SIO 212B: Geophysical Fluid Dynamics B – Spring 2020

Instructor

My name is Paola Cessi, and my office is in Room 366 in the OAR building (a.k.a. the Keck Building). My e-mail addresses is pcessi@ucsd.edu. I will not enter into extended electronic correspondence but for quick questions this is the best way to communicate. Please make an appointment by email for office discussions on zoom.

Class schedule

The schedule is Tu-Th from 11 to 12:20pm in zoom with meeting id 251-441-067 with a recitation on Wed 2pm - 3:20pm on zoom, with meeting id 550-346-973.

Assignments and assessment

The course is offered for **letter grade** only. If you have signed for S/U, please change to letter grade.

I will assign problems regularly on Tuesday, due the following Tuesday, and then discuss them in the recitation session on the Wednesday after the due date. As I have less than one day to grade them, I will not accept late homework. It would be best to hand them in Latex, so they are easy to read. To facilitate Latex assignments, I will upload the Latex file, as well as the pdf of the assignments, so you do not have to retype the equations that are already there. If this is too onerous *and* you have a very legible handwriting, you may send me a scanned copy of your hand-written assignement *in a single PDF*. A free smartphone app that allows to make a multipage PDF document is https://thegrizzlylabs.com/genius-scan.

In the recitation session it would be best if a student could volunteer to lead the discussion on the assignment. You can use your smartphone as a document video camera using, for example, Visualizer https://www.ipevo.com/software/visualizer as the driver (their phone app) and controller (their computer software), and share your screen, so that everybody can see your handwriting on a notepad. There are other softwares as well (i.e. EpocCam). Alternatively, if you have a tablet with a stylus, you can try that. We'll see how that works.

The grade in this course is based on an in-zoom mid-term test on 4/30/2020 (30%), in-zoom end of term test on 6/4/2020 (30%) and homeworks (40%) The in-zoom tests will be 80 minutes each, "closed books and closed notes", with problems *very* similar to those on the assignments. You may bring one sheet of paper to help your memory (written on both sides, if you wish). You are welcome to collaborate on assignements, as long as you socially-distance, but not on the in-zoom tests.

Recommended texts

I will follow different books for different topics. Here is the list I use:

Vallis, G.K. Atmospheric and oceanic fluid dynamics, Cambridge University Press, 2017.

Gill, Adrian E. Atmosphere-ocean dynamics. New York : Academic Press, 1982.

Pedlosky, Joseph. Geophysical fluid dynamics. 2nd ed. New York : Springer-Verlag, c1987.

Pedlosky, Joseph. Ocean circulation theory. Berlin ; New York : Springer, c1996.

Syllabus for SIO 212B

Homogeneous circulation theory and Sverdrup balance: The linear theories of Stommel and Munk and the nonlinear Fofonoff flow; Numerical solutions of the problem; The effects of topography. (Vallis 2017 Ch. 19)

The vertical structure of the wind-driven circulation: Two-layer QG, continuously stratified equations and QG models of planetary scale flows; eddy fluxes; PV homogenization. The ventilated thermocline. (Vallis 2017 Ch. 20, Pedlosky GFD, chapters 6.21-6.23, Pedlosky OCT Chapters 3 and 4).

Baroclinic instability (Vallis 2017 Ch. 9.5 and 9.7) The concept of residual circulation and transformed Eulerian mean (Vallis 2017 Ch. 10 + notes and papers).

The meridional overturning circulation: simple models with multiple equilibria (Vallis 2017 ch. 21).

The general circulation of the tropical atmosphere: symmetric models of the Hadley circulation. (Vallis 2017 Ch. 14 + in-class notes)

The Walker circulation: Gill's and Matsuno's models (Gill Chapter 11.14 and Vallis 2017 ch. 8.5 and 22.6)

Two-dimensional and geostrophic turbulence. (Vallis 2017 ch. 12)

The general circulation of the mid-latitude atmosphere: the maintenance of the midlatitude jet (Vallis 2017 ch. 15.1)

Simple models of El Nino - Southern Oscillation (Vallis 2017 ch. 22.7-22.9)