SIO 217B (Winter 2018)

Atmospheric and Climate Sciences II: Atmospheric Dynamics

Instructor: Ian Eisenman, (office) Nierenberg Hall 223, (email) eisenman@ucsd.edu, (phone) 858-534-0863.

Lectures and assignments *(evolving)*

Lecture schedule:

- Tue 1/09: Introduction (read textbook sections 1.1-1.2, 1.6.1), basic forces (1.4).
- Thu 1/11: Coriolis force (1.4, 1.6.1, 1.5)
- Tue 1/16: Material derivative, momentum equation (2.1-2.4, 1.3)
- Thu 1/18: Continuity equation, energy equation (2.5-2.6)
- Tue 1/23: Potential temperature, static stability (2.7)
- Thu 1/25: Isobaric coordinates, summary of governing equations (2.7, 1.6.2, 3.1)
- Tue 1/30: Balanced flow (3.2)
- Thu 2/01: Trajectories, thermal wind (3.3-3.4)
- Tue 2/06: Vertical motion, circulation (3.5, 4.1)
- Thu 2/08: Vorticity (4.2, 4.4)
- Tue 2/13: Barotropic potential vorticity (4.3, 4.5)
- Thu 2/15: Baroclinic potential vorticity (4.3)
- Tue 2/20: Simple waves (7.1-7.2)
- Thu 2/22: Propagating waves (7.3.2)
- Tue 2/27: Dispersive waves (7.2.2)
- Thu 3/01: Rossby waves (7.7)
- Tue 3/06: Quasi-geostrophic (QG) approximation (6.1-6.2)
- Thu 3/08: QG prediction (6.3)
- Tue 3/13: QG vertical motion (6.4)
- Thu 3/15: Cyclogenesis, baroclinic instability (8.1-8.2)
- Fri 3/16 - Sat 3/24: Take-home final exam (can be taken on any day during this period).

Lecture notes: (0) Contents, (0) Intro, (1) Forces, (2) Gov Eq, (3) Balanced Flow, (4) Vorticity, (5) Waves, (6) QGPV, (7) Review.

Homework assignments:

- HW-1 *(due 1/18)*
- HW-2 *(due 1/30)*
- HW-3 *(due 2/08)*
- HW-4 *(due 2/15)*
- HW-5 *(due 2/22)*
- HW-6 *(due 3/01)*
- HW-7 *(due 3/08)*
- HW-8 *(due 3/15)*

Course description

Date, time, location: Tuesdays and Thursdays, 11:00-12:20, 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 problem sets will be assigned approximately once per week. These homework assignments 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],
Atmosphere, Ocean and Climate Dynamics by John Marshall & Alan Plumb (2008) [here or here],
Introduction to Geophysical Fluid Dynamics by Benoit Cushman-Roisin and Jean-Marie Beckers (2011) [here],
Atmosphere-Ocean Dynamics by Adrian Gill (1982) [here],
An Introduction to Dynamic Meteorology, Fifth Edition, by J.R. Holton and G.J. Hakim (2012).