

NRES 954
Turbulent Transfer in Atmospheric Surface Layer
(3 Credits)

This course covers advanced topics on atmospheric boundary layer processes by which water vapor, carbon dioxide, sensible heat, dust, pollen and various pollutants are transported through the air. The material covered in the course is useful to students training for careers in meteorology, water resources, air pollution control, wind energy development and global environmental issues.

Catalog Description

Detailed study of turbulence mechanisms and characteristics needed to evaluate the exchanges of energy and matter in the atmospheric surface layer. Mass, momentum and energy balance equations. Turbulent kinetic energy balance. Stratified flows. Stability parameters. Special emphasis will be placed on turbulent transport over natural and vegetated surface. Flux-profile relationships. Turbulence spectra. Experimental observations. Discussion of pertinent applications: e.g., aerial dispersal of pollutants and spores, aerial application of chemicals, wind energy. Instrumentation and data-logging in turbulence research.

Learning Objectives

1. Comprehend the significant roles of wind structure, thermal stratification and turbulence in transport and dispersion of water vapor, carbon dioxide, dust, pollen and pollutants and, therefore, be able to make useful contributions in such areas as water resources, wind energy development, air pollution control, modeling aerial dispersal of spores and pollens and aircraft crop dusting and spraying.
2. Evaluate turbulent fluxes of water vapor, sensible heat, momentum and CO₂ using the eddy covariance and other micrometeorological techniques.
3. Identify the principles of wind velocity and atmospheric turbulence instruments and be able to use these instruments with appropriate data loggers.