SIO 212A (Winter 2017)

Geophysical Fluid Dynamics I

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

Lectures and assignments *(evolving)*

Lecture schedule:

- Tue 1/10: Basic equations [relevant textbook sections: Vallis (V) chapter 1, Cushman-Roisin & Beckers (C) chapters 1 & 3]
- Thu 1/12: Rotation, geoid (V 2.1-2.3, C 2)
- Tue 1/17: Scaling, hydrostatic approximation (V 2.6-2.7, C 4.3)
- Thu 1/19: Shallow-water equations, inertial oscillations (V 3.1, C 2.3)
- Tue 1/24: Potential vorticity (V 3.6.1, C 7.4)
- Thu 1/26: Geostrophic adjustment (V 3.8, C 15.2)
- Tue 1/31: Boussinesq approximation (V 2.4, C 3.7)
- Thu 2/02: Stratification, thermal wind (V 2.8.4, C 15.1)
- Tue 2/07: Eddy viscosity, Ekman spirals (V 2.12, C 4.2 & 8)
- Thu 2/09: Ekman transport, Ekman pumping
- **Fri** 2/10 *(make-up class)*: Sverdrup balance (V 14.1, C 20.1-20.2)
- Tue 2/14: Western boundary currents (V 14.2 & 14.5.3, C 20.3)
- Thu 2/16: Western boundary currents continued
- Tue 2/21: *No class (instructor on travel)*
- Thu 2/23: *No class (instructor on travel)*
- Tue 2/28: Quasigeostrophic approximation (V 5.3, C 16)
- Thu 3/02: Quasigeostrophic potential vorticity equation
- **Fri** 3/03 *(make-up class)*: Rossby waves (V 5.7, C 9.4)
- Tue 3/07: Rossby waves continued
- Thu 3/09: Baroclinic instability (V 6.5 & 6.7-6.8, C 17.3-17.4)
- Tue 3/14: Baroclinic instability continued
- Thu 3/16: Review session

Homework assignments:

Course description

Date, time, location: Tuesdays and Thursdays, 10:30-11:50, Revelle Conference Room (IGPP 4301).

Synopsis: The course will provide an introduction to the dynamics of rotating stratified flows. Many of the equations apply to both the ocean and the atmosphere, although we will focus primarily on large-scale flows in the ocean. Prerequisits include graduate-level coursework in fluid dynamics or permission of the instructor.

Office Hours: I will informally hold office hours immediately after each class. Students are also welcome to stop by my office anytime (knock if door is shut), but I recommend checking beforehand to make sure I am in.

Grading: 50% homework, 50% final exam.

Homework: There will be periodic homework assignments. 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.

Textbooks: Recommended readings will be drawn from
Atmospheric and Oceanic Fluid Dynamics by Geoffrey Vallis (2006) [online e-reader],
Introduction to Geophysical Fluid Dynamics by Benoit Cushman-Roisin and Jean-Marie Beckers (2011) [chapter PDFs].

Other textbooks covering aspects of the material we cover that you may also find useful:
Intro to Physical Oceanography by Robert Stewart (2008) [here],
Atmosphere-Ocean Dynamics by Adrian Gill (1982) [here],
Ocean Circulation Theory by Joseph Pedlosky (1998),
Geophysical Fluid Dynamics by Joseph Pedlosky (1987),
Atmosphere, Ocean and Climate Dynamics by John Marshall & Alan Plumb (2008) [here].