2017 Workshop: ionospheric electrodynamics

Long title
Challenges and advances in the low- and middle latitude ionospheric electrodynamics
Conveners
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Description

The ionospheric electrodynamo couples the lower atmosphere to the upper atmosphere at middle and low latitudes. In recent years observations and numerical simulations indicate that the lower atmospheric forcing can have measurable effects on the thermosphere-ionosphere system. While most studies focused on the daytime when the E-region wind dynamo dominates, there are effects in the F-region e.g., F-region wind dynamo, gravity and plasma pressure pressure gradient forces, which might have to be considered when interpreting and understanding satellite data and the TI system. Observations of night-time ion drift illustrate that the ionosphere and its electrodynamics is highly variable. Even at dawn and dusk the low-latitude and equatorial ion drift variations reflect the complexity of the system with the sudden changes in ionization and the wind system.

We invite contribution based on observations and/or numerical studies pertaining to the overarching topic of the low- and mid-latitude electrodynamics since the pioneering work by Art Richmond from the 1970s.

The following questions will be addressed and guide us in facilitating the workshop: What are the recent developments with respect to the ionospheric electrodynamics? What observations and modelling studies can lead to a better understanding of the night-time ionospheric electrodynamics? How can the different measurements be utilized to enhance our understanding of the dawn and dusk electrodynamics and its TI effect? How can magnetic field measurements be combined with other data to support our goal to improve our understanding of electrodynamic coupling and its influence on the TI system?

Agenda

- Rod Heelis (UTD) Introduction to ionospheric electrodynamics (pdf)
- Tim Fuller-Rowell (CIRES/NOAA) Electrodynamics - past, present, future (pdf)
- Dave Hysell (Cornell) 3-dimensional electrodynamics (pdf)
- Joe Huba (NRL) Toward a global electrodynamic model of the ionosphere (pdf)
- Nick Pedatella (NCAR) Atmosphere coupling through electrodynamics (pdf)
- Scott England (VT) Upcoming missions: What can be learned about the electrodynamics? (pdf)
- Naomi Maruyama (CIRES/NOAA) Storm effects at low latitudes (pdf)

Justification

The workshop theme addresses the electrodynamic coupling of the thermosphere-ionosphere system at low and mid-latitudes, its challenges and advances with the goal of better predicting TI variations. This goal directly pertains to the CEDAR strategic thrust #1 in the CEDAR Strategic Vision (2011): “Encourage and undertake a systems perspective of geospace” and thrust #5 “Fuse the knowledge base across disciplines”. The workshop theme is embedded in CEDAR strategic thrust #2 “Explore exchange processes at boundaries and transitions”. This is aligned with the National Academy of Sciences (NAS) Decadal Survey 2013-2022 Key Science Goal #2 “Determine the dynamics and coupling of the Earth’s magnetosphere, ionosphere and ionosphere and their response to solar and terrestrial inputs”

(1) The questions of the workshop can only be addressed with a comprehensive approach of combining ground and space-based observations with numerical modeling studies. (2) It is planned to explore the existing observations from ground-based instruments (e.g., radars, FPIs) and satellite missions (e.g,. TIMED, COSMIC, Swarm) to obtain direct or indirect information about neutral winds, electrc field, ionospheric currents associated with the electrodynamo proces. Numerical modeling will be utilized to test our understanding of the system processes. (3) Progress will be made by stating our current knowledge and the challenges, and identify ways to improve our understanding and predictive capabilities by combining observations and modeling.

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