内部磁気圏における Pc5 波動との共鳴によって形成される相対論的電子のピッチ角分布の特徴

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Characteristics of pitch angle distributions of relativistic electrons under interaction with Pc5 waves in the inner magnetosphere

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Radial transport of relativistic electrons in the inner magnetosphere has been considered as one of acceleration mechanisms of the outer radiation belt electrons and can be driven by the drift resonance with ULF waves in the Pc5 frequency range. The maximum changes of the electron in the radial distance (L) due to the drift resonance depend on the electron energy, pitch angle, and Pc5 wave structure. Those dependences are expected to form the characteristic pitch angle distributions (PADs) as a function of L and electron energy. In this study, we investigate PADs of relativistic electrons due to the drift resonance with a monochromatic Pc5 wave by using two simulation models of the inner magnetosphere: GEMSIS-Ring Current (RC) and GEMSIS-Radiation Belt (RB) models. The GEMSIS-RB simulations calculate guiding center trajectories of relativistic electrons in electric and magnetic fields obtained from the GEMSIS-RC model, which simulates a monochromatic Pc5 wave propagation in the inner magnetosphere.

The results show the characteristic PADs depending on the energy and L, which is explicable with the pitch angle dependence of resonance conditions. At a fixed location, those PADs can change from pancake (90 degree peaked) to butterfly (two peaks in oblique PAs) distributions as the transport by the monochromatic Pc5 wave progresses. These butterfly distributions are observed in the L range where electrons with lower PAs satisfy the resonance condition. It is also found that the lower PA electron with a fixed magnetic moment can be transported deeper inside because of the PA changes to larger values through the adiabatic transport, which enables them to satisfy the efficient resonance condition in wider L range compared to the 90 degrees PA electrons.