Relativistic electron flux dropout due to field line curvature during the storm on 1 June 2013

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A relativistic flux dropout is a sudden and significant decrease in the relativistic electron (> 1 MeV) population of the outer radiation belt occurring over timescales of a few hours. A significant dropout of relativistic electrons was observed by Van Allen Probes during the storm main phase on June 1, 2013. During the same period, MeV electron precipitation with isotropic pitch-angle distribution was also observed from POES but no EMIC waves were detected from either space- or ground-based magnetometers. Based on Tsyganenko empirical magnetic field model, magnetic field lines are highly non-dipolar and stretched at the night side in the inner magnetosphere. This condition can break the first adiabatic invariant (conservation of magnetic moment) and generate pitch-angle scattering of relativistic electron to the loss cone. To understand the relative roles of different physical mechanisms on this dropout event, we simulate flux and phase space density of relativistic electrons with event specific plasma wave intensities using the Comprehensive Inner Magnetosphere and Ionosphere (CIMI) model. We also employ pitch-angle scattering due to field line curvature in the CIMI model. We re-configure magnetic field every minute and update electric field every 20 seconds to capture convective and diffusive radial transport. CIMI-simulation with pitch-angle scattering due to field line curvature shows more depletion of relativistic electron fluxes and better agreement to observation. We conclude that pitch-angle scattering due to field line curvature is one of the dominant processes for the relativistic electron flux dropout.

Keywords: relativistic electron dropout, loss, field line curvature

