Cosmic Radio Noise Absorption in the High-Latitude Ionosphere during Solar Wind High-Speed Streams

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The effect of solar wind high-speed streams (HSSs) on energetic particle precipitation at auroral and subauroral latitudes (L = 3.8–5.7) is studied by using cosmic noise absorption (CNA) data measured by the Finnish riometer chain during 95 HSS events occurring between 2006 and 2008. The data are divided into "long" and "short" HSS events, depending on whether the maximum solar wind speed is reached within 24 h or later after the arrival of the corotating interaction region (CIR) at the bow shock. We find that CNA is more frequent during long events and extends to subauroral latitudes, contrary to short events. CNA is observed for at least 4 days after the CIR arrival during long events, and only 3 days during short events. In addition, CNA is divided into three categories, depending on whether it is associated with local substorm activity, with ultra-low-frequency (ULF) wave activity, or neither of these. Substorm-type CNA dominates in the 21–06 magnetic local time (MLT) sector, while ULF-type CNA dominates from morning to afternoon and follows the daily SYM-H index variations. This indicates the importance of having energetic (E > 30 keV) electrons available for interacting with the very-low-frequency (VLF) chorus waves, which may be modulated by ULF waves. Finally, we find a correlation between ULF-type CNA on the dayside and substorm activity on the nightside with a 30-min delay, suggesting that substorm injections energize electrons, which then drift to the morning and dayside, where they precipitate into the ionosphere.