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A new data-based model of the global magnetospheric B-field: Modular structure, parameterization, first results.

Nikolai Tsyganenko
State University of Saint-Petersburg, Institute of Physics, Dept. of Earth's Physics, Russian Federation
(nikolai.tsyganenko@gmail.com)

A new advanced model of the dynamical geomagnetosphere is presented, based on a large set of data from Geotail, Cluster, Polar, and Themis missions, taken during 138 storm events with SYM-H from -40 to -487nT over the period from 1996 through 2012 in the range of geocentric distances from ∼3Re to ∼60Re. The model magnetic field is confined within a realistic magnetopause, based on Lin et al. [JGRA, v.115, A04207, 2010] empirical boundary, driven by the dipole tilt angle, solar wind pressure, and IMF Bz. The magnetic field is modeled as a flexible combination of several modules, representing contributions from principal magnetospheric current systems such as the symmetric and partial ring currents (SRC/PRC), Region 1 and 2 field-aligned currents (FAC), and the equatorial tail current sheet (TCS). In the inner magnetosphere the model field is dominated by contributions from the SRC and PRC, derived from realistic particle pressure models and represented by four modules, providing variable degree of dawn-dusk and noon-midnight asymmetry. The TCS field is comprised of several independent modules, ensuring sufficient flexibility of the model field and correct asymptotic values in the distant tail. The Region 2 FAC is an inherent part of the PRC, derived from the continuity of the azimuthal current. The Region 1 FAC is modulated by the diurnal and seasonal variations of the dipole tilt angle, in agreement with earlier statistical studies [Ohtani et al., JGRA, v.110, A09230, 2005]. Following the approach introduced in our earlier TS05 model [Tsyganenko and Sitnov, JGRA, v.110, A03208, 2005], contributions from all individual field sources are parameterized by the external driving functions, derived from the solar wind/IMF OMNI database as solutions of dynamic equations with source and loss terms in the right-hand side. Global magnetic configurations and their evolution during magnetospheric storms are analyzed and discussed in context of the model results.