Geophysical Research Abstracts
Vol. 20, EGU2018-17943, 2018
EGU General Assembly 2018

Application of multi-parameter chorus and plasmaspheric hiss wave models in radiation belt modeling

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Numerical simulation studies of the Earth's radiation belts are important to understand the acceleration and loss of energetic electrons. The Comprehensive Inner Magnetosphere-Ionosphere (CIMI) model considers the effects of the ring current and plasmasphere on the radiation belts to obtain plausible results. The CIMI model incorporates pitch angle, energy, and cross diffusion of electrons, due to chorus and plasmaspheric hiss waves. These parameters are calculated using statistical wave distribution models of chorus and plasmaspheric hiss amplitudes. However, currently these wave distribution models are based only on a single parameter, geomagnetic index (AE), and could potentially underestimate the wave amplitudes. Here we incorporate recently developed multi-parameter chorus and plasmaspheric hiss wave models based on geomagnetic index and solar wind parameters. We then perform CIMI simulations for two geomagnetic storms and compare the flux enhancement of MeV electrons with data from the Van Allen Probes and Akebono satellites. We show that the relativistic electron fluxes calculated with multi-parameter wave models resembles the observations more accurately than the relativistic electron fluxes calculated with single-parameter wave models. This indicates that wave models based on a combination of geomagnetic index and solar wind parameters are more effective as inputs to radiation belt models.