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A relativistic electron dropout during the storm on June 1 2013

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A flux dropout is a sudden and considerable decrease in the relativistic electron population of the outer radiation belt on the timescale of a few hours. The dropout is generally driven by loss to the atmosphere mainly due to EMIC waves or drift loss to the magnetopause. A significant dropout was observed from Van Allen Probes during the storm on June 1 2013. However, there did not appear that EMIC waves are strong enough to cause considerable precipitating loss of Multi-MeV electrons from both Van Allen Probes and ground-based observatory during this dropout. Moreover, Polar-orbiting Operational Environmental Satellite (POES) rarely detected precipitating flux of > 1 MeV. To understand physical mechanisms of this dropout, we used Comprehensive Inner Magnetosphere and Ionosphere (CIMI) model and simulated flux and phase space density of relativistic electrons without pitch-angle scattering due to EMIC waves. The CIMI simulation using Tsyganenko 2004 magnetic model reproduced the significant dropout. The minimum last closed drift shell calculated by CIMI model was estimated to be L* = 4.55 during this event. CIMI also showed a strong induced-electric field due to displacement of the magnetic field line at the magnetic equator even at L* < 4.55, which can result in outward radial transport of relativistic electrons. We conclude that outward radial transport due to strong induced-electric field and drift loss to the magnetopause are main causes of this dropout.