

## Project Details

**ROSES ID:** NNH05ZDA001N

**Selection Year:** 2006

**Program Element:** Focused Science Topic

**Topic:** Shock acceleration of solar energetic particles by interplanetary CMEs

**Project Title:**

Ionospheric Behavior During the First Few Hours of Intense Geomagnetic Storms

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**Project Member(s):**

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**Summary:**

The impact of electric fields on the large-scale variation of plasma in the Earth's ionosphere is receiving increasing attention from the research community because it is of fundamental importance in understanding the structure and dynamics of the Earth's ionosphere during geomagnetic storms. Recent publications suggest that prompt penetration electric fields generated by the solar wind-magnetosphere interaction may have enormous consequences in changing the global structure of total electron content (TEC) in the dayside ionosphere, rapidly (within ~2-3 hours) after certain conditions in the solar wind are met. In earlier work, Foster et al., (2002) used a dense network of ground-based ionospheric measurements to detect mesoscale structures over North America that may be correlated with plasmaspheric structures known as drainage plumes, the latter widely believed to be due to storm-time electrodynamics in the inner magnetosphere. Both the dayside TEC increases, and the mesoscale mid-latitude structures, suggest the strong role of convection electric fields in determining ionospheric behavior during geomagnetic storms, but many questions remain about the origin of these fields and their ionospheric impact.

The focus of this proposal are the large-scale and large-magnitude changes in TEC that occurs early on during intense geomagnetic storms. Significant gaps in understanding these changes suggest the need for establishing an empirical relationship between solar wind conditions that trigger geomagnetic storms, and the resultant ionospheric response. Such an empirical relationship has clear scientific value, because the magnitude and promptness of the ionospheric response is not being predicted, in general, with existing models of geospace. It also has practical value for predicting the severity of near-Earth space weather given an upstream monitor of solar wind conditions, as is available, for example, from the ACE spacecraft.

Our approach will be to use a globally-distributed dataset of ionospheric measurements, obtained from the ground and from space, to relate the observed TEC behavior to upstream solar wind conditions. The dataset is available from Global Positioning System receivers on the ground and in orbit, and from dual-frequency ocean altimetry satellites. Our focus will be on dayside, large-scale plasma increases and re-structuring in the first few hours of intense storms. We will compare the observations to models to determine the degree and manner in which existing state-of-the-art models predict the observations and capture the physics.

## Publication References:

**Summary:** no summary

**Reference:**

Mannucci, A. J.; Tsurutani, B. T.; Abdu, M. A.; Gonzalez, W. D.; Komjathy, A.; Echer, E.; Iijima, B. A.; Crowley, G.; Anderson, D. ; (2008), Superposed epoch analysis of the dayside ionospheric response to four intense geomagnetic storms, Journal of Geophysical Research: Space Physics, Volume 113, Issue A3, CiteID A00A02, doi: 10.1029/2007JA012732

