SYLLABUS: Earth, Planetary, & Space Sciences 15
The Blue Planet: An Introduction to Oceanography

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1. Course overview

Notes on the course: The aim of the class is to be broad, informative and develop your scientific literacy on many, diverse and inter-connected aspects of the oceans, from the broadest planetary context to the nature and origin of water, the nature of ocean currents, waves, buoyancy & salinity cycles, interaction with the atmosphere and influence on climate; the distribution and nature of life, and we will go beyond to consider the buried oceans of other planets and satellites and their relation to the likelihood and distribution of life elsewhere.

You should end up being excited about the oceans and have a decent feeling for what we know, and what we don't know and want to know about the oceans.

Course philosophy and objectives: This course is focused on developing in you:

- a love/curiosity/fascination/interest with the oceans,
- a scientific understanding of how to solve problems relating to the oceans and climate, on advancing your critical thinking and analysis skills, and
- your development as a consumer and communicator of scientific information that relates to our lives.

We will study ways humans interact with the oceans, and explore the scientific underpinnings of our understanding of this important part of the Earth's system. My aim is for you to retain a "scientific way of thinking" and an interest in the oceans and climate beyond the class.

Pedagogy: The lecture component of the course uses "active learning" techniques, including a flipped classroom, spaced repetition, group work, project work, and service learning. The lab component of the course uses applied learning, and we encourage group work.

Learning objectives: You will be able to explain the societal relevance of the following topics, and discuss and solve problems related to the underlying geological, biological, chemical, physical, and climatic principles:

- How water affects climate: The properties of water and the cycling of water
- The greenhouse effect and global warming
- Understanding regional climate change: Atmospheric circulation
- Climate variability and winter storms in Southern California: El Nino

- Why the poles matter for understanding climate change
- The role of ocean circulation in climate change
- Past climate change on our planet – telling history from mud
- Why do we have oceans?
- Finding water on other planets
- Coastal development and coastal processes
- Waves and Tsunamis
- Tides and tide pooling
- Weird marine critters
- Ocean acidification: the biggest problem plaguing the oceans in the 21st century?
- How the oceans take up carbon dioxide emissions
- How is it that every other breath you take is from a marine plankton?
- Overfishing and sustainability

2. Course communication

Interaction: You have several opportunities for interaction. You can ask the professor questions on zoom during the class meeting time, and TAs during the class meeting time, or email to set up a time to meet. You should also interact with your classmates during class meeting times and on the CCLE discussion board. The TAs will be identifying class meeting times during week 1.

Have questions? Post on CCLE because other people likely have the same question. Leave them in the question box. Ask after class. Ask your TAs during office hours. Ask me during office hours. Ask a classmate. Make an appointment.

Email policy: There are 300+ students in the class, and to avoid answering the same question multiple times, we have developed a streamlined email policy.

1. Your question may be answered in the syllabus, so always first check if the information is there.
2. **Post all questions** (that are not of a confidential/personal nature) on the CCLE discussion board, as other people probably have the same questions, and the TAs and I will check it regularly and respond. If you are a student in the class and you answer a question on CCLE, the TAs and I will appreciate seeing people helping their fellow students, and you will receive extra credit (0.1% on your final grade for the first person who accurately answers a question)
3. After doing the above, you can email us at epss15w2021@gmail.com - please note that you have checked the syllabus and posted on CCLE, but your question was not answered – or let us know in your note if the issue is confidential/of a personal nature.

Email: Because of the large number of people in the course, we've designated an email to use for correspondence with the instructor and TAs. Please use **epss15w2021@gmail.com** for all correspondence.

3. Course structure

The course is structured to be compassionate to the course participants, the TA, and the professor, given the COVID-19 pandemic.

Lectures: Lectures are asynchronous because of the fact that some people have limited internet access. If you are able to, come to the lecture meeting time to discuss the course materials, ask questions, solve problems, and work on lecture assignments. Attending lectures is not required.

This is a flipped classroom: You should watch the bruincast videos on CCLE for lecture – note that slides are posted on CCLE. These are from when I last taught the course.

Notes are due on *lecture videos* each week, the following week by Friday at 5 pm. For each week, turn in 2-6 pages of notes that cover the range of material (single or double spaced, 10-12 point font, 1" margins, typed or hand-written). You can miss two weeks of notes and still get full credit.

Notes are due on the *reading* every week, the following week by Friday at 5 pm. For each week, turn in 2-6 pages of notes (single or double spaced, 10-12 point font, 1" margins, typed or hand-written) that cover the range of material discussed. You can miss two weeks of notes and still get full credit.

Here is a link where you can get a pdf of the reading that we will use through the term.
https://www.pdfdrive.com/essentials-of-oceanography-3-edition-d176058534.html

There are three *assignments* for the term that are due during weeks 3, 6, and 8. You can discuss the questions with your classmates, including on CCLE.

An ocean science communication project is also part of the class. This can be done in a group with family or friends or classmates. You can get extra credit if you want to do additional projects.

Lab: There are *8 labs that are associated with problem sets*. There are multiple lab times that are available where material will be discussed and you will work on problem sets, but you are not required to attend the labs. If you aren't able to attend the lab, you can do the work on your own or with classmates outside of the lab meeting time.

Your lowest lab score will be excluded from your final grade.

Before lab, watch the *video on CCLE for the lab*, and do the *pre-lab reading*. In lab, you will work on a *problem set* on your own or with classmates.

For any given lab, as an alternative to submitting the lab problem set, you can instead prepare a *lesson plan* for K-12 related to the topic following the example provided on CCLE, implement with someone in your household or virtually, and submit the lesson plan and photos/a link to a video of the lesson being delivered. Lesson plans will then be shared with K-12 teachers for their use. This activity can also be done for extra credit.

Assignments: All assignments should be submitted using Turnitin. There are no penalties for delays of of any work to be turned in until February 7. Beginning February 8, there are no penalties for delays up to a week; 5% off for each week late after, up to a maximum of 20% off. Delays in turning in assignments may result in delays in grading.

4. Course grading

The various graded aspects of the class are there to focus your attention on the key points of the class and to enhance your remembering the material based on scientific studies of how to foster learning and retention in university GE sciences courses. The final grades are weighted between different components. There is no curve.

Grade breakdown:

Notes on lecture: 15% (will start week 1)

Notes on reading: 15%

Course assignments (3 for term): 30%

Service learning – Science communication project: 10%

Labs: 30% (will drop lowest score)

A+ > 96; A > 92; A- > 90
B+ > 87; B > 83; B- > 80
C+ > 77; C > 73; C-> 70
D+ > 67; D > 63; D- >= 60
F < 60

My.UCLA will report final scores – no curve

Ocean or climate science communication project: This is usually the favorite part of this class. You can make a public service announcement, music video, commercial, documentary, detailed web page, write an article for an undergraduate science communication journal, make a comic book, or do something else (text-based entries should have figures and 1000-2000 words of text). You can work in groups of 2-4 people on a video project and in a group of 2 for a webpage or other types of projects. You can work with people outside of the course.

Videos should be 1-3 minutes long, and all projects are due on the Monday of Week 10. They need to be posted on youtube and made publicly available. Please send the course email the youtube link and a subject line – ocean/climate science communication project. List the names, emails, and UIDs of any people in the class who contributed to the project. The youtube description should be publically available and state that it is your UCLA EPSS 15 ocean/climate science communication project for Prof. Tripati. Some ideas for topics include: Oceans on acid, Sexy sea slugs, Sustainable sushi, Desalination, Tidal power, Oil spills, Oceans and environmental justice, Marine heat waves, Coral bleaching, Overfishing, Life in the abyss, Amazing cephalopods, Plastics in the ocean, Penguins and climate change, Whaling, Evolution of life in the ocean, Black smokers, and Sea ice.

Also here is a link to the class youtube channel with videos from previous years:

http://www.youtube.com/playlist?list=PL1UEJdZ1r6RmdVdfoeWBCcFXFR26lVND3

Careers in geoscience?

Advantages:

$$$$: Salaries are high compared to other occupations and there is excellent salary potential

Average salary for geologists in all sectors and locations and the full range of experience: $85,000
- Federal Government $87,000
- State Government $49,000
- Consulting services $75,000
- Marine geologists: $72,700
- Petroleum industry (0-2 years of experience): $93,000
- Data here: http://work.chron.com/pay-scale-geologist-3685.html
- http://www.oceancareers.com/2.0/career_salary.php?career_id=69

There are jobs! Great employability in environmentally-friendly and exploration-related areas, easy to find a job

Both BA and BS options available; lots of different majors AND you can get into your classes.
- Very interdisciplinary! Most satisfied and happy majors on campus from a recent report!
- BA in Earth and Environmental Science for those interested in the environment and want to develop earth science careers in K-12 science education, resource management, policy making, journalism, sustainable business, and the growing number of earth science-related problems.
- BS in Paleobiology (includes Geobiology and Astrobiology) for those interested in the life sciences, life in extreme environments, life on other planets, and paleontology
- BS in Engineering Geology for the more engineering inclined, including those interested in developing engineering solutions to geoscience problems.
- BS in Geophysics/Space Physics, or Applied Geophysics if you're interested in physics, astronomy, exploration, seismology, natural hazards, or engineering
- BS in Geology if you're interested in the geosciences as a whole. This degree combines all of the sciences

Advanced courses are interesting and rigorous

Opportunities to work outdoors, do field work, observe nature….or sit in front of a computer and do simulations

Undergraduates do research - meaningful work that makes direct contributions to our understanding

Classes involve field trips to places ranging from the Sierra Nevada Mountains, Hawaii, and the Grand Canyon

Fun and helpful faculty

Good and interesting classes

Majors are a good preparation for making a positive difference in the world

Careers involve many opportunities for travel

A career as a geologist is potentially the most fulfilling of all of the sciences, and amongst the more socially relevant of all of the sciences

Prestigious occupation

EPSS 15 – Introduction to Oceanography

A ROUGH GUIDE TO THE COURSE (PLEASE NOTE WE MAY DEVIATE FROM THIS SCHEDULE)

Wk.	**Lecture Topics and reading**	***Lab Section***
Introduction		
1	Overview; logistics, scientific method	*Intro, maps, charts*
Part 1: Water and the ocean-climate system; Southern California climate		
	The water cycle, energy, and heat	
	Properties of seawater	
2	Ocean acidification	*Seawater properties*
	The origin of Earth's oceans	
	Oceans on other planets…	
3	Circulation of the atmosphere	*Ocean pH and alkalinity*
	Circulation of the oceans	
Part 2: Geology and the oceans		
4	Ocean bathymetry and isostasy	*Ocean circulation*
	Plate tectonics	
5	Why the sea is salty	*Isostasy, bathymetry & plate tectonics*
	Underwater volcanoes	
6	Ocean sediments	*Marine sediments*
Part 3: Life in the sea		
	Marine algae	
	The biological pump and the carbon cycle	
7	Coral reefs	*Energy and climate*
	Ocean resources and fisheries	

8	Strange creatures of the sea	*Changing CO_2*
	Whales	

Part 4: The coastal environment

	Ocean Waves	
9	Tides	
	Tsunamis Mar	
	El Nino	
10	Beaches and coastal processes	
	Pollution and the oceans	

Required reading to complete.

Reading for weeks 1 and 2
Complete reading before week 2:
Appendices 1-5, Introduction, Chapters 1 (Planet “Earth”), and 5 (Water and seawater)
Chapters 6 (Air-sea interaction) and 7 (Ocean circulation)

Complete reading before week 3:
Chapters 2 (Plate tectonics and the ocean floor) and 3 (Marine provinces)

Complete reading before week 4:
Chapters 4 (Marine sediments) and 12 (Marine life and the Marine environment)

Complete reading before week 5:
Chapters 13 (Biological productivity and energy transfer) and 14 (Animals of the pelagic environment)

Complete reading before week 6:
Chapters 15 (Animals of the benthic environment) and 16 (The oceans and climate change)

Complete reading before week 7:
Chapters 8 (Waves and water dynamics) and 9 (Tides)

Complete reading before week 8:
Chapters 10 (The coast: Beaches and shoreline processes) and 11 (The coastal ocean)

Complete reading before week 9: Afterword

Extra Credit: You can get extra credit by writing up brief (1 page, single spaced, Times New Roman 12 point font, 1" margins) summaries of Oceanography-related seminars, video screenings and other events, books, or scientific articles and sharing on social media.

Specifically you can get 0.5 extra credit point every week (due each week on Friday at 10pm) by submitting a summary using turnitin and writing a one paragraph facebook post about the oceanographic content that you summarized, with the facebook post publicly available on the course facebook site.

Here is a link to the facebook site:
https://www.facebook.com/groups/186095331508034/

If you are not on facebook, then post on the discussion board.

Each combination summary and facebook post will count as 0.5 point towards the final average grade.

A total of 5 extra-credit points are possible for the course -- equivalent to ten 0.5 points given. The summary and facebook post needs to make it clear that you've actually watched the entire seminar or movie or read the post.

Please turn in your extra credit using turnitin, and include a screenshot of your facebook post. Be sure that your name and student ID are included!

Note: If you respond to questions on the CCLE discussion forum, then that will be factored into your extra credit score for that week, with 3 responses worth 0.5 extra credit points.

A. Oceanography film Screenings (*Optional -- 1/2 Extra Credit point for 1-page summary report*):

Most of these titles are available on Hulu for free, and on youtube.

We have several films that are really excellent – and a few that are less so. They are too long to show in lecture or lab sessions, but I would like as many students as possible to take the time to view some of them. Most films are rated on an EPSS scale of 1 to 10, with 10 being best. Ratings are based on a combination of scientific or social content and quality of scenes.

1. **The blue planet: Open Ocean** - Venture into the largest section of open ocean in the world, where endless blue stretches in every direction. There is nothing, save the burning sun above and the blackened abyss below. Learn how life survives in this difficult climate. EPSS rating 8.

2. **The blue planet: The Deep** – Dive into "The Deep" where the deepest recesses of the ocean are home to entire mountain ranges, perpetual night, and the weirdest life forms on Earth. EPSS rating 8.

3. **The blue planet: Seasonal Seas** – Watch as shafts of sunlight radiate through the ocean's "ceiling" and provide energy for the myriad creatures that live in the temperate sea, the richest of all underwater habitats. EPSS rating 8.

4. **The blue planet: Coral Seas** – Incredible time-lapse photography shows the dramatic formation of a coral reef, portraying the growth of its millions of inhabitants – and their ultimate destruction. EPSS rating 8.

5. **The blue planet: Ocean World** – Travel far and wide – from the eastern Pacific to Alaska, from the Bering Sea to the shores of Southern California- and begin to understand the complexity and power of our oceans. EPSS rating 8.

6. **The blue planet: Frozen Seas** – An environment where only the toughest survive, the Arctic and Antarctic are unrelenting habitats. Only in spring does life begin again. Plankton blooms and feeds vast hordes of migrating fish, walruses rake the seabed for clams, and minke and humpback whales gorge themselves on gigantic swarms of krill. But it is a brief spring feast – the ice soon returns and pushes life back into the ocean. EPSS rating 8.

7. **The blue planet: Tidal Seas**- Watch as the tidal seas explode with life – thanks to the ever-present tug of the moon's gravity – and learn why marshes are one of the most ecologically productive parts of the world. EPSS rating 8.

8. **The blue planet: Coasts**- Step out of the sea and onto the coasts, where the boundary between land and water serves as a demarcation line between the beach-loving creatures that live onshore and the hungry predators that wait just beneath the surface of the water. EPSS rating 8.

9. **Volcanoes of the deep sea-** Far below the waves, deep and remote, is an incredibly world teeming with life. Only a select few have been able to experience the magic of this place, until now. EPSS rating 7 – an odd scientific tale, some decent vent videos and some animations of vent bacteria.

10. **Secrets of underwater volcanoes** – Excitement erupts when the new explorers crew journeys to the center of the highest level of volcanic activity on Earth – 3 km below sea level. We journey 500 miles off the coast of Mexico on a quest to unlock the mysteries of the might underwater volcanoes. Remarkable video footage introduces us to the strange creatures that survive in the extremely hot environments around thermal vents, taken from a three-person research submarine. EPSS rating 7 – good science with mix of geology and biology, great video. As much a story about the scientists as it is about the science.

11. **Whales: an unforgettable journey**- Experience breathtaking close encounters with the largest mammal that ever lived on earth – the blue whale. Follow humbpacks, orcas, right whales, and dolphins for a stunning new perspective on these mysterious marine mammoths. EPSS rating 6 – not the best video, but if you want whales, you've got whales.

12. Rhythms of the tides

13. **Tsunami**- Made from NOVA TV shows on the great Sumatra quake of December 26 2004 and the tsunamis it produced. EPSS rating 9 – almost as great as the magnitude of the earthquake that produced the tsunami.

14. Ocean origins

15. Hurricane Katrina

16. **Silent sentinels-** Coral reefs are the jewels of the ocean. Communities of organisms as rich and diverse as any above or below the surface of the planet, they encircle the tropics like an azure necklace. They are being affected by global warming which drives coral bleaching, and ocean acidification. This film examines how corals and how they respond to climate change.

EPSS rating 9 – great science and great video.

17. **Perils of Plectropomus**- In recent years the dramatic life cycle of reef fish like plectropomus, the coral trout, have been pieced together by scientists. They have discovered it's a life lived against the odds. Today it's not just the natural environment that threatens them – it's the impact of humans. EPSS rating 8 – good science, good social messages, and great video.

18. **Condition black**

B. Oceanography or Climate book report (*Optional -- 1/2 Extra Credit point for 1-page summary report*):

1. **The Crystal Desert: Summers in Antarctica** (by David Campbell)
2. **The Oceans of Life: The Fate of Man and the Sea** (by Callum Roberts)
3. **Octopus: The Ocean's Intelligent Invertebrate (**Jennifer Mather**-** Coral reefs are the
4. **Late Victorian Holocausts: El Nino Famines and the Making of the third world** (by Mike Davis)
5. **The Great Ocean Conveyor: Discovering the trigger for abrupt climate change** (by Wallace Broecker)
6. **Climate Change in Prehistory: The end of the reign of Chaos** (by William Burroughs)
7. **The end of the line: How overfishing is changing the world and what we eat** (by Charles Clover)

Academic Honesty & Civility

Cheating and disruptive behavior in any form are never allowed. Guidelines established by the UCLA Academic Senate will be followed if a student is caught cheating or disrupting the educational process. These policies are available online and highlighted below. You have a responsibility to refrain from any form of academic dishonesty and to treat your fellow students, teaching assistants, and instructors with courtesy, civility, and respect.

Consulting on assignments is acceptable and encouraged as a potentially valuable learning practice. Study together, discuss methods, and check your answers against each other. You must do the work yourself and write your answers in your own words. It is your responsibility to make it clear to the grader that you worked through the entire problem yourself. Plagiarism (e.g., copying another student's answer, submitting others' work without attribution) results in an automatic score of zero on the assignment/exam and possible additional penalties, beginning with loss of whole grades. Ask the instructor or a TA if you have any questions about what this means. One way to be safe is to never show your written work to others or ask your study partners to see their answers. Focus instead on discussing the correct methods or principles.

Types of Academic Dishonesty:
Cheating
Dishonest conduct
Plagiarism
Collusion

Students have a responsibility to:
Refrain from cheating and plagiarism.
Refuse to aid or abet any form of academic dishonesty.
Notify professors and/or appropriate administrative officials about observed incidents of academic misconduct. The anonymity of a student reporting an incident of academic dishonesty will be protected.
Refrain from cheating and plagiarism.

Sexual harassment and violence policy

The University of California prohibits sexual violence and sexual harassment.

If you believe you have been, or are concerned about someone who you believe may be a victim of dating violence, domestic violence, sexual assault, sexual violence, sexual harassment, or stalking, please call UCLA's CARE Advisor at 310-206-2465 or CAREadvocate@caps.ucla.edu (Victoria Molino,) if you want to talk with someone confidentially, or contact the police at 911, and the UCLA Title IX officer at (310) 206-3417 and titleix@conet.ucla.edu (Kathleen Salvaty). Additional information is available here: http://www.counseling.ucla.edu/CARE.

Examples of types of math problems you'll need to be able to solve to pass the course:

1. If element X has a concentration of 15.6 g/L in seawater, and the ocean volume is 1.6×10^{21} L, what is the total mass of element X in the oceans?

2. Given that $A = BT^2$, then calculate A.

3. Given that our planet is a sphere and that ~70% of the surface is covered by water, then what area is covered by water? The radius of the Earth is 6,378 km.

4. Given that the total amount of energy received on the surface of the planet is $E_{in} = \pi(R_{EARTH})^2(SC)(1- A)$ and the energy radiated out is $E_{out} = 4\pi(R_{EARTH})^2(\sigma T^4)$, write a mathematical expression defining the energy budget of the planet Earth.

5. If $pK = -\log_{10}(K)$, then what is the value of K if pK = 4.5?