Unique Concurrent Observations of Whistler Mode Hiss, Chorus, and Triggered Emissions

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Abstract

We present a unique two hour ground based observation of concurrent magnetospheric hiss, chorus, VLF triggered emissions as well as ELF/VLF signals generated locally by the High Frequency Active Auroral Research Program (HAARP) facility. Eccentricity of observed wave polarization is used as a criteria to identify magnetospheric emissions and estimate their ionospheric exit points. The observations of hiss and chorus in the unique background of coherent HAARP ELF/VLF waves and triggered emissions allows for more accurate characterization of hiss and chorus properties than in typical ground based observations. Eccentricity and azimuth results suggest a moving ionospheric exit point associated with a single ducted path at L~5. The emissions exhibit dynamics in time suggesting an evolution of a magnetospheric source from hiss generation to chorus generation or a moving plasmapause location. We introduced a frequency band-limited (400Hz) autocorrelation method to quantify the relative coherency of the emissions. A range of coherency was observed from high order of coherency in local HAARP transmissions and their echoes to lower coherency in natural chorus and hiss emissions. Two possible scenarios of magnetospheric processes are presented to explain the evolution of emissions from hiss to chorus to two hop echoes.