# Intensity and Wave-normal Maps of Plasmaspheric Hiss Using Long-term Observation Data from the Akebono

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## 1. Introduction

Propagation characteristics and spatial distributions of plasmaspheric hiss are important for understanding the radiation belt slot region which is known to result from losses of energetic electrons by enhanced pitch-angle scattering by the whistler mode waves. The sources and generation mechanisms are, however, still controversial. In the present study, using long-term observation data from the Akebono, we constructed average intensity maps of the hiss with the wave map technique. In addition, we have statistically investigated wave normal angles with the WDF (Wave distribution function) analysis.

## 2. Data analysis

In order to perform a statistical analysis of wave intensity and wave normal angle of plasmaspheric hiss, we used data obtained by the VLF/MCA and PFX instruments onboard the Akebono satellite. The MCA (Multi-channel analyzer) makes spectral measurements of electric and magnetic fields with 16 channels of band pass filters. With the MCA spectrum from 1989 to 2005, we constructed average wave intensity maps in a magnetic meridian plane and in a magnetic equatorial plane, respectively. The PFX (Wave normal and Poynting flux analyzers) measures two components of electric field and three components of magnetic field with an output band width of 50Hz in a frequency range around 400Hz in the plasmaspheric hiss observation mode. With the WDF analysis, we can obtain energy distributions for arrival directions which satisfy dispersion relations of plasma waves.

## 3. Results

Our study shows that the intensity of plasmaspheric hiss clearly depends on substorm activity as measured by the AE index, consistent with Meredith et al. [1]. The hiss wave intensity maps also show a strong local time asymmetry. The large amplitude waves are observed at 6:00-19:00 MLT. From our extensive analysis, we have also found an $L$ dependence of hiss activity, with the larger amplitude waves being observed at lower $L$ during substorm active conditions. The same tendency can be found for solar activity. The average intensities of the waves during 1989-1991 and 2000-2001 are a few dB larger than those during 1992-1997 and 2005. The most intense waves are observed at lower $L$ during high solar activity.

The statistical results of the WDF analysis reveal that distributions of wave normal angles along the magnetic equator vary depending on $L$-value. The wave normal angles are widely distributed at $L>2.2$ while quasi-parallel propagations are hardly found at $1.2<L<1.8$. We have also found storm dependences of them.

## References

1. Meredith, N. P., R. B. Horne, R. M. Thorne, D. Summers, and R. R. Anderson (2004), Substorm dependence of plasmaspheric hiss, J. Geophys. Res., 109, A06209, doi:10.1029/2004JA010387.