270.653: Fluid Dynamics of the Earth and Planets II
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This course is a sequel to 270.425 Fluid Dynamics of the Earth and Planets I concentrating on aspects of planetary-scale atmospheric and oceanic circulation, plus rotating-stratified waves. We will emphasize physical understanding of the underlying fluid dynamics throughout.

Synopsis

1. Shallow-water dynamics. Inertia-gravity waves. Geostrophic adjustment. Two-layer system and normal modes. Energetics.

2. Potential vorticity and balance. Rossby wave propagation (horizontal). Primitive Equations. Rossby wave propagation (vertical)

3. *Large-scale Ocean Circulation:* Theory of the pycnocline and gyre circulation. Meridional overturning circulation and deep-western boundary currents. Buoyancy-driven circulations: Stommel-Arons Model, Sandstrom's theorem. Box models of meridional overturning circulation.

4. *Large-scale Atmosphere Circulation*: Baroclinic instability. Zonal-mean circulation, Eliassen-Palm theory and the transformed-Eulerian mean equations.

Assessment will be by homeworks (probably one on each section of the class) and a final oral exam.

We will meet twice each week for 80 minute classes. Schedule: Tuesdays & Thursdays, 1:30–3:00pm in Olin 145. Because of instructor travel, some classes may run until 3:30pm, or be rearranged.

Textbooks

- *Basic principles:*

  - Cushman-Roisin, B., and J.-M. Beckers, 2011: Introduction to Geophysical Fluid Dynamics, 2nd edition, Academic Press.
  - Marshall, J., and Plumb, R. A., 2008, Atmosphere, Ocean, and Climate Dynamics: An Introductory Text, Elsevier.

- *At the level of the class (although we won't cover all this material):* Vallis, G. K., 2006. Atmospheric and Oceanic Fluid Dynamics. Cambridge University Press, 745 pp.

- *Other useful texts:*

  - Klinger, B. A., and Haine, T. W. N., 2018, Ocean Circulation in Three Dimensions, Cambridge University Press. Draft available on Blackboard.
  - McWilliams, J. C., 2006, Fundamentals of Geophysical Fluid Dynamics, Cambridge University Press, 249 pp.
  - Pedlosky, J., 1996, Ocean Circulation Theory, Springer-Verlag.
  - Salmon, R., 1998, Lectures on Geophysical Fluid Dynamics, Oxford University Press.
  - Pedlosky, J., 1987, Geophysical Fluid Dynamics, Springer-Verlag.

Academic Integrity

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.

In addition, the specific ethics guidelines for this course are:

- Work collaboratively on homework problems, including sharing codes. But work on your own on write ups and clearly identify whom you worked with and how.

Report any violations you witness to the instructor. Please see the website https:// studentaffairs.jhu.edu/student-life/student-conduct/resources-conduct-ethics/ for more information.

Disability Services

Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu

Anxiety, Stress, and Mental Health

If you are struggling with anxiety, stress, depression or other mental health related concerns, please consider visiting the JHU Counseling Center. If you are concerned about a friend, please encourage that person to seek out their services. The Counseling Center is located at 3003 North Charles Street in Suite S-200 and can be reached at 410-516-8278 and online at http://studentaffairs.jhu.edu/counselingcenter/