2022 Workshop: High-Latitude Coupling and Waves

Long title
High-Latitude Space-Atmosphere Coupling and Wave Dynamics
Conveners
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Description

The 10+ years of lidar observations in Antarctica and the Arctic have posed significant challenges to our current understandings of the plasma-neutral coupling, wave dynamics, inter-hemispheric differences, and the atmospheric responses to the ionospheric, magnetospheric, and solar wind drivers. As an example, high-sensitivity lidar measurements have revealed positive (upward) sensible heat fluxes in the lower thermosphere, which contradict the conventional thinking but may well demonstrate the importance of fully compressible solutions for polarization relations of gravity waves and generation of secondary/tertiary gravity waves in the MLT. Another example is the striking differences observed in the thermosphere-ionosphere heavy and light metal species (e.g., Fe and Na). These surprising results invite community efforts to explore observational data and possible mechanisms, e.g., for the transport of constituents (both ions and neutrals), heat, and momentum from both neutral and ionospheric aspects, and for the plasma-neutral coupling. This workshop solicits presentations focusing on the high-latitude plasma-neutral coupling, wave dynamics, and transport studies. We welcome numerical modeling and theoretical studies that can help understand the observations and the underlying physics. We also welcome studies showing driving forces from above and from below, including neutral winds, temperatures, and wave fluxes as well as ionospheric and solar wind observations (such as current systems, ion convection, aurora, etc.).

Agenda

Wednesday (June 22) @ Topaz 3

https://cuboulder.zoom.us/j/91008874788

13:30 - 13:43 **Shun-Rong Zhang** - TID across polar cap

13:43 – 13:56 **Nick Pedatella** - Impact of Strong and Weak Stratospheric Polar Vortices on the MLT

13:56 – 14:09 **Arunima Prakash** - PMC inter-annual variations at McMurdo vs. solar cycle and polar vortex breakup

14:09 – 14:22 **Xinzhao Chu** - Surprising results of sensible heat and meteoric Na fluxes in the MLT at McMurdo and possible connection to secondary gravity waves

14:22 – 14:35 **Sharon Vadas** - Heat fluxes of gravity waves with non-zero vertical wavelengths, and connection to secondary gravity waves excited by local body forces from momentum deposition: comparison of fully compressible and Boussinesq solutions

14:35 – 14:48 **Komal Kumari** - Observational Study of Thermospheric Disturbances over Central Alaska during the 2013 Sudden “Stratospheric” Warming

14:48 – 15:01 **Haonan Wu** - A nested grid modeling of gravity wave propagation excited by Tonga eruption

15:01 – 15:11 **Ian Geraghty** - Gravity Wave Properties from the Stratosphere to the Lower Thermosphere: Results from 10 Years of Lidar Observations at McMurdo Station, Antarctica

15:11 – 15:21 **Jackson Jandreau** - Gravity Wave Dynamics over McMurdo, Antarctica as observed in 10 years of Lidar Data: Variability in Energy and Spectrum

Leave ~10 min for discussions and/or transition time.

Each speaker please leaves at least 1-2 min for Q & A. For example, a 13-min talk should finish the talk at 11-12 min, and then leave 1-2 min for questions.

Justification

This workshop aims to bring experimentalists, modelers, and theoreticians together to reveal gaps in our current understanding of some key issues in the field, and to

bridge the neutral atmosphere communities with the ionosphere and magnetosphere communities to tackle these gaps and some fundamental science questions. The key science challenges include
1) What are the roles of plasma-neutral coupling in shaping the compositions, structures, and transport in the space-atmosphere-interaction region?
2) What are the wave contributions to the constituent, heat, and momentum transport?
3) How do multistep vertical coupling impact the upper atmosphere and geospace?
4) How to understand the upward heat fluxes and abnormally large vertical winds observed at McMurdo? What new understandings can be gained via collaborative studies of discovery observations with high-resolution modeling?
5) Are there inter-hemispheric differences in the middle and upper atmosphere between the Arctic and the Antarctic? Are the larger-than-expected downwelling vertical winds and upward heat fluxes something special in Antarctica?

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Explore exchange processes at boundaries and transitions in geospace
Workshop format
Short Presentations
Keywords
Lidar observations, plasma-neutral coupling, transport, gravity-wave polarization relations
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