MMM SEMINAR SERIES

Signals of internal gravity waves generated by canopy-shear-layer turbulence: Field observations and theoretical explanations

Ying Pan

Penn State

The stably stratified canopy flows provide a natural laboratory to study wave-turbulence interactions – a persistent challenge faced by the community studying the nocturnal atmospheric boundary layer (ABL). Nighttime wavelike motions near forest canopy top have been observed using at least two types of instruments: aerosol backscatter lidar images and sonic anemometer measurements. Wave periods previously inspected from lidar images and sonic-anemometer time series during the Canopy Horizontal Array Turbulence Study (CHATS) showed comparable magnitudes but little case-to-case correlation. An existing theoretical explanation – based on linear stability analysis of the canopy-shear-layer mean flow – predicted wavelengths substantially smaller than those inspected from lidar images. In this work, new signals of internal gravity waves generated by canopy-shear-layer turbulence are identified from sonic-anemometer statistics during CHATS. The detected signals in spatial autocorrelation of time-block-averaged velocity fluctuations are well explained by the theoretical understanding of how stable stratification influences turbulent canopy flows. The new theoretical estimates of wavelengths and periods agree well with the overall properties of those inspected from lidar images. This agreement suggests potential advantages for understanding stably stratified near-surface flows using canopy-resolving large-eddy simulations (LES).

Thursday, 20 November 2025, 2:00PM

Refreshments 1:45PM

Please also join colleagues for refreshments and informal discussion after the seminar until 3:30PM

NCAR-Foothills Laboratory, 3450 Mitchell Lane

FL2-1022, Large Seminar

Seminar will also be live webcast

https://sundog.ucar.edu/public/page/MMM

Participants may ask questions during the seminar via Slido.