SIO 172 (Winter Quarter 2025)
Physics of the Atmosphere

Instructor: Joel Norris 327 MESOM *jnorris@ucsd.edu*
Teaching Assistant: Anamaria Navarrete *annavarrete@ucsd.edu*

Meeting Time and Location: Eckart 227 on Tues/Thurs from 2:00 to 3:20 p.m.

Office Hours: By appointment or as scheduled

Grading Criteria: 10% pre-class group exercises, 40% in-class quizzes, 50% final exam

Textbook: *Atmospheric Science: An Introductory Survey* (2nd edition)
J. M. Wallace and P. V. Hobbs
Online textbook (UCSD IP addresses only):
http://www.sciencedirect.com/science/book/9780127329512

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.

Student Teams: At the beginning of the quarter every student will be randomly assigned to a student team. Student teams will work together on in-class activities and pre-class exercises. Every member of the student team will receive the same grade for group work on pre-class exercises. Contact the instructor if a team member is consistently not making a fair contribution to the group effort or some other problem arises.

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.

Pre-class Exercises: Student teams are required to jointly complete pre-class exercises related to the assigned reading. Answers will be submitted on the course website, and all students on a team will receive the same grade.

Classroom Lectures: A portion of class time will be devoted to a non-comprehensive lecture on the course material that is primarily intended to provide an opportunity for students to ask questions so they can fully master the topic.

In-Class Activities: A portion of the class will be devoted to an in-class activity that will further develop understanding of the topic and/or apply knowledge to a task relevant to professionals working in the field of atmospheric science. Members of each student team will work together on the in-class activity.

Homework Exercises: Homework exercises are optional and ungraded. Students may freely collaborate and look at the homework solutions.

Quizzes and Examinations: There will be four in-class quizzes and a final exam. Students may not collaborate on in-class quizzes and the final exam, nor have access to the internet. Students will be permitted to bring a scientific calculator and a sheet of handwritten notes for use on the quiz or exam according to the guidelines specified by the instructor. Under ordinary circumstances, no make-up quizzes and exams will be offered. If a truly unavoidable emergency arises, contact the instructor as soon as possible.

No Remote Instruction: There will not be any remote instruction in this course nor recordings of the class period. All students are expected to attend every class unless ill.

Accommodations for Disability: Students requesting accommodations for this course due to a disability must provide a current Authorization for Accommodation (AFA) letter (paper or electronic) issued by the Office for Students with Disabilities (https://osd.ucsd.edu/). Students are required to discuss accommodation arrangements with instructors and OSD liaisons in the department IN ADVANCE of any exams or assignments.

Academic Integrity: Lack of academic integrity is inconsistent with good scholarship and good science. It misleads others and undermines the hard work of all students in the class. Academic dishonesty includes substituting another person's work as one's own, cheating on an exam, or helping another student commit academic dishonesty. Consult the instructor or TA if you have questions about the legitimacy of any activity. Further information may be found at academicintegrity.ucsd.edu.

Course Schedule

Date	**Topic**	**Reading**
Tu 1/07	Eulerian and Lagrangian frames of reference, advection	WH 1.1, 1.2 Background: MetEd A, B
Th 1/09	Ideal gas law, hydrostatic equation, geopotential height, hypsometric equation	WH 1.3.1-4, 3.1, 3.2.0-2
Tu 1/14	Meteorological observations, station model, wind and pressure, fronts, weather maps	WH 1.3.5-6, 3.2.3-4, Fig. 8.1 MetEd C, D
Th 1/16	Weather map lab	WH 8.1.1-2 (skim for basic understanding)
Tu 1/21	Review and Quiz #1	
Th 1/23	SIO Pier Field Trip (Subject to Change)	
Tu 1/28	Heat, work, dry adiabatic lapse rate, potential temperature, thermodynamic diagram	WH 3.3, 3.4

Th 1/30	Moisture parameters, lifting condensation level, latent heat, wet bulb temperature	WH 3.5.1-2
Tu 2/04	Saturated adiabatic lapse rate, equivalent potential temperature, stability and instability	WH 3.5.3-7, 3.6, MetEd E MetEd F (focus on basics)
Th 2/06	Skew-T lab	
Tu 2/11	Review and Quiz #2	
Th 2/13	Spectrum, radiance, flux, blackbody radiation, absorption, emission, greenhouse effect	WH 4.1, 4.2, 4.3 MetEd G
Tu 2/18	Scattering, optical phenomena, absorption lines, Beer's law	WH 4.4, 4.5.1-2
Th 2/20	Schwarzschild's equation, plane-parallel approximation, atmospheric radiative profiles	WH 4.5.3-4, 4.5.5.b MetEd H
Tu 2/25	Satellite imagery lab	WH 4.5.5, 4.6, MetEd I, J
Th 2/27	Review and Quiz #3	
Tu 3/04	Cloud droplet nucleation	WH 6.1
Th 3/06	Droplet growth, collision-coalescence	WH 6.4
Tu 3/11	Marine layer clouds, ice nucleation, cold cloud precipitation, artificial modification of clouds	WH 6.2, 6.3, 6.5, 6.6
Th 3/13	Review and Quiz #4	
Th 3/20	Final Exam	

MetEd A – Introduction to the Atmosphere
MetEd B – Basic Weather Processes
MetEd C – Foundations of Meteorological Instrumentation and Measurements
MetEd D – Introduction to Meteorological Charting
MetEd E – Skew-T Mastery
MetEd F – Principles of Convection: Buoyancy and CAPE (*focus on basics*)
MetEd G – Instrumentation and Measurement of Atmospheric Radiation
MetEd H – Nighttime Radiation and Cooling Rates of the Lower Atmosphere
MetEd I – Basics of Visible and Infrared Remote Sensing
MetEd J – Basic Satellite Imagery Interpretation