO 40
      IF((NOEND .EQ. 1  .OR.  NOEND .EQ. 3)  .AND.  NCYCLE .EQ. NUMCYC)
     1      GO TO 40
      XPOS = XTIC + TENBX
      YPOS = YTIC + TENBY
      CALL SYMBOL(XPOS, YPOS, HEIGHT, 2H10, THETA1, 2)
      CALL NUMBER((XPOS+EXPBX), (YPOS+EXPBY), EXPSIZ, EXP, THETA1, -1)
   40 CONTINUE
C
C
C   DRAW TIC MARKS
C
C
      CALL PLOT(XTIC      , YTIC      , 3)
      CALL PLOT(XTIC+DXMAJ, YTIC+DYMAJ, 2)
      IF(NCYCLE .EQ. NUMCYC)  GO TO 70
      IF(NRPT .LT. 0)  GO TO 60
      DO 50  ILOG=1,NUMLOG
      I = ILOG*NUMTIC + 1/NUMTIC
      XLOG = XTIC + SUBDIV(I)*COSANG
      YLOG = YTIC + SUBDIV(I)*SINANG
      CALL PLOT(XLOG+DXMIN, YLOG+DYMIN, 3)
      CALL PLOT(XLOG, YLOG, 2)
   50 CONTINUE
   60 NCYCLE = NCYCLE + 1
      EXP = EXP + 1.0
      GO TO 30
C
C
C   DRAW AXIS
C
C
   70 CALL PLOT(XTIC, YTIC, 3)
      CALL PLOT(X, Y, 2)
C
C
C   DRAW LABEL
C
C
      IF(LSUPR .EQ. 1  .OR.  NABS .EQ. 0)  RETURN
      XBIAS = 0.5*(S - BCDLEN)
      YBIAS = (-0.50 + SIGN(3.25, SIGNAX)) * BCDSIZ
      THETA2 = THETA - 90. * LTURN
      XBIAS2=0.
      OFFST=HEIGHT*2.5
      YBIAS2= -SIZNUM-OFFST
      IF (N .LT. 0) YBIAS2=OFFST
      IF (LTURN .EQ. 0) GO TO 80
      XBIAS2 = XBIAS -0.5*(S-HEIGHT)
   80 XPOS = X - YBIAS*SINANG + XBIAS*COSANG
     C +YBIAS2*SINANG - XBIAS2*COSANG
      YPOS = Y + YBIAS*COSANG + XBIAS*SINANG
     C -YBIAS2*COSANG -XBIAS2*SINANG
      IF(IEMSCT.NE.3 .OR. ITYP.GT.1) GO TO 85
      IF(THETA.EQ.0.0) GO TO 85
      YPOS=YPOS-0.375
      IF(N.LT.0) CALL SYMBOL((XPOS+0.5),YPOS,BCDSIZ,2HIR,THETA2,2)
      IF(N.GT.0) CALL SYMBOL(XPOS,YPOS,BCDSIZ,2HIR,THETA2,2)
      YPOS=YPOS+0.375
   85 CONTINUE
      IF(N.LT.0) CALL SYMBOL((XPOS+0.5),YPOS,BCDSIZ,BCD,THETA2,NABS)
      IF(N.GT.0) CALL SYMBOL(XPOS, YPOS, BCDSIZ, BCD, THETA2, NABS)
      RETURN
      END
```

```
      SUBROUTINE DRAW(X,Y,NPT,ICURVE)
C          DRAWS DIFFERENT KINDS OF CURVES FOR  Y VS X
C
C  X = XARRAY TO BE PLOTTED
C  Y = YARRAY TO BE PLOTTED
C  NPT = NUMBER OF POINTS TO BE PLOTTED
C  ICURVE INDICATES THE TYPE OF CURVE DRAWN
C        ICURVE = 1  SOLID LINE WITHOUT SYMBOLS
C        ICURVE = 2  DASHED LINE WITHOUT SYMBOLS
C        ICURVE = 3  DOTTED LINE WITHOUT SYMBOLS
C        ICURVE = 4  ALTERNATING DASHES & DOTS WITHOUT SYMBOLS
C        ICURVE = 5  ALTERNATING DASHES & 2 DOTS WITHOUT SYMBOLS
C        ICURVE = 6 TO 10 SAME AS 1 TO 5 WITH SYMBOLS AT EVERY POINT
C        THE SYMBOL CHOSEN IN THIS PROGRAM IS NO. 2 OF
C         THE LIST OF SYMBOLS AVAILABLE IN THE CALCOMP SYSTEM
C        ICURVE .GT. 10 ALTERNATING DASHES OF DIFFERENT LENGTHS
C          (THE ONES' DIGIT)*0.1 INCHES  WITH  (THE TENS' DIGIT)*0.1 INC
C        ICURVE .LT. 0  DATA POINTS ONLY,  WITH ABS(ICURVE) = SYMBOL NUMB
C
      COMMON /DXDY/ DX,DY, XMIN,YMIN, LOGLNX,LOGLNY, XMAXVL,YMAXVL
      DIMENSION X(NPT), Y(NPT), XT(100), YT(100)
      DATA KSYM, J, SIZ/2, 1, 0.05/
      KT = KSYM
      IF(ICURVE .LE. -1) KT = -ICURVE
CCC
CCC   IF ICURVE IS INPUT AS 0 RESET TO 1 TO PLOT LINE
CCC
      IF(ICURVE.EQ.0) ICURVE=1
C        PLOT THE  X, Y  PAIRS IN GROUPS OF 100 POINTS
      NEXT = 1
    5 LAST = NEXT + 99
      IF(LAST .LE. NPT) N = 100
      IF(LAST .GT. NPT) N = NPT - NEXT + 1
      IF(LAST .GT. NPT) LAST = NPT
C
      DO 10 M = NEXT,LAST
      I = M + 1 - NEXT
C        IF DOING LOG OR SEMI-LOG PLOT - CONVERT X AND/OR Y TO LOG(X)
      IF( LOGLNX .EQ. 0) XT(I) = X(M)
      IF( LOGLNX .EQ. 1 .AND. X(M) .GT. 0.) XT(I) = ALOG10(X(M))
      IF( LOGLNX .EQ. 1 .AND. X(M) .LE. 0.) XT(I) = XMIN
      IF( LOGLNY .EQ. 0) YT(I) = Y(M)
      IF( LOGLNY .EQ. 1 .AND. Y(M) .GT. 0.) YT(I) = ALOG10(Y(M))
      IF( LOGLNY .EQ. 1 .AND. Y(M) .LE. 0.) YT(I) = YMIN
C          &   IF X OR Y OUTSIDE OF PLOT FORCE TO NEAREST EDGE OF PLOT
      IF(XT(I) .LT. XMIN) XT(I) = XMIN
      IF(XT(I) .GT. XMAXVL) XT(I) = XMAXVL
      IF(YT(I) .GT. YMAXVL ) YT(I) = YMAXVL
      IF(YT(I) .LT. YMIN ) YT(I) = YMIN
   10 CONTINUE
C        CHOOSE TYPE OF CURVE PLOTTED DEPENDING ON ICURVE
      IF(ICURVE .LE.-1) CALL LINE (XT,YT,N,1,-1,KT,XMIN,DX,YMIN,DY,SIZ)
      IF(ICURVE .EQ. 1) CALL LINE (XT,YT,N,1,0,KT,XMIN,DX,YMIN,DY,.08)
      IF(ICURVE .EQ. 2)CALL DASH2(XT,YT,N,1,0,KT,XMIN,DX,YMIN,DY,.1,1,1)
      IF(ICURVE .EQ. 3) CALL DOT(XT,YT,N,1,0,KT,XMIN,DX,YMIN,DY,.08)
      IF(ICURVE .EQ. 4)CALL DSHDOT(XT,YT,N,1,0,KT,XMIN,DX,YMIN,DY,.08)
      IF(ICURVE .EQ. 5)CALL DSHDT2(XT,YT,N,1,0,KT,XMIN,DX,YMIN,DY,.08)
      IF(ICURVE .EQ. 6) CALL LINE(XT,YT,N,1,J,KT,XMIN,DX,YMIN,DY, SIZ)
      IF(ICURVE .EQ.7)CALL DASH2(XT,YT,N,1,J,KT,XMIN,DX,YMIN,DY,SIZ,1,1)
      IF(ICURVE .EQ. 8) CALL DOT(XT,YT,N,1,J,KT,XMIN,DX,YMIN,DY, SIZ)
      IF(ICURVE .EQ. 9)CALL DSHDOT(XT,YT,N,1,J,KT,XMIN,DX,YMIN,DY, SIZ)
      IF(ICURVE .EQ. 10)CALL DSHDT2(XT,YT,N,1,J,KT,XMIN,DX,YMIN,DY,SIZ)
      IF(ICURVE .LE. 10) GO TO 20
C        FOR ICURVE .GT. 10,  DETERMINE LENGTH OF DASHES
      LDASH1 = ICURVE/10
      LDASH2 = ICURVE-10*LDASH1
      CALL DASH2(XT,YT,N,1,0,0,XMIN,DX,YMIN,DY,.08,LDASH1,LDASH2)
   20 CONTINUE
      NEXT = LAST
      IF(LAST .LT. NPT) GO TO 5
C
      RETURN
      END
```

```
      SUBROUTINE DOT(X,Y,N,K,NUMSYM,USYM,XMIN,DX,YMIN,DY,SYMSZE)
CCC
CCC   DRAWS A DOTTED LINE
CCC
      DIMENSION X(N),Y(N),XD(200),YD(200)
      COMMON/XXDYYD/XD,YD
      DATA ISYMB,NUMDOT,DOTSIZ,DOTLEN/5, -1, 0.03, 0.09/
      IF (NUMSYM .LT. 0) GO TO 250
      XDOT = DX * DOTLEN
      YDOT = DY * DOTLEN
      RESID = DOTLEN
      MB = K+1
      DO 200 I = MB,N,K
      XLEN = (X(I)-X(I-K))/DX
      YLEN = (Y(I) - Y(I-K))/DY
      SLEN = SQRT(XLEN **2 + YLEN **2)
      IF(SLEN .LE. 0.) GO TO 200
      TLEN = SLEN + RESID
      NDOT = 0
      IF ( TLEN .LT. DOTLEN ) GO TO 150
      NDOT = INT(TLEN / DOTLEN)
      XSTEP = XDOT * XLEN/SLEN
      YSTEP = YDOT * YLEN/SLEN
      SS = 1. - RESID/DOTLEN
      YD(1) = SS * YSTEP + Y(I-K)
      XD(1) = SS * XSTEP + X(I-K)
      IF ( NDOT .LT. 2 ) GO TO 20
      DO 10 J = 2,NDOT
      XD(J) = XD(J-1) + XSTEP
      YD(J) = YD(J-1) + YSTEP
   10 CONTINUE
   20 CONTINUE
      CALL LINE (XD,YD,NDOT,1,NUMDOT,ISYMB,XMIN,DX,YMIN,DY,DOTSIZ)
  150 RESID = TLEN - NDOT * DOTLEN
  200 CONTINUE
250    CONTINUE
      IF(NUMSYM .EQ. 0) GO TO 300
      IF(NUMSYM .LT. 0) NUMSYM = IABS(NUMSYM)
      DO 40 MN = 1,N,NUMSYM
      CALL SYMBOL((X(MN)-XMIN)/DX,(Y(MN)-YMIN)/DY,SYMSZE,USYM,0.0,-1)
40    CONTINUE
300   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE DSHDT2(X,Y,N,K,NUMSYM,USYM,XMIN,DX,YMIN,DY,SYMSZE)
CCC
CCC   DRAWS A LINE WITH ALTERNATING DASH AND 2 DOTS
CCC
      DIMENSION X(N),Y(N),XD(200),YD(200)
      COMMON/XXDYYD/XD,YD
      DATA DOTLEN/0.09/
      KPT = 0
      IF (NUMSYM .LT. 0) GO TO 250
      XDOT = DX * DOTLEN
      YDOT = DY * DOTLEN
      RESID = DOTLEN
      MB = K+1
      DO 200 I = MB,N,K
      XLEN = (X(I)-X(I-K))/DX
      YLEN = (Y(I) - Y(I-K))/DY
      SLEN = SQRT(XLEN **2 + YLEN **2)
      IF(SLEN .LE. 0.) GO TO 200
      TLEN = SLEN + RESID
      NDOT = 0
      IF ( TLEN .LT. DOTLEN ) GO TO 150
      NDOT = INT(TLEN / DOTLEN)
      XSTEP = XDOT * XLEN/SLEN
      YSTEP = YDOT * YLEN/SLEN
      SS = 1. - RESID/DOTLEN
      YD(1) = SS * YSTEP + Y(I-K)
      XD(1) = SS * XSTEP + X(I-K)
      IF ( NDOT .LT. 2 ) GO TO 20
      DO 10 J = 2,NDOT
      XD(J) = XD(J-1) + XSTEP
      YD(J) = YD(J-1) + YSTEP
   10 CONTINUE
   20 CONTINUE
       DO 30 L = 1,NDOT
       KPT = KPT + 1
       IF(KPT .EQ. 1) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,3)
       IF(KPT .EQ. 5) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,2)
       IF(KPT .EQ. 6)
     +CALL SYMBOL((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,.03,5,0.0,-1)
       IF(KPT .EQ. 7)
     +CALL SYMBOL((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,.03,5,0.0,-1)
       IF(KPT .EQ. 7) KPT = 0
30     CONTINUE
       IF(KPT .GE. 1 .AND. KPT .LE.4)
     +CALL PLOT((X(I)-XMIN)/DX,(Y(I)-YMIN)/DY,2)
  150 RESID = TLEN - NDOT * DOTLEN
  200 CONTINUE
250    CONTINUE
      IF(NUMSYM .EQ. 0) GO TO 300
      IF(NUMSYM .LT. 0) NUMSYM = IABS(NUMSYM)
      DO 40 MN = 1,N,NUMSYM
      CALL SYMBOL((X(MN)-XMIN)/DX,(Y(MN)-YMIN)/DY,SYMSZE,USYM,0.0,-1)
 40   CONTINUE
300   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE DSHDOT(X,Y,N,K,NUMSYM,JSYM,XMIN,DX,YMIN,DY,SYMSZE)
CCC
CCC   DRAWS A LINE WITH ALTERNATING DASHES AND DOTS
CCC
      DIMENSION X(N),Y(N),XD(200),YD(200)
      COMMON/XXDYYD/XD,YD
      DATA DOTLEN/0.09/
      KPT = 0
      IF (NUMSYM .LT. 0) GO TO 250
      XDOT = DX * DOTLEN
      YDOT = DY * DOTLEN
      RESID = DOTLEN
      MB = K+1
      DO 200 I = MB,N,K
      XLEN = (X(I)-X(I-K))/DX
      YLEN = (Y(I) - Y(I-K))/DY
      SLEN = SQRT(XLEN **2 + YLEN **2)
      IF(SLEN .LE. 0.) GO TO 200
      TLEN = SLEN + RESID
      NDOT = 0
      IF ( TLEN .LT. DOTLEN ) GO TO 150
      NDOT = INT(TLEN / DOTLEN)
      XSTEP = XDOT * XLEN/SLEN
      YSTEP = YDOT * YLEN/SLEN
      SS = 1. - RESID/DOTLEN
      YD(1) = SS * YSTEP + Y(I-K)
      XD(1) = SS * XSTEP + X(I-K)
      IF ( NDOT .LT. 2 ) GO TO 20
      DO 10 J = 2,NDOT
      XD(J) = XD(J-1) + XSTEP
      YD(J) = YD(J-1) + YSTEP
   10 CONTINUE
   20 CONTINUE
       DO 30 L = 1,NDOT
       KPT = KPT + 1
       IF(KPT .EQ. 1) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,3)
       IF(KPT .EQ. 3) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,2)
       IF(KPT .EQ. 4)
     +CALL SYMBOL((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,.03,5,0.0,-1)
       IF(KPT .EQ. 4) KPT = 0
30     CONTINUE
       IF(KPT .GE. 1 .AND. KPT .LE.2)
     +CALL PLOT((X(I)-XMIN)/DX,(Y(I)-YMIN)/DY,2)
  150 RESID = TLEN - NDOT * DOTLEN
  200 CONTINUE
250    CONTINUE
      IF(NUMSYM .EQ. 0) GO TO 300
      IF(NUMSYM .LT. 0) NUMSYM = IABS(NUMSYM)
      DO 40 MN = 1,N,NUMSYM
      CALL SYMBOL((X(MN)-XMIN)/DX,(Y(MN)-YMIN)/DY,SYMSZE,JSYM,0.0,-1)
 40   CONTINUE
300   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE DASH2(X,Y,N,K,NUMSYM,JSYM,XMIN,DX,YMIN,DY,SYMSZE,
     +LDASH1,LDASH2)
CCC
CCC   VARIABLE LENGTH DASH ROUTINE
CCC
      DIMENSION X(N),Y(N),XD(200),YD(200)
      COMMON/XXDYYD/XD,YD
      DATA DOTLEN/0.1/
      KPT = 0
      IF (NUMSYM .LT. 0) GO TO 250
      M1 = 1 + LDASH1
      MS2 = M1 + 1
      M2 = MS2 + LDASH2
      XDOT = DX * DOTLEN
      YDOT = DY * DOTLEN
      RESID = DOTLEN
      MB = K+1
      DO 200 I = MB,N,K
      XLEN = (X(I)-X(I-K))/DX
      YLEN = (Y(I) - Y(I-K))/DY
      SLEN = SQRT(XLEN **2 + YLEN **2)
      IF(SLEN .LE. 0.) GO TO 200
      TLEN = SLEN + RESID
      NDOT = 0
      IF ( TLEN .LT. DOTLEN ) GO TO 150
      NDOT = INT(TLEN / DOTLEN)
      XSTEP = XDOT * XLEN/SLEN
      YSTEP = YDOT * YLEN/SLEN
      SS = 1. - RESID/DOTLEN
      YD(1) = SS * YSTEP + Y(I-K)
      XD(1) = SS * XSTEP + X(I-K)
      IF ( NDOT .LT. 2 ) GO TO 20
      DO 10 J = 2,NDOT
      XD(J) = XD(J-1) + XSTEP
      YD(J) = YD(J-1) + YSTEP
   10 CONTINUE
   20 CONTINUE
       DO 30 L = 1,NDOT
       KPT = KPT + 1
       IF(KPT .EQ. 1) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,3)
       IF(KPT .EQ. M1) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,2)
       IF(KPT .EQ. MS2) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,3)
       IF(KPT .EQ. M2 ) CALL PLOT((XD(L)-XMIN)/DX,(YD(L)-YMIN)/DY,2)
      IF(KPT .EQ. M2) KPT = 0
30     CONTINUE
      IF(KPT .GE. 1 .AND. KPT .LT. M1)
     +CALL PLOT((X(I)-XMIN)/DX,(Y(I)-YMIN)/DY,2)
      IF(KPT .GE. MS2 .AND. KPT .LT. M2)
     +CALL PLOT((X(I)-XMIN)/DX,(Y(I)-YMIN)/DY,2)
  150 RESID = TLEN - NDOT * DOTLEN
  200 CONTINUE
250    CONTINUE
      IF(NUMSYM .EQ. 0) GO TO 300
      IF(NUMSYM .LT. 0) NUMSYM = IABS(NUMSYM)
      DO 40 MN = 1,N,NUMSYM
      CALL SYMBOL((X(MN)-XMIN)/DX,(Y(MN)-YMIN)/DY,SYMSZE,JSYM,0.0,-1)
 40   CONTINUE
300   CONTINUE
      RETURN
      END
```

Table 9. Description of LOWTRAN Filter Programs Subroutines

		Page No.
LOWFIL	MAIN DRIVER PROGRAM. READS CONTROL CARDS AND TAPE7 OUTPUT FROM LOWTRAN.	188
WAVEN	CHANGES A SYSTEM RESPONSE FUNCTION VS WAVELENGTH (μm) TO A RESPONSE FUNCTION VS WAVENUMBER (CM^{-1})	195
BRACK	FINDS THE LOWTRAN WAVENUMBERS, WHICH BRACKET THE SYSTEM RESPONSE FUNCTION.	196
INTLOG	INTERPOLATES A PAIR OF VECTORS $F(I) = f(x_i)$, AND $X(I) = x_i$, $i = 1, 2, \ldots N$, TO A NEW SET OF COORDINATES $FNEW(J) = f(x_j')$ & $XNEW(J) = x_j'$, $j = 1, 2, \ldots M$.	195
BIGFIL	ROUTINE TO FIND THE MAXIMUM VALUE OF THE SYSTEM RESPONSE FUNCTIONS.	194
INTRAD	INTEGRATES THE EMITTED OR SCATTERED RADIANCE FROM LOWTRAN TIMES THE SYSTEM RESPONSE FUNCTION.	194
BLKBDY	WEIGHTS THE SYSTEM RESPONSE FUNCTION BY A BLACKBODY RADIANCE.	196
INTGRT	FINDS THE AVERAGE VALUE OF THE TRANSMITTANCE FROM LOWTRAN WEIGHTED BY THE SYSTEM RESPONSE FUNCTION.	194
COMBT	FINDS THE WEIGHTED AVERAGE TRANSMITTANCE DUE TO WATER VAPOR (BOTH BAND-TYPE AND CONTINUUM COMBINED) AND ALL THE OTHER GASES COMBINED.	196

Table 10. Listing of LOWTRAN 6 Filter Function Code

Pages 187 to 196

```
      PROGRAM LOWFIL(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
C
C
C     LOWTRAN 6 FILTER FUNCTION PROGRAM
C
C      PROGRAM WRITTEN BY
C
C                             ERIC P SHETTLE     OPA/AFGL
C                             JOHN D WISE        OPA/AFGL
C                             LEONARD W ABREU    OPI/AFGL
C
C
C------FILTER FUNCTION CONTROL INPUTS-----------------------------------
C      1.) CARD 1 NF,NEW,IFT,TEMP,IPRINT,NLOW (3I5, F10.2, 2I5)
C           NF = NUMBER OF FILTERS (I5)
C             IF NF > 0  READ IN NF FILTERS (NF<=15)
C             IF NF = 0  USE PRECEDING FILTERS AND LOWTRANOUTPUT, WITH
C               OPTION TO CHANGE BLACKBODY TEMPERATURE.
C             IF(NF < 0) STOP FILTER PROGRAM
C           NEW = OPTION TO USE SAME LOWTRAN DATA SET FOR NEXT FILTER--
C             0=NO, 1=YES--REWINDS LOWTRAN FILE (I5)
C           IFT = OPTION TO ENTER BLACKBODY TEMPERATURE
C             0=NO BLACKBODY, 1=FOLD IN BLACKBODY TEMPERATURE (I5)
C           TEMP = BLACKBODY TEMPERATURE IN DEGREES KELVIN (F10.2)
C           IPRINT = DATA PRINT CONTROL (I5)
C             IF IPRINT>=10, PRINT LOWTRAN TRANSMITTANCES AND INFO
C                 BELOW
C             IF IPRINT>=5, PRINT FILTER FUNCTION WITH BLACKBODY
C                 FUNCTION FOLDED IN.
C             IF IPRINT<5, ONLY PRINT FINAL TRANSMITTANCES.
C           NLOW = NUMBER OF LOWTRAN FILES TO BE READ (I5)
C
C     REPEAT CARDS 2 AND 3 NF TIMES
C      2.) CARD 2 IDFIL,KODE,IFWV,NW (2A10, 3I5)
C           IDFIL = FILTER IDENTIFICATION (2A10)
C           KODE = FILTER NUMBER (I5)
C           IFWV = OPTION TO CONVERT FROM WAVELENGTH TO WAVENUMBER--
C             0=YES, 1=NO (I5)
C           NW = NUMBER OF WAVELENGTHS FOR THE FILTER (I5) (NW<=80)
C
C      3.) CARD 3 (WAVE(I), FF(I), I=1,NW) (FREE FORMAT--AS MANY CARDS
C       AS NEEDED FOR NW WAVELENGTHS)
C           WAVE = WAVELENGTH OR WAVENUMBER
C           FF = CORRESPONDING FILTER FUNCTION
C      PROGRAM ASSUMES FILTER FUNCTION INPUTS ARE ON TAPE5 AND
C        LOWTRANOUTPUT FILES ARE ON TAPE7.
C-----------------------------------------------------------------------
C
      DIMENSION IVF(15), IVL(15), VF(15), NVL(15)
      DIMENSION BIGF(15),TRRDND(9,15)
      DIMENSION IDFIL(5,15), KODE(15), IFWV(15)
      DIMENSION NW(15)
      DIMENSION FILT(500), TRNRD(9,15)
      DIMENSION ACRO2A(20),ACRO2B(20),ACRO2C(20),ACO3A1(20),ACO3A2(20)
      COMMON/ /WAVE(80,15), FF(80,15), RST(500,10),VNU(500),ALAM(500)
      COMMON/ATM/VIS,TMP,DP,RANGE
    1 READ(5,910) NF, NEW, IFT, TEMP, IPRINT, NLOW
      WRITE (6,915)  NF, NEW, IFT, TEMP, IPRINT, NLOW
      IF(NF .GT. 0) NFIL = NF
```

```
      IF(NF .EQ. 0) GO TO 140
      IF(NF .LT. 0) GO TO 801
C
      DO 120 L=1,NFIL
      READ(5,920) (IDFIL(I,L),I=1,5), KODE(L), IFWV(L), NW(L)
      NT = NW(L)
      READ(5,*) (WAVE(K,L), FF(K,L), K=1,NT)
      IF(IFWV(L).EQ.1) GO TO 50
      WRITE (6,930)  (IDFIL(I,L), I=1,5), KODE(L), IFWV(L), NW(L),
     + (WAVE(K,L), FF(K,L), K=1,NT)
C
C        CONVERT FROM WAVELENGTH TO WAVENUMBER IF NECESSARY.
C        REVERSE ORDER OF FILTER FUNCTIONS AND WAVENUMBERS TO BE
C        COMPATIBLE WITH LOWTRAN.
C
       CALL WAVEN(WAVE(1,L), FF(1,L),NT)
   50 CONTINUE
      WRITE (6,940)  (IDFIL(I,L), I=1,5), KODE(L), IFWV(L), NW(L),
     +(WAVE(K,L), FF(K,L), K=1,NT)
  120 CONTINUE
C      IF NEW GE 1 USE PRECEDING LOWTRAN DATA READ
  140 IF(NEW .GE. 1) REWIND 7
C
C        *************** READ IN LOWTRAN DATA FILE *********************
C
C        READ LOWTRAN HEADER CARDS
C        READ IN LOWTRAN DATA FILE FROM TAPE--WAVENUMBER VS
C        TRANSMITTANCE FOR THE NINE MOLECULAR AND AEROSOL COMPONENTS
      DO 400 KK=1,NLOW
C
      WRITE (6,945)
      READ  (7,950) MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRT,TBOUND,SALB
      WRITE (6,950) MODEL,ITYPE,IEMSCT,M1,M2,M3,IM,NOPRT,TBOUND,SALB
      READ  (7,952) IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,
     +VIS,WSS,WHH,RAINRT
      WRITE (6,952) IHAZE,ISEASN,IVULCN,ICSTL,ICIR,IVSA,
     +VIS,WSS,WHH,RAINRT
      READ  (7,954) ACRD2A
      WRITE (6,954) ACRD2A
      READ  (7,954) ACRD2B
      WRITE (6,954) ACRD2B
      READ  (7,954) ACRD2C
      WRITE (6,954) ACRD2C
      IF(MODEL.NE.0) READ  (7,956) H1,H2,ANGLE,RANGE,BETA,RO,LEN
      IF(MODEL.NE.0) WRITE (6,956) H1,H2,ANGLE,RANGE,BETA,RO,LEN
      IF(MODEL.EQ.0) READ  (7,958) H1,P,T,DP,RH,WH,WO,RANGE
      IF(MODEL.EQ.0) WRITE (6,958) H1,P,T,DP,RH,WH,WO,RANGE
      READ  (7,954) ACD3A1
      WRITE (6,954) ACD3A1
      READ  (7,954) ACD3A2
      WRITE (6,954) ACD3A2
      READ  (7,960) V1,V2,DV
      WRITE (6,960) V1,V2,DV
      READ  (7,962) IRPT
      WRITE (6,962) IRPT
      READ (7,963) RAIN,CIRRUS
      NP = INT((V2 - V1)/DV) + 1
      IF(IPRINT.LT.10) GO TO 145
      IF(IEMSCT.EQ.0) WRITE (6,968) RAIN,CIRRUS
```

```
      IF(IEMSCT.GT.0) WRITE (6,969) RAIN,CIRRUS
  145 CONTINUE
      DO 150 J=1,NP
      IF(IEMSCT.EQ.0) READ  (7,964) VNU(J), ALAM(J), (RST(J,I),I=1,10)
      IF(IEMSCT.GT.0) READ  (7,968) VNU(J), ALAM(J), (RST(J,I),I=1,10)
      IF(IPRINT .LT. 10) GO TO 150
      IF(IEMSCT.EQ.0) WRITE (6,965) VNU(J), ALAM(J), (RST(J,I),I=1,9 )
      IF(IEMSCT.GT.0) WRITE (6,967) VNU(J), ALAM(J), (RST(J,I),I=1,10)
  150 CONTINUE
C
C     ++++++++++++++ CALCULATE WEIGHTED TRANSMITTANCES ++++++++++++++
C
C        THIS PART OF THE PROGRAM NOW LOOPS OVER EACH OF THE LOWTRAN
C        TRANSMITTANCES, CALCULATING WEIGHTED TRANSMITANCES FOR EACH
C        MOLECULAR OR AEROSOL COMPONENT
      DO 300 L=1,NF
      NT = NW(L)
C
C        FIND ARRAY IN LOWTRAN WAVENUMBERS WHICH BRACKETS THE FILTER
C        FUNCTION WAVENUMBERS.
C
      CALL BRACK(V1, WAVE(1,L), NT, DV, IVF(L), IVL(L), NVL(L))
      IA = IVF(L)
      IB = IVL(L)
      VF(L) = VNU(IA)
      WRITE (6,970)  KODE(L), (IDFIL(J,L), J=1,5)
      IF(IPRINT.GE.5)
     *WRITE (6,972)  IA, IB, NVL(L), VNU(IA), VNU(IB)
C
C        INTERPOLATE IN INPUT FILTER FUNCTION RESPONSES TO GET FILTER
C        FUNCTIONS FOR LOWTRAN WAVENUMBERS.
C
      CALL INTLOG(FF(1,L), WAVE(1,L), NT, FILT, VNU(IA), NVL(L))
C
C     CHECK INTERPOLATED FILTER VALUES
C     IF ANY ARE NEGATIVE RESET TO ZERO
C
      N=NVL(L)
      DO 210 I=1,N
      IF(FILT(I).LT.0) FILT(I)=0.
  210 CONTINUE
      CALL BIGFIL(FILT,NVL(L),BIGF(L))
      IF (IPRINT .LT. 5) GO TO 250
      IF(IEMSCT.EQ.0) IE=1
      IF(IEMSCT.GT.0) IE=10
      WRITE (6,976)  (VNU(M), FILT(M-IA+1), RST(M,IE), M=IA,IB)
  250 CONTINUE
      IF(IEMSCT.LT.1) GO TO 270
      IF(IEMSCT.EQ.2) GO TO 260
C
C     IEMSCT=1  STANDARD EMISSION RUN
C     INTEGRATE THE PATH RADIANCE AND TOTAL TRANS.
C
C     OR IEMSCT =3  DIRECT SOLAR
C     INTEGRATE THE TRANSMITTED IRRADIANCE AND TOTAL TRANSMITTANCE
C
      CALL INTRAD(FILT,RST(IA,1),NVL(L),DV,TRNRD(1,L))
      TRRDNO(1,L)=TRNRD(1,L)/BIGF(L)
      IF(IFT.EQ.1) CALL BLKBDY(TEMP,FILT,NVL(L),VNU(IA))
```

```
      IF(IPRINT.GE.5 .AND. IFT.EQ.1) WRITE (6,975)
      IF(IPRINT.GE.5 .AND. IFT.EQ.1)
     *WRITE (6,976) (VNU(M),FILT(M-IA+1),RST(M,IE),M=IA,IB)
      CALL INTGRT(FILT,RST(IA,10),NVL(L),TRNRD(9,L))
      GO TO 280
  260 CONTINUE
C
C     IEMSCT=2  EMISSION WITH SCATTERING
C     INTEGRATE THE PATH RADIANCE,SCATTERED RADIANCE,REFLECTED RADIANCE
C     TOTAL RADIANCE AND TOTAL TRANS.
C
      DO 265 I=1,7,2
      CALL INTRAD(FILT,RST(IA,I),NVL(L),DV,TRNRD(I,L))
      TRRDNO(I,L)=TRNRD(I,L)/BIGF(L)
  265 CONTINUE
      IF(IFT.EQ.1) CALL BLKBDY(TEMP,FILT,NVL(L),VNU(IA))
      IF(IPRINT.GE.5 .AND. IFT.EQ.1) WRITE (6,975)
      IF(IPRINT.GE.5 .AND. IFT.EQ.1)
     *WRITE (6,976) (VNU(M),FILT(M-IA+1),RST(M,IE),M=IA,IB)
      CALL INTGRT(FILT,RST(IA,10),NVL(L),TRNRD(9,L))
      GO TO 290
  270 CONTINUE
C
C     IEMSCT=0  STANDARD TRANSMISSION RUN
C     INTEGRATE ALL MOLECULES
C
C        MERGE WATER CONTINUUM WITH WATER BAND TO GET AVERAGE WATER
C        TRANSMITTANCE (WATAV).  MERGE GASES TO GET UNIFORMLY MIXED
C        GASES TRANSMITTANCE (GASAV).
C
      IF(IFT.EQ.1) CALL BLKBDY(TEMP,FILT,NVL(L),VNU(IA))
      IF(IPRINT.GE.5 .AND. IFT.EQ.1) WRITE (6,975)
      IF(IPRINT.GE.5 .AND. IFT.EQ.1)
     *WRITE (6,976) (VNU(M),FILT(M-IA+1),RST(M,IE),M=IA,IB)
      CALL CONST(FILT, RST, NVL(L), IA, WATAV, GASAV)
      DO 275 I=1,9
      CALL INTGRT(FILT,RST(IA,I), NVL(L), TRNRD(I,L))
  275 CONTINUE
      WRITE (6,977)
      WRITE (6,978)  (I, TRNRD(I,L), I=1,9)
      TWGA=WATAV*GASAV*TRNRD(8,L)*RAIN*CIRRUS
      T2TO9=TRNRD(2,L)*TRNRD(3,L)*TRNRD(4,L)*TRNRD(5,L)*TRNRD(6,L)*
     * TRNRD(7,L)*TRNRD(8,L)*TRNRD(9,L)*RAIN*CIRRUS
      WRITE (6,980)  T2TO9, TWGA, RAIN, CIRRUS
      IF(MODEL.EQ.0) WRITE (6,982)  VIS, T, DP, P, RANGE, TEMP,
     *TRNRD(1,L),WATAV,GASAV, TRNRD(8,L), KODE(L), (IDFIL(I,L), I=1,5)
      IF(MODEL.NE.0) WRITE (6,983) VIS,TEMP,TRNRD(1,L),WATAV,GASAV,
     *TRNRD(8,L),KODE(L),(IDFIL(I,L),I=1,5)
      GO TO 300
  280 CONTINUE
      WRITE (6,988)
      IF(MODEL.EQ.0) WRITE (6,984) VIS,T,DP,P,RANGE,TEMP,
     *TRNRD(1,L),TRNRD(9,L),KODE(L),(IDFIL(I,L),I=1,5)
      IF(MODEL.NE.0) WRITE (6,985) VIS,TEMP,TRNRD(1,L),TRNRD(9,L),
     *KODE(L),(IDFIL(I,L),I=1,5)
      WRITE (6,989)
      IF(MODEL.EQ.0) WRITE (6,994) TRRDNO(1,L)
      IF(MODEL.NE.0) WRITE (6,995) TRRDNO(1,L)
      GO TO 300
```

```
290 CONTINUE
    WRITE (6,988)
    IF(MODEL.EQ.0) WRITE (6,986) VIS,T,DP,P,RANGE,TEMP,
   +TRNRD(1,L),TRNRD(3,L),TRNRD(5,L),TRNRD(7,L),TRNRD(9,L),
   +KODE(L),(IDFIL(I,L),I=1,5)
    IF(MODEL.NE.0) WRITE (6,987) VIS,TEMP,TRNRD(1,L),TRNRD(3,L),
   +TRNRD(5,L),TRNRD(7,L),TRNRD(9,L),KODE(L),(IDFIL(I,L),I=1,5)
    WRITE (6,989)
    IF(MODEL.EQ.0) WRITE (6,996) TRRDNO(1,L),TRRDNO(3,L),TRRDNO(5,L),
   +TRRDNO(7,L)
    IF(MODEL.NE.0) WRITE (6,997) TRRDNO(1,L),TRRDNO(3,L),TRRDNO(5,L),
   +TRRDNO(7,L)
300 CONTINUE
C
C      TEST FOR END-OF-FILE.
C   LOWTRAN 6 SEPARATES FILES WITH A  -9999. CODE IN THE
C   FIRST WORD (F7.0) FOLLOWING THE LAST RECORD OF DATA OUTPUT.
C
    READ (7,999) DUM
    IF (DUM.EQ.-9999.) GO TO 400
310 WRITE (6,998)
    STOP
400 CONTINUE
    GO TO 1
801 CONTINUE
    STOP
C
C   ************************** FORMATS ******************************
C
910 FORMAT(3I5, F10.2, 2I5)
915 FORMAT(21H1 NUMBER OF FILTERS= , I5, 2X, 4HNEW=, I5, 2X, 4HIFT=,
   +I5,2X, 12HTEMPERATURE=, F10.2, 2X, 7HIPRINT=,I5,2X,5HNLOW=, I5)
920 FORMAT(5A4, 3I5)
930 FORMAT(//1H0,2X,12H FILTER NAME,10X,5HFILT#,2X,8HIFWV  NW,
   +/2X,5A4,2X,3I5/1X,9(14H WAVEL     FF  )/9(F8.3,F6.2))
940 FORMAT(2X,12H FILTER NAME,10X,5HFILT#,2X,8HIFWV  NW,
   +/2X,5A4,2X,3I5/1X,9(14H WAVEN     FF  )/9(F8.1,F6.3))
945 FORMAT(//1H0, 2X,10(4H****), 22H LOWTRAN CONTROL DATA ,
   + 10(4H****))
950 FORMAT(8I5,2F10.3)
952 FORMAT(6I5,4F10.3)
954 FORMAT(20A4)
956 FORMAT(6F10.3,I5)
958 FORMAT(3F10.3,2F8.1,2E10.3,F10.3)
960 FORMAT(3F10.3)
962 FORMAT(I5)
963 FORMAT(2F9.4)
964 FORMAT(F7.0,F8.3,10F8.4,F12.4)
965 FORMAT(2X,F7.0,F8.3,9F9.4)
986 FORMAT(F7.0,F9.3,9E9.2,F8.4)
987 FORMAT(2X,F7.0,F8.3,1P9E10.2,0PF10.4)
988 FORMAT(/5X,42H LOWTRAN TAPE 7 OUTPUT   TRANSMISSION CASE,
   +/2X,5HRAIN=,F9.4,2X,7HCIRRUS=,F9.4,
   +/2X,54H WAVEN   WAVEL      TOT TRN    H2O     CO2+      O3   ,
   +43H N2 CONT  H2O CONT MOL SCT  AEROSOL   HNO3 /)
989 FORMAT(/5X,42H LOWTRAN TAPE 7 OUTPUT    EMISSION CASE    ,
   +/2X,5HRAIN=,F9.4,2X,7HCIRRUS=,F9.4,
   +/2X,56H WAVEN   WAVEL      EMITTED RADIANCE   SCATTER RADIANCE ,
   +51H  GND REFL RADIANCE   TOTAL RADIANCE       INTEGRAL,
```

```
  +10H TOT TRANS/)
970 FORMAT(//18X,30HSUMMARY OF CALCULATIONS WITH  ,7HFILTER#, I3,
  + 2X, 12HFILTER NAME , 5A4/)
972 FORMAT(2X, 15H IVF, IVL, NVL=, 3I5,  2X,
  +24HLOWTRAN WAVENUMBERS FROM, F10.2, 2X, 2HTO, F10.2,
  + /30X,41HFILTER RESPONSES AND TOTAL TRANSMITTANCES/)
975 FORMAT(/30X,42HFILTER RESPONSES WITH BLACKBODY EMISSIVITY/)
976 FORMAT( 1X, 5(25HWAVE    RESP         T    ,1X), /
  + 5(F7.0, 1PE9.2, 0PF7.3,3X))
977 FORMAT(//36X,39H SENSOR WEIGHTED AVERAGE TRANSMITTANCES,
  +/21X,9HTOT TRANS,12H   H2O BAND ,9H   CO2   ,9H  OZONE  ,
  +2X,9H N2 CONT ,2X,9HH20 CONT ,9H MOL SCT ,2X,9HAER TRANS,
  +9H  HNO3   )
978 FORMAT(21H  CONSTITUENT TRANS.=, 9(I3, 1X, F5.3,1H,))
980 FORMAT(2X, 7H T2TO9=, F6.3, 4X, 6HTWGA= , F6.3,4X,7HTRAIN= ,F6.3,
  + 4X,9HTCIRRUS= ,F6.3)
982 FORMAT(/41H   VIS    T     DP    P      RANGE BBTEMP ,
  +32HTTOT TH2O TGAS TAER FILT#   NAME, /,
  +F5.1, 2F6.1, F6.0, F10.3, F6.0, 2F5.3,1X,2F5.3, I5, 5A4)
983 FORMAT(/49H   VIS   BBTEMP TTOT TH2O TGAS TAER FILT#    NAME,/,
  +3X,F5.1,1X,F6.0,4F5.3,1X,I5,5A4)
984 FORMAT(/41H    VIS    T     DP    P      RANGE BBTEMP,
  +32H EMIT RAD  TOT TRNS FILT#   NAME,
  +/,F5.1,2F6.1,F6.0,F10.3,F6.0,1PE10.3,0PF10.3,I5,5A4)
985 FORMAT(/45H VIS   BBTEMP EMIT RAD  TOT TRNS FILT#   NAME,
  +/,F5.1,1X,F6.0,1PE10.3,0PF10.3,I5,5A4)
986 FORMAT(/41H    VIS    T     DP    P      RANGE BBTEMP,
  +62H EMIT RAD  SCAT RAD  REFL RAD  TOT RAD   TOT TRNS FILT#   NAME,
  +/,F5.1,2F6.1,F6.0,F10.3,F6.0,1P4E10.3,0PF10.3,I5,5A4)
987 FORMAT(/13H VIS    BBTEMP,
  +62H EMIT RAD  SCAT RAD  REFL RAD  TOT RAD   TOT TRNS FILT#   NAME,
  +/,F5.1,1X,F6.0,1P4E10.3,0PF10.3,I5,5A4)
988 FORMAT(//8X,38H SENSOR WEIGHTED INTEGRATED RADIANCES )
989 FORMAT(//15X,29H FILTER NORMALIZED RADIANCES)
994 FORMAT(/41X,9H EMIT RAD,/,41X,1PE10.3)
995 FORMAT(/18X,9H EMIT RAD,/ 13X,1PE10.3)
996 FORMAT(/41X,39H EMIT RAD  SCAT RAD  REFL RAD   TOT RAD,
  +/,41X,1P4E10.3)
997 FORMAT(/,12X,39H EMIT RAD  SCAT RAD  REFL RAD   TOT RAD,
  +/,12X,1P4E10.3)
998 FORMAT(36H  ERROR--END OF FILE NOT ENCOUNTERED)
999 FORMAT(F7.0)
    END
```

```
      SUBROUTINE INTGRL(F, T, N, TRANS)
C
C     THIS SUBROUTINE COMPUTES A TRAPEZOIDAL INTEGRATION, WITH
C      FUNCTION *F* BEING INTEGRATED ALONG THE *T* AXIS.
C
      DIMENSION F(N), T(N)
      TSUM = ((F(1)*T(1)) + (F(N)*T(N)))/2.0
      SUM =(F(1) + F(N))/2.0
      NUM=N-1
      DO 200 I=2,NUM
      TSUM = TSUM + F(I)*T(I)
      SUM = SUM + F(I)
  200 CONTINUE
      TRANS = TSUM/SUM
      RETURN
      END
```

```
      SUBROUTINE INTRAD(F,T,N,DV,TRANS)
C
C     THIS SUBROUTINE PERFORMS AN INTEGRATION FOR F(FILTER FUNCTION)
C     AND T(RADIANCE) ALONG THE T AXIS
C
      DIMENSION F(N),T(N)
      RSUM=((F(1)*T(1))+(F(N)*T(N)))/2.0
      NUM=N-1
      DO 200 I=2,NUM
      RSUM=RSUM+F(I)*T(I)
  200 CONTINUE
      TRANS=RSUM*DV
      RETURN
      END
```

```
      SUBROUTINE BIGFIL(F,N,BIG)
CCC
CCC   ROUTINE TO CHOOSE LARGEST FILTER VALUE
CCC   TO APPLY TO NORMALIZATION OF RADIANCE RESULT
CCC   OBTAINED FROM SUBROUTINE INTRAD
CCC
      DIMENSION F(N)
      BIG=1.0E-14
      DO 10 I=1,N
      IF(F(I) .GT. BIG) BIG=F(I)
   10 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE INTLOG(XA, YA, NA,  XB, YB, NB)
C
C    THIS TAKES A SET OF DATA POINTS XA(I) VS YA(I) (I=1,..,NA)
C      AND GIVEN ANOTHER SET OF Y VALUES:  YB(I) ,  J=1,..,NB
C      FINDS THE CORRESPONDING X VALUES:  XB(J).
C
C     INTERPOLATES UNDER THE ASSUMPTION:  X = X0*EXP(-Y/H)
C
C    NOTE:  MUST HAVE YA(1) .LE. YB(1)&  YA(NA) .GE. YB(NB)
C        WHERE THE Y'S ARE IN ASCENDING ORDER
C
      DIMENSION XA(NA), YA(NA),  XB(NB), YB(NB)
C
      I = 1
      DO 50 J = 1,NB
    5 IF(YB(J)-YA(I) ) 20, 40, 10
   10 IF(I .EQ. NA) GO TO 25
      I = I + 1
      IF(YB(J) .GT. YA(I) ) GO TO 5
      GO TO 25
   20 IF(I .EQ. 1) I = 2
   25 II = I - 1
      IF(XA(I)*XA(II) .LE. 0. ) GO TO 30
      Z = XA(I)/XA(II)
      IF( ABS(Z-1.) .LT. 0.1 ) GO TO 30
      H = (YA(I) -YA(II) )/ALOG(Z)
      XB(J) = XA(II)*EXP( (YB(J)-YA(II) )/H)
      GO TO 50
   30 XB(J) = XA(II) + (XA(I)-XA(II) )*(YB(J)-YA(II) )/(YA(I)-YA(II) )
      GO TO 50
   40 XB(J) = XA(I)
      I = I + 1
   50 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE WAVEN(WAVE, FF, NW)
      DIMENSION WAVE(NW), FF(NW)
C
C        THIS SUBROUTINE CONVERTS AN  ARRAY OF WAVELENGTHS TO
C        AN ARRAY OF WAVENUMBERS, REVERSING THE ORDER OF THE WAVENUMBERS
C        IN THE PROCESS.
C
      M = NW/2
      DO 200 I=1,M
      K = NW-I+1
      FREQ = 1.E4/WAVE(I)
      WAVE(I) = 1.E4/WAVE(K)
      WAVE(K) = FREQ
      FS = FF(I)
      FF(I) = FF(K)
      FF(K) = FS
  200 CONTINUE
      L = 2*M
      IF(L .LT. NW) GO TO 300
      GO TO 400
  300 WAVE(I) = 1.E4/WAVE(I)
  400 RETURN
      END
```

```
      SUBROUTINE BRACK(WVN1, VIN, NW, DV, IFRST, LAST, NUMBER)
      DIMENSION VIN(NW)
C
C        PICKS OUT THE APPROPRIATE INDEXES OF A LARGER ARRAY
C        CORRESPONDING TO THE POSITIONING OF A SMALLER ARRAY.
C
      IFRST = INT((VIN(1) - WVN1)/DV) + 1
      LAST = INT((VIN(NW) - WVN1)/DV) + 2
      NUMBER = LAST - IFRST + 1
      RETURN
      END
```

```
      SUBROUTINE BLKBDY(TEMP, FF, NW, WAVE)
C
C     THIS SUBROUTINE MODIFIES THE FUNCTION "FF" BY INCORPORATING THE
C      ASSOCIATED WAVENUMBER ARRAY AND A FIXED BLACKBODY TEMPERATURE
C      INTO THE BLACKBODY EQUATION.
C
      DIMENSION FF(NW), WAVE(NW)
      IF(TEMP.LE.0.0) GO TO 301
      DO 200 I=1,NW
      FF(I) = (1.190956E-12*WAVE(I)**3)/(EXP(1.43879*WAVE(I)/TEMP) - 1.)
     * *FF(I)
  200 CONTINUE
      RETURN
  301 WRITE (6,901)
  901 FORMAT(/5X,46HNO BLACKBODY CALCULATION AS TEMP IS ZERO OR LESS/,
     *5X,32HTEMP SHOULD BE IN DEGREES KELVIN/)
      RETURN
      END
```

```
      SUBROUTINE COMBT(F, T, N, IA, WAT, GAS)
C
C        THIS SUBROUTINE COMBINES THE WATER BAND AND WATER CONTINUUM TO
C        GET THE WATER TRANSMITTANCE, COMBINES THE GAS TRANSMITTANCES TO
C        GET THE UNIFORMLY MIXED GASES TRANSMITTANCE, THEN INTEGRATES
C        BOTH TRANSMITTANCES WITH THE FILTER RESPONSES TO GET THE
C        WEIGHTED GAS AND WATER TRANSMITTANCE
C
      DIMENSION F(500), T(500,10), WTRN(500), GTRN(500)
      IB = IA + N
      DO 300 L=IA, IB
      LL=L-IA+1
      WTRN(LL) = T(L,6)*T(L,2)
      GTRN(LL) = T(L,3)*T(L,4)*T(L,5)*T(L,7)*T(L,8)
  300 CONTINUE
      CALL INTGRT(F, WTRN, N, WAT)
      CALL INTGRT(F, GTRN, N, GAS)
      RETURN
      END
```