Project Details

ROSES ID: NNH18ZDA001N
Selection Year: 2018
Program Element: Focused Science Topic

Topic: Mid-latitude and Equatorial Dynamics of the Ionosphere-Thermosphere System

Project Title:
Investigating Penetrating Electric Field Effect on the Vertical Ion Drift

PI Name: Qian Wu
PI Email: qwu@ucar.edu
Affiliation: NCAR
Project Member(s):
- Wang, Wenbin;Co-I;University Corporation for Atmospheric Research
- Knipp, Delores J;Co-I;NCAR
- Huang, Chaosong;Co-I;Air Force Research Laboratory

Summary:
The scientific question for this proposal: what is the penetrating electric field effect on the equatorial vertical ion drift? During substorms, the high-latitude penetrating electric field moves equatorward, affecting the mid- and low-latitude ionosphere. It is well known that the penetrating electric field can change the equatorial vertical ion drift [Basu et al., 2007]. The goal is to understand how the penetrating electric field is linked with the equatorial vertical ion drift. We also would like to know sources of longitudinal variations in the vertical ion drift, which could include non-migrating tides and planetary waves.

We plan to use the LTR (LFM-TIEGCM-RCM) model to investigate the penetrating electric field effect on the vertical ion drift. Wang et al. [2008] showed that only a directly coupled magnetosphere and ionosphere model was able to simulate the penetrating electric field effect on the vertical ion drift. LTR is the latest directly coupled magnetosphere and ionosphere model. We will also use more realistic lower boundary conditions in the LTR to simulate the effect of the tides on the vertical ion drift in the low latitudes. Non-migrating tides introduce longitudinal variations in the vertical ion drifts, which can affect the occurrence of plasma bubbles. We plan to conduct a vigorous validation effort. We will use vertical ion drift and electron density observations from C/NOFS (Communications/Navigation Outage Forecasting System) and DMSP (Defense Meteorological Satellite Program) to validate the simulations. Differences between the model and observations will be compared with observation errors. In addition, we will use the GOCE (Gravity field and Ocean Circulation Explorer) thermospheric wind data to track traveling atmospheric disturbances from high to low latitudes.

We will provide LTR simulations to the team. We can also provide C/NOFS observation analysis, ground-based ion drift and thermospheric wind observations, and satellite observations from DMSP and GOCE Our team has long experience with NCAR models and is also very familiar with C/NOFS and DMSP with many publications. Our team can provide robust validation not only for our simulations but also for other team members.

Publication References:

no references