2026 Workshop: Impact of Terrestrial Weather on the Space Weather of the ITM

Long title
Impact of Terrestrial Weather on the Space Weather of the Ionosphere-Thermosphere-Mesosphere
Grand Challenge
Conveners
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Description

Processes generated by terrestrial weather in the lower atmosphere (i.e., troposphere and stratosphere, altitudes less than ~50 km) are recognized by the scientific community as sources of variability in both the structure and composition of the ionosphere-thermosphere-mesosphere (ITM) region. The ITM is a confluence of energy and processes that interconnect Earth's atmosphere with space. Exposed to persistent wave forcing from terrestrial weather sources, and solar and magnetic forcing, the ITM is a domain of compelling scientific inquiry that connects thermodynamics, fluid dynamics, electrodynamics and plasma physics. Predicting its mean state and variability, the "space weather" is of significant national interest for space situation awareness including the very low earth orbit (VLEO) as the new frontier of space operations. Advancing the understanding of whole atmosphere interconnections between terrestrial and space weather requires coordinated modeling and observational efforts along with the implementation of new

technologies across different spatial and temporal scales. Of particular interest are wave-induced vertical coupling processes that alter the ITM state in multiple ways, including their influence on structure, composition, circulation, and electrodynamics. Recent efforts through NASA's Living With a Star program and ISSI workshops, to name just a few, clearly show that progress has been made but that significant gaps in our understanding remain. This GC workshop aims to seek the expertise of the broader CEDAR community to help revealing the critical links between weather and space weather through addressing four specific goals.

1. Quantify the variability of relevant neutral and ionospheric state parameters on different spatio-temporal scales, from regional to global, and from hours to inter-annual to climate: what are the observational baseline data sets we have, what are the gaps and will future space-based and ground-based measurements be able to close those gaps.

2. Develop a set of metrics to evaluate data-model comparisons.

3. Evaluate state-of-the-art models across different spatio-temporal scales and assess the impact of data assimilation on model performance.

4. Identify the important mechanisms that connect terrestrial variability with space weather on daily, sub-seasonal, inter-annual scales; examine how they vary with altitude and geographic regions.

Agenda

Zoom: https://clemson.zoom.us/j/98547395722

GC1A, TUESDAY, JUNE 23, 2026, 10-12 (Chairperson: TBD)

10:00 – 10:01 Jens Oberheide, Workshop Goals and Achievements

10:01– 10:15 Sreelekshmi Girijakumary, *Atmospheric Gravity Waves and Ionosphere-Thermosphere Coupling: Insights From AWE and HR-WACCM*

10:15 – 10:29 Shun-Rong Zhang, *Understanding gravity wave Influences through long-term GNSS MSTID observations and WACCM-X simulations*

10:29 – 10:43 Komal Kumari, *A High-Resolution WACCM-X Investigation of Global Characteristics of Medium-Scale Ionosphere-Thermosphere Disturbances During*

Major Sudden Stratospheric Warmings

10:43 – 10:57 Benjamin Martinez, *AWE results on the stratospheric and mesospheric GW response to the 2024 southern hemisphere SSW*

10:57 – 11:11 Pavel Inchin, *Small-scale Terrestrial Weather–Generated Gravity Wave and MSTID Forecasting*

11:11 – 11:25 Deepali Aggarwal, *MJO-Driven F-Region Ionosphere Tidal Variability: Separating E-Region Dynamo and Field-Aligned Wind Effects*

11:25 – 11:39 Latoya Wilcoxson, *Influences of Derecho Storms on the Ionosphere and Thermosphere: Gravity Wave Coupling and Thermospheric Wind Interactions*

11:39 – 11:53 John Meriwether, *Simultaneous detection of vertical wind oscillations and total electron content fluctuations from El Leoncito Observatory*

11:53 – 12:00 Shantanab Debchoudhury, *Convective AGW-driven TIDs and their impact on the vertical ionosphere: Results from a campaign with Millstone-Hill ISR*

GC1B, TUESDAY, JUNE 23, 2026, 13:30-15:30 (Chairperson: TBD)

13:30 – 13:44 Jiarong Zhang (via zoom), *Modulation of the semi-annual oscillation by stratospheric sudden warmings as seen in the high-altitude JAWARA Re-analyses*

13:44 – 13:58 Hanli Liu, *Hurricane Helene and their impact using AWE, GNSS TEC, WACCM-X, JAWARA, and NAVGEM*

13:58 – 14:12 Benedict Pineyro, *Impact of Wind Variability on the Nonlinear Evolution and Dissipation of Convective Gravity Waves in the Upper Mesosphere and Lower Thermosphere*

14:12 – 14:26 Manbharat Dhadly, *On the new MSIS and HWM with nm tides*

14:26 – 14:40 Fabrizio Sassi, *GEOS-MLT Development*

14:40 – 14:54 Enrique Rojas Villalba, *Constraining Neutral Wave Perturbations from TEC Signatures with Reduced Physics Models*

14:54 – 15:08 Guiping Liu, *GEOS-FP paper on convectively generated concentric waves*

15:08 – 15:22 Sunil Kumar, *Impacts of Northern and Southern Stratospheric Polar Vortices on the Mesosphere, Thermosphere, and Ionosphere*

15:22 – 15:29 Larisa Goncharenko, *Understanding ionospheric perturbations linked to the strength of stratospheric polar vortex*

15:29– 15:30 Jens Oberheide, *Closing Remarks*

File upload
GC intro talk during 2024 plenary (4.87 MB)
GC intro talk during 2025 plenary (757.41 KB)
GC intro talk during 2026 plenary (2.17 MB)
Justification

The workshop goals are not only at the heart of CEDAR's coupling and system science spirit but will also help to define more clearly the state-of-the-art in the light of future EZIE, DYNAMIC and GDC missions. Moreover, this workshop will provide an opportunity for NSF/CEDAR ground-based observatories to join forces with a broader community to synergistically enable a transformed view of terrestrial weather-space weather connection.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Explore exchange processes at boundaries and transitions in geospace
Develop observational and instrumentation strategies for geospace system studies
Fuse the knowledge base across disciplines in the geosciences
Manage, mine, and manipulate geoscience/geospace data and models
Workshop format
Short Presentations
Other
Keywords
weather, space weather, observational baseline, model performance
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