Project Details

ROSES ID: NNH22ZDA001N-LWS
Selection Year: 2022
Program Element: Focused Science Topic

Topic: FST #2: Coupling of the Solar Wind Plasma and Energy to the Geospace System

Project Title:
Interplanetary Disturbances Obliquity Effects in the Generation of db/dt Events

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Summary:
Ground Induced Currents (GICs) are a current concern in modern society as they flow through conductors and can damage power grids and oil pipelines. Interplanetary disturbances in the solar wind and substorms have been already identified as the main sources of geomagnetic disturbances responsible of GICs. However, the determination of the spatio-temporal distribution GICs during geomagnetic disturbances remains as an unsolved issue as the drivers that control transfer of energy between interplanetary disturbances and the inner magnetosphere and the ionosphere stay elusive. This becomes a challenge for forecasting of GICs and their potential impact on infrastructure. A more accurate characterization of both interplanetary disturbances and the resulting geomagnetic disturbance are essential to identify the drivers of GICs. This proposal aims to address the following questions:_x000D_
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1. What are the most common characteristics present interplanetary disturbances during large dB/dt events?_x000D_
2. How does the interplanetary disturbance front inclination angle affect global spatio-temporal of dB/dt events?_x000D_
3. What is the spatio-temporal of dB/dt events to substorms during an asymmetrically compressed magnetosphere?_x000D_
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To answer the preceding queries, we propose to examine particle and magnetic field data from the spacecraft that constitute the Heliophysics System Observatory (HSO) to study interplanetary disturbances and magnetic field from ground-based magnetometers from the year 2007 onwards to study the geomagnetic response. We will create independent catalogs of interplanetary disturbances and dB/dt events. This systematic combination of space and ground observations will allow the study of solar wind disturbances inducing geomagnetic disturbances generating GICs. Simultaneously, we will run MHD simulations to study the theoretical geomagnetic response to highly inclined disturbance fronts as well as the geomagnetic response to substorms during asymmetrical compression of the magnetosphere. The simulations will provide flexibility of controlling the initial conditions and evaluate idealized extreme cases as well as realistic cases._x000D_
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This project will investigate the relevance of multiple characteristics of ICMEs, CIRs, the pre-existing conditions when they occur, and identify their contribution to the generation of GICs. Some of these characteristics are the front inclination of the disturbance, the occurrence of ICMEs after CIRs, and ICMEs structure complexity. This project follows the goal of the LWS Focus Group #2 of investigate processes by which the solar wind drives the magnetosphere - ionosphere - thermosphere system" and is particularly compelling for specific objectives (3) investigating the physical processes controlling non-reconnection coupling," and (4) understanding the role of solar wind fluctuations in the coupling of the solar wind to the Earth."

Publication References:

no references