

MAST-455/655 Geophysical Fluid Dynamics (Spring 2024)

Instructor: Andreas Münchow (muenchow@udel.edu), Robinson 112A

Web-Site: <https://muenchow.cms.udel.edu/classes/gfd>

Time: Monday, Wednesday, Friday 1:50-2:45

Location: 202 Robinson Hall

Goal: Students shall appreciate the physical foundations of atmospheric and oceanic fluid motions on a rotating sphere from a common theoretical perspective with some reference to observations.

Synopsis: Development of the fundamental fluid dynamics used in analyzing flows in physical oceanography and meteorology. Fundamentals of vorticity dynamics and geostrophy, inviscid theory of Rossby waves, and Ekman boundary layers.

Scaling laws, non-dimensional parameters, and asymptotic expansions are all used to gain physical understanding from solutions to the Navier-Stokes equations in a rotating frame of reference. Immediate applications are the dynamics of weather, climate, oceans, and large lakes, however, engineering applications may relate to rapidly rotating systems with many degrees of freedom.

Pre-requisites: Calculus

Grades: 40% homework problems, 20% mid-term exam, 40% Term Paper & Presentation

Primary Text:

1_Cushman-Roisin, B. and J.-M. Beckers, 2011: Introduction to Geophysical Fluid Dynamics, Academic Press, Watham, MA, 828 pp.

Reference Texts:

2_Gill, A.E., 1982: Atmosphere-Ocean Dynamics, Academic Press Inc., Orlando, FL, 662pp.

3_Pedlosky, J., 1987: Geophysical Fluid Dynamics, 2nd Ed., Springer Press, New York, NY, 710pp.

Use of Advanced Automated Tools:

You are encouraged to use external resources and tools such as calculators, internet, ChatGPT, etc. Avoiding plagiarism, you must always indicate, quote, and reference your sources, even if you decide to use them in modified form. This applies to Artificial Intelligence tools and ChatBots such ChatGPT, Dall*e, etc. as it does to web-pages, academic literature, textbooks, and any other publications.

Academic Integrity:

Please familiarize yourself with UD policies regarding academic dishonesty. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, to re-submit the same assignment for different classes, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance. Complete details of the university's academic integrity policies and procedures can be found at <http://www1.udel.edu/studentconduct/policyref.html> Office of Student Conduct, 218 Hullihen Hall, (302) 831-2117. E-mail: student-conduct@udel.edu

Harassment and Discrimination:

The University of Delaware works to promote an academic and work environment that is free from all forms of discrimination, including harassment. As a member of the community, your rights, resource and responsibilities are reflected in the non-discrimination and sexual misconduct policies. Please familiarize yourself with these policies at <http://www.udel.edu/oei> . You can report any concerns to the University's Office of Equity & Inclusion, at 305 Hullihen Hall, (302) 831-8063 or you can report anonymously through UD Police (302) 831-2222 or the EthicsPoint Compliance Hotline at <http://www1.udel.edu/compliance>. You can also report any violation of UD policy on harassment, discrimination, or abuse of any person at this site: <http://sites.udel.edu/sexualmisconduct/how-to-report/>

Faculty Statement on Disclosures of Instances of Sexual Misconduct:

If, at any time during this course, I happen to be made aware that a student may have been the victim of sexual misconduct (including sexual harassment, sexual violence, domestic/dating violence, or stalking), I am obligated to inform the university's Title IX Coordinator. The university needs to know information about such incidents in order to offer resources to victims and to ensure a safe campus environment for everyone. The Title IX Coordinator will decide if the incident should be examined further. If such a situation is disclosed to me in class, in a paper assignment, or in office hours, I promise to protect your privacy--I will not disclose the incident to anyone but the Title IX Coordinator. For more information on Sexual Misconduct policies, where to get help, and how to reporting information, please refer to www.udel.edu/sexualmisconduct. At UD, we provide 24-hour crisis assistance and victim advocacy and counseling. Contact 302-831-1001, UD Helpline 24/7/365, to get in touch with a sexual offense support advocate.

For information on various places you can turn for help, more information on Sexual Misconduct policies, where to get help, and reporting information please refer to <http://www.udel.edu/sexualmisconduct>

Inclusion of Diverse Learning Needs:

Any student who thinks he/she may need an accommodation based on a disability should contact the Office of Disability Support Services (DSS) office as soon as possible. The DSS office is located at 240 Academy Street, Alison Hall Suite 130, Phone: 302-831-4643, fax: 302-831-3261, DSS Website (<http://www.udel.edu/DSS/>). You may contact DSS at dssoffice@udel.edu

Non-Discrimination:

The University of Delaware does not discriminate against any person on the basis of race, color, national origin, sex, gender identity or expression, sexual orientation, genetic information, marital status, disability, religion, age, veteran status or any other characteristic protected by applicable law in its employment, educational programs and activities, admissions policies, and scholarship and loan programs as required by Title IX of the Educational Amendments of 1972, the Americans with Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, Title VII of the Civil Rights Act of 1964, and other applicable statutes and University policies. The University of Delaware also prohibits unlawful harassment including sexual harassment and sexual violence.

For inquiries or complaints related to non-discrimination policies, please contact:
Director, Institutional Equity & Title IX Coordinator- Susan L. Groff, Ed.D. groff@udel.edu,
305 HULLIHEN HALL NEWARK, DE 19716 (302) 831-8063

For complaints related to Section 504 of the Rehabilitation Act of 1973 and/or the Americans with Disabilities Act, please contact: Director, Office of Disability Support Services, Anne L. Jannarone, M.Ed., Ed.S. - ajannaro@udel.edu
Alison Hall, Suite 130, Newark, DE 19716 (302) 831-4643 OR contact the U.S. Department of Education - Office for Civil Rights
(<https://wdcrocolp01.ed.gov/CFAPPS/OCR/contactus.cfm>)

Student Mental Health & Wellbeing

In addition to impacting your overall well being, diminished mental health can interfere with optimal academic performance. If this course is causing or contributing significant mental or emotional stress, then please reach out to me directly. However, problems with other parts of your life can also contribute to decreased academic performance. UD's Center for Counseling & Student Development (CCSD) provides cost-free and confidential mental health services to help you manage personal challenges that threaten your emotional or academic well-being. Remember, getting help is a smart and courageous thing to do -- for yourself and for those who care about you.

- Contact me
 - If you are struggling with this class, please check-in during office hours or contact me by email at muenchow@udel.edu
- Check-in with your academic advisor
 - If you are struggling in multiple classes, unsure whether you are making the most of your time at UD, or unsure what academic resources are available at UD.
- UD's Center for Counseling & Student Development and UD Helpline
 - CCSD is open and available remotely, and 24/7 mental health support remains available on the UD Helpline at 302-831-1001 for any student in need of someone to talk to. Visit [CCSD's website](#) for additional information and resources.
- UD's Crisis Text Line
 - Text "UDTEXT" or "STEVE" at 741741 for students of color to connect with confidential text message support.
- Division of Student Life

- Explore the Student Life's [Wellbeing webpage](#) for a comprehensive listing of well-being resources, activities and services available to all students.