Project Details

ROSES ID: NNH09ZDA001N
Selection Year: 2010
Program Element: Focused Science Topic

Topic: Determine the Behavior of the Plasmasphere and its Influence on the Ionosphere and Magnetosphere

Project Title:
Modeling the Plasmasphere and its Influence on Plasma Waves and Ring Current Distributions in the Inner Magnetosphere

PI Name: Vania Jordanova
PI Email: vania.jordanova@unh.edu
Affiliation: University of New Hampshire
Project Member(s):
- Glocer, Alex ; Collaborator; null
- Welling, Daniel ; Postdoctoral Associate; University of Michigan
- Zaharia, Sorin G; Co-I; Los Alamos National Laboratory
- Thomsen, Michelle F; Co-I; Planetary Science Institute

Summary:
The behavior of the plasmasphere and the plasmapause is closely connected with the dynamics of energetic particles in the inner magnetosphere. During the main phase of geomagnetic storms and periods of enhanced convection the plasmasphere is eroded and forms dayside drainage plumes, while during storm recovery phases and reduced convection the plasmasphere refills with cold plasma from the ionosphere and expands. Various plasma waves are generated within regions of spatial overlap of anisotropic ring current source populations and cold plasma. These waves cause significant changes in radiation belt and ring current fluxes, which may lead to substantial damage of space-borne and ground-based technological systems, and endanger human activities. Predicting inner magnetosphere dynamics and protecting these assets are of great interest to the NASA LWS and the National Space Weather programs. The main scientific goal of this investigation is to provide better understanding and modeling capability of the plasmasphere, plasma waves, and energetic particle dynamics in the inner magnetosphere. These are key objectives of this LWS TR&T solicitation, Focused Science Topic (a). The methods include a combination of fundamental kinetic plasma theory, global numerical models, and ground-based and satellite data. Several physics-based models will be used to study the coupled plasmasphere-magnetosphere system. A fluid model will be used to simulate the behavior of the plasmasphere during magnetic storms, employing a self-consistently calculated convection electric field from the Space Weather Modeling Framework (SWMF). The concurrent injection of ring current particles into the inner magnetosphere and the excitation of electromagnetic ion cyclotron (EMIC) waves and chorus emissions will be simulated with a state of the art transport code (a ring current-atmosphere interaction model with self-consistent magnetic field, RAM-SCB) coupled with the plasmasphere model, and using the dynamic solar-wind driven outputs of the SWMF. Global maps of plasmaspheric density, plasmapause position, and plasma wave distributions in the equatorial plane will be obtained. The model predictions will be compared with in-situ data from LANL and THEMIS satellites and global images from IMAGE and TWINS. The acceleration and loss mechanisms for ring current ions and radiation belt electrons will be investigated to determine their applicability during various storm phases. The results will be published and made available for the upcoming LWS Radiation Belt Storm Probes (RBSP) mission that will be launched in 2012.

Publication References:

no references