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CHAMP observations of Pc3 pulsations in the polar cusp region

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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, where broadband pulsations with period range 0.5-40 sec and large-amplitude, narrow-band Pc 3 pulsations were observed at South Pole Station. Subsequently, a number of researchers 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.

In this poster we report on Pc3 band pulsations observed in the polar cusp region using vector magnetometer data from the German CHAMP satellite, which orbited in a near-polar, circular orbit at an initial altitude of ∼450 km. The magnetic field measurements from CHAMP are of excellent accuracy and resolution, which has enabled clear magnetic field observations of Pc3 pulsations in the ionosphere at low latitudes.

A problem with attempting to observe Pc3 pulsations in low Earth orbits through the polar cusp ionosphere is that the magnetic field data are contaminated by large spatial magnetic field variations caused by the rapid rate at which the satellite traverses cusp region field aligned currents. In an effort to mitigate this problem, we used magnetometer data from the cusp region ground station DRV as a check on Pc3 activity in conjunction with the CHAMP data.

Some initial results of this investigation are:
• Inspection of unfiltered CHAMP data generally indicates an increase in broad-band wave power across the cusp region with occasional large-amplitude narrow-band oscillations.
• The amplitude of the field aligned compressional component in the Pc3 band observed on CHAMP is generally at least an order of magnitude less than the toroidal and poloidal wave components, probably due to the effects of field aligned currents on the transverse components.
• For many Pc3 events identified in the cusp region ground station data, the time series and spectra at DRV and CHAMP are similar, though not identical.
• In a statistical comparison of Pc3 activity at DRV and CHAMP, there appears to be a good correlation between the presence or absence of H-component activity at DRV and compressional component activity at CHAMP.