VLF Chorus and Hiss Characteristics as Observed at *L*=2.4 and Their Relation to the Plasmapause

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Abstract

Broadband electromagnetic wave data (from 0 to 50 kHz) acquired via the Stanford University VLF/ELF receiver located at Palmer Station, Antarctica (*L*=2.4) is used to identify and characterize magnetospheric chorus and hiss emissions. We discuss ensemble characteristics, such as time of day occurrence and correlation with DST and Kp, of all multi-minute chorus and hiss emissions observed at Palmer in 2003. Additionally, we discuss the correlation of particular types of chorus and hiss from the year 2001 with plasmapause proximity to Palmer's *L*-shell as determined by the EUV instrument on board the IMAGE satellite.

1. Extended Summary

Naturally generated magnetospheric VLF waves are important contributors to the dynamics of energetic electrons in the Earth's radiation belts. Both VLF chorus and hiss can contribute to radiation belt electron losses via resonant pitch-angle scattering. In addition, resonant interactions with chorus can result in the acceleration of electrons to higher energy. Therefore, knowledge of the daily and geomagnetic conditions during which hiss and chorus are prominent may give us valuable insights into the dynamics of the Earth's radiation belts.

In this paper, we use broadband electromagnetic wave data (from 0 to 50 kHz) acquired via the Stanford University VLF/ELF receiver located at Palmer Station, Antarctica (*L*=2.4) to identify and characterize magnetospheric chorus and hiss emissions. Additionally, we discuss the correlation of particular types of chorus and hiss from the year 2001 with plasmapause proximity to Palmer's *L*-shell as determined by the EUV instrument on board the IMAGE satellite. Waves originating from outside the plasmapause will be expected to interact with significantly higher energy particles than those originating from within the plasmapause, due to the reduction in electron density (lowered plasma frequency) across the plasmapause boundary.

As is typical with mid-latitude stations (*L*~3), chorus is observed at Palmer most often and with the greatest intensity at approximately 0600 magnetic local time (local dawn), although a seasonal shift is apparent over the course of the year, involving a center-time shift of three hours or more from winter to summer. A two-banded structure is often evident within individual chorus emissions, with separate intensity peaks at approximately 1 kHz and 2.3 kHz. These two peaks occur, on average, at the same local time. Generally, chorus is not observed above 6 kHz. Chorus tends to occur in disturbed conditions: 75% of all chorus emissions are seen when Kp >= 4-, compared with the net occurrence rate of of Kp values greater than 4- of 50%. Similarly, 75% of all chorus emissions are seen when DST <= -20 nT, compared with the net occurrence rate of DST values less than -20 nT of 50%.

Strong hiss is typically observed at Palmer in the evening hours, centered around 1830 magnetic local time (local dusk). Hiss center frequency often increases over time, along with its upper and lower cutoff frequencies, although it is generally restricted to be less than 4 kHz. Hiss tends to occur in mildly disturbed conditions; 75% of all hiss emissions occur when Kp >= 3+, compared with the net occurrence rate of Kp values greater than 3+ of 55%. Similarly, 75% of all hiss emissions are seen when DST <= -15 nT, compared with the net occurrence rate of DST values less than -15 nT of 60%.