the broadbeam antenna. The characteristics of this event show that the geometry of the precipitation region can explain departures of the spectral index from the theoretical value.

The results we have shown are representative of those obtained from the events we have examined. Those events which are associated with small-spatial-scale precipitation regions show departure of the spectral index from the theoretical value of 2; those events which cover the entire field of view of the broadbeam antenna show no deviation. We have found no event in the broadbeam data which was not consistent with the simulation using the IRIS data; this includes events on the edge of the IRIS field of view, which are seen as much smaller events in the broadbeam riometer record, if they are observed at all. The small departures of broadbeam measurements from the simulated results can be attributed to differences in the actual broadbeam antenna pattern from that modelled using conventional antenna theory, when the discrepancies in the absorption are larger than allowed for in the simulation procedure; these discrepancies are on the order of a few tenths of decibels, in any case, and do not call for re-examination of either the simulation technique or magnetoionic theory.

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Magnetic pulsations in the polar cap

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The polar caps may be defined as the regions surrounded by the northern and the southern auroral ovals. The southern oval, in moderate magnetic activity, lies near $-80°$ magnetic latitude at local magnetic noon and near $-65°$ at midnight. South Pole Station, at the geographic pole, may be considered to travel daily in a circle of latitude $-74°$ around a fixed south magnetic pole. Therefore, the station is somewhat equatorward of the auroral oval at noon and poleward of the oval at midnight. At times of moderate magnetic activity, the station should spend several hours each day in the polar cap. In the study of magnetic pulsations propagating in the magnetosphere, the polar caps are, in one sense, unique (Fraser-Smith 1982). The Earth's magnetic field lines that intercept the polar caps (the north and south lobes of the magnetotail) do not close in the opposite hemisphere, in dipole fashion, but extend indefinitely in space, downstream in the solar wind. Many magnetic pulsations on the closed field lines have been interpreted as due to resonant oscillations of the Earth's magnetic field lines (Cummings, O'Sullivan, and Coleman 1969). Since the polar cap field lines are open, the occurrence of resonant oscillations seems unlikely. Yet, there are pulsations observed on the ground, in the polar cap, and in space, on tail-lobe field lines. This article covers South Pole observations of magnetic pulsations in the interval from January through June of 1983.

The search coil magnetometers at South Pole Station are similar to those installed at Siple Station, Antarctica, in 1972 (Taylor et al. 1975). The east-west sensor record from a typical day, 3 March 1983 is first analyzed. The amplitude spectrum of figure 1 gives the frequency structure of the first 21.3 minutes of data of the 3 March record. The frequency range is divided into Pc 3, 4, and 5 frequency segments (22 to 100 millihertz, 6.7 to 22 millihertz, and 1.7 to 6.7 millihertz, respectively) and the average amplitude of each segment is shown. The average band 3, 4 and 5 amplitudes in nanotesla per second are used as measures of the signal amplitude in these frequency bands in the subsequent figures.

Figure 2 gives a 24-hour record (3 March) of the band 3 amplitude measures, one each 21.3 minutes. The broad peak before noon magnetic local time is typical of the higher amplitude signals seen each day when the station passes under the auroral oval and cusp. The amplitude is much lower, mostly below .01 nanotesla per second, from 1430 through midnight to 0430 magnetic local time (we expect—on the average—that the station will be in the polar cap from 1800 to 0600 magnetic local time).

All 35 days of our 1983 data sample have been used in figure 3 which shows the average, for all days, of the band 3 measures in each 21.3 minute segment of the 24-hour day. Similar plots

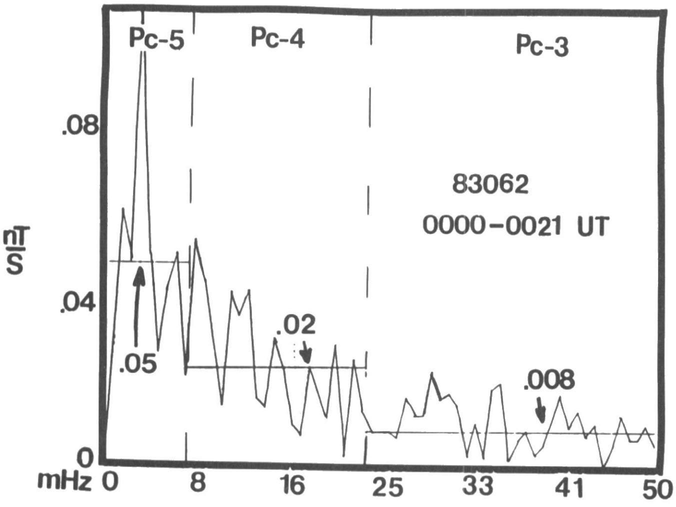

Figure 1. Frequency spectrum. A spectrum of pulsations in the first 21.3 minutes of 3 March is shown with the amplitude in nanotesla per second (nT/s) as a function of frequency, 0 to 50 millihertz (mHz). The spectrum is divided into Pc 3, Pc 4, and Pc 5 frequency bands. The average amplitude of each band is shown as a solid horizontal line. (UT denotes universal time.)

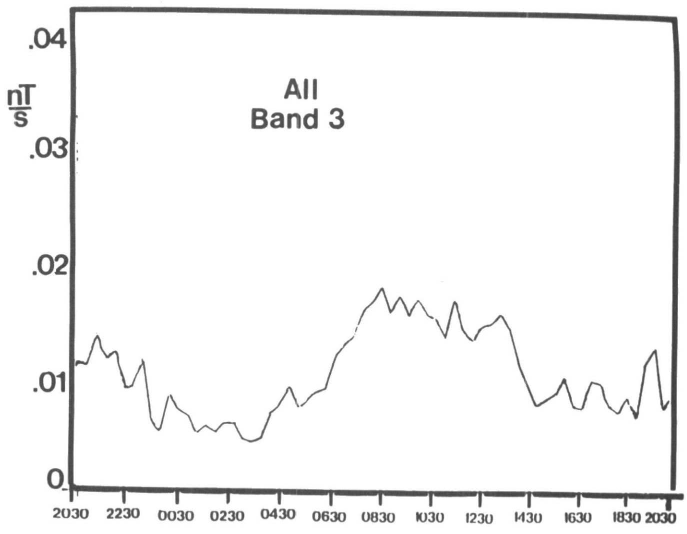

Figure 3. All data average—band 3—24-hour record. The band 3 measure, as shown in figures 1 and 2, is taken for a specific 21.3-minute interval, say 0000 to 0021.3 universal time, in each day of the data sample. These 35 numbers are averaged to give one point of this plot. (MLT denotes magnetic local time. nT/s denotes nanotesla per second.)

were made, but not shown here, for bands 4 and 5. These figures may be used to observationally specify, for ultra-low-frequency waves, the time interval during which South Pole Station is in the polar cap. Taking the rise and fall of the dayside amplitude maximum as indicating the exit from and entrance to the polar cap, 0430 magnetic local time seems to be the dawn limit and 1430 magnetic local time the dusk limit. The limits appear to be skewed toward the dawn, compared to the symmetrical 0600 and 1800 limits expected. In addition, there is another maximum in the night-time hours. The lowest level is near 0300 magnetic local time for all bands.

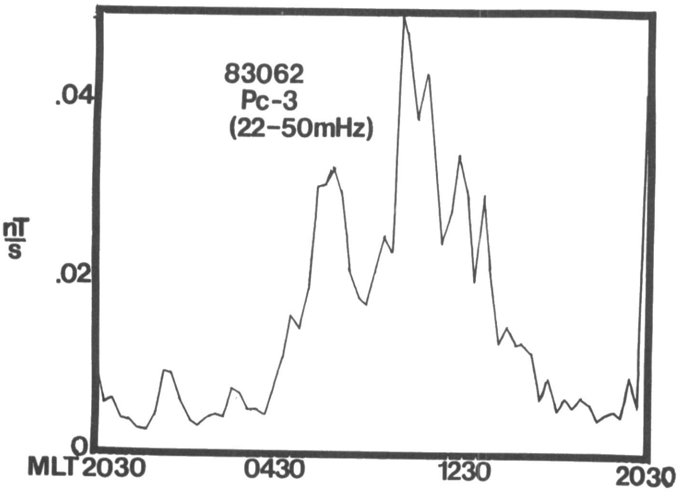

Figure 2. Band 3 amplitude measure for 3 March. The average band 3 amplitude is taken for each 21.3-minute segment of 3 March and plotted as a 24-hour record. (mHz denotes millihertz. MLT denotes magnetic local time. nT/s denotes nanotesla per second.)

In conclusion, pulsations in the polar cap are strongly affected by auroral oval activity, not only when the South Pole Station is under the dayside auroral oval and cusp, 0430 to 1430 magnetic local time. There is also an evening maximum of activity seen in the averaged data, 2030 to midnight magnetic local time, presumably related to evening auroral oval activity. This pulsation activity is seen as bursts of pulsations on individual days occurring at random times in the evening. Although the bursts on individual days occur at random times, when the data is averaged a broad evening maximum is produced.

The amplitudes above are in nanotesla per second, appropriate for the response of the magnetometer. We can translate the amplitudes into the magnetic field pulsation amplitudes in nanotesla by choosing a representative frequency for each band. For band 3, taking .04 hertz as a representative frequency, the amplitude .01 nanotesla per second in figure 3 gives .04 nanotesla.

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