GEMSIS-RC、RBに基づく電子とPc5単色波のドリフト共鳴のピッチ角依存性

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Pitch angle dependence of drift resonance of relativistic electrons with a monochromatic Pc5 wave based on GEMSIS-RC and RB models

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Radial transport of relativistic electrons due to Ultra Low Frequency (ULF) waves in the Pc5 frequency range (1.67mHz - 6.67mHz) is one of important candidates to accelerate the outer radiation belt electrons. The acceleration is considered as a result of the drift resonant process. This process is a resonant mechanism between the electron drift motion in the dipole-dominated magnetic field configuration and the electromagnetic fluctuations of Pc5 waves in the inner magnetosphere. The resonance violates the third adiabatic invariant of electrons, while it conserves the first and second adiabatic invariants. Recent studies have pointed out that the radial transport due to the drift resonance can produce one or more localized peaks in radial profile of the phase space density (PSD) [Degeling et al., 2008]. Ukhorskiy et al. [2008] indicated that collective motion of outer belt electrons can exhibit large deviations from radial diffusion. Since the peak in PSD is considered as an evidence of local acceleration [e.g., Reeves et al., 2013], these studies have raised fundamental questions in the radiation belt electron acceleration. Thus, it is important to understand fundamental characteristics of the collective motion of the electrons against the Pc5 waves in the inner magnetosphere.

In this study, we combined two simulation models of the inner magnetosphere: GEMSIS-RC (ring current) and RB (radiation belt) models. The GEMSIS-RC model is a self-consistent and kinetic numerical simulation code solving the five-dimensional drift-kinetic equation for the ring-current ions in the inner-magnetosphere coupled with Maxwell equations [Amano et al., 2011]. The GEMSIS-RB code conducts test particle trajectory tracings of relativistic electrons in arbitrary magnetic and electric field configurations [Saito et al., 2010]. We conducted Pc5 wave simulation with GEMSIS-RC, and then the obtained time variations of the magnetic and electric fields are used as inputs to GEMSIS-RB to calculate the electron transport due to the Pc5 wave. To investigate fundamental behavior of the transport, we investigated effects of a monochromatic wave on the radial transport. The result shows combination of these models can reproduced the localized peaks in PSD due to phase bunched transportation and electrons with oblique pitch angle (~70 degrees) are transported deeper inside to small L region than 90 degrees electrons. In this presentation, we will discuss possible mechanisms to cause the pitch angle dependence of the electron radial transport .

References:
Degeling and Rankin, J. Geophys. Res., 113, A10220, doi:10.1029/2008JA013254, 2008.
Ukhorskiy et al., J. Atmos. Solar Terr. Phys., 70, 1714-1726, 2008.
Reeves et al., SCIENCE, 341, 991, doi: 10.1126/science.1237743, 2013.
Amano et al., J. Geophys. Res., 116, A02216, doi:10.1029/2010JA015682, 2011
Saito et al., J. Geophys. Res., 115, A08210, doi:10.1029/2009JA014738,2010