General Information:
This course is a general survey of boundary layer meteorology. The atmospheric boundary layer is the part of the atmosphere affected by turbulence induced by the flow over an underlying surface. The atmospheric boundary layer plays a central role in the exchange of heat, moisture and momentum between land, ocean and the atmosphere. In this course, we will explore the fundamental concepts of planetary boundary layers. Application of theory in the atmospheric boundary and forecast models will also be presented.

Time and Place: T/TR 2:00 to 3:15 Rm Q110

Instructor: Dr. Sen Chiao, Link 205, 321.674.8008, schiao@fit.edu

Prerequisites: MET 4305 or permission of instructor.

Proposed Grading: Homework: 20%; Midterm: 30%; Final: 30%; Term project: 20%


Recommendation texts:

Tentative topics: (not necessarily in order of presentation):
The closure problem and semi-empirical theories of turbulence
Reynolds averaging and scaling laws
Buoyancy effects on mean flow and turbulence
Monin-Obukhov similarity theory
Turbulence kinetic energy (TKE) budget in the PBL
Instrumentation and observational platforms for PBL experiments
Observed characteristics of atmospheric boundary layers
Energy fluxes at ocean and land surfaces
Numerical and physical modeling of PBL
Parameterizations in general circulation and mesoscale models

Tentative Schedule:
Jan 15: Mean boundary layer characteristics (BLM Ch1): Definition, structure, evolution, turbulence, micrometeorology, and impact.
Jan 22: Statistical tools: Reynolds averaging, turbulence spectrum, kinematic fluxes, friction velocity (BLM Ch2)

Jan 29: Governing equations for turbulent flow, derivation, simplifications, scaling (BLM Ch3)

Feb 5: Turbulent variances, perturbation equations, Deardorff convective scaling, and variance equations. (BLM Ch4)

Feb 12: Turbulence kinetic energy, TKE budget, stability, (BLM Ch5)

Feb 19: Richardson number, Obukhov length (BLM Ch5)

Feb 26: Mid term & Turbulence closure, local and nonlocal closures (BLM Ch6)

March 12: Turbulence closure, local and nonlocal closures Contd (BLM Ch6)

March 19: Boundary conditions and external forcings (BLM Ch7)

March 26: Time series methods, (BLM Ch8)

April 2: autocorrelation, Fourier spectrum (BLM Ch8)

April 9: Similarity theory (BLM Ch9)

April 16: Log wind profile (BLM Ch9)

April 23: Measurement and simulation (BLM Ch10)

April 30: presentation, catch-up, review and etc.