Project Details

ROSES ID: NNH09ZDA001N
Selection Year: 2010
Program Element: Focused Science Topic

Topic: Determine the Behavior of the Plasmasphere and its Influence on the Ionosphere and Magnetosphere

Project Title:
A 3D climate and weather global topside ionosphere and plasmasphere model

PI Name: Mark Moldwin
PI Email: mmoldwin@igpp.ucla.edu
Affiliation: niversity of Michigan
Project Member(s):
- ZOU, SHASHA ; Co-I/Science PI; University of Michigan
- Yizengaw, Endawoke ; Co-I/Institutional PI; Boston College

Summary:
Key objective is to combine IMAGE EUV, GPS TEC, in situ, and ULF resonance data to make a 3D global topside ionosphere and plasmaphere empirical model that includes Ne, mass density, and information on composition. The model parameterization will include discrimination between the plasmasphere and trough.

We propose to develop a global space climate and weather model of the topside ionosphere and plasmasphere density using ground and space-based two-dimensional (latitude vs. altitude) tomographic imaging. The results of this model will be used to improve IRI modeling efforts and serve as a stand-alone empirical model helping to constrain such parameters of mass composition. Current global models provide monthly averages of ionospheric properties and do a poor job of modeling the topside ionosphere. Currently there are few mass density models and very limited composition modeling

efforts. The new model will provide a topside ionospheric and plasmaspheric electron density as a function of local time, latitude (over both hemispheres), altitude and solar

drivers. The data will be constructed using nearly a decade of data allowing the examination of long term climate solar driving dependences as well as regional weather information. This research goal directly addresses the NASA LWS TR&T Focused Science Topic a (Determine the Behavior of the Plasmasphere and its Influence on the Ionosphere and Magnetosphere). LEO satellites equipped with dualband

GPS receivers (including C/NOFS and COSMIC) offer a breakthrough opportunity for remote sensing and monitoring of the topside ionosphere and plasmasphere. Tomographic imaging of LEO GPS TEC goes beyond two-dimensional TEC maps and

allows the determination of topside ionosphere and plasmaspheric density altitude profiles, global coverage, and in combination with ground-based TEC tomography the

ability to differentiate changes in F region density with topside ionospheric/plasmaspheric density variations.

In addition, we propose to combine simultaneous observations of the plasmaspheric mass density with the LEO-GPS TEC-inferred electron number density measurements to

study the evolution of average mass density of the plasmasphere. The NSF MEASURE,SAMBA and McMac magnetometer arrays were designed to utilize the cross-phase technique to measure the ULF resonance frequency. The combination of TEC and ULFmass density observations will allow us to study the day-to-day variability of the ionosphere including composition of ionospheric and plasmaspheric densities.

Publication References:

no references