

270.653: Fluid Dynamics of the Earth and Planets II Spring Term 2011.

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This course is a sequel to 270.425 concentrating on planetary-scale atmospheric and oceanic circulation. 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*: 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 Ocean Circulation*: Baroclinic instability. Zonal-mean circulation, Eliassen-Palm theory and the transformed-Eulerian mean equations.

Assessment will be by homeworks and an oral exam.

We will meet twice each week for 80 minute classes. Schedule: Tuesdays & Fridays, 1:00–2:30pm.

Textbooks

- *Basic principles*: Cushman-Roisin, B., 1994: Introduction to Geophysical Fluid Dynamics, Prentice Hall.
- *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.