Arase衛星S-WPIA解析におけるプラズマ波動電界較正に関する評価
Calibration of electric fields dedicated to the measurement of the S-WPIA of the Arase Satellite

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The outer radiation belt consists of high-energy electrons. They are strongly affected by geomagnetic activities in the relation to solar wind conditions. The important science target of the Arase mission is to clarify generation/loss mechanisms of relativistic electrons in the outer radiation belt. Wave-particle interactions are thought to be a plausible mechanism for generation/loss processes of relativistic electrons. S-WPIA (Software-type Wave-Particle Interaction Analyzer) is installed in the Arase satellite. The WPIA is a newly developed observation system that enables us to quantitatively understand the interaction between plasma waves and electrons. The WPIA has the capability to identify a relative phase angle of a plasma wave vector and a velocity vector of each detected particle. Since phase information of observed plasma waves is essential to the WPIA, precise calibrations of plasma wave data are important. While the calibration data for the magnetic field sensors are identical to those we obtained during the ground tests of the instruments, the calibration data for electric field sensors strongly depend on plasma parameters around the satellite. Furthermore, there are still unclear parameters at the inputs of preamplifiers relating to the connection with electric field sensors. The calibration for electric field data needs to be performed carefully consulting observation data after the launch.

The present paper focuses on the calibration of plasma wave data for the S-WPIA’s data processing. We picked up events including whistler-mode chorus emissions and lightning-whistler waves. They all are electromagnetic waves, so-called whistler mode waves. The amplitude ratios of their electric field and magnetic field components can be theoretically calculated referring to the Appleton-Hartlee equations. Poynting vectors of whistler mode waves can be also theoretically obtained. We compared the observation results of the picked up events with the theoretical ones. The results show the precise calibration for the magnetic field data have been made. On the other hand, the calibration for the electric field data should be further modified consulting plasma parameters and other uncertain parameters at the input of preamplifiers. In the present paper, we will discuss the improvement of the calibration for electric field data by correcting the calibration table to aim the precise S-WPIA data processing.

