

Project Details

ROSES ID: NRA-02-OSS-01

Selection Year: 2003

Program Element: Independent Investigation: LWS

Project Title:

Global MHD Simulation Study of Polar Cap Energy Deposition

PI Name: Steven Slinker

PI Email: atn@g.ucla.edu

Affiliation: Naval Research Laboratory/

Project Member(s):

- Fedder, Joel A; COI; George Mason University
- Ossakow, Sidney L.; Authorizing Official; Naval Research Laboratory

Summary:

The objective of this research program is to study deposition of energy into the polar cap ionosphere. Deposition from both Joule heating and auroral precipitation will be considered. The flow of energy from the solar wind to the polar caps will be mapped through the magnetosphere, and its dependence on solar wind parameters will be determined. This research is important because the rate of energy deposition can exceed many hundreds of gigawatts during geomagnetic storms. The scale height of the atmosphere can be affected which causes perturbations in spacecraft orbits. Variations in the neutral winds occur and the effects propagate to mid and low latitudes. The research strategy is to use global MHD simulations of the magnetosphere to study polar cap heating. The simulation effort will consist of two types of studies. The first set of studies will be to simulate real events. We will choose interesting periods for study, i.e., times of disturbance when good estimates of the energy input to the polar caps can be made from observations. We will require that the data be sufficiently comprehensive to perform the simulations and to verify the results. The data sets will include solar wind data to be used as the input conditions for the simulation code, and magnetospheric and ionospheric data to be used for verification of the simulation results. The second type of effort will be model numerical studies where, for example, the solar wind data or solar flux are modified in one or more parameters. We will survey the energy deposition as a function of solar wind ram pressure, IMF strength and direction. The dipole tilt of the Earth will be varied to assess seasonal deposition effects. By changing the solar flux, solar cycle dependences can be studied. This research directly supports NASA's Living with a Star (LWS) objective of determining energy transfer from its generation by solar activity to its deposition in the upper atmosphere, namely, the critical link from the solar wind through the Earth's magnetosphere into the ionosphere. It specifically addresses the first of the five objectives of the LWS program, ``Scientific Understanding."

Publication References:

Summary: "

Reference: Slinker, Steven NRL - Global MHD Simulation Study of Polar Cap Energy Deposition