Syllabus - MAE578 Environmental Fluid Dynamics - Fall 2010

Lectures and short lab demonstrations on the dynamics of geophysical and environmental fluid flows. Prerequisites: Familiarity with basic fluid mechanics is desirable but not absolutely necessary.

Instructor: Huei-Ping Huang, hp.huang@asu.edu Office:ISTB2 219A Office hours: 1:30-5:00 Tuesdays
Course website: http://www.public.asu.edu/~hhuang38/MAE578.html

Textbook: *"Atmosphere, ocean, and climate dynamics, an introductory text", J. Marshall and R. A. Plumb, Academic Press,* **Required**. This book covers the basic material for the first half of this course. Lecture notes will be provided to supplement the textbook.

Other recommended textbooks:

For large-scale flows related to weather and climate:
(1) "*Atmospheric and oceanic fluid dynamics", G. K. Vallis, Cambridge University Press*
(2) *"Atmosphere-ocean dynamics", A. E. Gill, Academic Press*
(3) *"Geophysical fluid dynamics", J. Pedlosky, Springer-Verlag*
(4) *"An introduction to dynamic meteorology", J. R. Holton, Elsevier-Academic Press*

All are excellent and slightly more advanced than Marshall & Plumb. Anyone who is serious about the subject should have at least one on their bookshelves. (Book (1) is a good starter for a more advanced study.)

For environmental flows at smaller scales:
(1) *An introduction to boundary layer meteorology, R. B. Stull, Springer*
(2) *Turbulence and diffusion in the atmosphere, A. K. Blackadar, Springer*

They are among the few textbooks on the subject that are friendly to beginners. Unfortunately, (1) is very expensive and (2) is out of print (except for Kindle edition); Try to borrow a copy from the library if you are interested.

Course outline

Expect substantial revision as the course progresses. We also plan to conduct 2-3 laboratory sessions outside the regular class schedule (likely using office hours)

1. Overview (1 lecture)
2. Energy balance of large-scale atmospheric circulation (3 lectures)
3. Stratified flow: vertical structure, static stability, and convection (4 lectures)
4. Water vapor and precipitation (1 lecture)
5. Survey of the momentum and energy equations of fluid flows (4 lectures)
6. The effect of earth rotation (5 lectures)
7. Atmospheric boundary layer & near-surface processes (4 lectures)
8. Effect of topography and gravity waves (1 lecture)
9. Global-scale circulation of the atmosphere and oceans (4 lectures)
10. Issues with numerical simulation and prediction (1 lecture)

Grade will be based on homework assignments and a term paper. No exams.