2026 Workshop: ITM long-term variation

Long title
Long-term variation in the ionosphere-thermosphere-mesosphere (ITM) system
Conveners
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Description

This session invites both observational and modeling studies of the long-term variation of the ionosphere-thermosphere-mesosphere (ITM) system (from seasonal, to solar-cycle timescales, to multi-decadal). The ITM system is strongly coupled with the geospace environment above it and the lower atmosphere below. The complex external coupling processes and the internal physical and chemical processes lead to significant global variations in different time scales, from seasonal to decades. However, the discontinuous observation in the long term make it challenging to investigate the long-term changes in the ITM system and its causes. In recent years, the advantage of numerical simulations and the increasing amount of observations have helped improve our understanding of the variations of the ITM system. In this workshop, we will discuss the variation of the ITM system across different time scales and the mechanisms behind them.

Agenda

This workshop will follow a short-presentation format, with approximately 13 minutes allocated for each talk, including Q&A. The session will begin with observation-related presentations, followed by simulation-related presentations.

10:00 *Opening*

10:03 **Enrique Rojas Villalba** - *A Multi-Instrument View of Long-Term Ionospheric Variability at the Magnetic Equator*

10:16 **Asti Bhatt** - *Auroral ionosphere imaged for 1.5 solar cycle with PFISR*

10:29 **Tyler Karasinski** - *Seasonal Impacts of Atmospheric Tides on High-Latitude Gravity Waves*

10:42 **Emilie Lo** - *Storm-time*
Variation of □□O/N₂ Transition Latitude Observed by GOLD and ICON

10:55 **Shun-Rong Zhang** - TBD

11:08 **Komal Kumari** - *Long-Term Observations of Gravity Waves and Winds from the Distributed MANGO Observatory Network*

11:21 **Joe McInerney** - *Effects of Kp Geomagnetic Index on 21st Century WACCM-X Projections*

11:34 **Liying Qian** - *Long-term Increase in Equatorial Rayleigh-Taylor Instability: Synergistic Effects of Greenhouse Gas Cooling and Geomagnetic Field Secular Variations*

11:47 *Discussion*

Justification

The ITM system shows significant global scale variation in different time scales, including seasonal variation, solar-cycle variation, and decades-long variation. The coupling between internal processes and external forcings from above and below leads to these complex variations in the ITM system. The long-term variation of the ITM system causes a decreasing trend of neutral density in the upper atmosphere and further show a strong impact on the satellite drag, orbit determination, and space debris accumulation. Understanding the contribution of different internal processes and external forcings to the variation and long-term trend of the ITM system is critical due to the blooming development of the aerospace industry nowadays.

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Explore exchange processes at boundaries and transitions in geospace
Explore processes related to geospace evolution

Workshop format

Short Presentations

Keywords

Seasonal variation, solar-depending variation, long-term trend in the upper atmosphere.

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