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THE EFFECTS OF MAGNETIC STORM PHASES ON F-LAYER IRREGULARITIES FROM AURORAL TO EQUATORIAL LATITUDES

Jules Aarons and Michael Mendillo, Co-Principal Investigators

Boston University
Center for Space Physics
Boston, MA 02215

COMPARISON OF F-LAYER IRREGULARITIES DURING PERIODS OF HIGH AND LOW SOLAR FLUX

EQUATORIAL STUDIES

The review of equatorial data relative to F-layer irregularities continued during this period with an emphasis in this quarter on determining the effects of localized effects on the generation of F-region irregularities. The study compares initially for one month TEC and scintillation data for Manila, the Philippines, Palehua, Hawaii Tepei, Taiwan , and Osan, Korea all in the Pacific Sector. For some periods in 1980 and 1981, all the data are available. The initial study will be the data set for July 1980.

HIGH LATITUDE STUDIES

We have analyzed the data provided by Dr. Leonard Kersley of the University College of Aberystwyth, Wales and his group. Data from several periods of interest in the low sunspot years of 1985 and 1986 has been contoured. The data available for the study of contrasting low and high solar flux years includes that from the University College data set taken in Kiruna, Sweden as well as other data taken in Goose Bay, Labrador. We also have access to equatorial observations for these dates. Evaluation of data sets has included new analysis as well as the utilization of older data, much of it at this date merely reduced.

PROPOSED PRESENTATION

We are preparing the following material to be put into an abstract for the Ionospheric Effects Symposium.

THE SUNSPOT CYCLE AND "AURORAL" F LAYER IRREGULARITIES

J. Aarons, L. Kersley (University College of Wales) and A.S. Rodger (British Antarctic Survey)

The use of the word "aurora" for many different observations at high latitudes has limited the concepts involved; this is particularly true for F region irregularities. Observations setting the position of the auroral oval are made with the 5577 Å green line emitted predominantly at E layer heights. Starkov and Feldstein have shown that the change in position of the auroral oval for constant Kp, as a function of sunspot cycle, is of the order of one degree difference between sunspot maximum and sunspot minimum. However irregularities in the F region do not have the same behavior as the auroral 100 km observations and for the same magnetic index show large differences in position as a function of solar flux.

The data from Goose Bay, Labrador observing from 67° to 70° Corrected Geomagnetic Latitude indicate that the occurrence of scintillation at 250 MHz during a year of low solar flux (1986) is enormously reduced compared to the occurrence for the same magnetic conditions during a year of high solar flux (1980). Data from the low altitude orbiting Transit satellites taken in Lerwick, Scotland indicate that the scintillation boundary for low K values, moves equatorwards of the order of 4 to 10 degrees (depending on arbitrary values of scintillation level chosen) as sunspot maximum is approached. For example the October-November periods of 1987 shows the 10-20% occurrence of scintillation of moderate level at 65 degrees of corrected geomagnetic latitude for 1987 and 53 degrees for the higher flux year of 1988. Higher occurrence of

20%-30% levels of scintillation show a change of 4 degrees for the same comparison.

Using a shorter time scale, an earlier unpublished study of scintillations (Hawkins, 1974) during extended quiet periods for a year of relatively high to moderate sunspot numbers (127 and 89) showed that as the days of low magnetic activity continued the mean scintillation index also decreased.

Scintillation intensity is a function both of the disturbing mechanism and the ambient electron density. Changes in electron density has been proposed as the dominant mechanism for changes in high latitude irregularity intensity. The contrary evidence against the use of electron density as the predominant parameter has two aspects i.e. that scintillations maximize during the night when electron density is lower. In addition during certain phases of many magnetic storms, the intensity of the irregularities increases yet the local F-layer electron density decreases. This may lead to the formulation of two mechanisms, one for the conditions of low solar flux and quiet magnetic conditions and the second for mechanisms operating during magnetic storms.

PUBLICATIONS

Refereed Paper Published During This Period

Mendillo, M. J. Baumgardner, X. Pi, P. J. Sultan, and R. Tsunoda Onset Conditions for Equatorial Spread F, J. Geophys. Res. 97, 13,865-13,876, September 1, 1992

Non-Refereed Papers Published

Balan, N., J. Aarons, A.S. Rodger and C.A. Gurgiolo: The Effects of Magnetic Storm Phases on F-Layer Irregularities, Advances in Space Research 12, (6) 223-226, 1992

Aarons, Jules: The Longitudinal Occurrence of Equatorial F-Layer Irregularities AGARDOGRAPH, June 1992

PRESENTATIONS

The paper entitled "The Longitudinal Occurrence of Equatorial F Layer Irregularities" was presented at the Beacon Satellite Meeting held in Boston on the last week in June 1992. The presentation emphasized the evaluation of those components of the available data base relevant to the occurrence of equatorial plume irregularities. A paper on a similar subject but with emphasis on the physics and the relevance to systems such as GPS was presented at the AGARD Meeting on Radio Location Techniques held in the early part of June 1992.