Project Details

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Program Element: Focused Science Topic

Topic: Effects of Ionospheric-Magnetospheric Plasma Redistribution on Storms

Project Title:
A comprehensive self-consistent inner magnetosphere model

PI Name: Vania Jordanova
PI Email: vania.jordanova@unh.edu
Affiliation: University of New Hampshire
Project Member(s):
- Liemohn, Michael W.; Co-I; University of Michigan
- Zaharia, Sorin G; Co-I; Los Alamos National Laboratory
- Toth, Gabor ; Co-I; University of Michigan

Summary:
We propose to develop a comprehensive model of the inner magnetosphere that will include a kinetic ring current/radiation belt model coupled with a 3-D force balance model that calculates self-consistently the magnetic field and inductive electric field, and an MHD model coupled to an ionospheric model that calculates self-consistently the convection electric field. The individual models will be linked together by integrating them into the Space Weather Modeling Framework (SWMF) developed at the University of Michigan. Unique features of all models will thus be combined in obtaining a fully self-consistent inner magnetosphere (IM) model that takes into account the anisotropic plasma distribution. Such anisotropy is critically important for determining the onset of instability for various plasma waves which affect the dynamics of both ring current ions and radiation belt electrons. Our kinetic code treats these wave instability processes self-consistently with the evolving energetic particle populations. In the coupled model the dynamics of the ring current, plasmasphere, ionosphere, and radiation belts will be treated self-consistently with the evolving outer magnetosphere, driven by available information on solar activity. This will significantly improve the predictive capabilities of the model and is aligned with the strategic NASA goals and Science Outcomes 3B. The model results will be compared with in situ and ground-based data in order to constrain the free model parameters and improve the model accuracy. The main scientific aims of this proposal are:

1) To provide a specification and forecasting of the ring current ion composition, anisotropy, and energy redistribution during magnetic storms, a key objective of this LWS TR&T solicitation, Focused Science Topic (b) of the Targeted Investigations.

2) To provide a global specification of the magnetic and electric fields in the IM, and evaluate the effectiveness of various acceleration and loss processes on ring current and radiation belt variability as function of interplanetary conditions.

3) To determine electromagnetic ion cyclotron (EMIC) waves excitation and particle precipitation patterns as function of interplanetary triggers, and provide their distribution during various storm phases.

Publication References:

no references