Exploration Geophysics (1986) **17**, 8

Geomagnetic Pulsations

Solar wind-induced geomagnetic pulsations and fluctuations

K. D. Cole

Department of Physics, La Trobe University, Bundoora, Vic. 3083, Australia.

The solar wind generates geomagnetic pulsations by direct interaction with cold plasma of ionospheric origin in the geomagnetic field. The solar wind also induces changes in the energetic particle populations of the magnetosphere which cause further pulsations. Commonly, the upper limit of the period of pulsations is taken as about 5 min. Fluctuations with periods longer than 5 min are also induced by the action of the solar wind.

The amplitude distributions of such geomagnetic pulsations and fluctuations depend strongly on geomagnetic latitude (and thus also on geographic latitude). They have a peak in amplitude at the geomagnetic equator, but maximum amplitudes occur in the auroral zones. The extent of the auroral zones varies depending on the strength of the disturbance of the magnetosphere. In large magnetic storms the southern auroral zone extends up to Australia.

Propagation of Pc3–4 pulsations at low latitudes

F. W. Menk, B. J. Fraser, C. Ziesolleck and P. W. McNabb

Physics Department, University of Newcastle, NSW 2308, Australia.

Magnetic pulsations are ultra-low frequency (ULF) oscillations in the geomagnetic field with periods of the order of 1–1000 s. These pulsations are manifestations of hydromagnetic waves generated in the magnetosphere by a variety of physical processes and instabilities. Pc3–4 waves fall in the period range 10–150 s and appear to be produced by resonant oscillations of the earth's magnetic field lines, generally driven by the solar wind as it flows around the magnetosphere. Figure 1 shows a schematic representation of these interaction regions.

At synchronous orbit the Pc3–4 waves exhibit an harmonic structure which is characteristic of a driven resonance (Takahashi *et al.* 1984). This structure can be used to deduce the properties of the magnetospheric particles which are distributed along the particular oscillating field line. Furthermore, there is a correlation between the occurrence of Pc3–4 waves and properties of the solar wind (Greenstadt *et al.* 1981). This indicates that the energy source of the pulsations may lie in the solar wind. Recording Pc3–4 pulsations at ground stations thus provides a means of continuously monitoring the state of the magnetospheric plasma and the solar wind.

A puzzling feature of ground observations of Pc3–4 pulsations is that they may be seen at very low and high latitudes as well as middle latitudes (Campbell 1963). High latitude stations map to regions of the magnetosphere that are external to the plasmapause (Fig. 1), while low latitude stations correspond to regions inside. The plasmapause forms a boundary in the magnetospheric plasma representing a sharp increase, of over two orders of magnitude, in plasma density. Thus field lines mapping to low latitudes originate in a higher density region than those projecting to high latitudes. The plasmapause may act as a reflecting boundary to waves propagating in the outer magnetosphere, making it difficult for sufficient wave energy to penetrate and drive field line resonances within the plasmasphere. However, these waves are observed virtually every day at low latitudes.

At this stage, observations of wave phase and polarization characteristics at low latitudes have yielded contradictory results, and their propagation to these latitudes is not well understood. Several authors (e.g. Fraser & Ansari 1984) have reported propagation of signals away from the local noon meridian and left-handed polarization in the prenoon sector (right-handed postnoon) when viewed in the direction of the