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Inner magnetosphere responses to the solar wind-magnetosphere energy transfers: Storms, saw-tooth oscillations and steady magnetospheric convection events.

N. Ganushkina (1,2), M. Kubyshkina (3), M. Liemohn (2), and T. Pulkkinen (1)

(1) Finnish Meteorological Institute, Space Research, Helsinki, Finland (natalia.ganushkina@fmi.fi, +358 9 19294603), (2) University of Michigan, Ann Arbor MI, USA, (3) University of St.-Petersburg, St.-Petersburg, Russia

We present a quantitative investigation of the processes controlling the inner magnetospheric magnetic field topology during several dynamical states of the Earth's magnetosphere, namely, geomagnetic storms, sawtooth oscillations and steady magnetospheric convection (SMC) events. For this analysis we use our event-oriented model, a unique tool to provide a realistic representation of the magnetospheric magnetic field during disturbed times for specific events. The model is specified using solar wind and IMF data, all available in-situ and ground magnetic field measurements, and in addition, the magnetic field direction information derived from plasma electron distribution functions from the LANL MPA instrument. The output from this model is an input to the Inner Magnetosphere Particle Transport and Acceleration model (IMPTAM). This model traces ions and electrons with arbitrary pitch angles in the drift approximation in time-dependent magnetic and electric fields taking into account the loss processes. The initial particle distribution and boundary conditions are set and varied during the modeling based on observations during specific events.

We model two storm events, one moderate with Dst drop of - 150 nT on November 6-7, 1997 and one intense with Dst drop of - 250 nT on October 21-23, 1999, two saw-tooth events, on October 22, 2001 and April 18, 2002, and two SMC events on February 3-4, 1998 and May 5, 1998. With this modeling we quantify which of the major current systems cause what aspects of the magnetic field distortion during magnetospheric dynamical states. With our physics-based numerical models we will determine the flow of plasma leading to the current systems that dominate the magnetic field distortion of the magnetosphere. In addition, the contribution of temporal variations of plasma dynamics (e.g., dispersed and dispersionless injections) to magnetic field distortions will be investigated. Furthermore, the detailed comparison between sawtooth oscillations and steady magnetosphric convection (SMC) events in terms of their observational features and model outputs will be conducted. By the analysis of sawtooth oscillations and steady magnetospheric convection (SMC) events a fundamental question whether the sawtooth events form a new class of magnetospheric events or whether they are simply quasi-periodic storm-time substorms will be addressed.