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MARN5061
Advanced Dynamical Oceanography
Department of Marine Sciences
University of Connecticut

Fall 2022 Syllabus
v0.1, August 25, 2022

Excluding materials for purchase, this syllabus may change in the course of the semester. The most up-to-date version will be available on HuskyCT.

Course information and intructor

Course title: Advanced Dynamical Oceanography
Credits: 3
Modality: Hybrid/synchronous (in-person/Webex)
Prerequisites: None
Course times and location: Tuesdays and Thursdays, 9:30-10:45 am at MAR123, with a Webex link for students to join remotely.

Instructor: Cesar B Rocha, Assistant Professor of Marine Sciences. My pronouns are he/him/his, and I prefer that you call me by my first name (pronounced CEH-zar, unlike the salad; the *e* in the first syllable is vocalized as the *e* in *bet* and *met*). My office is Room 188 in the Lowell P. Weicker Jr. building (aka Marine Sciences building), and my email is cesar.rocha@uconn.edu.

Office hours: TBD.

COVID guidelines: Please read the complete campus COVID guidelines.

Course description

Building on basic fluid dynamics concepts, and inspired by some observational facts, this course will introduce students to a hierarchy of large-scale and mesoscale ocean models, with an emphasis on building an understanding of the fundamental dynamics of ocean circulation.

Course materials

Course Web site: I will keep the most up-to-date class schedule, including the assignment and suggested reading for each week, on the course's Github repository (https://github.com/cesar-rocha/MARN-5061).

Textbook: I strongly recommend these two books by Geoff Vallis:

- Essentials of Atmospheric and Oceanic Fluid Dynamics, Cambridge University Press.
- Atmospheric and Oceanic Fluid Dynamics, Cambridge University Press.

Essentials is an excellent text for most of the material we will cover, and I will try to follow it as much as I can. But some topics are described in more detail in AOFD.

Course structure and schedule

The course is organized in three parts:

I A review of basic geophysical fluid dynamics (Navier-Stokes equations in a rotating frame, hydrostatic balance, geostrophic balance, Ekman dynamics).

II The theory of large-scale ocean circulation (planetary geostrophy, wind-driven gyres, abyssal circulation, and meridional overturning circulation).

III The theory of mesoscale ocean circulation (quasi-geostrophy, planetary waves, barotropic and baroclinic instability, ocean eddies and isopycnal mixing).

Below is a weekly program. The most up-to-date program is available on the course's Github page.

Week 1
Introduction to the class and fundamentals of fluid dynamics .

Week 2
Equations of motion on a rotating planet and tangent-plane approximations.

Week 3
Introduction to scaling and scale analysis; geostrophic motion.
First homework assignment.

Week 4
Ekman dynamics, surface and bottom Ekman layers, Ekman pumping.

Week 5
Introduction to ocean gyres, planetary geostrophy and Sverdrup balance.
Second homework assignment.

Week 6
More on ocean gyres, Stommel and Munk models.

Week 7
The thermocline and the meridional overturning circulation (MOC).

Week 8
The Antartic Circumpolar Current.

Week 9
The quasi-geostrophic model, linearization and Rossby waves.
Homework assignment 3.

Week 10
Catch-up week. TBD.

Week 11
Barotropic and baroclinic instabilities.

Week 12
Ocean eddies and geostrophic turbulence.

Week 13
No classes (Happy Thanksgiving!)

Week 14
Quiet week. Students will work on finalizing their projects; I will be available in the classroom for help.

Week 15
Student presentations.

Course requirements and grading policy

Assessment

Score rage	Letter grade
≥93.0	A
90.0–92.9	A-
87.0–89.9	B_+
83.0–86.9	B
80.0–82.9	B-
77.0–79.9	C_+
73.0–76.9	C
70.0–72.9	C-
67.0–66.9	D_+
63.0–66.9	D
60.0–62.9	D-
<60	F

Students are required to *actively participate in the class* (10%), complete *homework assignments* (40%), and complete and present a *final project* (50%). The table on the right shows the grading scale for the course.

Participation involves asking questions and interacting with the instructor and students in the class discussion. Assignments will be standard problems sets. The final project should be done in pairs or groups of 3 and involves a presentation about an ocean dynamics topic that interests you and was not covered in class (e.g., the dynamics of El Nino/Southern Oscillation). The instructor will work with the students on identifying a topic and provide instructions on how to prepare a good presentation. The instructor will be available to provide feedback on the final project development along the semester.

Due dates and late policy

All due dates will be identified on the course Web site. Deadlines are 11:59 pm Eastern Standard Time. I may change dates as the semester progresses. All changes will be communicated at least one week prior to the new due date.

If you have a good reason (caregiving, illness, hardships), please do not hesitate to ask for an extension *prior to the deadline*. No late assignments will be accepted unless previously discussed with me. Students with learning disabilities are eligible for extended due dates and other accommodations through the Center for Students with Disabilities (see Students With Disabilities below).

Feedback

I will strive to provide feedback on your assignments within a week of the due date. I also commit to sharing mid-semester partial grades to help you plan for the second half of the term.

Resources for Students Experiencing Distress

The University of Connecticut is committed to supporting students in their mental health, their psychological and social well-being, and their connection to their academic experience and overall wellness. The University believes that academic, personal, and professional development can flourish only when each member of our community is assured equitable access to mental health services. The University aims to make access to mental health attainable while fostering a community reflecting equity and diversity and understands that good mental health may lead to personal and professional growth, greater self-awareness, increased social engagement, enhanced academic success, and campus and community involvement.

Students who feel they may benefit from speaking with a mental health professional can find support and resources through the **Student Health and Wellness-Mental Health** (SHaW-MH) office. Through SHaW-MH, students can make an appointment with a mental health professional and engage in confidential conversations or seek recommendations or referrals for any mental health or psychological concern.

Mental health services are included as part of the university's student health insurance plan and also partially funded through university fees. If you do not have UConn's student health insurance plan, most major insurance plans are also accepted. Students can visit the **Student Health and Wellness-Mental Health located in Storrs on the main campus in the Arjona Building, 4th Floor,** or contact the office at **(860) 486-4705, or https://studenthealth.uconn.edu/** for services or questions**.**

Accommodations for Illness or Extended Absences

Please stay home if you are feeling ill and please go home if you are in class and start to feel ill. If illness prevents you from attending class, it is your responsibility to notify me as soon as possible. You do not need to disclose the nature of your illness, however, you will need to work with me to determine how you will complete coursework during your absence.

If life circumstances are affecting your ability to focus on courses and your UConn experience, students can email the Dean of Students at dos@uconn.edu to request support. Regional campus students should email the Student Services staff at their home campus to request support and faculty notification.

COVID-19 Specific Information: People with COVID-19 have had a wide range of symptoms reported – ranging from mild symptoms to severe illness. These symptoms may appear 2-14 days after exposure to the virus and can include:

- Fever
- Cough
- Shortness of breath or difficulty breathing
- Chills
- Repeated shaking with chills
- Muscle pain
- Headache
- Sore throat
- New loss of taste or smell

Additional information including what to do if you test positive or you are informed through contract tracing that you were in contact with someone who tested positive, and answers to other important questions can be found here: https://studenthealth.uconn.edu/updates-events/coronavirus/

Mask and Social Distancing Expectations

Refer to UConn Campus Guidelines for ongoing updates.

Please be respectful of the wishes of those who prefer to maintain social distancing. For their own protection, unvaccinated individuals are requested to maintain 6 feet social distancing from others.

Classroom/Virtual Classroom Guidelines

Recording Lectures

Classes for this semester's course may be conducted virtually. As the host, I may record these sessions. The recording feature for others in attendance will be disabled so that no one else will be able to record a session. In order to protect student privacy and intellectual property rights, students are prohibited from recording any session, or any portion of a session, by other means. At my discretion and in accordance with University policies and guidelines, I may share one or more of the recorded sessions with the class to provide students with an additional opportunity to review course content. The sharing of any recorded content without my written permission is prohibited. If you would like to ensure your likeness is not captured during an online class, please turn your camera off. For recordings conducted in person, please alert me to any concerns so that I may take steps to help ensure you are not recorded.

Please remember that the unauthorized recording or sharing of course content may be considered a violation of the law, University policy, and/or The Student Code.

The web-based video delivery of each class in this course is for sole use of the students enrolled in this course. Any other use of these class videos or any pictures or derivatives of the class videos without the written consent of the course's professor is prohibited.

The videos created by students as part of this course are for sole use of the students enrolled in this course. Any other use of these videos or any pictures or derivatives of the videos without the written consent of the video creator is prohibited.

Statement of Copyright: My lectures, notes, handouts, and displays are protected by state common law and federal copyright law. They are my own original expression and I've recorded them prior or during my lecture in order to ensure that I obtain copyright protection. Students are authorized to take notes in my class; however, this authorization extends only to making one set of notes for your own personal use and no other use. I will inform you as to whether you are authorized to record my lectures at the beginning of each semester. If you are so authorized to record my lectures, you may not copy this recording or any other material, provide copies of either to anyone else, or make a commercial use of them without prior permission from me."

Students with Disabilities

The University of Connecticut is committed to protecting the rights of individuals with disabilities and assuring that the learning environment is accessible. Students who require accommodations should contact the Center for Students with Disabilities, Wilbur Cross Building Room 204, (860) 486-2020 or http://csd.uconn.edu/.

Software/Technical Requirements (with Accessibility and Privacy Information)

The software/technical requirements for this course include:

- Equipment Recommendations (https://remotework.uconn.edu/equipment-recommendations/)
- HuskyCT/Blackboard (HuskyCT/ Blackboard Privacy Policy)
- Adobe Acrobat Reader (Adobe Reader Accessibility Statement, Adobe Reader Privacy Policy)

- Google Apps (Google Apps Accessibility, Google for Education Privacy Policy)
- Microsoft Office (free to UConn students through UConn Software Catalog) (Microsoft Accessibility Statement, Microsoft Privacy Statement)
- Dedicated access to high-speed internet with a minimum speed of 1.5 Mbps (4 Mbps or higher is recommended).
- WebCam

NOTE: This course has NOT been designed for use with mobile devices.

Privacy Statement: For information on managing your privacy at the University of Connecticut, visit the University's Privacy page.

Help

Technical and Academic Help provides a guide to technical and academic assistance.

This course uses the learning management platform, HuskyCT. If you have difficulty accessing HuskyCT, you have access to the in person/live person support options available during regular business hours through the Help Center. You also have 24x7 Course Support including access to live chat, phone, and support documents.

Student Technology Training

Student technology training is now available in a new HuskyCT short course created by students for students. It will prepare you to use the IT systems and services that you will use throughout your time at UConn, whether learning online or on-campus. It is available at https://lms.uconn.edu/ultra/courses/_80016_1/cl/outline .

Minimum Technical Skills

To be successful in this course, you will need the following technical skills: Use electronic mail with attachments.

- Save files in commonly used word processing program formats.
- Copy and paste text, graphics or hyperlinks.
- Work within two or more browser windows simultaneously.
- Open and access PDF files.

Evaluation of Course Experience

Students will be given an opportunity to provide feedback on their course experience and instruction using the University's standard procedures, which are administered by the Office of Institutional Research and Effectiveness (OIRE).

The University of Connecticut is dedicated to supporting and enhancing teaching effectiveness and student learning using a variety of methods. The Student Evaluation of Teaching (SET) is just one tool used to help faculty enhance their teaching. The SET is used for both formative (self-improvement) and summative (evaluation) purposes.

Additional informal formative surveys and other feedback instruments may be administered within the