GEMSIS-RC モデルに基づいた内部磁気圏へのイオンインジェクションによる ULF 波動励起の研究

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A study of the ULF wave excitation by ion injections into the inner magnetosphere based on the GEMSIS-RC model

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The radial diffusion of the electrons from the plasma sheet to the inner magnetosphere driven by ULF (Ultra Low Frequency) waves has been considered as one of the candidate mechanisms to cause drastic variation of the Earth's outer radiation belt. However, efficiency of the mechanism under realistic ULF characteristics and distribution is far from well understood. One of excitation mechanisms of the ULF waves is the drift-bounce resonance with ions injected into the inner magnetosphere during substorms. Drift-bounce resonance can allow energy to be transferred from energetic ions into high-m ULF waves [e.g., Southwood and Hudges, 1983]. Under GEMSIS (Geospace Environment Modeling System for Integrated Studies) project at STEL, Nagoya University, we have 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 [Amano et al., 2011]. We applied the GEMSIS-RC model for simulation of simple ion injections into the inner magnetosphere to test its capability of describing fast time scale phenomena. Two cases of background profile, i.e., cases without/with plasmapause in the simulation domain, are compared. We compare a few case of injected ion phase space density (PSD) profile such as the isotropic Maxwellian with loss cones and) anisotropic PSD with Tperp greater than Tpara with energy around 16 keV puls-minus 1.6 keV. For case of anisotropic PSD, the excitation of fluctuations and the spectrum matched the expectation from drift bounce resonance conditions for 16 keV ions for k=1-2. Both toroidal and poloidal modes are excited. In the presentation, we will also discuss dependence of the ULF excitation on the energy and density of injected ions.