

Project Details

ROSES ID: NRA-00-OSS-01

Selection Year: 2001

Program Element: Independent Investigation: LWS

Project Title:

Modeling Ionospheric High Latitude F-region Plasma Structures

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Summary:

Observations have shown that the high latitude F region ionosphere contains a variety of large-scale plasma structures (polar cap patches, polar cap arcs, boundary blobs, subauroral blobs, auroral blobs, and auroral ionospheric cavities). Through the use of global F-region fluid models, researchers have successfully simulated the production and evolution of many of these structures. Some of the successes have involved demonstrating the efficacy of various mechanisms for producing typical patches or blobs. Other efforts have focused on simulating the climatology of these structures. However, there has been much less work on modeling these structures at a particular place and time. In this proposal, we plan to use a physics-based ionospheric model to specify on a given day where and when these structures will occur. We will focus on what is needed to accurately model the structures called patches and blobs (regions of enhanced F-region plasma density). We will address three issues: (1) What physical processes and numerical techniques need to be included in a realistic weather model? (2) How well do the inputs to the model need to be specified? (3) How does the model compare to observations? While the first two issues can be explored with model sensitivity studies, it is only by comparing to observations that the relevance of the sensitivity analysis can be assessed. As a result, observations will be critical to the success of the effort. The importance of this work in large part comes from the observation that smaller scale plasma irregularities are often imbedded within the larger scale patches and blobs. These small-scale irregularities can cause scintillations in radio waves propagating through the ionosphere. Thus, understanding the production and evolution of large-scale plasma structures is a key component of being able to specify and forecast ionospheric impacts on radar and satellite operations in the high latitudes.

Publication References:

no references