Project Details

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

Topic: Storm effects on the global electrodynamics and the middle and low latitude ionosphere

Project Title:
Understanding the Evolution and Impacts of Storm-Enhanced Electric Fields in the Mid-Latitude Ionosphere

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Summary:
The proposal is directed to the NASA LWS TR&T Targeted Investigation program element and addresses the Focused Science Topic, Storm effects on the global electrodynamics and the middle and low latitude ionosphere , which is identified by program descriptor T3d. We seek a deeper understanding of the penetration of nominally high-latitude ionospheric electric fields into the mid and low-latitude ionosphere and accordingly into the inner magnetosphere. During quiet periods the electric field is largely confined to the high-latitude zone and is highly variable in both time and space. During geomagnetic storms the electric field penetrates into the inner magnetosphere where it produces significant changes in magnetosphere-ionosphere coupling and major changes in the subauroral ionosphere. Two of the major goals of LWS science are to understand the processes that lead to these disturbances and to predict when they will occur. Reaching these goals requires a significantly improved understanding of the spatial and temporal evolution of both ionospheric and magnetospheric electric fields during storms.

We propose to analyze observations collected with a new HF radar operating at the Wallops Flight Facility (=50) for insight into the evolution of penetration electric fields. This radar, a joint project of JHU/APL and NASA/WFF, extends the capabilities of the existing Super Dual Auroral Radar Network (SuperDARN) for observing electric fields and ionization irregularities into the mid-latitude region. The Wallops radar began operations in early May of 2005 and has observed several types of subauroral electric field arising from geomagnetic disturbance. The fields and their effects are effectively imaged over large areas (~thousands of kilometers) with high spatial (~tens of kilometers) and temporal (~minutes) resolutions. We shall use data from the Wallops radar, the existing high-latitude SuperDARN network, and related space- and ground-based instruments to characterize the activity and to obtain a global-scale view of the structure and dynamics of disturbance electric fields and plasma convection in the magnetosphere-ionosphere system.

Our research plan is specifically tailored to serve the research objectives of the Focused Research Topic T3d. Specifically, we will (i) compile and characterize a database of mid-latitude electric field events, (ii) characterize the occurrence of subauroral polarization electric fields including their spatial and temporal variability and effects on the ionosphere, (iii) describe the occurrence of penetration electric fields and their ionospheric effects, and (iv) specify the global electric field as a parameter that conditions the occurrence of subauroral electric fields. This latter task will draw on mapping ionospheric convection with SuperDARN modified by subauroral effects with projection into the magnetosphere using established codes. We will also provide critical data and supporting analysis to assist the efforts of the T3d Science Team, including the testing and development of comprehensive models. We further propose to have the PI on this proposal serve as Team Coordinator.

Publication References:

no references