

SIO 20 – The Atmosphere

Winter Quarter 2021

Instructor: Dr. Casey Wall (cawall@ucsd.edu)

Teaching Assistants: Emma Beer (ebeer@ucsd.edu) and Clay McClure (ccmclur@ucsd.edu)

Class Meeting Times: This class will be fully remote. Lectures will be presented through Zoom on Tuesday and Thursday 2:00-3:20 pm, and recordings of the lectures will be posted on the course website on Canvas. You can decide if you would like to watch lectures in real time or the recordings. There will be no penalty for choosing to watch recorded lectures.

Discussion Section Meeting Times:

- Friday 9:00-9:50 am
- Friday 10:00-10:50 am
- Friday 2:00-2:50 pm
- Friday 3:00-3:50 pm

All discussion sections will be held on Zoom.

Office Hours:

Dr. Casey Wall	Tuesday 3:30-4:30 pm, Wednesday 1:00-2:00 pm, or by appointment
Emma Beer	Thursday 3:30-4:30 pm
Clay McClure	Thursday 3:30-4:30 pm

Course Description: This course is an introduction to weather and climate. The main objectives of the course are to:

- study the composition, energetics, and circulation of the atmosphere
- learn how to use tools that are designed to help us interpret the weather
- learn how to be a knowledgeable observer of the atmosphere

We will learn to read weather maps, identify clouds, and interpret radar and satellite images, and we will use these tools to study atmospheric composition, structure, and circulation. Topics we will cover include radiation, convection, generation of clouds and precipitation, thunderstorms, hurricanes, midlatitude weather systems, weather forecasting, air pollution, climate variability, and climate change.

Required Textbook: Weather: A Concise Introduction
by Gregory Hakim and Jerome Patoux

Grading Criteria: Your final grade will be determined based on the following components:

- 50% homework (4 homework assignments)
- 30% quizzes (4 quizzes)

- 15% final exam
- 5% participation (as determined by answering “lecture questions” starting at the beginning of the third week of class)

You will be assigned a total score based on these weights. The conversion of total score to letter grade is described in the Grading Policy on the Canvas class website.

Participation: Each lecture will be posted online along with several “lecture questions” for you to answer in Canvas. You are expected to watch every lecture and to participate by answering the questions as you watch. In order to get credit for participation, you must submit your answers to the lecture questions on Canvas *within 24 hours of the time that the lecture is posted online*. The participation grade is based on completion of the lecture questions, not on whether the answers are correct. The purpose of the questions is to promote your engagement with the material and your success in learning.

Homework: You are encouraged to collaborate with your peers on homework as long as each student does his or her own work (i.e., no copying). Homework will be assigned and submitted on Canvas, and the answers will be reviewed in discussion section after the due date. *All homework must be completed on time*. If you must miss a homework submission because of an emergency (e.g. serious illness), then you must contact Dr. Wall within 24 hours of the homework due date to determine whether you can have an extension. You will be required to provide documentation, without which there will be no extension.

Quizzes and Final Exam: There will be a total of four quizzes and one final exam. The final exam will take place on Thursday 3/18/2021. The quizzes and final will be administered via Canvas and will include questions in multiple choice, fill-in-the-blank, and short-answer format. You will be accountable for understanding all material covered in lectures, in the readings, in the homework, and provided on the course website. *No collaboration is allowed on the quizzes or final exam.*

Alternate Quizzes and Examinations: Quizzes will be assigned after lecture on Tuesdays, and you must submit your answers to the quiz before the beginning of the following lecture on Thursday. Make sure that your schedule allows you to complete every quiz within this time window. *Alternate quizzes will not be offered*. If you must miss a quiz because of an unavoidable emergency, then you must contact Dr. Wall within 24 hours of the missed quiz to determine whether you are eligible for a make-up quiz. You will be required to provide documentation, without which there will be no make-up quiz and a grade of zero will be assigned for the missed quiz. Make-up quizzes are decided on a case-by-case basis. Similarly, *alternate times for the final exam will not be offered*.

Academic Integrity

The table below shows resources you may use for different types of assigned work:

	Open Note	Open Book	Open Internet	Collaboration Allowed
Homework	✓	✓	✓	✓
Quizzes	✓	✓	X	X
Lecture Questions	✓	✓	X	✓

How to be successful in this class:

- Watch all lectures and answer the associated “lecture questions” on Canvas
- Complete the assigned reading *before* lecture
- Attend discussion sections and ask questions
- Attend office hours and ask questions
- Form remote study groups with your peers to collaborate on homework assignments and prepare for quizzes
- Turn in homework on time. *No late homework will be accepted.*
- Study for quizzes

Everyone who works hard can be successful in this class! It is possible for everyone to get an A+ (see grading policy on Canvas).

Email Communication: Emails sent to the instructor or teaching assistants should include “SIO 20” in the subject line. Questions about course material should be asked in class, in a discussion section, or during office hours, not via email.

Class Schedule

Date	Topics and <i>key concepts</i>	Reading	HW/Quiz
Tu 1/5	(1) Course Introduction and Weather Measurements <i>temperature, pressure, wind, precipitation</i>	pp. 1-16	
Th 1/7	(2) Weather Stations and Weather Maps <i>surface station model, surface maps, upper-level maps</i>	pp. 17-28	
Tu 1/12	(3) Atmospheric Composition and Cloud Types <i>atmospheric gases, sources and sinks, aerosols, cloud types</i>	pp. 42-50, 113-116	
Th 1/14	(4) Energy Transfer and Radiation <i>conduction, convection, electromagnetic radiation, emission, absorption, transmission, scattering, reflection, halo, rainbow</i>	pp. 51-61, 28-29, 124-125	

Tu 1/19	(5) Radiation and Satellite Imagery <i>selective absorption, types of satellite images</i>	pp. 60-66, 29-41	Quiz 1 assigned
Th 1/21	(6) Greenhouse Effect, Diurnal and Seasonal Cycle <i>greenhouse effect, radiation balance and imbalance, diurnal and seasonal cycle, land-ocean contrast</i>	pp. 66-74	Quiz 1 due
Tu 1/26	(7) Saturation, Humidity, and Dew Point <i>evaporation, condensation, saturation, vapor pressure, relative humidity, dew point, dew and frost</i>	pp. 75-89	
Th 1/28	(8) Fog and Cloud Generation <i>nucleation, radiative and adiabatic cooling, fog generation mechanisms, cloud generation mechanisms</i>	pp. 90- 102	HW 1 due
Tu 2/2	(9) Lapse Rate, Atmospheric Stability, and Convection <i>dry and moist adiabatic lapse rate, orographic lifting, rain shadow, stability, instability, conditional instability, deep convection</i>	pp. 94- 112	Quiz 2 assigned
Th 2/4	(10) Precipitation Processes <i>collision and coalescence, Bergeron process, ice nuclei, accretion, cloud seeding, types of precipitation</i>	pp. 117- 123	Quiz 2 due
Tu 2/9	(11) Mid-quarter Review Session		
Th 2/11	(12) Pressure and Wind <i>pressure gradient force, Coriolis force, geostrophic wind, gradient wind, cyclonic and anticyclonic, friction</i>	pp. 126- 140	HW 2 due
Tu 2/16	(13) Local and Regional Wind Systems <i>sea/land breeze, mountain/valley breeze, katabatic wind, land/ocean pressure and wind, monsoons</i>	pp. 128- 130, 140-144, 157-159	Quiz 3 assigned
Th 2/18	(14) Global Wind Systems <i>distribution of precipitation, global temperature, jet stream, three-cell model</i>	pp. 145- 156	Quiz 3 due

Tu 2/23	(15) El Niño and California Climate <i>El Niño Southern Oscillation, teleconnections, California climate and weather, Santa Ana wind</i>	pp. 159-166	
Th 2/25	(16) Air Masses, Fronts, and Midlatitude Cyclones <i>air masses, fronts and associated weather, midlatitude cyclone development, role of upper-level wave, convergence and divergence</i>	pp. 167-185	HW 3 due
Tu 3/2	(17) Severe Weather <i>thunderstorm types, gust front, microburst, squall line, lightning, tornadoes</i>	pp. 188-200	Quiz 4 assigned
Th 3/4	(18) Tropical Cyclones and Weather Forecasting <i>geographical distribution, structure, development, and dissipation of tropical cyclones; probability and uncertainty in forecasting; numerical models; initial conditions; ensemble forecasting; chaos</i>	pp. 201-226	Quiz 4 due
Tu 3/9	(19) Air Pollution and Climate Change <i>smog, particulates, adverse weather conditions and topography, radiative forcing, climate feedbacks, effects of global warming on circulation and precipitation</i>	pp. 227-243	
Th 3/11	(20) Review Session		HW 4 due
Th 3/18	Final Exam		Final