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Performance Assessment of CIMI Electron Precipitation During Geomagnetic Storm

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The Comprehensive Inner Magnetosphere-Ionosphere Model (CIMI) is designed by coupling the Comprehensive Ring Current Model (CRCM) and the Radiation Belt Environment (RBE) model (Fok et al., Journal of Geophysical Research: Space Physics, 119, 2014). The model provides electron and ion distribution functions in Earth's radiation belt, ring current, estimates energies of precipitated electrons and ions in the ionosphere, calculates plasmaspheric density, ionospheric height-integrated Hall and Pedersen conductivities, ionospheric convection potentials. An important feature of CIMI model is calculation of electron precipitation from diffusion-convection equation that accounts both for particle drift in the inner magnetosphere and wave-particle interactions through various plasma waves. In this paper, the performance of the CIMI in terms of precipitating particle energy distribution is evaluated during the geomagnetic disturbed period of May 31 – June 1, 2013 (minimum Dst = -124nT). The performance of CIMI is observed in correspondence with Defense Meteorological Satellite Program (DMSP) satellite observations. Precipitated electrons (30 keV > E > 500eV) from Earth's plasma sheet go through wave-particle interactions and produce diffuse aurora, that can be simulated with CIMI model. We compare CIMI electron precipitation energy channels for DMSP energy bins and analyze CIMI performance for different energy bins, mean energy and for the total integrated energy flux. In addition, CIMI model has different options for ionospheric conductance model: 1) empirical model of Hardy et al. (Journal of Geophysical Research: Space Physics, 92, 1987) that depends on Kp-index, and 2) Robinson's formulation (Robinson et al., Journal of Geophysical Research: Space Physics, 92, 1987) where ionospheric conductance depends on electron precipitation mean energy and total energy flux. We study CIMI model performance for two different models of ionospheric conductance and evaluate the feedback of electron precipitation on the ring current and ionospheric electric field.