2026 Workshop: ML/AI applications in the MLT

Long title
Machine Learning Applications in Observing and Modeling the Mesosphere and Lower Thermosphere
Conveners
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Description

Recent advances in MLT observations and modeling lead to a rapid growth in data volumes, creating new opportunities for machine learning (ML) and artificial intelligence (AI) applications. This workshop will bring together observers, modelers, and data scientists to explore ML/AI approaches for MLT applications across data analysis, model development, and community tools. Topics include automated detection and characterization of waves and fine-scale structures, development of ML-ready datasets, data-model integration, and ML-based parameterizations in first-principles and whole-atmosphere models, as well as methods and tools from other disciplines with direct relevance to the MLT. The workshop aims to share recently developed and open source applications, foster collaboration across observational and modeling communities, and establish ML/AI as a community capability for future MLT research.

Agenda

Room 101, 13:30-15:30, June 24, 2026 (Wednesday)

- 13:30 - 13:40, Session Opening
- 13:40 - 14:00, Ben Martinez, A TEC-Driven O/N_2 Prediction Model Trained on GOLD Observations
- 14:00 - 14:20, Jiahui Hu, Cross-Variable Reconstruction of MLT Zonal Winds and Temperature from WACCM-X Simulations: Toward Meteor Radar Applications

- 14:20 - 14:40, Anh Phan, Improving AWE Airglow Measurements Through Machine Learning-Based Identification of Clouds and Artifacts
- 14:40 - 15:00, Minjing Li, Diffusion-Based Deep Learning Models for High-Latitude Electrodynamics
- 15:00 - 15:20, Pan Yang, Prediction of Global Ionospheric TEC Enhancement in response to Solar Flares
- 15:20 - 15:30, Closing discussion

Justification

While recent CEDAR activities have highlighted machine learning applications in the ionosphere-thermosphere (IT) system, comparable efforts in the mesosphere and lower thermosphere (MLT) remain less explicitly organized. The MLT combines distributed and heterogeneous observations, strong temporal variability, and increasing output from regional to global models, which together create challenges for conducting systematic and reproducible analyses using traditional approaches alone. A dedicated workshop will provide a focused discussion to connect ongoing but largely independent efforts, exchange practical experience, and identify shared needs for applying ML/AI to MLT datasets and models in ways that are consistent with established physics-based research.
At the same time, the rapid growth in data volume and model resolution is making scalable and automated analysis strategies increasingly important for the CEDAR community. ML/AI offers a pathway to complement existing methods by enabling efficient feature identification, consistent long-term statistics, and transferable analysis workflows across instruments and models. By bringing together observers, modelers, and data scientists, this workshop will help define common practices for ML-ready datasets, promote open and reproducible tools, and foster new collaborations. These outcomes will support the development of ML/AI as a shared community capability for future MLT studies and strengthen links among currently fragmented activities within the CEDAR community.

Related to CEDAR Science Thrusts:
Develop observational and instrumentation strategies for geospace system studies
Manage, mine, and manipulate geoscience/geospace data and models
Workshop format
Short Presentations
Round Table Discussion
Keywords

Physics-Informed Machine Learning, Data-Model Integration, Community Tool, MLT Application

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