ESS200B: (Oceans and) atmospheres

Course goal: To introduce fundamental concepts common to planetary atmospheres.
Location: Geology 4677
Time: T/R 10:30 – 11:50

Course outline:

I. Intro to atmospheres
   A. The compositions and origins of the atmosphere
   B. Atmospheric escape and evolution
   C. (Photochemistry and the fate of volatiles)
II. Global energy balance and radiation
   A. Albedo and global energy balance
   B. Simple models of radiative transfer
   C. The greenhouse and antigreenhouse effects
   D. Runaway greenhouse and snowball Earth
   E. (Scattering)
III. Vertical structure and thermodynamics of planetary atmospheres
   A. Hydrostatic balance
   B. Dry and moist adiabats
   C. (Atmospheres as heat engines)
IV. Atmospheric dynamics
   A. Convection
   B. Fundamental forces
   C. The primitive equations
   D. Scale analysis; geostrophic flow; thermal wind
   E. General circulation
   F. Waves and eddies
V. Land-sea-atmosphere interactions
   A. Boundary layer energy and momentum fluxes
   B. Wind-driven ocean currents
   C. Precipitation
VI. Planetary atmospheres and climate

Labs and demonstrations:
A variety of fluid dynamics labs/demonstrations will accompany the above topics. Most of these will be done in the classroom, but a few will require us to go to Prof. Aurnou's lab. I expect to use scheduled class time for labs/demonstrations.

Primary resource:
Atmosphere, Ocean, and Climate Dynamics, Marshall & Plumb, Academic Press, 2008
Other resources:
An Intro. to Dynamic Meteorology, Holton, Elsevier Academic Press, 2004
Principles of Planetary Climate, Pierrehumbert, Cambridge Press, 2010
Atmospheric Science, Wallace & Hobbs, Academic Press, 2006
Atmospheric and Oceanic Fluid Dynamics, Vallis, Cambridge Press, 2006