2023 Workshop: Dynamics and Energetics in the Mesosphere, Lower and Middle thermosphere

Long title
Variability of Composition, Temperatures, and Neutral winds in the Mesosphere, Lower and middle Thermosphere Region Driven by forcing from above and below
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Description

This workshop focuses on the chemistry, dynamics, and the atmosphere state in the altitude regime of ~ 70 km – 200 km. This is a transition region between the lower and upper atmosphere where the atmosphere transitions from being well-mixed to diffusively separated, and where the homopauses for various species, mesopause, and turbopause are located. Furthermore, atomic oxygen is created by photodissociation in the lower thermosphere and is distributed throughout the upper atmosphere by winds, eddy and molecular diffusion. This region is strongly driven by forcing originated from both the Sun (solar irradiance, energy and momentum input from the magnetosphere), and the lower atmosphere (waves/tides, turbulent mixing). It is also the region where infrared cooling by CO2 and NO occurs. The energy and momentum forcing mentioned above works together to drive the mesosphere and lower thermospheric residual circulations and the thermosphere circulation. These circulations, in conjunction with turbulent mixing and tides, drive complicated spatial and temporal variability in neutral composition. Solar heating, Joule heating, chemical heating, and the circulations cause a thermal structure in the region that has the most dramatic vertical changes in the upper atmosphere. The composition and temperature structures also feedback and impact winds. This workshop welcomes short presentations that regard composition, temperature, and winds in this region, using various methods including ground and space-based measurements, numerical and empirical modeling, and theoretical analysis.

Agenda

This session will be in-person only.

13:30 - 13:42 **Brian Harding**

Day-to-Day Variability of Neutral Winds Observed by the MANGO FPI Network and ICON-MIGHTI

13:42 - 13:54 **Guiping Liu**

Thermospheric O/N_2 and Temperature Comparison of GOLD with MSIS and WACCM-X

13:54 - 14:06 **Katelynn Greer**

Polar Vortex Effect on the Thermospheric O/N_2

14:06 - 14:18 **Jian Du**

Inter-Annual Variability of Tides in the Mesosphere, Ionosphere, and Thermosphere from WACCM-X SD Run

14:18 - 14:30 **Jiarong Zhang**

Mesospheric Water Vapor as a Tracer for the Residual Mean Circulation during SSW Events

14:30 - 14:42 **Eliana Nossa**

Lower E-region Layers at Mid-Latitudes

14:42 - 14:54 **Federico Gasperini**

Wave-Driven Circulation Impact during SSWs

14:54 - 15:06 **Minjing Li**

Climatology of Dayside E-region Zonal Neutral Wind Shears from ICON-MIGHTI

15:06 - 15:18 **Manbharat Dhadly**

Short-Term Variability in DE3 using MIGHTI, SABER, TIDI

15:18 - 15:30 **Marcin Pilinski**

Gravity Wave Effects on Thermospheric Neutral Winds: Observations at Mars and Ionospheric Impacts

Justification

Variability of composition, temperature, and winds in the ~ 70 - 200km altitude region is very complicated due to complex physical processes involved by forcing from both above and below. In addition, this is a region that historically lacks measurements due to difficulty in probing it. Many aspects of the composition, temperature, and winds are not known or not well understood. However, it is critical to advance our understanding of the dynamics and chemistry in this region as it is where strong ion-neutral coupling occurs to profoundly affect the dynamics, electrodynamics of the whole coupled geospace. For example, O is created in this region and becomes a major species above ~ 200 km that is vital in determining both the mass density in the upper thermosphere and electron density in the F2 region.

Recent NASA GOLD has provided composition and temperature data in this region since October 2018, while NASA ICON has also provided composition, winds, and temperature data in this region since October 2019. This period (2018 – present) is also concurrent with the Whole Heliosphere and Planetary Interactions (WHPI), which is an international initiative focused around the solar minimum period that aims to understand the interconnected sun-heliosphere-planetary system, with coordinated observing and modeling efforts. Various research has been done to understand composition, temperature, and winds in this region, during both geomagnetically quiet and more active times. It is timely to hold a CEDAR workshop so that community can come together to present, discuss, and further our understanding of this very complicated and vitally important region.

Workshop format
Short Presentations
Keywords
composition, dynamics, mesosphere, thermosphere
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