

AOSC 611: DYNAMICS OF OCEAN AND ATMOSPHERE - II

James Carton and I (co-instructors) welcome you to AOSC 611 which builds upon concepts learned in AOSC 610. Unlike the previous course, this one is a bit more quantitative and fluid dynamical in character. To facilitate learning, Jim and I plan to use a nice book that was published in late 2006 as text for the course.

Course Philosophy: One advantage of having a text book is that you can anticipate what the next lecture will cover. As we intend to follow the book closely, please spend the necessary time at home deriving equations in advance of the lecture. That will make the lectures more meaningful as they target dynamical concepts and interesting manipulations. Of course, some derivations will be done in class but given this is the second course in the dynamics sequence, class time will not be used for "hand-holding" in derivations. Please develop a comfort level with the manipulation of differential equations by staying abreast of the material from day-1. The course is challenging and seeks to develop advanced understanding of dynamical concepts and analytical competence in quantitative expression and manipulation. Course grades will recognize the development of these skills.

Evaluation: We will have one mid-term (30%) and a final (45%); the remaining 25% will be for home assignments that will be given after each chapter. If you want to excel, please attempt the unassigned problems in the book as well.

Book information

- Title: Atmospheric and Oceanic Fluid Dynamics By Geoffrey Vallis
- Publisher: Cambridge University Press
- ISBN-10: 0521849691; ISBN-13: 978-0521849692
- Available at Amazon for \$67.10 + shipping; may be available locally as well

Class room and meeting times: M,W,F 11-11:50am in Room 2416 in the CSS Bldg.

Course content

- Chapter 3: Shallow Water Systems
 - Dynamics of single shallow layer
 - Reduced gravity equations
 - Multi-layer shallow water equations
 - Geostrophic balance and thermal wind
 - Form drag
 - Conservation properties of shallow water systems
 - Shallow water waves
 - Geostrophic adjustment
 - Available potential energy

- Chapter 5: Simplified equations for Ocean and Atmosphere
 - Geostrophic scaling
 - The planetary geostrophic equations
 - The shallow water quasi-geostrophic equations
 - The continuously stratified quasi-geostrophic system
 - Quasi-geostrophy and Ertel potential vorticity
 - Energetics of quasi-geostrophy
 - Rossby waves
 - Rossby waves in stratified geostrophic flow
 - Wave kinematics, group velocity and phase speed

- Chapter 6: Barotropic and Baroclinic Instability
 - Kelvin-Helmholtz instability
 - Instability of parallel shear flow
 - Necessary conditions for instability
 - Baroclinic instability
 - The Eady problem
 - Two-layer baroclinic instability
 - An informal view of the mechanism of baroclinic instability
 - The energetics of linear baroclinic instability
 - Beta, shear and stratification in a continuous model

- Equatorial Waves from Holton's book (section 11.4)

We promise an exciting semester of teaching and learning. With a positive attitude we all can accomplish a lot, notwithstanding a few hiccups that will surely be in our path.

Sumant and Jim