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GEMSIS-RC モデルに基づいた環電流とプラズマ圏が内部磁気圏 ULF 波動に与える影響の研究
Effects of the ring current and plasmasphere on ULF waves in the inner magnetosphere based on the GEMSIS-RC model

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Electron acceleration mechanisms to cause drastic variation of the Earth's outer radiation belt is one of key issues of the geospace researches. While the radial diffusion of the electrons driven by ULF waves has been considered as one of the candidate mechanisms, efficiency of the mechanism under realistic ULF characteristics and distribution is far from understood. GEMSIS (Geospace Environment Modeling System for Integrated Studies) of STEL, Nagoya University, is the observation-based modeling project for understanding energy and mass transportation from the Sun to the Earth in the geospace environment. Aiming at understanding the dynamics of the inner magnetosphere during the geospace storms, the GEMSIS-Magnetosphere working team has developed a new physics-based model for the global dynamics of the ring current (GEMSIS-RC model). The GEMSIS-RC model is a self-consistent and kinetic numerical simulation code solving the five-dimensional collisionless drift-kinetic equation for the ring-current ions in the inner-magnetosphere coupled with Maxwell equations.

We applied the GEMSIS-RC model for simulation of global distribution of ULF waves to test its capability of describing fast time scale phenomena like SCs and ULF waves. Two cases of background profile, i.e., cases without/with plasmapause in the simulation domain, are compared. The result shows that existence of plasmapause strengthens ULFs outside the plasmapause and widens the MLT region where the E_r (toroidal) component is excited from initially-given E_phi (poloidal) component. Comparison between runs with/without ring current ions show that the existence of hot ring current ions can deform and amplify the original sinusoidal waveforms. The deformation causes the energy cascade to higher frequency range (Pc4 and Pc3 ranges). The cascade is more pronounced in the high beta case. Combination with GEMSIS-RB model reproduced rapid radial transport by the drift resonance for ions with drift period of 600 seconds as theoretically expected.

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