2022 Workshop: Composition, Temperature, and Winds in the MLT Region

Long title
Composition, Temperature, and Winds in the Mesosphere and Lower Thermosphere Region
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Description

This workshop focuses on the chemistry, dynamics, and the atmosphere state in the altitude range of ~ 70 km – 200 km of the mesosphere and lower thermosphere region. 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

Quan Gan

Seasonal and intra-seasonal variations in the thermospheric O/N2 seen by GOLD

Astrid & Rafael

The EZIE mission: the neutral wind measurement around 80 km

Ningchao Wang

Nitric Oxide Concentration: A New Dataset Derived from SABER Measurements

Erdal Yigit

Thermospheric mean winds and circulation as observed by ICON

Jack Wang

Impact of Lower Thermospheric Mean Circulation on Atomic Oxygen Transport

Koushik Neelakantan

Tidal advection of water vapor in the MLT studied using WACCMX

Enrique

Estimating electron densities from coherent backscatter echoes at ~ 150 km over Jicamarca

Minjing Li

Preliminary results of neutral wind shears in the E-region based on ICON MIGHTI data

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.

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Workshop format
Short Presentations
Keywords
composition, temperature, winds, the MLT region
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