

## Absolute Direction Finding Method for the PWE/OFA Data

# Mamoru Ota[1]; Yoshiya Kasahara[1]; Shoya Matsuda[2]; Hirotsugu Kojima[3]; Ayako Matsuoka[4]; Mitsuru Hikishima[5]; Yasumasa Kasaba[6]; Mitsunori Ozaki[7]; Satoshi Yagitani[1]; Fuminori Tsuchiya[8]; Atsushi Kumamoto[9]  
[1] Kanazawa Univ.; [2] ISEE, Nagoya Univ.; [3] RISH, Kyoto Univ.; [4] ISAS/JAXA; [5] ISAS; [6] Tohoku Univ.; [7] Electrical and Computer Eng., Kanazawa Univ.; [8] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.; [9] Dept. Geophys., Tohoku Univ.

The ERG (Arase) satellite was launched on 20 December 2016 to study acceleration and loss mechanisms of relativistic electrons in the Earth's magnetosphere. The Plasma Wave Experiment (PWE), which is one of the science instruments on board the ERG satellite, measures electric field and magnetic field. The PWE consists of three sub-systems; EFD (Electric Field Detector), OFA/WFC (Onboard Frequency Analyzer and Waveform Capture), and HFA (High Frequency Analyzer). The OFA/WFC measures electromagnetic field spectra and raw waveforms in the frequency range from few Hz to 20 kHz, and the OFA produces three kind of data; OFA-SPEC (power spectrum), OFA-MATRIX (spectral matrix), and OFA-COMPLEX (complex spectrum). The OFA-MATRIX measures ensemble averaged complex cross-spectra of two electric field components, and of three magnetic field components. The OFA-COMPLEX measures instantaneous complex spectra of electric and magnetic fields. These data are produced every 8 seconds in the nominal mode, and it can be used for polarization analysis and wave propagation direction finding.

In general, spectral matrix composed by cross-spectra of observed signals is used for direction finding, and many algorithms have been proposed. For example, Means method and SVD method can be applied on the assumption that the spectral matrix is consists of a single plane wave, while wave distribution function (WDF) method is applicable to the observation data in which are combined by multiple numbers of plane waves. When we cannot obtain cross-spectra between electric field and magnetic field, it is impossible to distinguish the absolute direction of waves by applying those methods. The wave direction estimation only using the OFA-MATRIX data has same problem above mentioned.

We developed a new absolute direction finding method using the OFA-MATRIX and OFA-COMPLEX. In this presentation, we introduce the method for the OFA data and evaluation results of the reliability of the estimation.