2018 Workshop: Waves and Turbulence

Long title
Instability, Wave Breaking and Turbulence: Current work, outstanding challenges, and future progress
Conveners
Richard Collins
David Fritts
Alan Liu
Description

Turbulence (characterized by randomness, nonlinearity, diffusivity, vorticity, and dissipation) remains an outstanding challenge in understanding coupling, energetics and dynamics of the atmosphere. Turbulence couples the mesosphere-lower thermosphere (MLT) both upward to the upper thermosphere and F-region and downward to the mesosphere and stratosphere. The upward coupling impacts the composition of the thermosphere and satellite drag. The downward coupling impacts the transport of nitric oxides and the ozone layer. However significant uncertainties are reported in the estimates of turbulent activity and transport in both observational and modeling studies. Given that the primary source of turbulence is breaking gravity waves, understanding turbulence also requires understanding of instabilities and wave-breaking. A variety of observational methods (e.g., imager, lidar, radar, ion-gauge) use different techniques and methods to characterize turbulence. General circulation models characterize wave breaking and turbulence as sub grid-scale models through parameterizations. Understanding the role of wave-breaking and turbulence has seen recent progress in modeling (both in synoptic-scale and mesoscale models) and observations (i.e., resonance lidar, incoherent scatter a radar, low noise ion-gauges, temperature mappers). Goal is to present current capabilities, identify outstanding challenges, and propose areas for progress and future initiatives.

Agenda

Monday 1:30 pm - 3:30 pm
1:30 pm - 1:35 pm Opening Remarks - Richard Collins
1:35 pm - 1:50 pm Post Grand Challenge - Jeff Thayer

1:50 pm - 2:10 pm Waves and Turbulence in Circulation Models - Anne Smith
2:10 pm - 2:30 pm Hi-Res Studies of Waves and Instabilities - David Fritts
2:30 pm - 2:50 pm Plasma turbulence in the E-Region- David Hysell
2:50 pm - 3:05 pm Ion Gauge measurements of Turbulence - Boris Strelnikov
3:05 pm - 3:20 pm Airglow Studies of Waves and Instability - James Hecht
3:20 pm - 3:30 pm Estimating turbulence from satellite measurements - Gary Swenson

Thursday 10 am - noon'ish (possible 12:15)
10:00 am - 10:05 am Opening Remarks - Richard Collins
10:05 am - 10:20 am Na lidar measurements of wave and turbulent heat fluxes - Fan Yang
10:20 am - 10:35 am Gradient-driven E-region turbulence - Matthew Young
10:35 am - 10:50 am PFISR Measurements of Turbulence - Jintai Li
10:50 am - 11:05 am High Resolution Measurements of Smaller Scales and GWs using Na Mixing Ratios - Katrina Bossert
11:05 am - 11:20 am Estimating turbulence from satellite measurements - Jia Yue
11:20 am -11:35 am Large eddy simulations of waves and transport - Jonathan Snively
11:35 am - 11:45 am Toward a new capability for upper atmospheric research using atomic oxygen lidar: The TOMEX-plus experiment - James Clemmons
11:45 am - 11:50 am Turbulent structures in the aurora as illustrated by STEVE - Elizabeth MacDonald
11:50 am - 12:15 am Open Panel Comments and Review

Justification

CEDAR Goals 1) Coupling by waves and turbulence remains a major challenge in understanding the coupling between the space-atmosphere interaction region and space (above) and the atmosphere (below). Wave-driven turbulence is an exchange process at the boundary between space and the atmosphere that is still crudely represented in our models. 2) The workshop will provide a forum for modellers and observers to look at how we represent and observe wave-breaking and turbulence across scales, provide a systems perspective and identify outstanding challenges and possible solutions.

Decadal Survey Goals 1) How does the ionosphere-thermosphere system respond to, and regulate, magnetospheric forcing over global, regional, and local scales? (AIMI

Science Goal 1 - Global Behavior of the Ionosphere-Thermosphere) 2) How does lower-atmosphere variability affect geospace? (AIMI Science Goal 2 - Meteorological Driving of the Ionosphere-Thermosphere System) 3) How is our planetary environment changing over multi-decadal scales, and what are the underlying causes? (AIMI Science Goal 4 - Planetary Change)

The workshop is focused on developing community initiatives to address outstanding challenges.

View PDF