SIO 217B (Winter 2015)

Atmospheric and Climate Sciences II: Atmospheric Dynamics

Instructor: Ian Eisenman, (office) Nierenberg Hall 223, (email) eisenman@ucsd.edu, (phone) 858-822-5176.

Lectures and assignments

Lecture schedule:

- Mon 1/05: Introduction (read textbook sections 1.1-1.2, 1.6.1), basic forces (1.4).
- Wed 1/07: Coriolis force (1.4, 1.6.1, 1.5)
- Mon 1/12: Material derivative, momentum equation (2.1-2.4, 1.3)
- Wed 1/14: Continuity equation, energy equation (2.5-2.6)
- Mon 1/19: *No class, Martin Luther King Holiday*
- Wed 1/21: Potential temperature, static stability (2.7)
- Mon 1/26: Isobaric coordinates, summary of governing equations (2.7, 1.6.2, 3.1)
- Wed 1/28: Balanced flow (3.2)
- Mon 2/02: Trajectories, thermal wind (3.3-3.4)
- Wed 2/04: Vertical motion, circulation (3.5, 4.1)
- Mon 2/09: Vorticity (4.2, 4.4)
- Wed 2/11: Barotropic potential vorticity (4.3, 4.5)
- Mon 2/16: *No class, President's Day Holiday*
- Wed 2/18: Baroclinic potential vorticity (4.3)
- Mon 2/23: Simple waves (4.3, 7.1-7.2)
- Wed 2/25: Propagating waves (7.3.2)
- Mon 3/02: Rossby waves (7.7)
- Wed 3/04: Quasi-geostrophic (QG) prediction (6.2-6.3)
- Mon 3/09: QG vertical motion, cyclogenesis (6.4, 8.1)
- Wed 3/11: Baroclinic instability (8.2)

Lecture notes: Contents, Intro, Forces, Gov Eq, Balanced Flow, Vorticity,

Homework assignments:

Approximately one assignment per week.

- HW-1 *(due 1/14)* (solution)
- HW-2 *(due 1/28)* (solution)
- HW-3 *(due 2/04)*
- HW-4 *(due 2/11)*
- HW-5 *(due 2/25)*
- HW-6 *(due 3/04)*
- HW-7 *(due 3/11)*

Course description

Date, time, location: Mondays and Wednesdays, 12:30-1:50pm, Spiess Hall 330.

Synopsis: The purpose of this course is to provide an introduction to the fundamental ideas of dynamic meteorology, in which the atmosphere is understood as a fluid dynamical system. This subject is unavoidably mathematical, and you will need to develop (or already have) familiarity with aspects of vector calculus and partial differential equations. We will keep the study informed by observations, but the emphasis will be on the theory of atmospheric motions.

Office Hours: Students are welcome to stop by my office anytime (knock if door is shut), but I recommend checking beforehand to make sure I am in. One ideal time is right after class. You can also make an appointment.

Grading: 50% homework, 50% take-home final exam.

Homework: This material is best learned by working through problems, and there will be weekly problem sets. Homework problem sets may be turned in one class later than they are due (grace period). Homework will be graded on a ✓+, ✓, ✓- basis, and each student's lowest homework grade will be dropped in the calculation of the final grade. Students are encouraged to work together on homework exercises as long as each student turns in only his or her own work. Please do not consult homeworks or solutions from previous years.

Exam: There will be a take-home final exam.

Textbook: *An Introduction to Dynamic Meteorology, Fourth Edition*, by J.R. Holton (2004) [here].

Other textbooks covering aspects of the material we cover that you may also find useful:
Mid-Latitude Atmospheric Dynamics by Jonathan Martin (2006) [here],
Global Physical Climatology by Dennis Hartmann (1994) [here],
An Introduction to Dynamic Meteorology, Fifth Edition, by J.R. Holton and G.J. Hakim (2012).