

SIOC 217B (Winter 2022)

Atmospheric and Climate Sciences II: Atmospheric Dynamics

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Instructor Absence: I do not plan to have any absences.

Office Hours: By appointment.

Attendance Expectations: Students are expected to attend every class with exceptions only for illness, quarantine, or direct time conflicts with important research commitments.

Grading Option: Letter grade required for first year SIO graduate students. S/U is permissible for all other students.

Grading Criteria: 30% final exam, 70% homework exercises

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

Course Website: On UCSD Canvas. You should frequently check the website for class information, supplemental notes, homework assignments, and assigned reading.

Homework Exercises: Homework assignments must be completed on time and extensions will be granted only in exceptional circumstances. Incorrect homework may be returned for revision.

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 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)
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*