Modeling the inner magnetosphere: Radiation belts, ring current, and composition

Alex Glocer, NASA Goddard Space Flight Center

The space environment is a complex system defined by regions of differing length scales, characteristic energies, and physical processes. It is often difficult, or impossible, to treat all aspects of the space environment relative to a particular problem with a single model. In our studies, we utilize several models working in tandem to examine this highly interconnected system. The methodology and results will be presented for three focused topics: 1) Rapid radiation belt electron enhancements, 2) Ring current study of Energetic Neutral Atoms (ENAs), Dst, and plasma composition, and 3) Examination of the outflow of ionospheric ions. In the first study, we use a coupled MHD magnetosphere - kinetic radiation belt model to explain recent Akebono/RDM observations of >2.5 MeV radiation belt electron enhancements occurring on timescales of less than a few hours. In the second study, we present initial results of a ring current study using a newly coupled kinetic ring current model with an MHD magnetosphere model. Results of a dst study for four geomagnetic events are shown. Moreover, direct comparison with TWINS ENA images are used to infer the role that composition plays in the ring current.
In the final study, we directly model the transport of plasma from the ionosphere to the magnetosphere. We especially focus on the role of photoelectrons and and wave-particle interactions. The modeling methodology for each of these studies will be detailed along with the results.