2019 Workshop: High latitude IT processes

Long title
Reconciling observations and models of high-latitude IT processes
Conveners
Cheryl Huang
Olga Verkhoglyadova
Dogacan Ozturk
Russell Landry
Description

Current ionosphere-thermosphere (IT) models, including empirical, physics-based and assimilative, represent the average system qualitatively well under most conditions. However, when detailed quantitative comparisons of data with model predictions are carried out for specific events, significant discrepancies appear. The discrepancies can arise due to the (i) incomplete understanding of the underlying physical processes, (ii) approximations and assumptions made in models, (iii) numerical constraints, as well as (iv) uncertainties in the measurements, and (v) lack of data coverage, measurements of critical physical parameters, insufficient temporal and/or spatial resolution. This workshop aims at an open discussion of these discrepancies, challenging observations, and what the community can do to advance IT forecasting.

We aim to reconcile the observations and models of high-latitude IT processes by addressing the following questions:

1. How well do models couple processes at relevant scale sizes in space and time?

2. How well do models capture energy input, transport and dissipation in high-latitude IT?

3. How can measurements from various platforms be utilized to determine high-latitude drivers for IT modeling?

4. Which quantities can be used to test model performance and identify sources of discrepancies?

5. How can data be utilized in improving modeling efforts?

6. How can we quantify the discrepancies and their propagation across different scales and processes?

Suggested applications include but not limited to:

• Disturbances related to magnetic activity – energy input and transfer, formation and evolution of SAPS/SAIDs, others

• Cusp dynamics and ion outflow

• Conductivity in high-latitude IT system

• Role of waves in energy dissipation

• Polar cap patches

• HF radar transmissions

Workshop format will be short presentations followed by moderated group discussion. We will use Google Docs to continue discussions and document the workshop.

We invite colleagues with an interest in IT measurements and modeling to participate in this discussion.

Agenda

1. Jiang Liu - Dawn side auroral polarization streams

2. Larry Lyons - Flow channel control of substorm azimuthal expansion

3. Russell Landry - Storm-time DMSP Poynting flux measurements and conductance estimations

4. Michael Negale - Tracking Polar Cap Patches Using a Reconstructed Ionosphere

5. Joaquin Diaz-Pena - Polar cap boundary dynamics

6. Zihan Wang - Observation and modeling of polar cap patches

7. Ying Zou - Effect of substorms on upper thermospheric winds

8. Olga Verkhoglyadova - Importance of Magnetosphere-Ionosphere-Thermosphere coupling at meso- and small-scales

9. Doga Ozturk - Modeling meso-scale electric field variabilty through GCMs

10. Qingyu Zhu - Impact of binning methods on high-lat electrodynamic forcing

11. Ildiko Horvath/Cheryl Huang - MIT coupling captured by OpenGGCM

12. Meghan Burleigh - Ion outflow, model and rocket data

13. Rachel Frissell/Andy Gerrard - NJIT AGOs

14. Ashton Reimer - New RISR capability

15. Nathaniel Frissell - Antarctic HF receiver

16. Alex Chartier/Ethan Miller - RadioICE: A new HF ionospheric sounder in Antarctica

Justification

1. Science Challenges Investigating the sources and propagation of the discrepancies that arise between model results and measurements will improve the understanding of the underlying physical processes that couple the Magnetosphere-Ionosphere-Thermosphere system across different scales, and potentially advance IT forecasting capabilities.

The workshop intends to bring together and build new collaborations among the data and modelling communities as well as between researchers specialized in the Magnetosphere, Ionosphere and Thermosphere fields. Furthermore, the October 2018 article by the Space Weather Editorial Board titled “Communicating Uncertainty and Reliability in Space Weather Data, Models and Applications”, indicates that quantification of the discrepancies will be an integral part of Space Weather studies going forward. This is another reason why the proposed workshop will be vital and timely for the CEDAR community.

2. Relevance to the CEDAR Strategic Plan By employing a systems science perspective to discuss the integration of data products and improve the predictive capabilities of numerical models, the proposed workshop will support the implementation of CEDAR Strategic Thrusts 1 - “Encourage and Undertake a

Systems Perspective of Geospace” and 6 - “Manage, Mine and Manipulate Geoscience Data and Models”. The proposed workshop aims to understand how mass, momentum and energy is transferred across the Magnetosphere, Ionosphere and Thermosphere systems, which closely aligns it with the CEDAR Strategic Thrust 2 - “Explore Exchange Processes at Boundaries and Transitions” mission.

Summary

Shared Slides for the High-Latitude I-T Processes (pdf)

View PDF