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Analytical Hiss Wave Model Derived from NASA's Van Allen Probes and JAXA's Arase Spacecraft Observations

Hiss waves are whistler-mode emissions in the Earth's plasmasphere, characterized by broad frequency spectra and irregular structures, and they play a key role in the loss of radiation belt electrons. While numerous studies have investigated hiss wave distributions using satellite observations, no model currently combines their distributions across both low and high latitudes. To address this gap, hiss wave characterization needs to be extended to high latitudes using observations from NASA's Van Allen Probes and JAXA's Arase spacecraft, enabling a more comprehensive understanding of their spatial variability.

As hiss waves are mainly located inside the plasmasphere, the first step of developing hiss wave model is to identify the plasmapause position. We successfully applied the hyperbolic tangent fitting method of Kim et al. (2019) to determine the plasmapause location. As a next step, we extract hiss wave events from satellite observations. This provides the foundation for analyzing the spatial distribution of hiss waves. Additionally, surface wave structures on the plasmapause are identified, offering further insights into magnetospheric dynamics. The next stage of this study will involve developing empirical models of plasmaspheric hiss by first quantifying their occurrence rate, then characterizing the observed amplitude distribution, and finally integrating these results to construct a predictive model of wave intensity across the inner plasmasphere.

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