Project Details

ROSES ID: NNH10ZDA001N
Selection Year: 2011
Program Element: Focused Science Topic

Topic: Low-To Mid-Latitude Ionospheric Irregularities and Turbulence

Project Title:
ELECTRODYNAMICS OF EQUATORIAL PLASMA INSTABILITIES

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Summary:
A four-year research program is proposed to study the electrodynamics of plasma instabilities

that develop in the nighttime equatorial ionosphere and can lead to the onset of equatorial

spread F (ESF). Understanding and modeling ESF is important because of its impact on

space weather: the associated electron density irregularities can scintillate radio wave signals

which can adversely impact communication and navigation systems. The primary scientific

objective is to address the question, what is the electrodynamic nature of equatorial

F region plasma instabilities? In particular we will investigate the difference between

two-dimensional and three-dimensional electrodynamic effects on the onset and evolution of

equatorial instabilities. This study will combine the 3D electrodynamics model developed

at Cornell University with the Naval Research Laboratory (NRL) ionospheric codes SAMI3

and SAMI3/ESF.

To achieve closure we will continually compare model results to data (e.g., radar measurements, in situ satellite data) to assess the validity of the model results

for explaining ESF day-to-day variability.

The proposed research directly addresses several objectives of the Living With a Star Targeted Research and Technology Focused Science Topic "Low- to Mid-Latitude Ionospheric

Irregularities and Turbulence" by improving models of F region plasma instabilities, quantifying the role of E and F region coupling on these instabilities, and understanding the

connection between large-scale ionospheric processes and the development of electron density irregularities.

Publication References:

Summary: no summary

Reference: Aveiro, H. C.; Hysell, D. L.; Park, J.; Lühr, H.; (2011), Equatorial spread F-related currents: Three-dimensional simulations and observations, Geophysical Research Letters, Volume 38, Issue 21, doi: 10.1029/2011GL049586

Summary: no summary

Reference: Aveiro, H. C.; Hysell, D. L.; Caton, R. G.; Groves, K. M.; Klenzing, J.; Pfaff, R. F.; Stoneback, R.; Heelis, R. A.; (2012), Three-dimensional numerical simulations of equatorial spread F: Results and observations in the Pacific sector, Journal of Geophysical Research, Volume 117, Issue A3, doi: 10.1029/2011JA017077

Summary: no summary

Reference: Hysell, D. L.; Milla, M. A.; Condori, L.; Meriwether, J. W.; (2014), Data-driven numerical simulations of equatorial spread F in the Peruvian sector: 2. Autumnal equinox, Journal of Geophysical Research: Space Physics, Volume 119, Issue 8, pp. 6981-6993, doi: 10.1002/2014JA020345