Project Details

ROSES ID: NNH06ZDA001N
Selection Year: 2007
Program Element: Independent Investigation

Topic: Investigate the Global Distribution, Sources and Effects of Large Electron Density Gradients at Middle and Low Latitudes

Project Title:
Study of conjugate polar ionospheric storm response during typical and extreme solar wind conditions using ACE and DMSP satellite observations

PI Name: Marc Hairston
PI Email: hairston@utdallas.edu
Affiliation:
Project Member(s):
-

Summary:
It is well known that solar wind conditions (the IMF and the ram pressure) are, through the magnetosphere, the primary drivers of the ionospheric phenomenon in the polar region (cross polar cap potential drop, convection patterns, triggering of storms, etc.). What is not as well understood are the differences in these phenomena between the two polar ionospheres as they react to the same drivers. To first order it would appear that the phenomenon in the two hemispheres should be the same (such as the potential drop) or mirror images (such as the convection pattern). However this neglects the feedback role the ionosphere itself plays. During solstices there is a marked difference in the conductance between the sunlit summer pole and the darkened winter pole, so there should be a significant difference in the currents, the potential distribution, and the potential drop between the two hemispheres. To date there have been only a few limited observations that have addressed whether this asymmetry in the potential and potential distribution exists or not, so the question is still open. But with the observations from the plasma instruments on multiple DMSP spacecraft in polar orbit it is possible to select periods where we have simultaneous observations in both hemispheres. The upcoming launch of DMSP-F17 in fall 2006 combined with the ongoing mission of DMSP-F13 will give us, for the first time, a long-term dataset of simultaneous dawn-dusk polar passes in opposite hemispheres. We propose to identify these periods then compare the DMSP observations of the potential distribution, potential drop, polar cap size, field-aligned current, location of the auroral boundary, etc. with the solar wind drivers (IMF magnitude and orientation, ram pressure, etc.) measured by the NASA spacecraft ACE. The results will definitely answer whether or not there is a difference in the two polar ionospheric regions' responses to the solar wind drivers under both nominal and storm time conditions and, if there is a difference, how they are mediated by the magnetosphere and ionosphere. This proposal to the independent investigation component of the Living with a Star TR&T program will support the LWS goals by furthering the understanding of the solar wind-magnetosphere-ionospheric coupling and the storm-time response of the ionosphere to the solar wind drivers. In addition this work will make use of the NASA funded on-line databases of the ACE and DMSP data.

Publication References:

Summary: no summary

Reference: Lockwood, Mike; Hairston, Marc; Finch, Ivan; Rouillard, Alexis; (2009), Transpolar voltage and polar cap flux during the substorm cycle and steady convection events, Journal of Geophysical Research, Volume 114, Issue A1, CiteID A01210 , doi: 10.1029/2008JA013697

Summary: no summary

Reference: Hosokawa, K.; Tsugawa, T.; Shiokawa, K.; Otsuka, Y.; Nishitani, N.; Ogawa, T.; Hairston, M. R.; (2010), Dynamic temporal evolution of polar cap tongue of ionization during magnetic storm, Journal of Geophysical Research: Space Physics, Volume 115, Issue A12, CiteID A12333, doi: 10.1029/2010JA015848