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Two-way self-consistent simulation of the inner magnetosphere driven by realistic electric and magnetic fields

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The geomagnetic storm of August 6, 2011 is examined using the two-way self consistent coupling between the kinetic Hot Electron and Ion Drift Integrator (HEIDI) model, the Block Adaptive Tree Solar Wind Roes-Type Scheme (BATS-R-US) MHD model and the Ridley Ionospheric Model (RIM) through the Space Weather Modeling Framework (SWMF).
HEIDI solves the time dependent, gyration and bounce-averaged kinetic equation for the phase space density of different ring current species and computes full pitch angle distributions for all local times and radial distances. This model was generalized to accommodate arbitrary magnetic fields and through the coupling with the SWMF it obtains magnetic field description along with plasma distribution at the model boundaries from the BATS-R-US model within the SWMF. Electric field self-consistency is assured by the passing of convection potentials from the Ridley Ionosphere Model (RIM) within SWMF.

Our study tests the various levels of coupling between the three models, highlighting the role the magnetic field, plasma sheet conditions and the cross polar cap potential play in the formation and evolution of the ring current. We use the results of the coupled HEIDI, BATSRUS and RIM models during disturbed conditions to study the importance of a kinetic self-consistent approach to the description of geospace.