Development of Ray Tracing Applicable for Whistler Mode Waves in the Inner Magnetosphere

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The Arase satellite was launched on December 20, 2016, and the Plasma Wave Experiment (PWE) on board the Arase revealed various kinds of plasma waves in the inner magnetosphere. The PWE has a function of direction finding of the plasma waves by measuring two components of electric fields and three components of magnetic field. Analysis of the propagation paths is indispensable to elucidate the propagation characteristics of the waves.

Ray tracing is a method to calculate propagation paths of plasma waves numerically. A general purpose ray tracing program applicable to whistler mode wave has been published by Kimura and Goto [1]. In the present study, we improved this program and made it possible to apply whistler mode waves in the inner magnetosphere.

In the ray tracing calculation, a series of differential equations determining a ray path is given and a ray path can be derived by solving the differential equations numerically when we provide an appropriate plasma density profile and an ambient magnetic field model. In the conventional program [1], the global core plasma model (GCPM) version 2.2 and the International Reference Ionosphere (IRI) model 2007 were available for plasma density profile, and the 10-th generation of the International Geomagnetic Reference Field (IGRF) model was introduced for magnetic field model. In the present study, we updated the plasma model to GCPM version 2.4 and IRI 2016. We also improved the magnetic field model by combining the 12-th generation of the IGRF model and the Tsyganenko model (TS05). Thanks to the improvement, we expect to trace the ray paths of chorus generated outside of the plasmasphere under more realistic parameters. In the presentation, we introduce the performance of our ray tracing and show some trials applied to the chorus events observed by the Arase/PWE.

[1] I. Kimura and Y. Goto, Ray Tracing, http://waves.is.t.kanazawa-u.ac.jp/ (cited Feb. 19, 2018)

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