

Course Syllabus

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SIO 210

Introduction to Physical Oceanography

Class Information:

Synchronous class meetings: Tuesday & Thursday: 11-12:20 PT

- Zoom: <https://ucsd.zoom.us/j/99574520636?pwd=VVZoeExpODNxVzILSUVORmtUZENpQT09>
(<https://ucsd.zoom.us/j/99574520636?pwd=VVZoeExpODNxVzILSUVORmtUZENpQT09>)
- Meeting ID: 995 7452 0636
- Password: RV Revelle

Synchronous tutorials and office hours:

- Math Tutorial (w/ Channing)
 - (time/zoom link TBD)
- Office hours w/ Channing
 - (time/zoom link TBD)
- Office hours w/ Ratnaksha
 - (time/zoom link TBD)
- Office hours w/ Sarah
 - (time/zoom link TBD)

Email addresses:

- Sarah Purkey (spurkey@ucsd.edu)
- Ratnaksha Lele (rlele@ucsd.edu (<mailto:rlele@ucsd.edu>))
- Channing Prend (cprend@ucsd.edu (<mailto:cprend@ucsd.edu>))
- Lynne Talley (ltalley@ucsd.edu (<mailto:ltalley@ucsd.edu>))
- Jim Swift (jswift@ucsd.edu)

Class website: [Canvas](#)

Homework discussion board: <https://piazza.com/class/kf7f0qjp94i4g0>

Course overview and objectives

Introduction to Physical Oceanography covers the fundamentals of global ocean circulation and the forces that drive it. This class is designed to lay a foundational understanding of ocean dynamics needed for all SIO graduate programs including biological oceanography, chemical oceanography, physical oceanography, geophysics, atmospheric science, and climate studies.

The primary course objectives include:

- Recognizing and explaining the observed large-scale circulation of the ocean
- Applying the theoretical framework to the real ocean through examples
- Gaining an intuition for oceanography, including basic vocabulary and mathematical equations
- Understanding the role ocean circulation plays in climate
- Gaining insight into how ocean circulation affects your own area of research and study

Prerequisites: Calculus and basic physics, or consent from the instructor. If it has been a while since you took math/physics courses, please attend the math tutorials with Channing during the first month of class.

Course Schedule

Course material will be presented through a combination of synchronous and asynchronous online lectures. The core of the material will be pre-recorded and available to view PRIOR to the day we will cover the subject in class. In class synchronous activities will follow on from the pre-recorded lectures and include time to ask questions, see more detailed examples, and have time to work on in class and homework problem sets with your classmates. All synchronous lectures will be recorded and made available within 24 hours after class.

A rough outline of class schedule is below. Details and updates will be maintained on canvas. Please check back occasionally for the full course schedule, updates, lecture links, and assignments.

- Oct. 1: Introductions and logistics
- Oct. 6: Properties of sea water and Observational Tools
- Oct. 8: Properties of sea water II
- Oct. 13: Typical distributions of properties in the ocean
- Oct. 15: Budgets (continuity equation)
- Oct. 20: Scales and forces of the ocean
- Oct. 22: Coriolis and Geostrophic Balance
- Oct. 27: Basic equations of motion continued
- Oct. 29: Coriolis and Geostrophic Balance continued (Thermal wind)
- Nov 3: Review
- **Nov 5: Mid-term**
- Nov. 10: Friction and Ekman; Eastern boundary currents & the ACC
- Nov. 12: Vorticity, PV, Sverdrup balance, (western boundary currents, Rossby waves, edies)

- Nov. 17: Deep circulation and thermohaline circulation
- Nov. 19: Global circulation: Currents of the world
- Nov. 24: The water-masses of the world (deep water formation)
- Nov. 26: Thanksgiving
- Dec. 1: Waves and tides
- Dec. 3: Natural climate variability and the oceans
- Dec. 8: Climate change and the oceans
- Dec. 10: Presentations, recap
- **Dec 16: Final exam**

Text book

- *Descriptive Physical Oceanography: An Introduction, 6th edition* by L. Talley, G. Pickard, W. Emery, J. Swift

Available online at (<https://www.sciencedirect.com/book/9780750645522/descriptive-physical-oceanography> (<https://www.sciencedirect.com/book/9780750645522/descriptive-physical-oceanography>)). You must be logged into the UC VPN to download pdf chapters for free. I will also upload the pdfs to the class google drive and link to Canvas. You should not have to pay to download the pdfs. The pdfs are also available for download from a google drive here ([210_SIO_google_Drive_DPO \(https://drive.google.com/drive/folders/1CTXRibRqIokf8YifnDRq1rIDFsag9ull?usp=sharing\)](https://drive.google.com/drive/folders/1CTXRibRqIokf8YifnDRq1rIDFsag9ull?usp=sharing)).

If you would like to purchase the hard copy, it is available on amazon and is a great resource to have on your bookshelf. Note, much of the reading we will be doing of this class is actually in the supplementary material which is not in the printed version. Regardless, it is a great book to own!

Assessment: Assignments, exams and discussion boards

Homework: We will have 4 homework problem sets assigned throughout the quarter. You will have approximately two weeks to complete each. They will include some math problems which will need to be written out by hand and then scanned or photographed and uploaded for grading. Working in small groups on these is highly recommended. We will help facilitate some of that during the zoom class calls. The TA's have also set up a piazza discussion board to help manage questions on the homework.

In class assignments: There will be some group work including "labs" during the synchronous zoom classes in small breakout rooms. For example, you will be put in small groups to view online rotating tank experiments and discuss/answer short questions as a group. This is designed to help reinforce course material and see the physics in action! If you are not able to attend class, there will be an alternative option for you to watch the videos on your own or with other students closer to your time zone.



Discussion board: There will occasionally be class discussion board questions on canvas accompanying the online lectures. You will get participation credit by participating in these discussion boards.

Exams: We will have a midterm and a comprehensive final.

Short paper or data project:

There will be a final project on a topic of your choosing.

You can choose between:

- (1) Review of a pair of published papers (written report), see “[Guidelines for paper](#) ”.
- (2) Data project using Java Ocean Atlas, with Jim Swift (individual or group presentation, written report). See “[Letter from Jim Swift regarding JOA](#). ”

Oct. 13: Pick project type (paper or data project). Sign up on TBD google doc.

Oct. 27: Short topic description due (very short)



Dec. 8: Data project or paper due










Dec. 10: 1 powerpoint slide summarizing your paper or data project to be presented to your classmates









Grading


Percentages: Final exam (25), mid-term exam (15), project/paper (20), 4 homework assignments (8 each), In-class assignments, discussion boards & participation (8)










Course Summary:

| Date | Details |
|------------------|---|
| Thu Sep 24, 2020 |  SIOC 210 - Physical Oceanography - test https://canvas.ucsd.edu/calendar?event_id=171096&include_contexts=course_20065 |
| | 3:15pm to 4:15pm |
| Thu Oct 1, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] https://canvas.ucsd.edu/calendar?event_id=231819&include_contexts=course_20065 |
| | 11am to 12:30pm |









| Date | Details | |
|------------------|---|-----------------|
| Mon Oct 5, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205083&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Oct 6, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231820&include_contexts=course_20065) | 11am to 12:30pm |
| Wed Oct 7, 2020 |  SIOC 210 - Math Tutorial (https://canvas.ucsd.edu/calendar?event_id=192680&include_contexts=course_20065) | 11am to 12pm |
| |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192712&include_contexts=course_20065) | 4pm to 6pm |
| Thu Oct 8, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231821&include_contexts=course_20065) | 11am to 12:30pm |
| Mon Oct 12, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205084&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Oct 13, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231822&include_contexts=course_20065) | 11am to 12:30pm |
| |  Argovis (https://canvas.ucsd.edu/courses/20065/assignments/225568) | due by 11:59pm |
| Wed Oct 14, 2020 |  SIOC 210 - Math Tutorial (https://canvas.ucsd.edu/calendar?event_id=192681&include_contexts=course_20065) | 11am to 12pm |






| Date | Details | |
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| | include_contexts=course_20065 | |
| |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192713&include_contexts=course_20065) | 4pm to 6pm |
| Thu Oct 15, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231823&include_contexts=course_20065) | 11am to 12:30pm |
| Mon Oct 19, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205085&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Oct 20, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231824&include_contexts=course_20065) | 11am to 12:30pm |
| |  Homework #1 (https://canvas.ucsd.edu/courses/20065/assignments/214855) | due by 11:59pm |
| Wed Oct 21, 2020 |  SIOC 210 - Math Tutorial (https://canvas.ucsd.edu/calendar?event_id=192682&include_contexts=course_20065) | 11am to 12pm |
| |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192714&include_contexts=course_20065) | 4pm to 6pm |
| Thu Oct 22, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231825&include_contexts=course_20065) | 11am to 12:30pm |

| Date | Details | |
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| Mon Oct 26, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205086&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Oct 27, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231826&include_contexts=course_20065) | 11am to 12:30pm |
| |  Project description (https://canvas.ucsd.edu/courses/20065/assignments/217129) | due by 11:59pm |
| Wed Oct 28, 2020 |  SIOC 210 - Math Tutorial (https://canvas.ucsd.edu/calendar?event_id=192683&include_contexts=course_20065) | 11am to 12pm |
| |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192715&include_contexts=course_20065) | 4pm to 6pm |
| Thu Oct 29, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231827&include_contexts=course_20065) | 11am to 12:30pm |
| Fri Oct 30, 2020 |  Class work 10/27/20: Taylor columns (https://canvas.ucsd.edu/courses/20065/assignments/220805) | due by 11:59pm |
| Mon Nov 2, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205087&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Nov 3, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231828&include_contexts=course_20065) | 11am to 12:30pm |

| Date | Details | |
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| | include_contexts=course_20065) | |
| |  Homework #2 (https://canvas.ucsd.edu/courses/20065/assignments/218805) | due by 11:59pm |
| Wed Nov 4, 2020 |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192716&include_contexts=course_20065) | 4pm to 6pm |
| Thu Nov 5, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231829&include_contexts=course_20065) | 11am to 12:30pm |
| |  midterm (https://canvas.ucsd.edu/courses/20065/assignments/223677) | due by 11:59pm |
| Mon Nov 9, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205088&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Nov 10, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231830&include_contexts=course_20065) | 11am to 12:30pm |
| Wed Nov 11, 2020 |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192717&include_contexts=course_20065) | 4pm to 6pm |
| Thu Nov 12, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231831&include_contexts=course_20065) | 11am to 12:30pm |
| Fri Nov 13, 2020 |  Ekman lab (https://canvas.ucsd.edu/courses/20065/assignments/225565) | due by 11:59pm |

| Date | Details | |
|------------------|---|-----------------|
| Mon Nov 16, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205089&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Nov 17, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231832&include_contexts=course_20065) | 11am to 12:30pm |
| Wed Nov 18, 2020 |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192718&include_contexts=course_20065) | 4pm to 6pm |
| |  Gyre lab (https://canvas.ucsd.edu/courses/20065/assignments/226854) | due by 11:59pm |
| Thu Nov 19, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231833&include_contexts=course_20065) | 11am to 12:30pm |
| Mon Nov 23, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205090&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Nov 24, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231834&include_contexts=course_20065) | 11am to 12:30pm |
| Wed Nov 25, 2020 |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192719&include_contexts=course_20065) | 4pm to 6pm |
| Thu Nov 26, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu) | 11am to 12:30pm |

| Date | Details | |
|------------------|--|-----------------|
| Mon Nov 30, 2020 | /calendar?event_id=231835&include_contexts=course_20065) | |
| |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205091&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Dec 1, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231836&include_contexts=course_20065) | 11am to 12:30pm |
| |  Homework #3 (https://canvas.ucsd.edu/courses/20065/assignments/226774) | due by 11:59pm |
| Wed Dec 2, 2020 |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192720&include_contexts=course_20065) | 4pm to 6pm |
| Thu Dec 3, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231837&include_contexts=course_20065) | 11am to 12:30pm |
| Mon Dec 7, 2020 |  SIOC 210 - Office Hours [Ratnaksha] (https://canvas.ucsd.edu/calendar?event_id=205092&include_contexts=course_20065) | 12pm to 1:30pm |
| Tue Dec 8, 2020 |  SIOC 210 - Physical Oceanography - Purkey [FA20] (https://canvas.ucsd.edu/calendar?event_id=231838&include_contexts=course_20065) | 11am to 12:30pm |
| |  Data and paper projects (https://canvas.ucsd.edu/courses/20065/assignments/232218) | due by 11:59pm |

| Date | Details | |
|------------------|---|----------------|
| Wed Dec 9, 2020 |  SIOC 210 - Office Hours (Channing) (https://canvas.ucsd.edu/calendar?event_id=192721&include_contexts=course_20065) | 4pm to 6pm |
| Thu Dec 10, 2020 |  1 slide presentation (https://canvas.ucsd.edu/courses/20065/assignments/235013) | due by 11:59pm |
| |  HW#4 (https://canvas.ucsd.edu/courses/20065/assignments/232219) | due by 11:59pm |
| |  Class work: 10/20/20 (https://canvas.ucsd.edu/courses/20065/assignments/218506) | |
| |  Unnamed Quiz (https://canvas.ucsd.edu/courses/20065/assignments/224661) | |