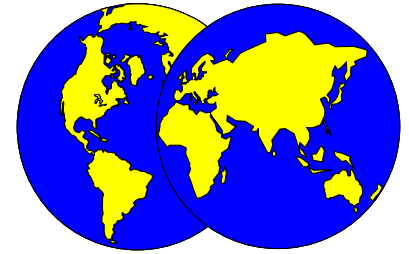


Why Learn Oceanography?



Earth is called the “Blue Planet” because water is abundant on this “3rd Rock from Sun”. Indeed, oceans dominate the Earth’s surface and have been crucial to the evolution of our living environment, including that of the life on Earth. The study of oceans thus offers the most comprehensive approach to understand our natural habitat. Specifically, our discussions during this course will explore the following questions.

1

What processes create and sustain the ocean basins, making Earth the water planet?

Earth, Venus and Mars are compositionally alike and receive comparable amount of Solar heat. Why does only Earth have abundance of water, then? How to reconcile the facts that ocean floor rocks are ≤ 200 Ma old, compared to ≤ 4.2 Ga old rocks on land, even though oceans cover $>70\%$ of the Earth’s surface and appeared ~ 4 Ga ago, particularly as the geological evidence supports no appreciable growth of the Earth’s surface?

Textbook Chapters

Chapter 1: An Ocean World
Chapter 3: Plate Tectonics
Chapter 4: Continental Margins and Ocean Basins

2

What can we learn from the geology, chemistry and physics of the materials that fill ocean basins?

How do we know that the site where we now have the Himalayas was once a deep ocean or that Utah was once in the tropics?

Why is the seawater salty? What does it tell of the origin of seawater? Where has water on Earth come from? Earth’s Interior? Outer Space?

Will global warming first make the Earth drier or the oceans cooler? Why is the beach sand so hot, but water cold, on a hot, sunny, summer afternoon? Why do the beaches in temperate latitudes disappear in winter?

Textbook Chapters

Chapter 5: Sediments
Chapter 6: Water and Ocean Structure
Chapter 7: Seawater Chemistry

3

How do oceans modulate the climate?

Why does land at $\sim 30^\circ\text{N}$ and S latitudes tend to have deserts and oceans at these latitudes a halocline all year round?

Why is Europe warmer than other locations at the same latitudes? Is Europe heading for an Ice Age?

What is El Niño? What is La Niña? Should we expect this year’s Atlantic hurricane season to be stronger, or milder, than normal? Should we expect this summer in California to be warmer and drier, or cooler and wetter, than normal?

Textbook Chapters

Chapter 8: Atmospheric Circulation
Chapter 9: Ocean Circulation
Ocean circulation and climate

4

What processes affect the coast? How?

Why do waves break on reaching the shore? Would you expect Hawaii to have milder surf than Bahamas, or wilder? Why does a beach get inundated on full and new moon nights but a boat in the open ocean has no such experience? How about tsunamis — when the tsunami strikes the shore, the effect is often devastating, but a boat in the open ocean rides a tsunami without even feeling it? How does coastal construction — a groin or a break-water wall or the seawall — affect the coast?

Textbook Chapters

Chapter 10: Wave Dynamics and Wind Waves
Chapter 11: Tsunami, Seiches, and Tides
Chapter 12: Coasts

5

What factors define the marine ecosystem and how?

Does life essentially owe its existence to Sun? What is SLiMe? Archea? Why do we believe that plant evolution was not intrinsic to oceanic environment? Snakes occur in the Pacific and Indian oceans, but not in Atlantic, except for the reefs. Why? Shark attacks are most frequent during summer in temperate latitudes, not in the tropics. Why?

Textbook Chapters

Chapter 13: Life in oceans
Chapter 14: Primary Producers
Chapter 15: Marine animals
Chapter 16: Marine communities

6

What resource and environmental factors make the oceans so critical to our collective survival?

Can oceans augment the world food resources? Water resources? Energy resources? How relevant are oceans to the current concerns about climate change? Waste disposal?

Textbook Chapters

Chapter 17: Marine resources
Chapter 18: Environmental concerns