Relativistic Electron Precipitation and Acceleration by Parallel Propagating Whistler Chorus Waves: GEMSIS-RBW Simulations

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Whistler chorus wave has an important role to accelerate electrons to over a few MeV from hundreds of keV, as well as to precipitate relativistic electrons into the atmosphere. These electrons are scattered through electron cyclotron resonance process at not only a magnetic equator but also off-equatorial region. The scattering of electrons at off-equatorial region shows a nonlinear acceleration process through a phase trapping by a raising tone whistler chorus element propagating parallel to a magnetic field line. On the other hand, relativistic electrons with pitch angle close to the loss cone can also be scattered at the off-equatorial region, and be a cause of relativistic electron precipitation into the atmosphere through the pitch angle scattering.

This study shows a competitive process between relativistic electron acceleration and loss by whistler chorus waves, using the GEMSIS-RBW model. The RBW simulation calculates wave-particle interactions between whistler chorus waves and radiation belt electrons along a magnetic field line. Whistler chorus waves propagating at higher magnetic latitudes can precipitate electrons with higher kinetic energies. On the other hand, electrons with a few hundreds of keV can be accelerated into relativistic energies through the nonlinear phase trapping process. Discussion will focus on flux variation associated with the competitive process between the acceleration and loss. Influence of relativistic electron precipitation on the flux depletion will also be discussed.