2024 Workshop: Geospace dynamics

Long title

A Systematic Perspective of Geospace Dynamics through Modeling and Observations

Conveners

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Description

Recent advances in coupled models of the whole geospace system (mesosphere, thermosphere ionosphere and magnetosphere) and their components, as well as new ground and space observations, enables the community to gain new insights into the cross-scale, dynamic response of the geospace, as a system, to varying external driving conditions. This workshop invites both modeling and data analysis presentations that include but not limited to: 1) quantifying energy and momentum inputs to and effects on the upper atmosphere under disturbed solar irradiance and solar wind conditions such as solar flare, eclipse, interplanetary shocks, high speed streams, and coronal mass ejections, and from lower atmospheric waves including gravity waves, tides and planetary waves; 2) investigating regional and global mesoscale and large-scale processes generated in the thermosphere and ionosphere under such conditions and the cross-scale coupling between these processes, 3) understanding the global propagation and evolution of thermosphere and ionosphere structures of multiple temporospatial scales such as traveling atmospheric disturbances (TADs) and traveling ionospheric disturbances (TIDs), and 4) comparing model and data, revealing model-data discrepancy, and guiding model improvement.

Justification

The whole geospace system (mesosphere, thermosphere ionosphere and magnetosphere) is an open, nonlinear, dynamic and strongly coupled system that is greatly influenced by external solar radiation, solar wind and lower atmospheric weather conditions. At high latitudes Joule heating, particle precipitation and ion

drag of different temporal and spatial scales are imposed on the thermosphere and ionosphere (I-T) system, not only changing local neutral and plasma density, temperature, and velocity, but also generating local mesoscale and large-scale structures that propagate globally and redistribute energy and momentum to other regions, producing global perturbations to the I-T system. Waves from the lower atmosphere also deposit energy and momentum in the I-T modifying its global circulation, composition and dynamo electric fields and thereby its local and global structures. Furthermore, transient solar events of flares and eclipse also affect photochemical processes of the I-T system. To understand the effects of external forcings from above and below and their coupling with internal processes requires both first principles models of the coupled geospace system that can accurately represent the dynamic variability of multi-scales and data to validate models and guide model development. This is critical to understanding the fundamental physics within the geospace system and better predicting the space weather events that affect human space activity.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Explore exchange processes at boundaries and transitions in geospace
Fuse the knowledge base across disciplines in the geosciences
Manage, mine, and manipulate geoscience/geospace data and models
Include a virtual component?
Yes
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