Project Details

ROSES ID: NRA-02-OSS-01
Selection Year: 2003
Program Element: Independent Investigation: LWS

Project Title:
Coupled Model of Storm-Time Effects on the Low- and Mid -Latitude Ionosphere

PI Name: Richard Wolf
PI Email: rawolf@rice.edu
Affiliation: Rice University
Project Member(s):
- Spiro, Robert Walter; COI; Rice University
- Slinker, Steven ; COI; Naval Research Laboratory
- Huba, Joseph ; COI; Naval Research Laboratory
- Sazykin, Stanislav ; COI; Rice University
- Joyce, Glenn R.; COI; Naval Research Laboratory
- Vorhaben, Jean ; Authorizing Official; Rice University

Summary:
The proposed research centers on self-consistently calculating the storm-time variations of the low- and mid-latitude ionosphere. This will be accomplished by coupling SAMI3, the new NRL model of the low- and mid-latitude ionosphere, and the Rice Convection Model of inner magnetosphere electrodynamics. At present, SAMI3 relies on an input electric field model, while the RCM uses an input ionospheric conductance model. When coupled, SAMI3 will provide conductance values to the RCM, while the RCM will provide electric fields to SAMI3. We propose to answer the following scientific questions: -- How do magnetospherically driven electric fields that penetrate into the low- and mid-latitude ionosphere evolve as a function of longitude and latitude during magnetic storms? -- What is the response of the ionosphere to penetrating electric fields as a function of geophysical parameters (e.g., geomagnetic conditions, solar EUV, longitude, latitude, etc.)? -- Will the output from the coupled codes, when applied to major storm events like the Bastille Day 2000 storm, agree with the observed dramatic prompt-penetration electric fields and density disturbances? In the later phases of the research, realistic wind fields will be input to the coupled codes in order to investigate the effects of disturbance neutral winds on electric fields and ionospheric structure. For simulated events, we will investigate the effect of the model electric field on the linear growth rate of the generalized Rayleigh-Taylor instability, which is believed to trigger spread F. The proposed research program directly addresses a major objective of NASA's Living with a Star (LWS) program: to determine the mid- and low-latitude ionospheric response to geomagnetic storms. Ionospheric variability can adversely affect navigation, communications, and radar systems. At present, ionospheric behavior during geomagnetic storms is not well enough understood to meet LWS requirements. The self-consistent coupling of the RCM and SAMI3 will provide a basis for qualitatively and quantitatively understanding this complex phenomenon on a global scale.

Publication References:

Summary: "

Reference: Wolf, Richard Rice University - Coupled Model of Storm-Time Effects on the Low- and Mid -Latitude Ionosphere

Summary: no summary

Reference: Huba, J. D.; Joyce, G.; Sazykin, S.; Wolf, R.; Spiro, R.; (2005), Simulation study of penetration electric field effects on the low- to mid-latitude ionosphere, Geophysical Research Letters, Volume 32, Issue 23, CiteID L23101, doi: 10.1029/2005GL024162