2026 Workshop: ITM long-term variation

Long title
Long-term variation in the ionosphere-thermosphere-mesosphere (ITM) system
Conveners
Chih-Ting Hsu
Wenbin Wang
Liying Qian
Shunrong Zhang
Joe McInerney
Dong Lin
chihting@ucar.edu
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.

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