

# Syllabus for ATOC 5061: Dynamics of Oceans

## 1 Contacts

The professor for this class is: Baylor Fox-Kemper

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Office: Ekeley room S250B, 303-492-0532

## 2 Goals

In this class you will:

- Learn about many of the physical processes that occur in the ocean.
- Learn about some of the simple models used to understand these processes.
- Learn about some of the dominant balances that occur in and describe these processes.
- Learn tools for studying some of these processes numerically and analytically.
- Discuss how these approaches might apply to more realistic models and observations.

## 3 Meetings and Places

We will meet Mondays, Wednesdays, and Fridays from 12:00-1:00 in Ekeley W240 (CSES Computer Lab). Office hours will be by appointment at my office (Ekeley S250B). You can check my availability here: <http://fox-kemper.com/contact>. I have a group meeting with my students that you can attend if you like, and I encourage you to attend the oceanography seminars on Monday 4-5 (Duane E126).

The student computer lab upstairs in the stadium and Ekeley W240 will soon have the software we'll be using (matlab and other stuff from my webpage) loaded. I can get access to W240 for you after hours if you like. The W240 room is right around the corner from my office, so you can find me if there are problems. All RAs are entitled to a free matlab license for their work machines—I can help with that, too.

## 4 Website

The primary class site is <http://fox-kemper.com/5061>. The class webpage is where all of your assignments will be announced, links to reading, notes, and models will be posted, etc.

## 5 Textbooks and Software

The official textbook for the class is, *Atmospheric and Oceanic Fluid Dynamics*, by G. K. Vallis. We will be focusing on Chapters 5-10 of this book. There will also be chapters in other books and research papers linked through the webpage, and those may be password-protected. The username is `atoc5061_10` and the password is `modelshun`. All of the required readings will be posted on the website, and links will be made to articles and chapters not from Vallis. Hard copies of many of these books are available from the library. Also, my notes will be posted there.

## 6 Assignments and Exams

I plan for biweekly assignments for this class. The concept is that we will discuss a topic or method in lecture, fiddle around with the models if relevant in class, and then you will follow up at home by doing reading and some calculations with the model. There will be no midterm or final exam this semester. All homeworks will count equally toward your grade. Auditors are encouraged to do the assignments as well.

## 6.1 Why turbulence?

Traditionally, ocean dynamics is taught as a lecture course where rotating, stratified Navier-Stokes is analyzed over and over under different dominant balances. Much of the class takes place in the quasi-geostrophic framework or the planetary geostrophic framework, and often the example problems are either too trivial (e.g., plane Rossby waves) or too hard (e.g., the Charney instability) to get much of a handle on the underlying physical concepts on the first pass.

Turbulence is the primary challenge of all fluid mechanics, and it is of crucial importance to the atmosphere, ocean, and their modeling. We'll be discussing both the traditional 3d turbulence, and the rotating, stratified turbulence of the larger scales in the atmosphere and ocean.

## 6.2 Help Me Out with the Notes and Models

I appreciate any comments—positive, negative, critical, suggesting new sections or suggesting removal of sections. Even just comments like ‘I have no idea what you mean by this word/sentence/paragraph/chapter’ are great. It is all useful to me and will improve the class and notes. Similarly, when we use the matlab models, clarifying which ones are easy or hard to understand is very useful in improving the codes.

As we go along, I will be posting the notes and models as soon as I have a working draft available. I'll keep changing them, fixing bugs and typos, and adding pieces as the class progresses. So, If you want to keep a set, I would encourage you not to print them out as soon as they appear, but wait a while after we talk about each section in class.

## 7 Policies

I encourage you to work together on the homeworks, and I do not mind at all if you share figures or matlab scripts. However, you are all required to submit a version of each assignment as first author (that is, one that you wrote yourself).

A few other items.

- Assignment deadlines are firm, extension requests need to be made before the deadline, not after.
- Attendance is expected. If you will miss a class, please let me know when and why so I can be sure you'll get any announcements, etc. I have experimented in the past with video-conferencing with some success for predictable absences.
- Clothing and behavior (e.g., cell phone use) should be appropriate for a learning environment.
- Discrimination and harassment will not be tolerated.
- Please contact me if you have any disabilities that require accommodation.

And the CU boilerplate version, which I support:

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and [www.Colorado.EDU/disabilityservices](http://www.Colorado.EDU/disabilityservices)

Disability Services' letters for students with disabilities indicate legally mandated reasonable accommodations. The syllabus statements and answers to Frequently Asked Questions can be found at [www.colorado.edu/disabilityservices](http://www.colorado.edu/disabilityservices)

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Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at <http://www.colorado.edu/policies/classbehavior.html> and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student\\_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code)

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All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council ([honor@colorado.edu](mailto:honor@colorado.edu); 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode/>