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A VLF BEACON TRANSMITTER AT SOUTH POLE

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A VLF Beacon Transmitter operating at 19.4 kHz has been established at South Pole, and operated for two years, during the period of November 2003 to November 2005 for the purpose of continuous measurement of both steady and burst precipitation of relativistic (>300 keV) electrons from the Earth's magnetosphere.

The relativistic electron population as measured at geosynhronous orbit, exhibits pronounced fluctuations in association with substorm and solar activity. Although these phenomena are extensively measured on satellites, little is known about the extent of associated precipitation into the ionosphere, and their ionospheric effects. When they do precipitate, these highly energetic electrons penetrate to altitudes as low as 30-40 km, producing ionization, x-rays and possibly affecting chemical reactions involving ozone production. The VLF beacon transmitter at South Pole was designed, developed and established with custom-made equipment, and routinely operated 24 hours a day and 7-days a week as a Space Weather instrument. The beacon operated at 19.4 kHz, radiating a few hundred watts of total power with a ~6.25 km (tip-to-tip length) long horizontal dipole antenna. The VLF beacon operates autonomously under computer control with a synoptic schedule of ~1 min ON out of every 15 min. The VLF beacon signal was regularly detectable at Palmer Station, and at other locations, such as Halley (UK), and the variations of the amplitude and phase of the signal were found to exhibit clear and characteristic signatures of energetic particle injection events, during substorms and other major geomagnetic disturbances. The data set in hand is currently being compared to energetic particle data from low altitude spacecraft (e.g., SAMPEX, NOAA/POES) utilized to develop proxy measures of precipitating energetic particle populations from subionospheric VLF amplitude/phase data. We provide a comprehensive summary of VLF beacon observations, with particular emphasis on opportunities for international collaboration. with ELF/VLF measurements of the VLF Beacon signal at other Antarctic Stations.