Numerical calculations for flux enhancement of radiation belt electrons observed by ARASE: GEMSIS-RBW simulations

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ARASE satellite, launched in December 2016, has observed several magnetic storms with large flux enhancement of MeV electrons so far. During some magnetic storms, the ARASE detected intense whistler-mode chorus emissions in the heart of the outer radiation belt. The whistler-mode chorus may be responsible for the flux enhancement of relativistic electrons, but there is no direct evidence from observations how whistler-mode chorus waves participate in the rapid flux enhancement.

By using the GEMSIS-RBW simulation, we demonstrate development of flux distributions of radiation belt electrons, such as pitch angle distributions and energy spectra, in order to study roles of whistler-mode chorus waves for the rapid flux enhancement during magnetic storms. The RBW simulation calculates wave-particle interactions between radiation belt electrons bouncing along a field line and whistler-mode chorus waves propagating parallel to the field. Several input parameters for the RBW simulations, such as the background plasma density, magnetic field, and dynamic spectra of whistler waves, are obtained from the ARASE satellite during magnetic storms. The simulations are carried out in a field line at which the ARASE is located during the storm.

By comparing the electron flux in energy larger than a few hundred keV observed by the ARASE with the RBW simulation results demonstrating development of electron distributions for a few hours, we study how the electrons are accelerated to relativistic energy range. We will also discuss roles of nonlinear scattering processes for the flux enhancement during the magnetic storms observed by the ARASE.