2022 Workshop: Electrodynamics Thermosphere Ionosphere Modeling

Long title
Electrodynamics Thermosphere Ionosphere Modeling
Conveners
Jack Wang
Min-Yang Chou
Naomi Maruyama
Ludger Scherliess
Endawoke Yizengaw
Piyush Mehta
jack.c.wang@nasa.gov
Description

Accurately forecasting the neutral and electron densities in the thermosphere and ionosphere is of operational importance for space weather modeling. Both CEDAR and GEM communities have recognized that due to the maturity and increasing complexity of state-of-the-art space weather models, there is a great need for a systematic and quantitative evaluation of different modeling approaches. To access the current state of the space weather model predictions against observations, GEM and CEDAR communities initiated community-wide model validation activities: GEM GGCM in 2008 and CEDAR Electrodynamics Thermosphere Ionosphere (ETI) Model Validation Challenge in 2009. The GEM-CEDAR Model Validation Challenge (https://ccmc.gsfc.nasa.gov/challenges/GEM-CEDAR/), built upon the GEM GGCM and CEDAR ETI Challenges, was initiated in 2011 Joint GEM-CEDAR Workshop and continued to be held until 2019.

After a 2-year pause, the CEDAR Electrodynamics Thermosphere Ionosphere Modeling workshop will be resumed this year. The workshop seeks to bring together modelers and data providers again to facilitate collaboration among modelers, data providers and research communities; as well as to facilitate interaction between research and operation communities in developing metrics for space weather models. The workshop this year will focus on scientific and operational aspects of the performance of ionosphere-thermosphere models, and addressing challenges of

model data comparisons and metrics studies. The Community Coordinating Modeling Center (CCMC) will support this workshop and maintain a web site with interactive access to model output archive and observational data used for metrics studies. Our goal is to continue the progress of the ionosphere/thermosphere model validation studies carried out through “International Forum for Space Weather Capabilities Assessment” (https://ccmc.gsfc.nasa.gov/assessment/forum-topics.php).

We would like to invite IT modelers/experimentalists to present/perform observations and simulations across different instruments and models. Results during storm times are especially encouraged. We will also discuss which physical parameters and what reliable observations to be used for this effort, and which time period to be chosen for discussion in next year’s CEDAR workshop.

Agenda

1. New development of TIEGCM and validation (Wenbin Wang, *HAO NCAR*)

2. Predicting ionospheric dynamics at low latitudes using neural networks: Applications to ionogram and spread-F forecasting (Enrique Rojas, *Cornell University*)

3. Evaluation of TEC/foF2 prediction of coupled ionosphere-thermosphere models (Ja Soon Shim, *Yonsei University, Korea*)

4. Assessment of ionospheric models with the ground-based and spaceborne GNSS observations during geomagnetic storms in the low and moderate solar flux years (Min-Yang Chou, *CCMC NASA*)

5. Exploring the validation of the Assimilation Canadian High Arctic Ionospheric Model (A-CHAIM): An operational system for high latitude HF propagation (David Themens, *University of Birmingham, UK*)

6. Scientific machine learning: Quantifying global response of thermosphere density to geomagnetic storms (Piyush Mehta, *West Virginia University*)

7. Comparison of EXTEMPLAR model densities with the SET-HASDM density database (Dan Weimer, *Virginia Tech., presented by* Piyush Mehta)

8. Thermosphere model assessment using CAMEL (Comprehensive Assessment of Models and Events using Library tools framework) during geomagnetic storm time

(Jack Wang, *CCMC NASA*)

9. Community Discussion: developing metrics for space weather model evaluations (Moderator: Jack Wang)

Justification

This workshop will address the CEDAR Strategic Thrust #5 as the workshop will facilitate collaboration among modelers, data providers and research communities in order to address the differences between various modeling approaches, to track model improvements over time, and to provide feedback for further model improvement. This workshop will also address ionosphere-thermosphere-magnetosphere (ITM) coupling to better understand relationship between IT dynamics and energy input from the magnetosphere that is relevant to one of scientific goals of the Decadal Survey for Solar and Space Physics.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Develop observational and instrumentation strategies for geospace system studies
Workshop format
Short Presentations
Keywords
space weather, neutral density, TEC, scintillation
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