2021 Workshop: TAD TIDs and MSTIDs

Long title
Advances in atmosphere vertical coupling and its relationship with ionosphere-thermosphere oscillatory phenomena (TAD/TIDs/MSTIDs)
Conveners
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Description

This workshop will combine papers in the following subjects:

(1) State-of-the-art investigations of the atmospheric processes that enable or indicate coupling and energy transfer within the atmosphere layers, including the MSTIDs phenomena. We welcome submissions on methodologies, including theory, modeling, observation, and experiment. Particularly attention is given to mid-latitude, but studies from other latitudes are also welcome.

(2) Traveling Ionospheric Disturbances are a frequent feature of the ionosphere at all latitudes. It is believed that there are a number of processes responsible for their generation including the Perkins instability, high latitude forcing, lower atmospheric forcing resulting from severe tropospheric weather events (e.g., hurricanes, tornadoes, tropical cyclones, thunderstorms), earthquakes, tsunamis, volcanic eruptions, meteor impacts, as well as explosions, spacecraft launches, etc. We want to better understand the origin of TIDs and how to distinguish different types of TIDs from each other. We are interested in modeling and data studies of TIDs, as well as how to use multi-instrument approaches to better understand the phenomena.

(3) The formation of high-latitude, equatorially propagating TIDs/TADs are phenomena made possible by the strongly coupled nature of the I-T system. Their origins have been tied to magnetospheric processes such as Joule heating and auroral precipitation. Another way the high latitude disturbances can affect lower latitudes is through the penetrating electric field, particularly during geomagnetically active times. Penetrating electric fields can change the low latitude dynamo, ion drift, and thermospheric winds leading to other consequences. Recent improvements in I-T modeling and observational coverage allow new insights into

the ways in which TIDs/TADs connect the high- and low-latitude I-T system. Inspired by these updated tools, this workshop aims to address the challenge of the role of TADs and TIDs in connecting the high and low latitude I-T systems by fostering collaborative efforts among present and future research activities. To this end, data and modeling results investigating the origins of high-latitude TIDs/TADs and their impacts on low latitude aeronomy are welcome.

Agenda

Quantifying the contributions of geomagnetic and lower atmospheric forcing in the TEC variability over Europe - by Tarique Siddiqui, Leibniz Institute of Atmospheric Physics.

Investigation of VLF Radio Sounding for Studying Semi-Diurnal Tide and Gravity Waves - by Alireza Mahnoudina, Institute of Geophysics, University of Tehran.

Spectral analysis of the equatorial ionosphere observed using Giant Metrewave Radio Telescope (GMRT) - by Sarvesh Mangla, Indian Institute of Technology Indore.

On the role of E-F region coupling in the generation of nighttime MSTIDs during summer and equinox: Case studies over northern Germany - by Sivakandan Mani, Leibniz Institute of Atmospheric Physics.

Characterization of TIDs in the lower ionosphere of sub-auroral and medium latitudes and their modulation by geomagnetic activity - by Christiano Brum and Pedrina Terra, Arecibo Observatory/ UCF and Fabio Vargas, University of Illinois

Impacts of Seasons and High Latitude Forcing on LSTID/LSTADs - by Manbharat Dhadly, NRL.

LSTADs and LSTIDs at Different Altitudes - by Cheng Sheng, University of Texas Arlington.

Justification

MSTIDs are one of the most observed perturbations in the nighttime ionosphere in mid latitudes. Arguably, many aspects of their nature and evolution are still poorly understood, being their full characterization one unsolved question in the aeronomy community. Studies show that under favorable conditions, gravity waves propagating upward from the troposphere can penetrate to the higher ionosphere and contribute to the formation of MSTIDs. However, the mechanism of these

coupling processes and how the waves can penetrate the IT system are not uncovered clearly in models nor observations. One of the difficulties that contribute to this gap of knowledge is the non-optimized observations without enough altitude and spatial resolution to explore the vertical coupling of the atmospheric regions, including the IT system. On the other hand, understanding the formation, progression, and global impacts of Traveling Atmospheric/Ionospheric Disturbances (TADs/TIDs) is one of the long-standing challenges of space weather research. Given our ever-increasing reliance on space-based technology, we have reached a critical point where distinguishing their role in low latitude variability and the energy budget of the ionosphere-thermosphere system is crucial for advancing global ionosphere-thermosphere (I-T) space weather research and forecasting. In this workshop we intend to put together to the CEDAR community the most recent studies on how the low atmosphere might affect the upper atmospheric levels and impact the IT system, and its relationship with observations of MTIDS. This session also aims to help to define new pathways to explore the new perspective of optimized observations of the whole atmospheric vertical coupling in general.

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