URSI GASS 2021, Rome, Italy, 28 August - 4 September 2021

Spatial Distribution of Wave Spectra in the Inner Magnetosphere Observed by PWE/OFA on board the Arase

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The ERG (Exploration of energization and Radiation in Geospace) project is a mission to study plasma physics in the Earth's inner magnetosphere. The Plasma Wave Experiment (PWE) is one of scientific instruments on board the Arase, and it measures electric field from DC to 10 MHz and magnetic field from a few Hz to 100 kHz. Because the inclination of the Arase is 31 degrees, which is much larger than that of Van Allen Probes (~10 degrees), this orbital configuration provides the ability to explore not only the equatorial region but also the off-equatorial region in the inner magnetosphere. The OFA (onboard frequency analyzer) is one of the receivers of the PWE and it continuously measures electric and magnetic wave spectra in the frequency range from 64 Hz to 20 kHz (Matsuda et al., 2018). This frequency range is crucial for plasma wave observation because chorus waves, magnetospheric hiss, lightning whistlers and magnetosonic waves are detected, with a time resolution of 1 second as a nominal operation mode.

In the present paper, we statistically analyzed the power spectrum measured by the OFA to clarify the spatial distribution of the electric and magnetic field intensity of the typical emissions observed in the inner magnetosphere. First, we compared our results with the previous statistical work done using the spectral data recorded by the Van Allen Probes (e.g. Malaspina et al., 2017), and confirmed that the results are almost consistent with those derived from the observation by Van Allen Probes at low latitudes. Next we examined the spatial distribution of the wave activities in the off-equatorial region. We demonstrated that ECH waves are observed mainly in the lower latitude region at multiple frequencies between $n\,f_c$ and $(n+0.5)\,f_c$, where f_c is the in-situ electron cyclotron frequency and n is an integer value. Magnetosonic waves are also confined to the lower latitude region. On the other hand, the frequency of plasmaspheric hiss is almost constant regardless of the magnetic latitude. As for chorus emission, the frequency normalized by the local f_c tends to be lower at higher magnetic latitude. When we normalize the frequency electron cyclotron frequency mapped onto the magnetic equator (f_{ce}), they mainly appear at almost constant frequency below half of f_{ce} in the higher latitude region, suggesting that most chorus in the higher latitude region consists of lower band chorus (LBC).

In the presentation, we report the global distributions of various plasma waves as a function of magnetic latitude, magnetic local time and L-value.

References

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