Topic: Focused science topics for Strategic Goal 4 (Ionosphere-Thermosphere): Determine the sources of daily variability in the thermosphere and ionosphere

Project Title:
Determination of the Causes of Day-to-Day Variability in the Middle and Low Latitude Ionosphere

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Project Information:
Data assimilation models have been successfully used for several decades as a dominant tool for specifications and forecasts in meteorology and oceanography and recently also gained prominence in ionospheric studies. We have developed a data assimilation model that uses a physics-based ionosphere-plasmasphere model and an Ensemble Kalman filter as a basis for assimilating a divers set of measurements. The primary output of the model is the 3-dimensional electron density distribution in the ionosphere and the self-consistent global distributions of the ionospheric drivers.

We propose to use this new data assimilation to specify monthly-mean electron densities, electric fields, and neutral winds and composition in the low- and mid-latitude region. This innovative approach will combine the multitude of diverse data sets with a physics-based model for the ionosphere in a synergistic way to enhance the scientific return of both the observations and the model. The data that we will assimilate include: Radio occultation, UV radiance, and Tri-Band Beacon data from the six COSMIC satellites; UV from the GUVI inbstrument; Total electron content from hundreds of GPS sites and from the TOPEX and Jason-1 satellites; Ne profiles from ionosondes; and Ne observations from DMSP satellites.

Our research plan is specially tailored to serve the objectives of Focused Science Topic for Strategic Goal 4. Specifically, the accurate specifications of the ionosphere-thermosphere environment will be used to identify the causes of day-to-day variability in the 3-dimensional ionospheric plasma distribution. The important components of this proposal are specification of the ionospheric plasma morphology on a monthly basis including its drivers, an investigation of the ionospheric variability using our month-mean values as a baseline, an investigation of the variability of ionospheric drivers and its relationship to the plasma density variations, and the comparison of our data assimilation results with observations from incoherent scatter radars.

ROSES ID: NNH07ZDA001N
Duration:
Selection Year: 2008
Program Element: Focused Science Topic

Citations:

Summary: no summary

Citation: Shim, J. S.; Scherliess, L.; Schunk, R. W.; Thompson, D. C.; (2008), Spatial correlations of day-to-day ionospheric total electron content variability obtained from ground-based GPS, Journal of Geophysical Research: Space Physics, Volume 113, Issue A9, CiteID A09309, doi: 10.1029/2007JA012635

Summary: no summary

Citation: Shim, J. S.; Scherliess, L.; Schunk, R. W.; Thompson, D. C.; (2010), Neutral wind and plasma drift effects on low and middle latitude total electron content, Journal of Geophysical Research, Volume 115, Issue A4, CiteID A04307, doi: 10.1029/2009JA014488