



**Tuesdays 9:30-11:20, Warren Weaver Hall 512**

### **Instructor**

Edwin Gerber

gerber[at]cims[dot]nyu[dot]edu (e-mail is the best way to reach me)

WWH 910, Office hours by appointment

212.998.3269

### **Course Description**

What effects the large scale circulation of the atmosphere? The goals of this course are to illustrate the processes that govern atmospheric fluid flow, from the Hadley cells of the tropical troposphere to the polar night jet of the extratropical stratosphere, and to prepare you for research in the climate sciences. Much of our work will be to explain the zonal mean circulation of the atmosphere, but in order to accomplish this we'll need to learn a great deal about eddies and waves, deviations from the zonal mean. It turns out that eddies, planetary, synoptic (weather system size) and smaller in scale, are the primary drivers of the zonal mean circulation throughout much, if not all, of the atmosphere!

### **Class Expectations**

I expect that students will have taken a course on Geophysical Fluid Dynamics, or the equivalent, and so are already familiar with the equations of fluid flow appropriate for the Earth's atmosphere. If you haven't taken a course on this subject, you will likely need to do some work on your own to prepare for lectures. If you are concerned, please contact me individually and we can discuss your background.

In terms of the course itself, I look forward to seeing you in all the lectures! If you can't make it, please e-mail me in advance if at all possible. Do the homework; it will solidify the lectures. Work together; you'll learn more as a group. Ask questions, both of me and your fellow classmates!

Your grade will be based on a final project. You'll be expected to write your results up, as if for a journal article, and to present them in a short, conference style talk. While solid results are certainly the most important requisite for a successful research career, as with most things in life, the packaging matters, so it's important to learn good communication and presentation skills!

### **Required Textbook**

Geoffrey K. Vallis, 2006, *Atmospheric and Oceanic Fluid Dynamics: Fundamentals and Large-Scale Circulation*, Cambridge University Press, 745 pp.

### **Additional Resources (for background and context)**

Edward Lorenz, 1967, *The Nature and Theory of the General Circulation of the Atmosphere*, World Meteorological Organization, 161 pp. (find it on course page)

Gabrielle Walker, 2007, *An Ocean of Air*, Houghton Mifflin Harcourt, 288 pp.

Spencer Weart, *The Discovery of Global Warming*, Harvard University Press, 230 pp.

Other materials and links will be posted on the course website.

### **Course Plans**

In terms of information, our goal is to cover Part III of the Vallis text, looking back to earlier sections for valuable tools that we'll need. A second goal is to learn how to use models as a tool in research. The goal will be to blend numerical experiments with pencil and paper work! Topics that we'll cover include:

The Equations for the Atmospheric Circulation

The Hadley Circulation

The Extratropical Jets

Eddy-Mean Flow interactions

The Stratospheric Circulation

### **Final Project**

The goal is to design and conduct an experiment with an Atmospheric General Circulation Model to further explore material we've covered in the course, or illustrate another topic of the atmospheric circulation. You'll write up your methodology and results in a short journal style article, and present them in class in a short conference style talk. We will use the model as part of the course, so you'll have time to get familiar with it's use before the time comes to select a project.