SIOC 217B (Winter 2025)

Atmospheric and Climate Sciences II: Atmospheric Dynamics

Instructor: Joel Norris MESOM 327 858-344-7005 (cell) *jnorris@ucsd.edu*

Meeting Time and Location: Eckart 236 on Tues/Thurs from 11:00 a.m. to 12:20 p.m.

Office Hours: By appointment or as scheduled

Grading Criteria: 60% final exam, 40% quizzes

Textbook: An Introduction to Dynamic Meteorology, 4th Edition by J. R. Holton
UCSD only: http://www.sciencedirect.com/science/bookseries/00746142/88

Web Tutorials: *MetEd*: https://www.meted.ucar.edu/
This website provides useful online tutorials on a variety of topics. A quick registration is required. It is not necessary to take the pre-assessments or quizzes or share results with the instructor.

Homework Exercises: Homework is optional and ungraded, but understanding it may be useful preparation for quizzes.

Reading Expectations: Students are expected to read the assigned textbook sections and web tutorials ahead of class. Complete understanding is not expected, but students should be prepared to ask questions in class to clarify any material that is unclear.

Collaboration: Students are encouraged to collaborate on homework exercises so long as each student does his or her own work. No collaboration is allowed on exams.

Examinations: There will be a four in-class quizzes and a final exam.

Course Modules:

1. Conventions; Lagrangian vs. Eulerian frame; advection (Holton 1.1, 1.2, 1.3, 2.1.0)
2. Navier-Stokes equation; fundamental forces (Holton 1.4)
3. Hydrostatic balance; hypsometric equation; vertical profiles; coordinates (Holton 1.6)
4. Rotating reference frame; oblate shape of Earth; Coriolis force (Holton 1.5. 2.1.1, 2.2)
5. Spherical coordinates (Holton 2.3)
6. Momentum equations; geostrophic and other wind balances (Holton 2.4, 3.1.1, 3.2)
7. Trajectories and streamlines (Holton 3.3)
8. Continuity equation; vertical velocity (Holton 2.5, 3.1.2, 3.5.0, 3.5.1, 3.6)
9. Mechanical and thermodynamic equations; static stability (Holton 2.6, 2.7, 3.1.3, 3.5.2)
10. Thermal wind (Holton 3.4)

11. Circulation; sea breeze generation (Holton 4.1)
12. Relative, planetary, and absolute vorticity; vorticity equation (Holton 4.2, 4.4)
13. Potential vorticity; barotropic vorticity (Holton 4.3, 4.5, 4.6)
14. Boundary layer; turbulent flux (Holton 5.1, 5.2)
15. Surface layer; Ekman layer (Holton 5.3, 5.4)
16. Fronts and related weather; cyclone structure (Holton 6.1)
17. Quasigeostrophic system of equations; quasigeostrophic vorticity (Holton 6.2)
18. Geopotential tendency equation; quasigeostrophic potential vorticity (Holton 6.3)
19. Omega equation; Q-vector formulation; cloud conveyor belt (Holton 6.4, 6.5)

If time permits

20. Properties of waves (Holton 7.1, 7.2)
21. Shallow water equation; barotropic Rossby waves (Holton 7.7.1)
22. Forced topographic Rossby waves (Holton 7.7.2, 10.5.1)

Other topics in Holton are covered in SIOC 250, *Advanced Atmospheric Dynamics*