2016 Workshop: Making sense of geospace observations

Long title
Making sense of high-latitude geospace observations: modeling, data fusion and assimilation
CEDAR-GEM
Conveners
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Description

Specification of the electrodynamic state of the polar ionosphere is of paramount interest to the CEDAR-GEM community. It defines one of the major driving forces of the thermosphere and ionosphere and provides us with a means to probe physical processes in the magnetosphere. The recent advent of global monitoring of magnetic perturbation fields on the ground and at LEO altitudes, and ionospheric plasma velocities made available through the ground-based radars (e.g., AMPERE, SuperMag, and SuperDARN) prompts us to reexamine the limitations of the conventional approach to the modeling of electromagnetic processes adopted in our science community. This workshop addresses the challenges associated with obtaining a self-consistent global description of field-aligned, Pedersen and Hall currents, ionospheric conductivity, electric fields, and neutral winds from a combination of multiple types of high-latitude geospace observations. Short presentations will be followed by a roundtable discussion.

Agenda

4:00-4:10 Tomoko Matsuo - Introduction (pdf)

4:10-4:20 Mike Ruohoniemi - SuperDARN Uncertainties (pdf)

4:20-4:30 Jesper Gjerloev - Global continuous magnetosphere-ionosphere coupling

4:30-4:40 Ryan Mcgranaghan - Data fusion in conductivity specification (pdf)

4:40-4:50 Don Hampton - Ground based optical estimates of electron precipitation energetics in the auroral zone (pdf)

4:50-5:00 Russel Cosgrove - Conductance and conductivities (pdf)

5:00-5:10 Rob Gillies - Initial RISR-C results with REGO, SWARM, and SuperDARN: Velocity comparisons (pdf)

5:10-5:20 Mark Conde - FPI neutral wind mapping

5:20-5:30 Art Richmond - AMPERE-driven TIEGCM (pdf)

5:30-5:40 Binzheng Zhang - The "unexpected" quiet-time thermospheric wind

5:40-6:00 All - Open Discussion

Justification

This joint CEDAR-GEM workshop aims to address challenges associated with system-level science questions regarding the magnetosphere ionosphere-thermosphere coupling processes, especially as pertaining to electrodynamics at high-latitudes. Specific challenges include the following: (1) Our current understanding of magnetosphere-ionosphere-thermosphere coupling processes is built largely on analysis of individual parameters from one type of observation. In order to gain and deepen quantitative understating of the coupling processes, we need an effective, comprehensive approach to combining observations obtained from various ground-based sensors (ISR, SuperDARN, magnetometers, imagers, FPIs, and more) as well as space-based sensors (drift meters, magnetometers, particle analyzers, imagers, etc.). It is important to estimate and account for uncertainties and biases in different observation types and in a model, when contrasting and combining multiple types of electrodynamics observations to obtain a self-consistent description of high-latitude geospace system. (2) Ionospheric conductivity serves as a critical linkage in coupling between the magnetosphere, ionosphere and thermosphere, playing an essential role in the closure of field-aligned currents between the magnetosphere and ionosphere, and in the energy and momenturm transfer from the magnetosphere to the ionosphere and thermosphere. Nonetheless, direct global monitoring of the conductivity is almost non-existent. (3) Influences of the neutral wind dynamo are often neglected in the application of Ohm's law to ionosphere-magnetosphere

coupling, with effects comparable to the uncertainty associated with the conductivity. In the attempt to close the gap in our understanding, it is important to examine whether or not the flywheel effect can be seen in electrodynamics observations. This workshop’s objectives are aligned with CEDAR New Dimension Strategic Thrust #1: “Encourage and Undertake a Systems Perspective of Geospace and Thrust” and #6: “Manage, Mine, and Manipulate Geoscience Data and Models”, and compliment the GEM Focus Group “Geospace Systems Science”.

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