Numerical simulation of energetic electrons dynamics on the Oct. 2001 magnetic storm

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We study the storm event occurred in October 2001 and examine the dynamics of energetic electrons in the inner magnetosphere using satellite observations and numerical simulations. The storm has a well-developed main phase and slow recovery phase, although the substorm activity in the recovery phase is quite small. During the storm, NOAA satellites successively observe the spatial and temporal evolution of energetic particles in the inner magnetosphere. The hot electrons increase at the dawn-side from main phase to early recovery phase. In contrast, the relativistic electrons in the outer belt disappear during the main phase but show significant enhancement around the late main phase to early recovery phase.

We simulate the evolution of phase space distribution function of ring current and radiation belt electrons for energy range from a few hundred eV to a few MeV using the UNH RAM code [Jordanova et al., JGR, 106, 7, 2001], which solves the time-dependent, bounce-averaged kinetic equation of particle drifts, radial diffusion and loss due to Coulomb collisions. We also consider wave-particle interactions in the model. In the simulation, the time-dependent particle distributions measured from the MPA and SOPA instruments on the geosynchronous LANL satellites are used as the outer boundary conditions. We compare the RAM simulation with satellite observations and study the time-evolution of global particle distribution during the storm. We also discuss the contribution of each physical process to particle transport and loss.