Observations of Pc3 band pulsations in the polar cusp region by CHAMP.

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Pc3 pulsations are observed in the polar cusp region near local magnetic noon. The first reports of these pulsations were in ground-based magnetometer data. For example, Engebretson et al. [1] reported observing broadband pulsations with period range 0.5-40 sec and large-amplitude (up to 20 nT peak to peak), narrow-band Pc 3 pulsations at South Pole Station. Subsequently, a number of researchers [2], [3], [4] have used SuperDARN radars to observe the electric field associated with Pc3 pulsations in the polar cusp ionosphere. They reported occasional observations of large-amplitude narrow-band Pc3 pulsations with peak power at cusp latitudes. However, a clear understanding of the propagation mechanism of these waves from the source region to the high latitude ionosphere is still lacking [3], [4].

The German CHAMP satellite was launched on 15 July 2000 into a near-polar, circular orbit at an initial altitude of ~450 km which has decayed to ~400 km. The magnetic field measurements from CHAMP are of unprecedented accuracy and resolution, which has enabled clear magnetic field observations of low latitude Pc3 pulsations in the ionosphere for the first time. In this poster we report on the first observations of Pc3 band pulsations in the polar cusp region using the vector magnetometer data from CHAMP.

Some initial results of this investigation are:

- Inspection of unfiltered data generally indicates an increase in broad-band wave power across the cusp region with occasional large-amplitude narrow-band waves.
- Amplitudes of the transverse toroidal and poloidal wave components are always at least an order of magnitude larger than the field aligned compressional component.
- Maximum entropy dynamic spectra indicate that the broad-band waves consist of a number of discrete frequency components.
- The narrow-band pulsations seem to exhibit a single dominant frequency in the toroidal component, which is different from any of the multiple broad-band frequencies.

The next step in this investigation will be to combine HF radar observations of cusp Pc3 electric fields with CHAMP observations of cusp Pc3 magnetic fields. However, a problem which arises with CHAMP is that it traverses field lines very rapidly, which can result in measurable frequency shifts in wave spectra if there is a significant spatial gradient in the wave phase.

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