Pitch angle dependence of drift resonance and its effects on the formation of pitch angle distributions of relativistic electrons

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Radial transport of relativistic electrons in the inner magnetosphere can be driven by drift resonance with Pc5 Ultra Low Frequency (ULF) waves. Radial transport due to the drift resonance has also been considered as an important acceleration candidate of the outer radiation belt electrons. A key point of the drift resonance is that the energy and equatorial pitch angle of electron changes with the radial transport under conservation of first and second adiabatic invariants. It can affect the drift period of electron and make the resonant electron become longer into the resonant range. Therefore, the transport efficiency of electrons is different from each equatorial pitch angle and it is expected to contribute the formation of pitch angle distribution.

In this study, we focus on the radial transport of relativistic electrons due to the drift resonance with a monochromatic Pc5 wave and investigate dependence of the radial transport on the equatorial pitch angle of electron. For this purpose, we combine 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 Boltzmann equation for the ring-current ions coupled with Maxwell equations. The GEMSIS-RB code conducts test particle trajectory tracings of relativistic electrons in arbitrary magnetic and electric field configurations. We first conduct 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 trace relativistic electron trajectories under the calculated Pc5 wave. We trace a great number of electrons to sample wide range of 5-D phase space. Simulation results show the pitch angle distribution can be formed butterfly distribution from the initial flat distribution. We also discuss the differences of transport efficiency of electron with each equatorial pitch angle.