2023 Workshop: Wave-induced Vertical Coupling

Long title
Wave-induced Vertical Coupling in Space-Atmosphere Interaction Region
Conveners
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Description

Atmospheric waves are crucial to the transport and deposition of momentum and thermal energy throughout the middle and upper atmosphere. Upward propagating waves over a wide range of spatiotemporal scales alter the upper atmospheric state in multiple ways. These wave-induced changes in the thermosphere can also perturb the ionospheric state given that the primary source of ionosphere plasma is the photoionization of neutral constituents. Meanwhile, waves can directly alter the ionospheric electrodynamics through modulation of dynamo wind fields.

Recent ICON, GOLD, and COSMIC-2 missions provide cross-platform and multi-variable measurements of the ionosphere and thermosphere system (I-T system), which facilitates advancement of our understanding of whole atmosphere coupling. Whole and/or middle/upper atmospheric general circulation models (GCMs) have seen significant recent development, which efficiently fill the observational gaps that currently exist, especially in the data sparse region between 100-200 km. The use of GCMs allows for a detailed examination of coupling processes that may not be disentangled from observations. With three concurrent geospace missions over the past several years, opportunities for validating coupling processes can be leveraged. This workshop invites presentations on any subject that is of demonstrable relevance to the following topics, including but not limited to: 1) wave-wave interaction and corresponding impacts on the I-T system, 2) wave-induced transport and turbulence influence on structure, composition, and circulation, 3) plasma-neutral coupling through upward-propagating waves, and 4) current numerical modeling capabilities of understanding the coupling processes. It is desired that this workshop will allow participants to form collaborations for targeted observational

and modeling studies of specific wave coupling phenomena to be executed in the future.

Agenda

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Ruth Lieberman: 10:00 – 10:14

Tidal and Planetary Wave Modulation of Gravity Wave Forcing

Zishun Qiao: 10:14 – 10:28

Interhemispheric Coupling during Major NH SSWs and the Role of Waves: Preliminary Results

Jens Oberheide: 10:28 – 10:42

A statistical study of the tidal weather of the MLT region using MIGHTI/ICON observations

Chris Krier: 10:42 – 10:56

Tidal Impact on Column O/N_2 Variability: Addressing the Limitation of Ionospheric Contamination

Huixin Liu: 10:56 – 11:10

Impact of El Niño-induced O_3 variability on MLT tides

Garima Malhotra: 11:10 – 11:24

Coupling between thermospheric gravity waves and non-migrating tides simulated by the Whole Atmosphere Model

Sharon Vadas/Erich Becker: 11:24 – 11:38

Multi-step vertical coupling of gravity waves from the lower to upper atmosphere

Masaru Kogure: 11:38 – 11:52

Characteristics of gravity wave horizontal phase velocity spectra in the OH airglow layer over the Antarctic stations, Syowa and Davis

Enrique Rojas: 11:52 – 12:00

Exploring the use of coherent scatter radars and ionosondes for studying gravity waves in the equatorial region

Justification

This workshop will facilitate collaboration among the CEDAR research community and emphasize the role of the cross-dataset integration and the fusion of model and observation. This workshop will also address whole atmosphere coupling to better understand relationship between I-T dynamics and energy input from below that is relevant to one of the scientific goals of the Decadal Survey for Solar and Space Physics.

This workshop will directly contribute to CEDAR Strategic Thrust #1: Encourage and undertake a systems perspective of geospace. Strategic Thrust #2: Explore exchange processes at boundaries and transitions in geospace. Strategic Thrust #3: Explore processes related to geospace evolution. Strategic Thrust #4: Develop observational and instrumentation strategies for geospace system studies. Strategic Thrust #6: Manage, mine, and manipulate geoscience/geospace data and models.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Explore exchange processes at boundaries and transitions in geospace
Workshop format
Short Presentations
Keywords
vertical coupling, gravity waves, tides, planetary waves
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