2016 Workshop: Meteorological events and TI system

Long title
How do meteorological events couple into the thermosphere-ionosphere system?
Conveners
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Description

Observations and numerical simulations indicate that meteorological events can have measurable effects in the thermosphere and ionosphere. Recently, studies indicated that events like sudden stratospheric warmings, earthquakes, and periods of strong gravity waves present striking examples of such vertical coupling. However the importance of other meteorological events such as the current El Nino or even the average meteorological variability for the upper atmosphere is not known. The coupling of the lower to the upper atmosphere and ionosphere is complex and very dynamic. The mechanism of the coupling are not well understood. Using observations and numerical experiments some progress could be made in explaining possible coupling mechanism during meteorological disturbances e.g., modifications in the lower atmospheric background, changes in the wave spectrum and propagation conditions, nonlinear coupling of waves and generation of secondary waves, modifications of the electric field, the effect on the global thermospheric circulation and composition. Due to the complexity of the system a comprehensive picture is challenging to develop. Most studies focused on the coupling during the daytime and the low latitude region, and just recently studies expanded to middle and high latitudes. An additional complication is to delineate the variability due to solar radiation and geomagnetic activity from the variability due to the lower atmosphere in observations.

We invite discussions and presentations based on observations and numerical studies pertaining to the overarching question if and how meteorological events couple into the thermosphere-ionosphere system. The following questions will be addressed and guide in facilitating this workshop: • What is the wave spectrum generated by different meteorological events and its temporal variability? Can these waves influence the MLT region and through which mechanism? What is the

comparative importance of the wave spectrum changes versus changes in the propagation conditions? What observational data are currently available and what data are needed to answer these questions? How can modeling efforts guide the community in search for the answers? • What is the comparative importance of the thermosphere-ionosphere effects of upward propagating waves versus in-situ forcing and quiescent geomagnetic forcing? What are the vertical and latitudinal coupling mechanisms at day and night time?

Agenda

Sudden Stratospheric Warming:

- Nick Pedatalla (modeling & understanding IT response)
- Laynn Harvey (polar vortex)
- Larisa Goncharenko (nighttime effects)

Gary Swenson (Atomic Oxygen transport in the upper mesosphere, and continuity)

Gravity Waves:

- Katrian Bossert & Chris Heale (excitation & vertical coupling)

ENSO:

- Vu Nguyen (tidal changes)
- Thomas Immel (TIMED results)
- Astrid Maute (IT modeling)

Justification

The coupling of the lower atmosphere to the thermosphere and ionosphere is complex and very dynamic, and studying it is complicated by the variability in solar and geomagnetic forcing. The coupling spans from the troposphere to the thermosphere-ionosphere and therefore the workshop’s goal is to foster exchange and collaboration between researchers from the different atmospheric regions by focusing on the effects of meteorological events. The workshop encourages the contributions from observational and numerical studies to enhance the synergy by exchanging knowledge of meteorological effects. We plan on soliciting one or two introductory presentation especially for students, and have contributed short presentations with group discussion of the different aspects of vertical coupling during meteorological events. The workshop theme 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 will address the energy transfer from the lower to the upper atmosphere, which 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”

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