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Upper-Band Chorus Wave Observations During the Closest Conjunction of NASA's Van Allen Probe B and JAXA's Arase Spacecraft

The outer radiation belt of Earth is a highly dynamic and complex system. Chorus waves, naturally occurring plasma waves, are considered among the most important drivers of electron acceleration and precipitation in this region. They have in two distinct bands based on their frequency: Upper Band Chorus (UBC; 0.5 fce < f < fce) and Lower Band Chorus (LBC; 0.05 fce < f < 0.5 fce), where fce is the equatorial electron gyrofrequency. Due to their spatial and temporal variability, a single satellite mission cannot provide a comprehensive view, making it essential to combine data from multiple missions for effective understanding and modeling.

In this study, we analyze UBC measurements obtained during a conjunction of NASA's Van Allen Probe B (RBSP-B) and JAXA's Arase spacecraft on April 12, 2018, when the satellites approached within a minimum separation of approximately 865 km. The conjunction event was identified using window criteria of L-shell ±0.25, magnetic local time (MLT) ±0.25, and magnetic latitude ±2 degrees.

The correlation between extracted UBC wave amplitudes measured by the two satellites was small (~−0.2), reflecting the strong spatial–temporal variability of plasma waves. This result is consistent with existing literature, as a separation of ~1000 km is insufficient to overcome local variability.However, the Probability Density Function (PDF) of chorus amplitudes from the two satellites shows comparable spread and well-aligned peaks, indicating good agreement between their observations. After flipping the RBSP dataset in time order, the Cumulative Distribution Function (CDF) of the maximum of ratios shows that 85% of the pointwise maximum ratios between the two datasets fall within a factor of 2, further supporting strong agreement.

These findings reinforce the feasibility of combining data from both satellite missions with minimal intercalibration effort.

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