ATMO 579
Boundary Layer Meteorology and Surface Processes

Class Hours and Location: TuTh 9:30AM - 10:45AM Phys-Atmos Sci, Rm 488

Instructor: Dr. Francina Dominguez (email: francina@hwr.arizona.edu), PAS 536b, 621-4652.

Office Hours: TuTh 10:45AM – 12:00AM - Phys-Atmos Sci, Rm 586B. Or by appointment email francina@hwr.arizona.edu

Required Text: An Introduction to Boundary Layer Meteorology by Roland B. Stull. Kluwer Academic Publishers, The Netherlands. 670pp

Supplemental Text: An Introduction to Environmental Biophysics by Gaylon S. Campbell and John M. Norman Springer. 286 pp.

Objective: This course is designed for students in the atmospheric sciences, hydrology and related fields. It provides a framework for understanding the basic physical processes that govern mass and heat transfer in the atmospheric boundary layer and the vegetated land surface.

Course outline:

1. Mathematical and Conceptual Tools

a. Introduction
   - History, observation and modeling

b. Mathematical and conceptual tools
   - Mean and Turbulent Parts
   - Reynolds Averaging
   - Eddy Flux

c. Basic Equations for mean and fluctuating quantities
   - Basic equations for mean variables and turbulent departures.

2. Atmospheric Boundary Layer

d. Turbulence Kinetic Energy and Stability
   - TKE budget derivation and contributions
   - Stability concepts, local and non-local

e. Scaling Laws for Mean and Turbulent Quantities
   - Wind profile
   - Monin-Obukhov
   - Similarity Theory
   - Turbulence Closure
   - Non-local closure and Mixed Layer

f. Surface Roughness
   - Zero-plane displacement and aerodynamic roughness length
   - Vegetation canopy

3. Land Surface

g. Mass and Energy fluxes at the land surface
   - Surface energy balance, radiation fluxes
   - Latent Heat: Penman-Monteith and Priestly Taylor
   - Bare soil and canopy evaporation
   - Transpiration from Vegetation and other biophysical controls
   - Sensible heat

h. Soil Moisture and Temperature
   - Soil heat flux and temperature
   - Soil Moisture Availability

Grading: 60% of the grade is based on four mini-projects that combine theoretical and applied material. 15% of the grade will be homework assignments. The remaining 25% of the grade is based on a student term project. Term project proposal will be due approximately midway through the semester, and term projects will be due by the last class of the semester. Project write-ups will be as articles written in AGU/AMS format and should include an introduction, methodological description, presentation of results, discussion, summary, and figures. Students will also present their results in the form of a 10 to 15 minute oral presentation during approximately the last one to two weeks of the course, depending on course enrollment. There are no examinations.

Course prerequisites:
MATH 223, 254, PHYS 141/253, basic programming skills, atmospheric or Fluid Mechanics, or by permission of the instructor. Experience with Matlab is highly recommended.

Attendance Policy: All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion if the instructor is given reasonable notice. Absences for travel and university activities will be honored if the instructor is given reasonable advance notice. Students are responsible for all material missed in class.

Academic Integrity: The UA Code of Academic Integrity, Code of Conduct and Student Code of Conduct are strictly followed. All students are responsible for knowing the codes and abiding by them. See http://web.arizona.edu/~dos/uapolicies/. You can submit complaints about fellow students online at http://dos.web.arizona.edu/uapolicies/index.html. Your submission is completely anonymous, and I will investigate the allegations further.

Disability Resource Center: I remind students who are registered with the Disability Resource Center that I must receive appropriate documentation if they are requesting reasonable accommodations.

Course Withdrawal: