

SIO 60
Experiences in Oceanic and Atmospheric Sciences
4 Units

Term: Fall 2021

Class Meeting Days, Hours, Location:

Monday Lecture: 9:00–9:50am (online only)
W (In Person) 9:00–11:50am ([Makerspace in Hydrolab](#), unless otherwise announced)

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Course Description:

Oceanic and atmospheric sciences are introduced through a series of modules where students learn basic principles in the classroom and then have hands-on experiences demonstrating these principles. The course will include trips to the beach, the Scripps Pier, and laboratories at Scripps Institution of Oceanography.

Prerequisites: none.

Student Learning Outcomes:

Upon completion of this course, students should be able to:

1	Demonstrate new ability to learn and communicate concepts in oceanic and atmospheric science through hands-on activities to support theoretical concepts.
2	Recognize and apply the main atmospheric principles governing the earth's energy balance, with specific focus to radiation & seasons, humidity, and pressure.
3	Determine and apply the main oceanic principles governing the ocean's circulation, with a specific focus on the general circulation, ocean gyres, and the influence of wind and waves.
4	Interpret and analyze the interactions between the atmosphere and ocean that drive weather and heat exchange worldwide, including ocean currents, heat exchange, and Coriolis force.
5	Generate new data through field collection and laboratory analysis.
6	Operate and experiment with instrumentation to investigate atmospheric and oceanic principles.

Required Materials:

Readings from the primary literature and texts will be assigned throughout the quarter.

Useful but not required texts:

Marshall and Plumb (2007) *Atmosphere, Ocean and Climate Dynamics: An Introductory Text*
Donald C. Ahrens *Essentials of Meteorology*, 7th Edition

Course Topics:

- I. Basic physical characteristics of the ocean and atmosphere
- II. Ideal gas law, Seawater Equation of State, Hydrostatic Balance, Archimedes principle
- III. Stratification, vertical structure, Diffusion
- IV. Radiation balance, convection, wind, pressure
- V. Rotation, Coriolis effect, geostrophic winds
- VI. General circulation of the atmosphere
- VII. General circulation of the ocean
- VIII. Coastal processes (wind, waves, and tides)
- IX. Introduction to climate change science
- X. Introduction to Air/sea Interactions

Course Format:

This course will be both lecture and lab based, with 50 min lectures on Monday (remote) and Wednesday (in person) each week, and lab-based exercises Wednesday. See time and locations on page 1. Most labs will involve data collection outside of the classroom, so please be prepared to partake in such activities with appropriate clothing and footwear. **The topics of labs are subject to change or rearrangement.*

Dates	Topics	Assignments
Week 1: Sept 27-Oct 1	Characteristics of Atmosphere and Ocean, vertical structure. <i>Lab 1 (9/29): Balloon Launch at Scripps Pier</i>	Lab 1 due 10/3
Week 2: Oct 4-8	Radiation balance, temperature, wind. <i>Lab 2 (10/6): Radiation & Temperature at La Jolla Shores beach</i>	Lab 2 due 10/10
Week 3: Oct 11-15	Equations of state, pressure, and buoyancy in the ocean <i>Lab 3 (10/13): Hydrostatic Pressure / Stratification</i>	Lab 3 due 10/17
Week 4: Oct 18-22	Rotation, Coriolis effect, Geostrophy. <i>Lab 4 (10/20): Rotating tank–Geostrophy</i>	Lab 4 due 10/24
Week 5: Oct 25-29	General Circulation of the Atmosphere <i>Lab 5 (10/27): Rotating tank - General circulation</i>	Lab 5 due 10/31
Week 6: Nov 1-5	Convection, clouds and climate change. <i>Lab 6 (11/3): Birch Aquarium Tour</i>	Project proposal due 11/5 Lab 6 due 11/7
Week 7: Nov 8-12	General Circulation of the Ocean. <i>**Lab 7 (11/6-7): At sea on the R/V Sproul**</i>	Lab 7 due 11/14
Week 8: Nov 15-19	Waves and general circulation of the ocean. <i>Lab 8 (11/17):Waves.</i>	Lab 8 due 11/21
Week 9: Nov 22-26	Coastal oceanography <i>Lab 9 (11/24): Pier data collection and technology demonstration</i>	Lab 9 due 11/28
Week 10: Nov 29- Dec 3	Course Review; Group Presentations	<i>Presentations</i>

Basis for final grade: Assessment and Weighting

There are 100 possible points available for this course.

Assessment	Details	Weighting	Student learning outcome #
Lab Reports	Each week, we will complete a lab during the Wednesday two-hour time period. The assignments will be posted at the beginning of the week. Students will be expected to review the lab assignment before the lab begins on Wednesday. Lab reports will be due electronically Sundays at 11:59 pm. Details on overall lab report expectations and template can be found below.	50%	1, 2, 3, 5, 6
Final Project/ Group Presentation	Students will be divided in groups of 3-4. During the last week of class (Dec 1), groups will give conference-style presentations (12 min + questions) on a current research topic in oceanic or atmospheric science. Topics will be chosen in consultation with the instructors.	20%	1, 2, 3, 4
Quizzes	We will have weekly online quizzes to incentivize keeping up with the lecture and lab materials. Quizzes will be posted on Mondays and must be completed by 09:00 am on Wednesday. There will be a one-hour time limit (the quiz should take no more than 10 minutes to complete)	20%	1, 2, 3, 4
Class Participation	We expect students to synchronously attend both the online and in-person components of the class. Extra participation points can be earned through participation in discussion boards on Canvas or live discussions during lecture.	10%	1

Final letter grades will be determined using a standard scale:

90 – 100% **A**; 80 – 89.9% **B**; 70 – 79.9% **C**; 60 – 69.9% **D**; 0 – 59.9% **F**

Weekly Checklist:

In general, each week, you will have to complete the following:

- Attend Monday lecture from 9:00 to 9:50 am synchronously
- Complete pre-lab reading of background information and instructions
- Watch any “overflow lecture” material asynchronously
- Complete pre-lab concept check quiz by Wednesday 9:00 am
- Attend Wednesday lecture/lab session from 9:00 to 11:50 am in person
- Submit lab report by Sunday 11:59 pm

Template for Lab Reports:

You can download a template that you must use for **ALL** your lab report submissions on Canvas.

Before the lab and before starting the lab report, carefully read all of the instructions posted on Canvas! If you don't know how to calculate it or what it means, Google it or look at the definition in the lecture notes! Or ask your professors or TA during office hours!

Here are some general dos and don'ts for your lab report:

- Do not copy and paste all the background information into your lab report.
- Do copy the question prompt in your lab report (see examples below).
- If the questions are numbered in the instructions, number them in your lab report. Include the prompt for the question.
- Answer **ALL** parts of the question. Separate each part of the question to show us which part you are answering – this makes it easier for us to award points for each part of the question rather than searching for your answer.
- You can answer questions using bullet points. Your answers do not need to be in paragraph form.
- Show your work and how you calculated what was asked for. Do not just trust Excel! We cannot give partial points if we don't know where your final answer came from!
- Always include units!
- Don't make up things that aren't in the data. Even if the question asks if you see something, the answer might be no!
- Your answers should not be more than a page per question.
- Include the header and footer in this template.

Observations: If you are asked to report observations, be as detailed as possible without writing more than a paragraph. Note when, where and how events occurred. Be specific when changes are observed. Always report the general weather and ocean conditions. Your observations should enable you to remember what the conditions were 10 years from now when you read your report.

Trends: Trends are big picture. Just because there is a little blip in the data (e.g., 1-2 points change) doesn't mean there is an overall trend. Use words like increase and decrease when describing trends. Be specific (i.e., don't just say it changed or there is a trend). What changed? Did it increase or decrease? What is the trend?

Similar vs. Different: Don't just state that things are the same or different. Tell us how they are the same and how they are different. Use words like higher or lower when comparing (not increase/decrease).

Academic Integrity:

"Academic Integrity is expected of everyone at UC San Diego. This means that you must be honest, fair, responsible, respectful, and trustworthy in all of your actions. Lying, cheating or any other forms of dishonesty will not be tolerated because they undermine learning and the University's ability to certify students' knowledge and abilities. Thus, any attempt to get, or help another get, a grade by cheating, lying or dishonesty will be reported to the Academic Integrity Office and will result sanctions. Sanctions can include an F in this class and suspension or dismissal from the University. So, think carefully before you act by asking yourself: a) is what I'm about to do or submit for credit an honest, fair, respectful, responsible & trustworthy representation of my knowledge and abilities at this time and, b) would my instructor approve of my action? You are ultimately the only person responsible for your behavior. So, if you are unsure, don't ask a friend—ask your instructor, instructional assistant, or the Academic Integrity Office. You can learn more about academic integrity at academicintegrity.ucsd.edu"

(Source: Academic Integrity Office, 2018)

You will be working with partners and in teams to complete lab exercises in this course, but all students are expected to write up their own individual lab reports. This means, for example, if the lab assignment requests you to write up a short paragraph of your observations about an experiment, that paragraph should be written in your own words and not duplicated between yours and your partner's assignment submissions. If you have any questions about how the academic integrity standards apply to your lab report assignments, please ask the instructors or TA.