Lightning Whistler Observed by the WFC on board the Arase Satellite in the Earth's Plasmasphere

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Waveform Capture (WFC) on board the Arase (ERG) satellite.

The ERG (Exploration of energization and Radiation in Geospace) project is a mission to elucidate the acceleration and loss mechanisms of relativistic electrons in the inner magnetosphere during magnetic storms. Arase was launched on Dec. 20, 2016, and has been operated for more than one year. The WFC (Waveform Capture), is one of sub-systems of the PWE (Plasma Wave Experiment) on board the Arase (ERG) satellite. It measures waveforms below 20 kHz for the 2 components of the electric field and 3 components of the magnetic field. The WFC designed to measure chorus, hiss, and lightning whistlers. Two kinds of operation modes, which are called chorus mode, and EMIC mode, are implemented. The chorus mode and EMIC mode are mainly operated around the apogee and perigee, respectively. The WFC data are stored as CDF file for easier data analysis.

Characteristic of Lightning Whistlers Observed by the WFC

Whistler is prominent bursts of Very-Low-Frequency (VLF) electromagnetic energy produced by frequent lightning discharges. It propagates along the geomagnetic field lines from southern to northern hemisphere, and vice versa. Dispersion of whistler indicates a gap of propagation delay in the frequency domain. Because their spectral properties mainly depend on the plasma environments (electron density and ambient magnetic field) along their propagation paths, these data are relevant to the estimation of electron density profile. In this study, we investigated lightning whistler measured by the WFC. We analyzed magnetic field component measured by the WFC. The flow of the system processing is as follows. First, we calculate an absolute value using 3 components of magnetic field waveforms and convert it into power spectra by FFT with Hanning window. We examine the spectra of lightning whistlers below 10 kHz referring to the classification by Helliwell (1965). In the presentation, we will introduce characteristic of lightning whistler found in the WFC data observed by the Arase.

1. Robert. A. Helliwell, "Whistler and Ionospheric Phenomena" *Stanford University Press***.** Page 83. 1965