Project Details

ROSES ID: NNH05ZDA001N
Selection Year: 2006
Program Element: Focused Science Topic

Topic: Solar wind plasma entry and transport in the magnetosphere

Project Title:
Plasma sheet ion properties, sources, and transport for different solar wind, geomagnetic, and solar cycle conditions

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- Trattner, Karlheinz Johann; Collaborator; University of Colorado, LASP
- Nagai, Tsugunobu ; Collaborator; Tokyo Institute of Technology
- Goldstein, Melvyn L; Collaborator; NASA Goddard Space Flight Center
- REME, Henri ; Collaborator; University Paul Sabatier
- Rich, Frederick J.; Collaborator; MIT Lincoln Laboratory

Summary:
Overall Objectives:

We have developed a technique for inferring plasma sheet ion density (n), temperature (T), and pressure (p) from ionospheric observations. Using this method and DMSP data, we were able to create 2D images of plasma sheet n, T, and p, which show that the plasma sheet is colder and denser during periods of northward IMF than southward IMF. This proposal outlines a study to (1) complement our remote sensing technique with in situ measurements; (2) construct 2D/3D plasma sheet n, T, and p profiles as functions of plasma sheet location, geomagnetic activity, solar wind conditions, and solar cycle; (3) investigate the roles of reconnection, Kelvin-Helmholtz instability, and kinetic Alfven waves in transporting magnetosheath particles to plasma sheet; (4) the causes of the dawn-dusk asymmetry in the plasma sheet flanks; (5) ion and electron heating; (6) electron dynamics; and (7) plasma sheet injection into the inner magnetosphere and radiation belt/ring current.

Research Plan:

To carry out our proposed study, we will use ionospheric and in situ observations as well as 2D simulations that include full ion and electron dynamics and non-MHD processes. We will construct 2D plasma sheet profiles of location, geomagnetic activity, solar wind conditions, and solar cycle using DMSP and in situ observations for almost two solar cycles. We will also link an inner magnetospheric model with plasma sheet profiles. We will pool NASA Geospace SR&T, NASA LWS TR&T, and non-NASA resources. A team member, Jay Johnson, has just received a Geospace SR&T grant to carry out electromagnetic simulations to investigate magnetosheath particle transport across the magnetopause boundary. Another team member Mei-Ching Fok will link her radiation belt/ring current model with the proposed plasma sheet profiles. The proposed project can stand alone, but it will achieve greater goals if done in coordination with simulations. Rather than comparing observations with fortuitous published simulation/modeling results, we will actually be able to design joint observation-simulation studies.

Relevance to NASA LWS TR&T Program:

The proposed efforts directly address the topics of interest to the 2005 NASA LWS TR&T Focused Science Topic C (T3C) that solicits "investigations that predict and quantify: (1) the amount of solar wind plasma entering the magnetosphere as a function of location on the magnetopause; (2) the processes by which plasma is transported from the magnetopause into the magnetosphere to form the plasma sheet; and (3) the mechanisms by which plasma is injected into the inner magnetosphere for different solar wind, geomagnetic, and solar cycle conditions." [ROSES 2005 - A.21].

We will disseminate all of our research results at AGU sponsored meetings and journals as they become available. Moreover, we will attend Focused Science Topics team meetings where the PI and the Co-Is will present our results and participate in the discussions.

Publication References:

no references