

The Ocean Environment: Setting the Scene

ES 383

Colby at Bigelow, September 2019



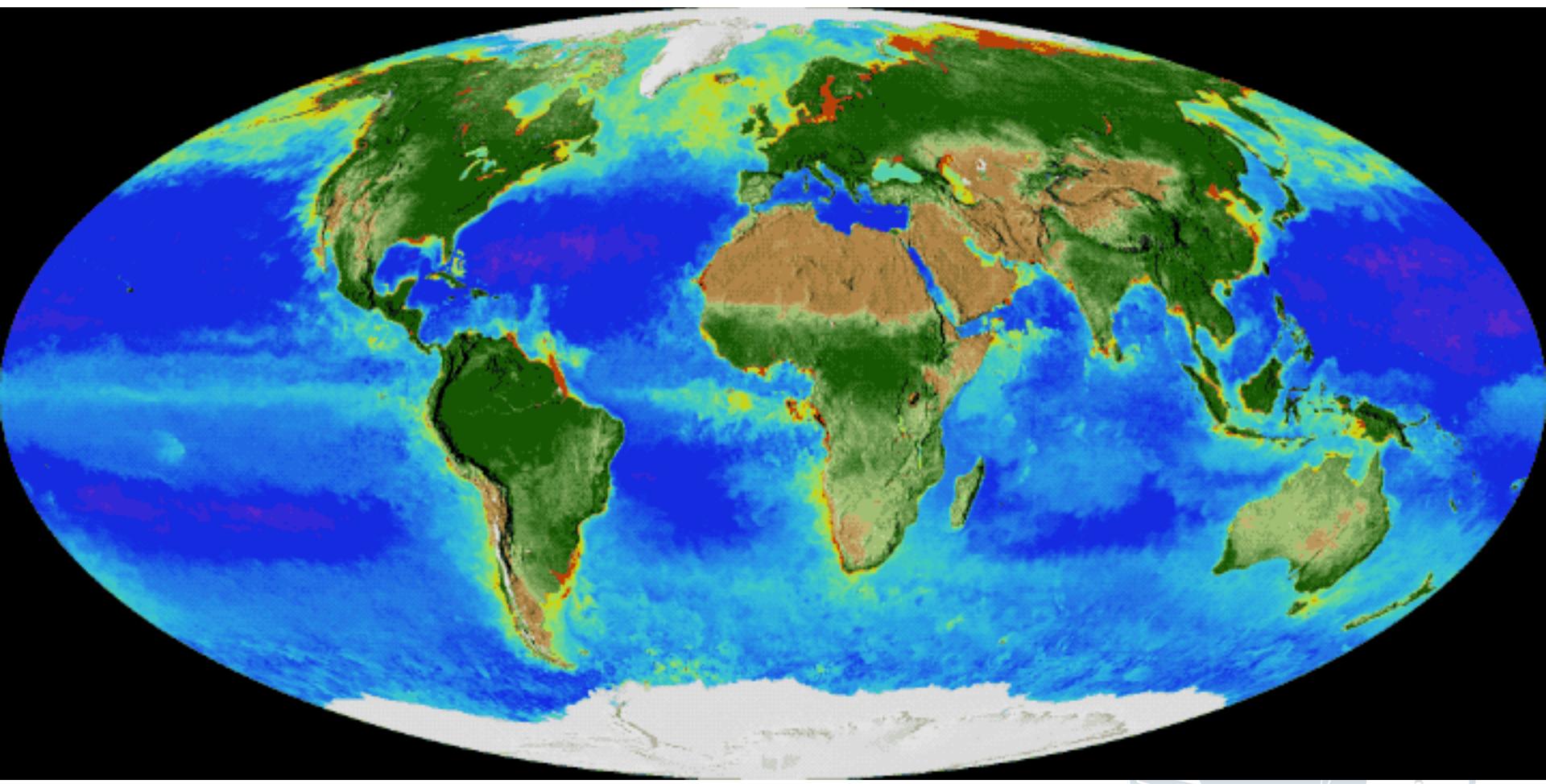
"Take a peep over the weather bow, and then back to me and tell me what ye see there."

...
The prospect was unlimited, but exceedingly monotonous and forbidding; not the slightest variety that I could see.

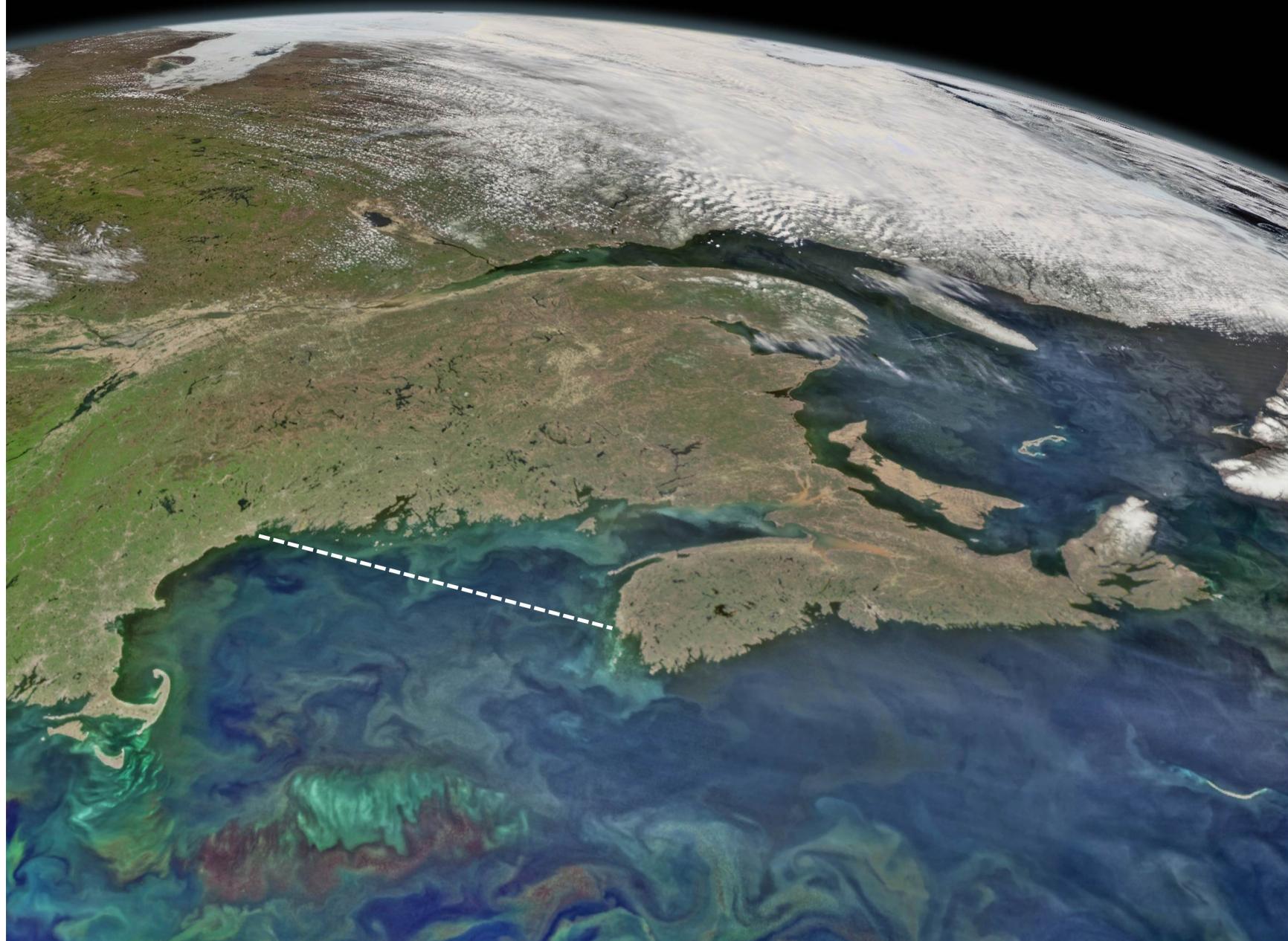
...
"Not much," I replied- "nothing but water"







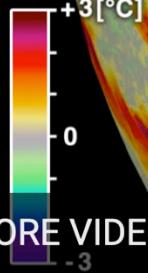
Gulf of Maine GNATS Transect; Suomi-NPP/VIIRS True-Color Image; 14 May 2015; Courtesy of NASA Ocean Color Group, Goddard Space Flight Center





watch later Share
2018-10-22

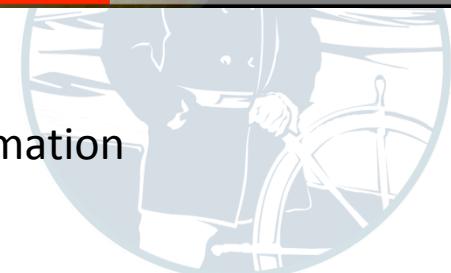
Sea Surface
Temperature
Anomaly



MORE VIDEOS

[https://podaac.jpl.nasa.gov/animations/
SST_Response_to_2018_Atlantic_Hurricane_Season_Data_Animation](https://podaac.jpl.nasa.gov/animations/SST_Response_to_2018_Atlantic_Hurricane_Season_Data_Animation)

- Hurricane
- Tropical Storm
- Tropical Depression
- Sub-tropical Storm
- Sub-tropical Depression

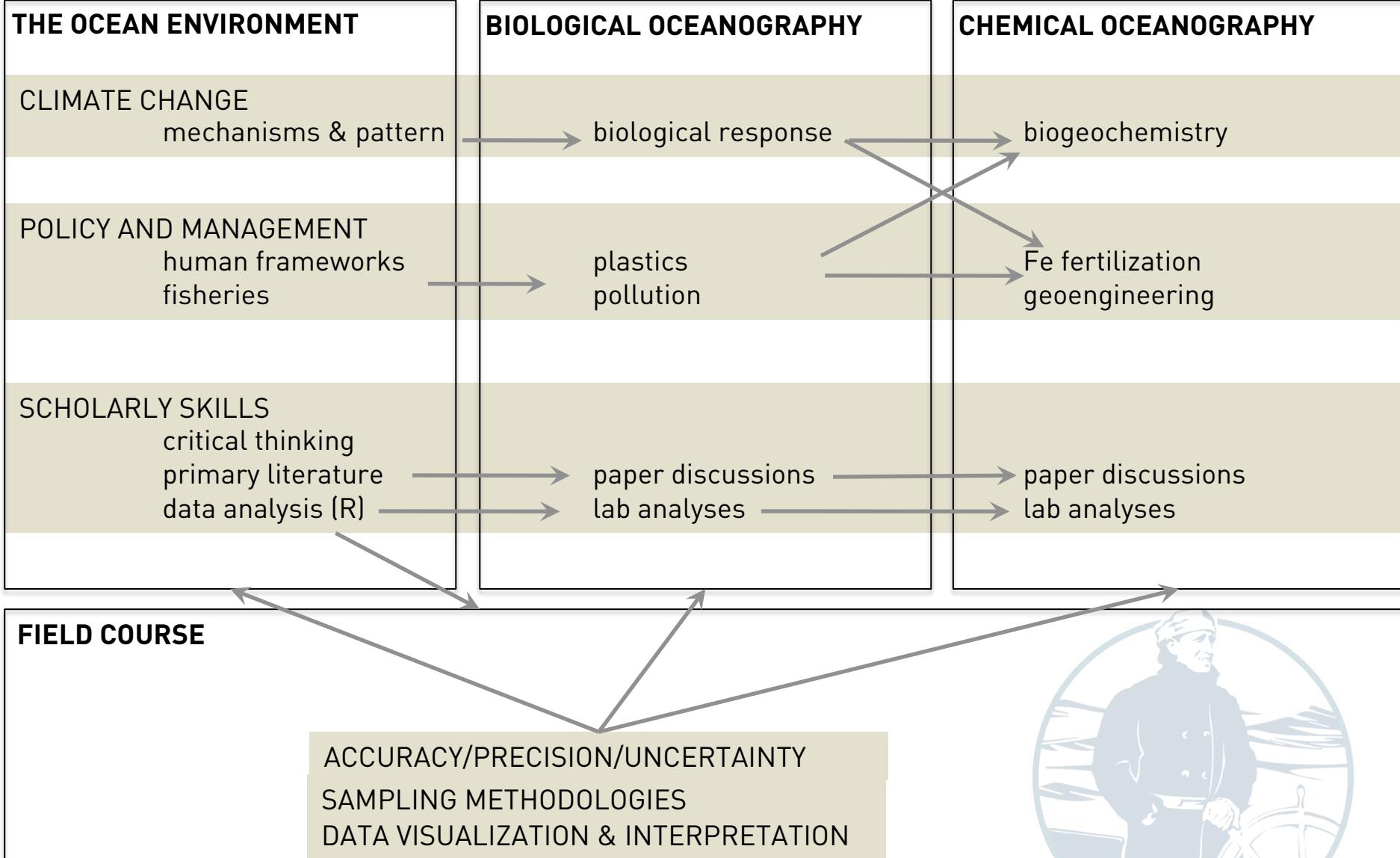


MULTI-DISCIPLINARY

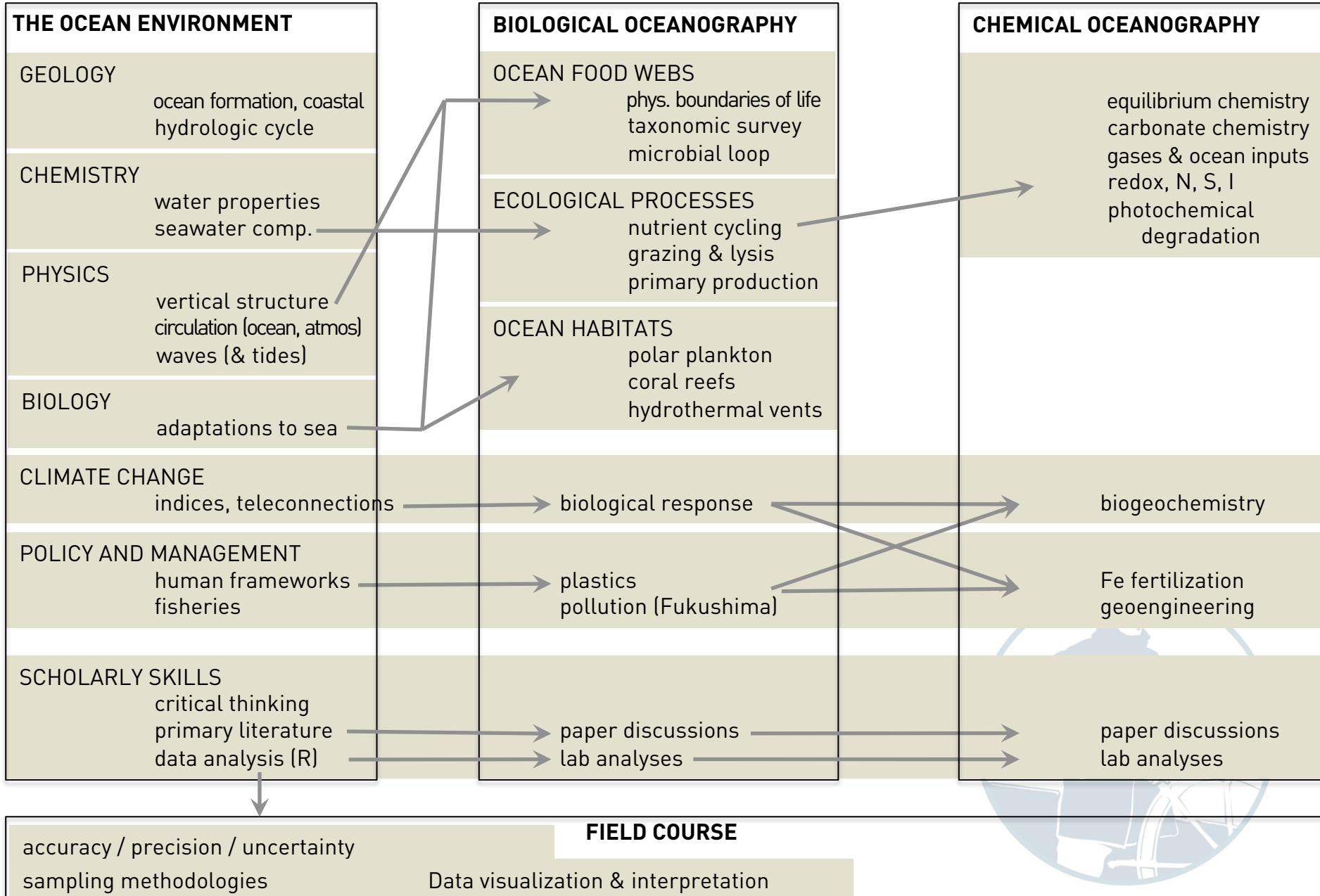
Biological (course 2)
Chemical (course 3)
Physical
Geological
Earth System Science
Engineering
Social Science



THE CHANGING OCEAN

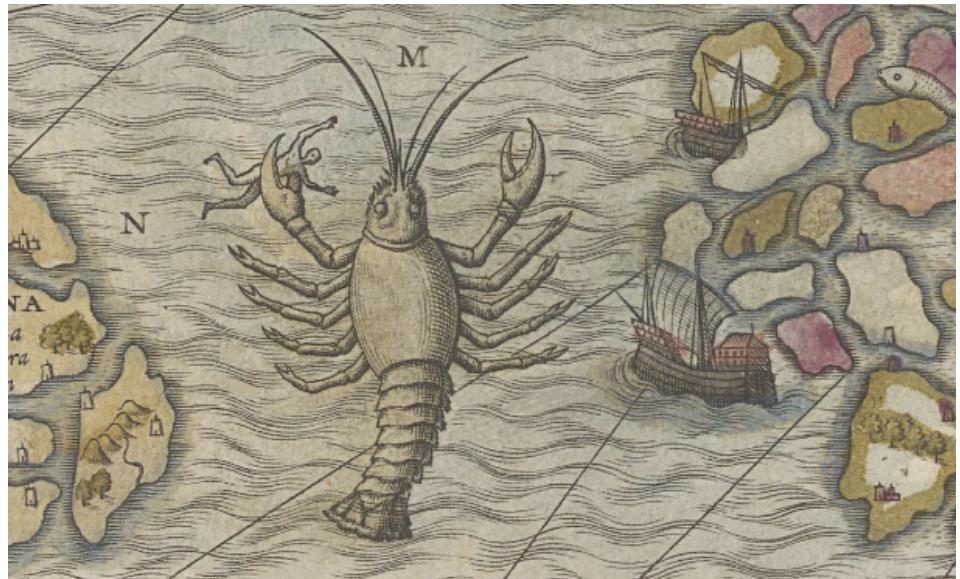


THE CHANGING OCEAN



History

Our perception of the ocean has changed over time



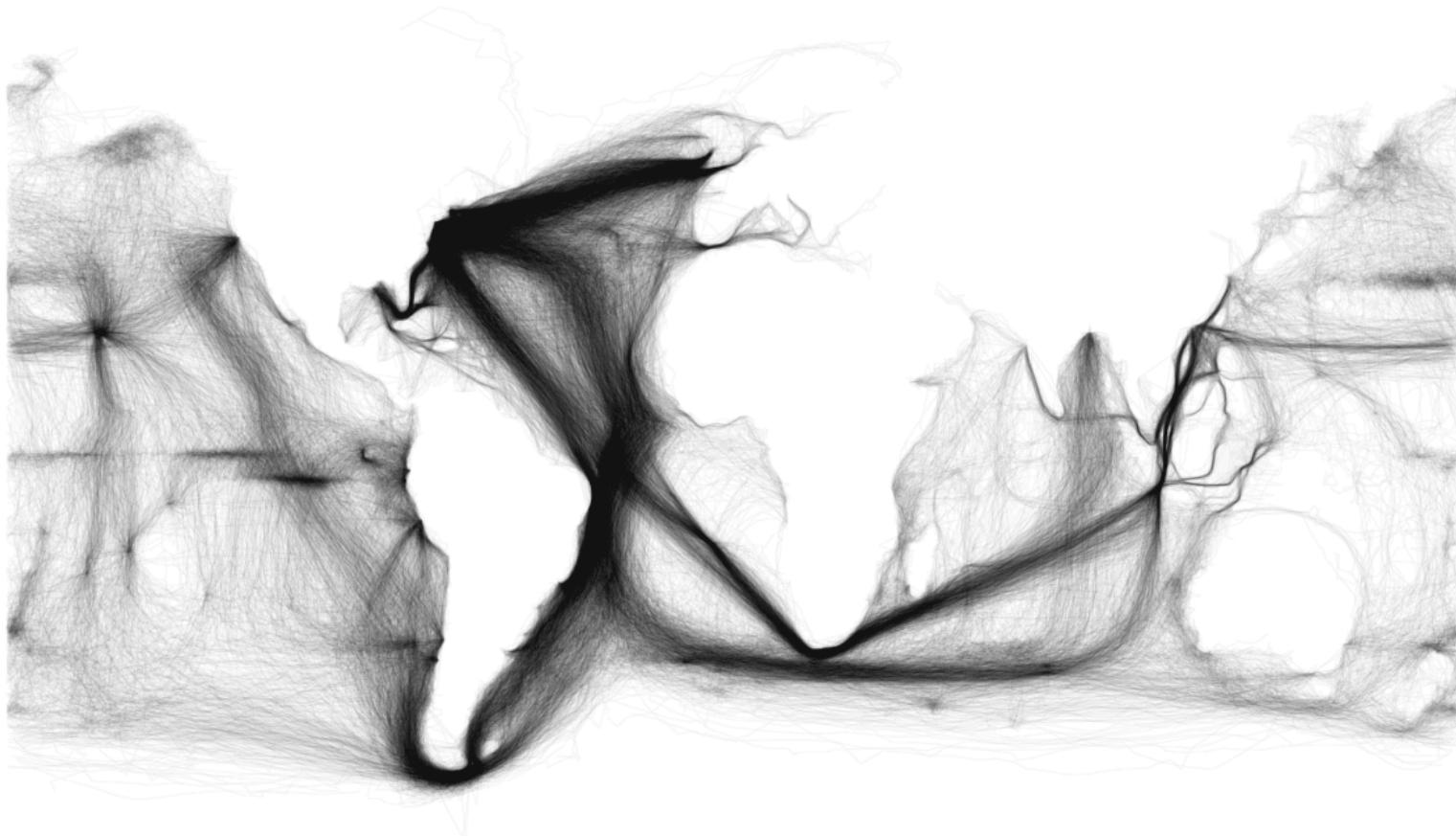
History

- New lands
- New or better trade routes
- Financial reward (colonization)
- Charts of lands, winds, currents (Hydrography)
- Improved navigational methods
- Trade, commerce



First chart of the Gulf Stream, Benjamin Franklin, 1769

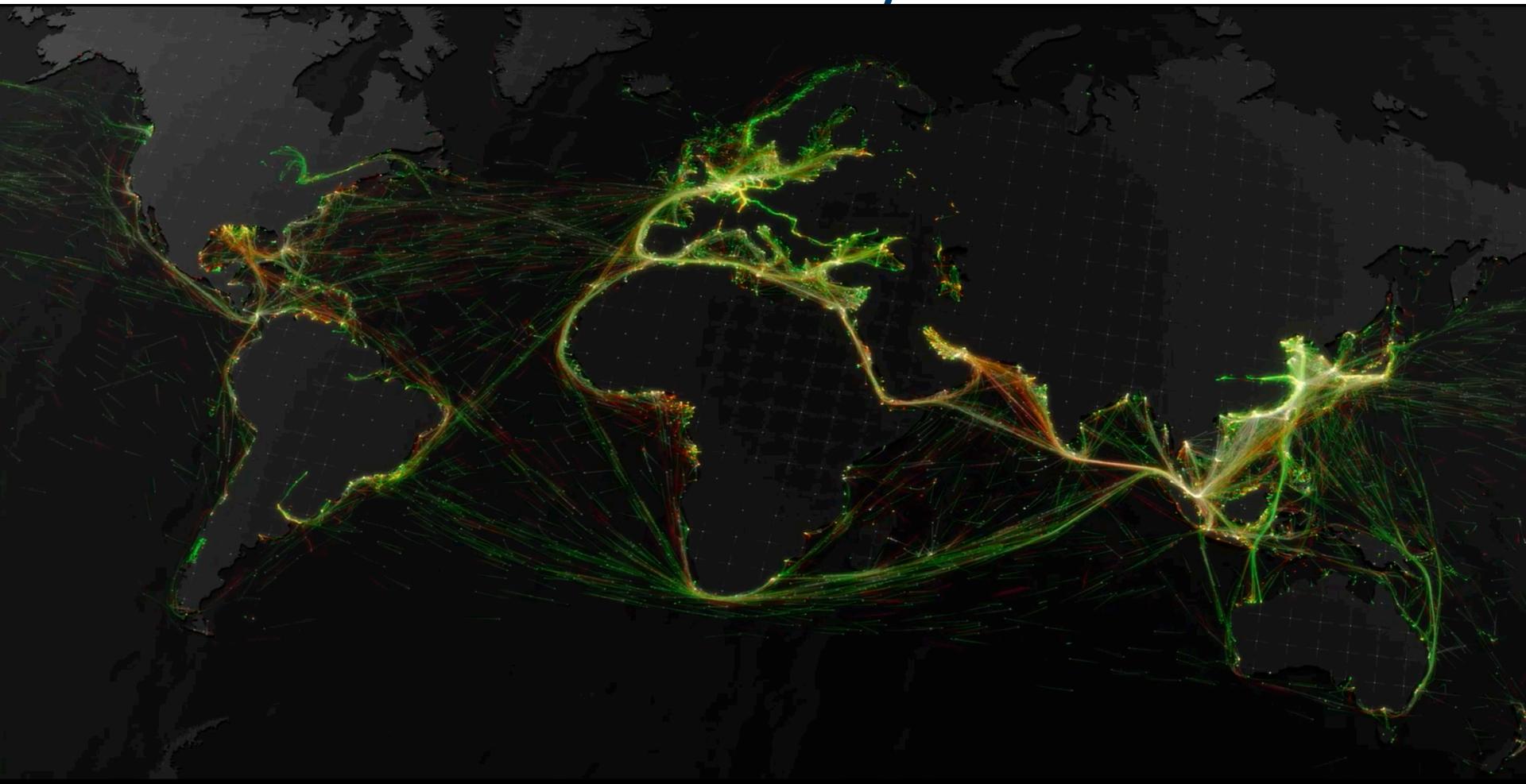
History



19th-century whaling: <https://youtu.be/Tn7fQ5mYHPA>



History



The modern version:

https://www.youtube.com/watch?v=JLg1_dnWXR8



History

- Practical
 - Fisheries
 - Aquaculture
 - Resource extraction
 - Transportation
 - Geopolitics
- Curiosity
 - Beagle (Darwin)
 - Tara expedition
- Sustainability
→ Climate system



Location system

- **Latitude:** parallels, 0-90°N, 0-90°S
 - **Longitude:** meridians, 0-180°E, 0-180°W
 - 23.5°: tropics of Cancer (N), Capricorn (S)
 - 66.6°: Arctic (N), Antarctic (S) circles
 - 0° latitude: ?
 - 0° longitude: ?
 - ? °: international date line
-
- Time keeping: Greenwich, GMT = Zulu = Universal Time Coordinated, UTC= Military time 0-24h



Location system

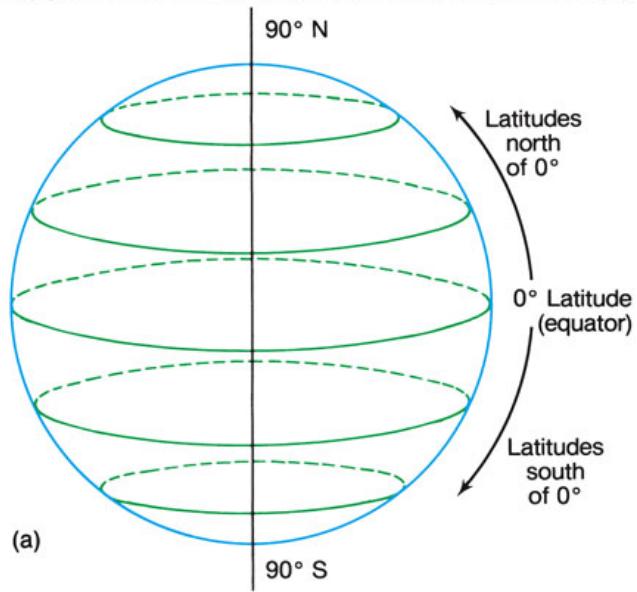
- **Latitude:** parallels, 0-90°N, 0-90°S
- **Longitude:** meridians, 0-180°E, 0-180°W
- 23.5°: tropics of Cancer (N), Capricorn (S)
- 66.6°: Arctic (N), Antarctic (S) circles
- 0° latitude: → Equator
- 0° longitude: → Prime Meridian
- ? °: international date line → ≈180°

- Time keeping: Greenwich, GMT = Zulu = Universal Time Coordinated, UTC= Military time 0-24h

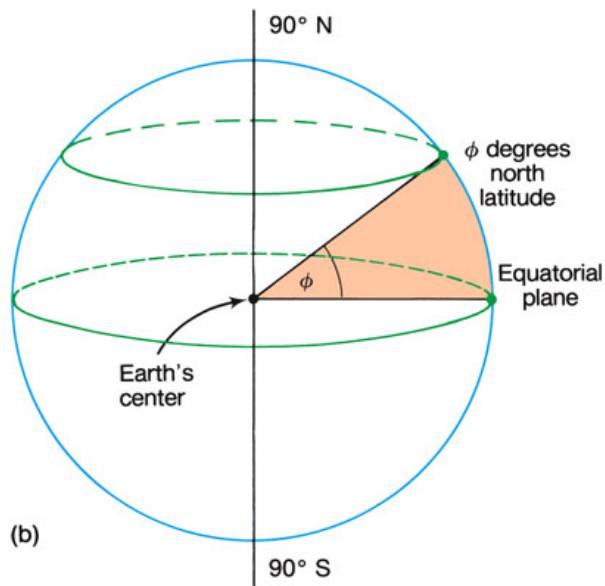


Location system

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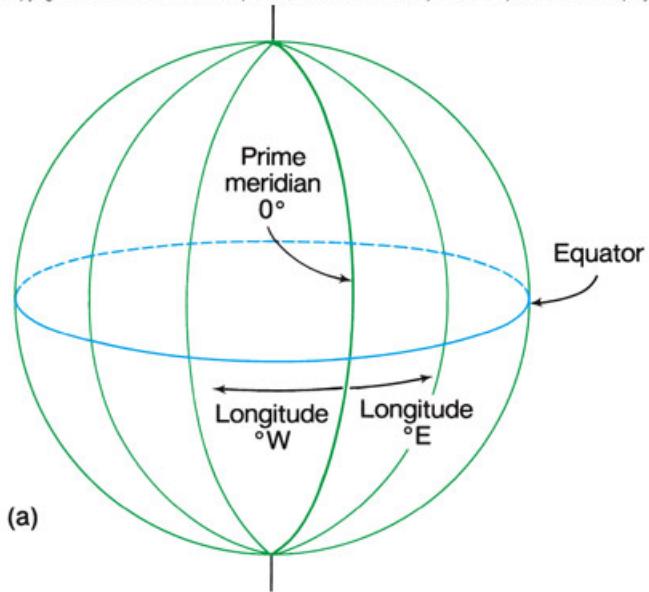


(a)

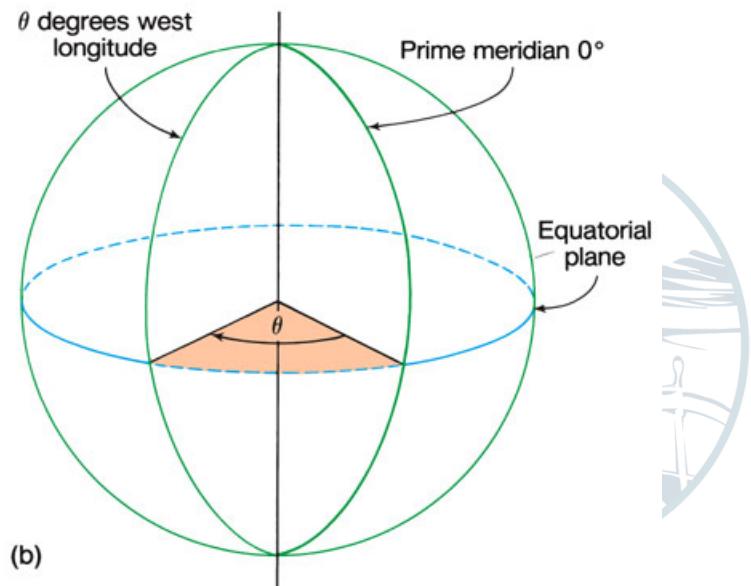


(b)

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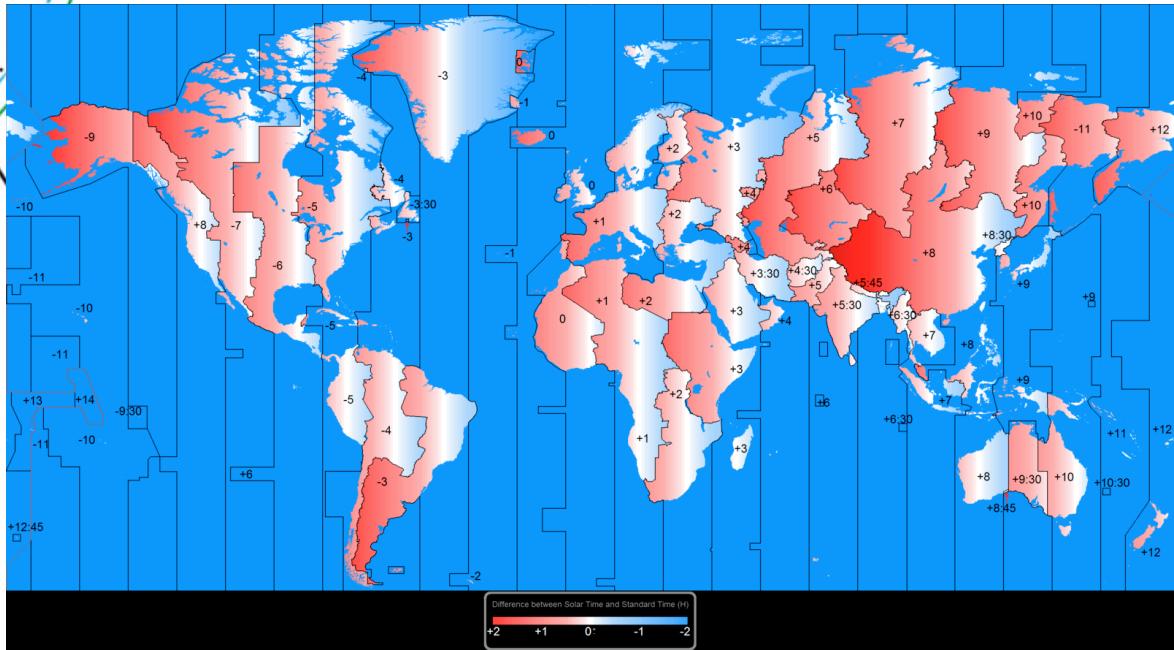
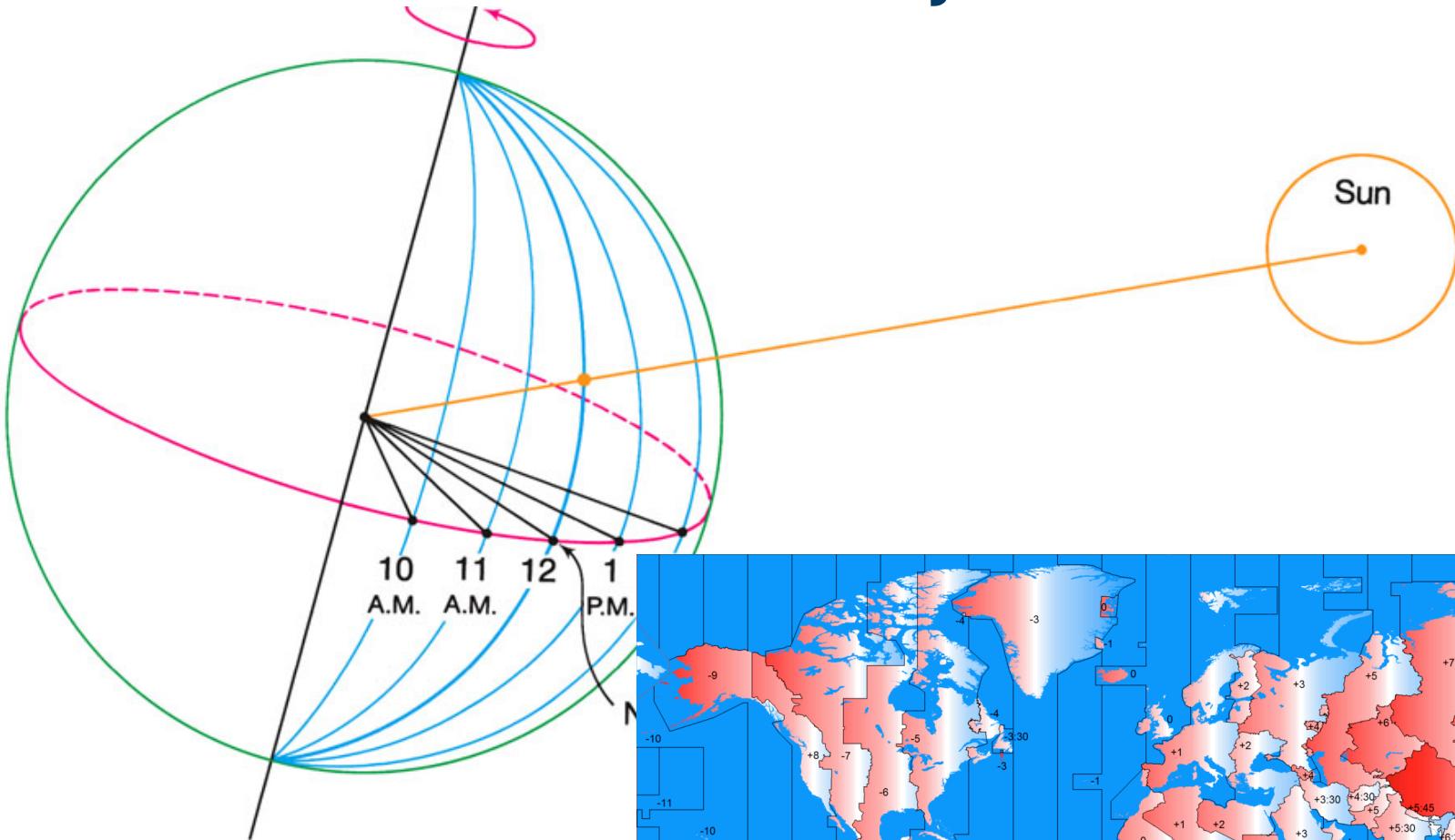
(a)



(b)

Bigelo (b)

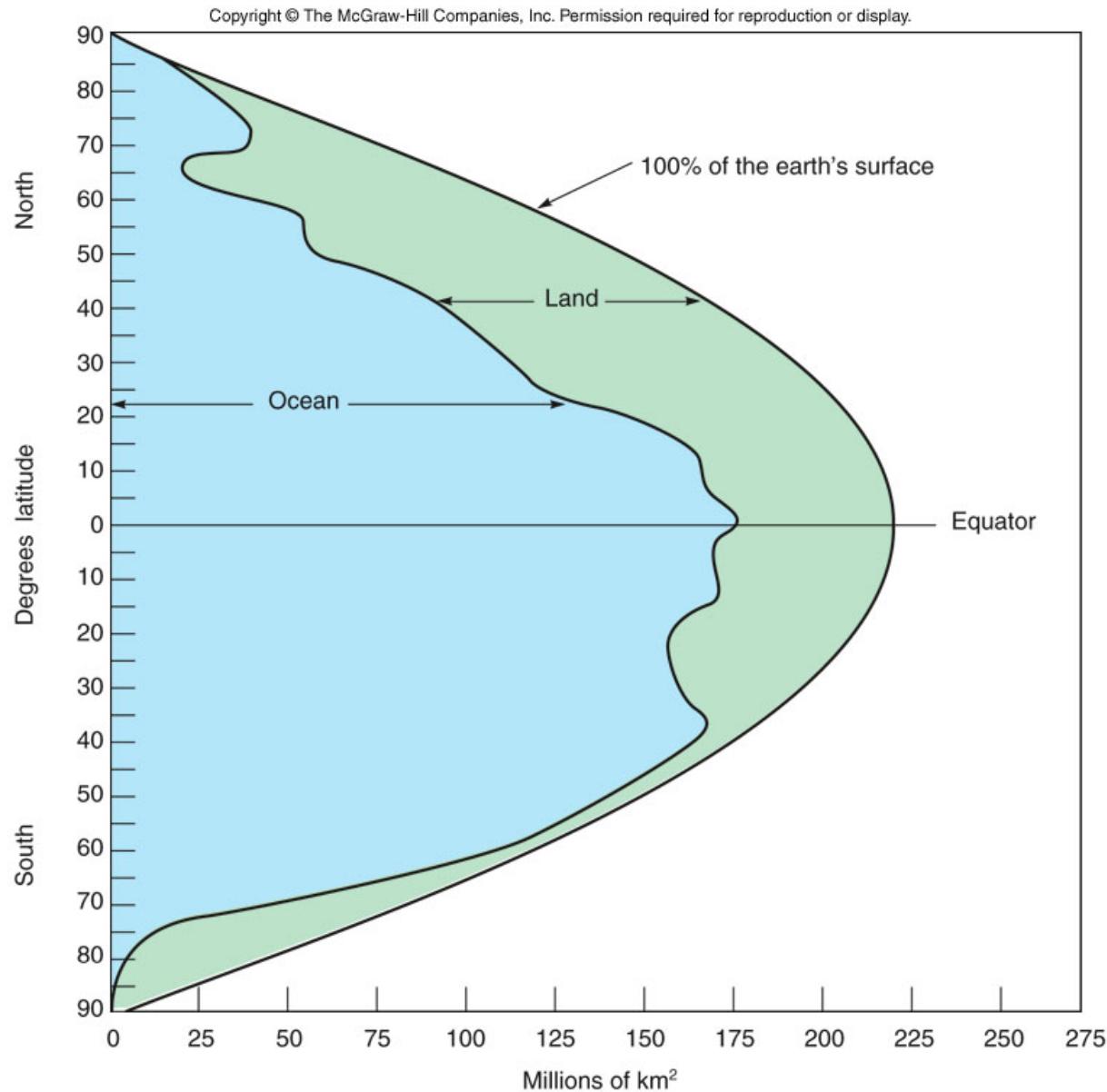
Location system



Location system

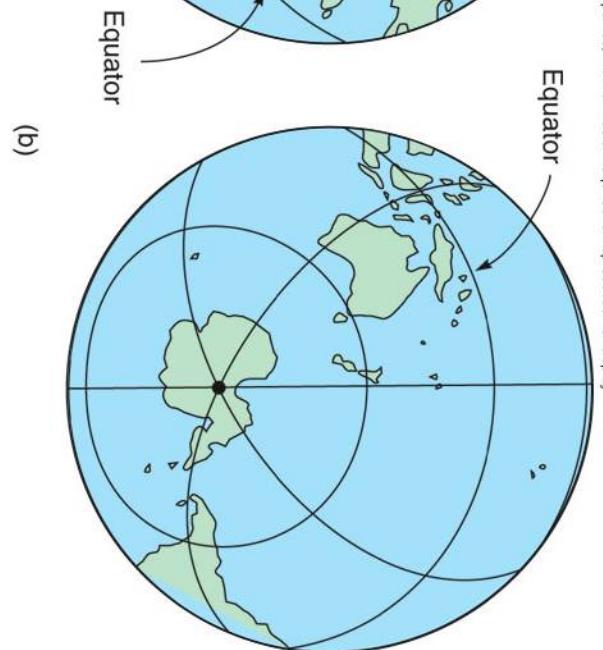
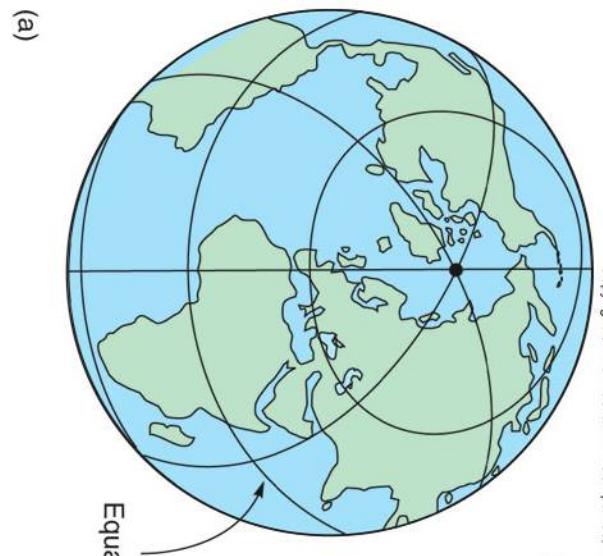
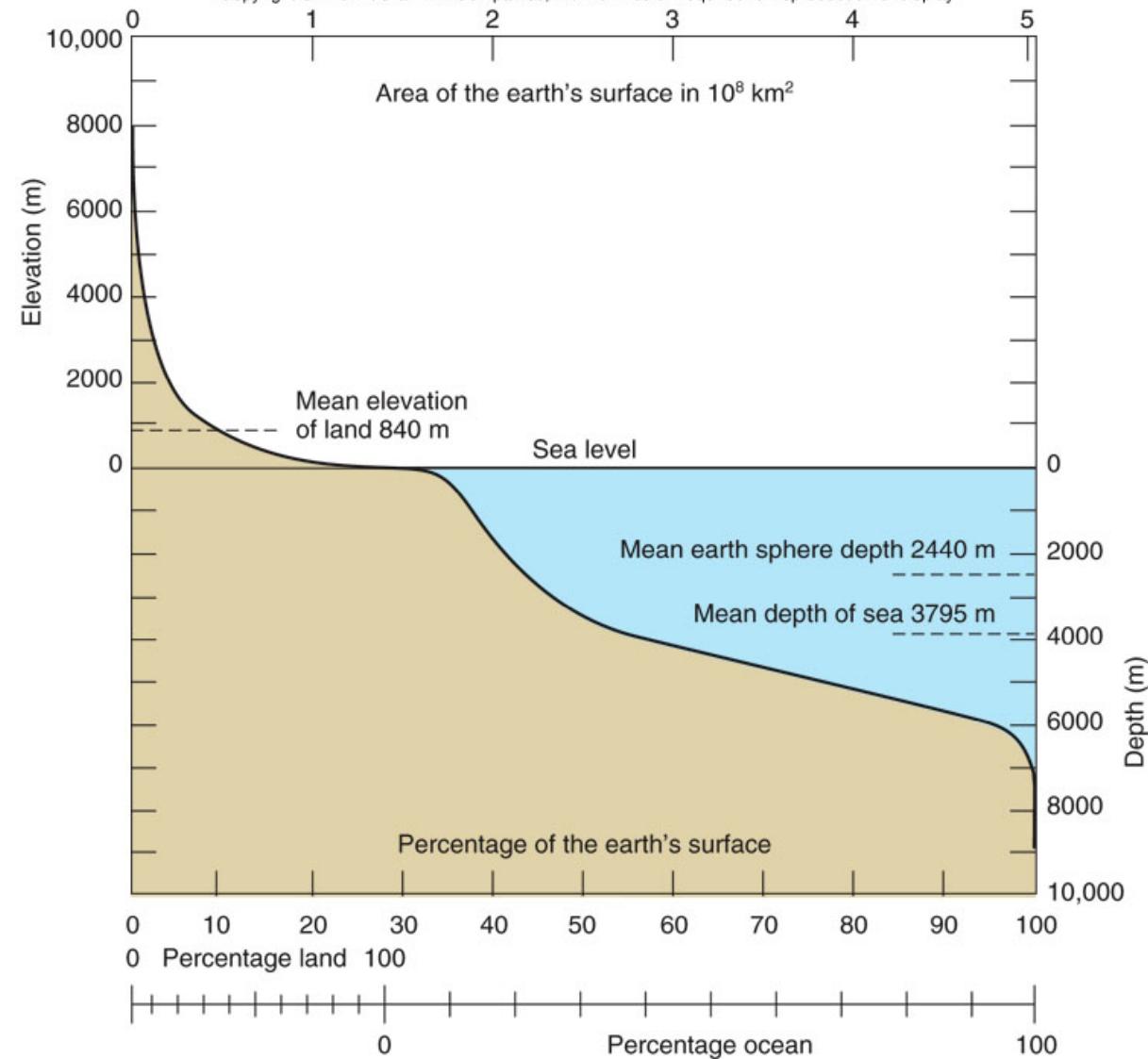


Land/water distribution



Land/water distribution

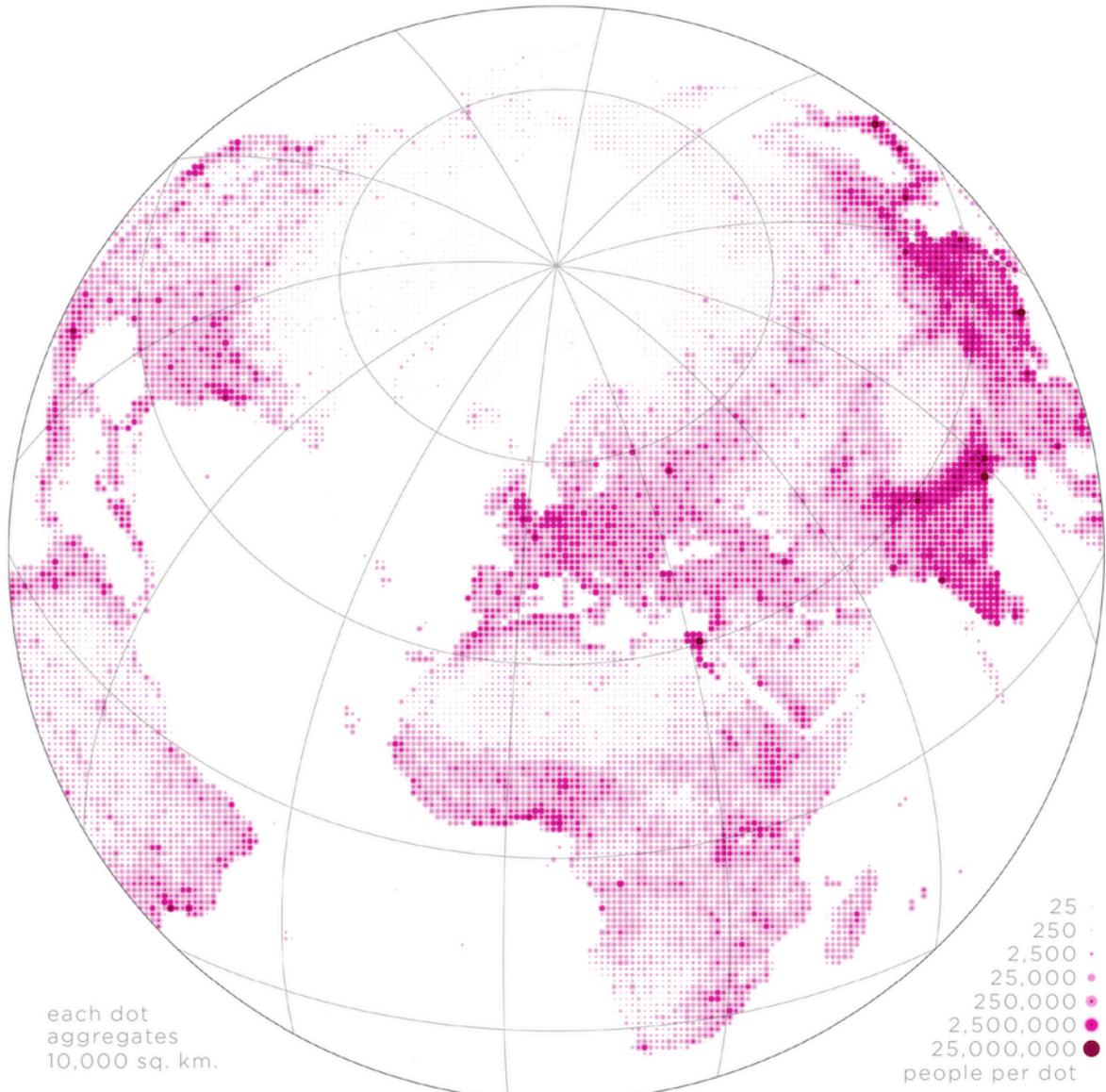
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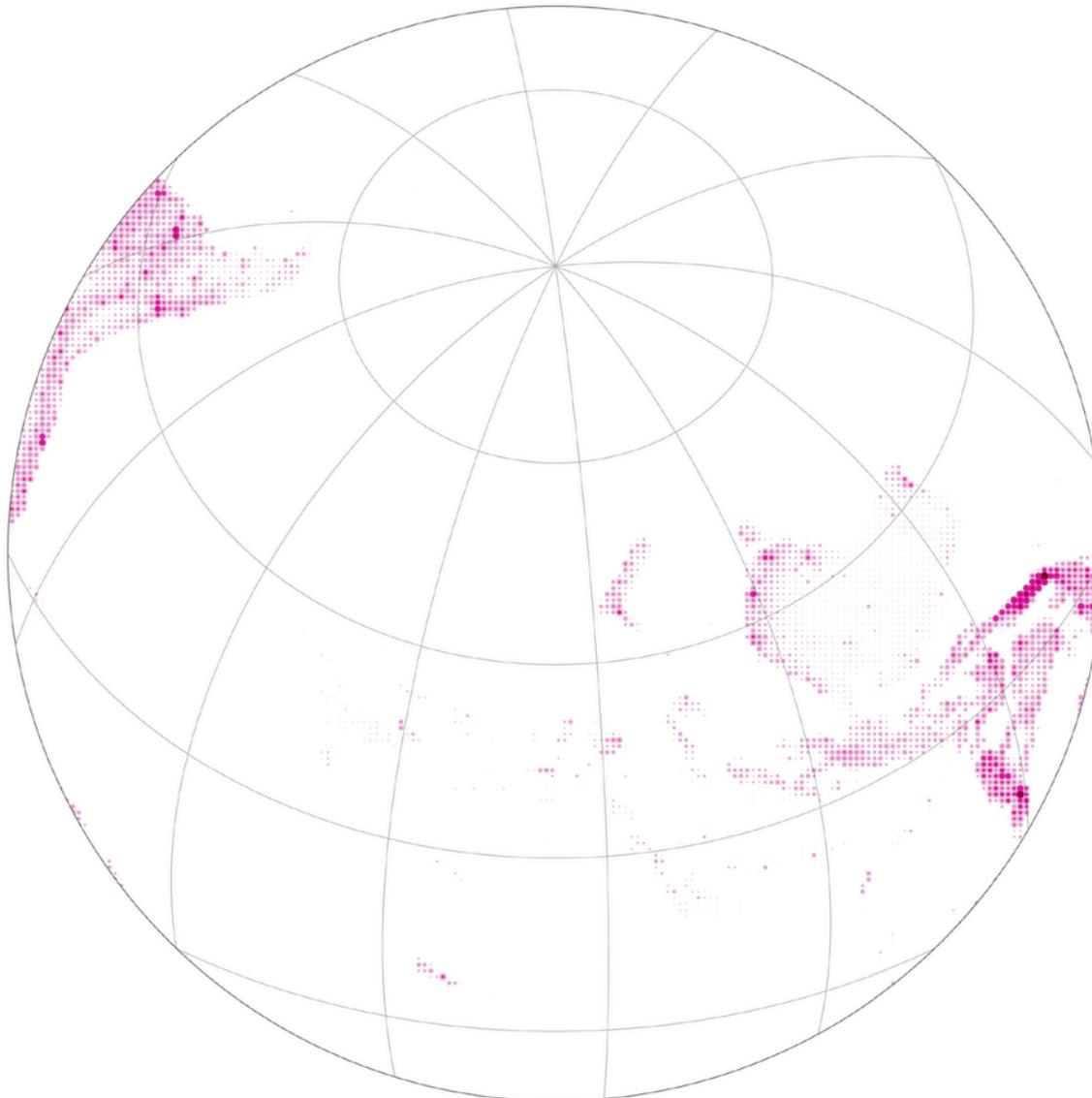
Hemispheres

93% of the world's population



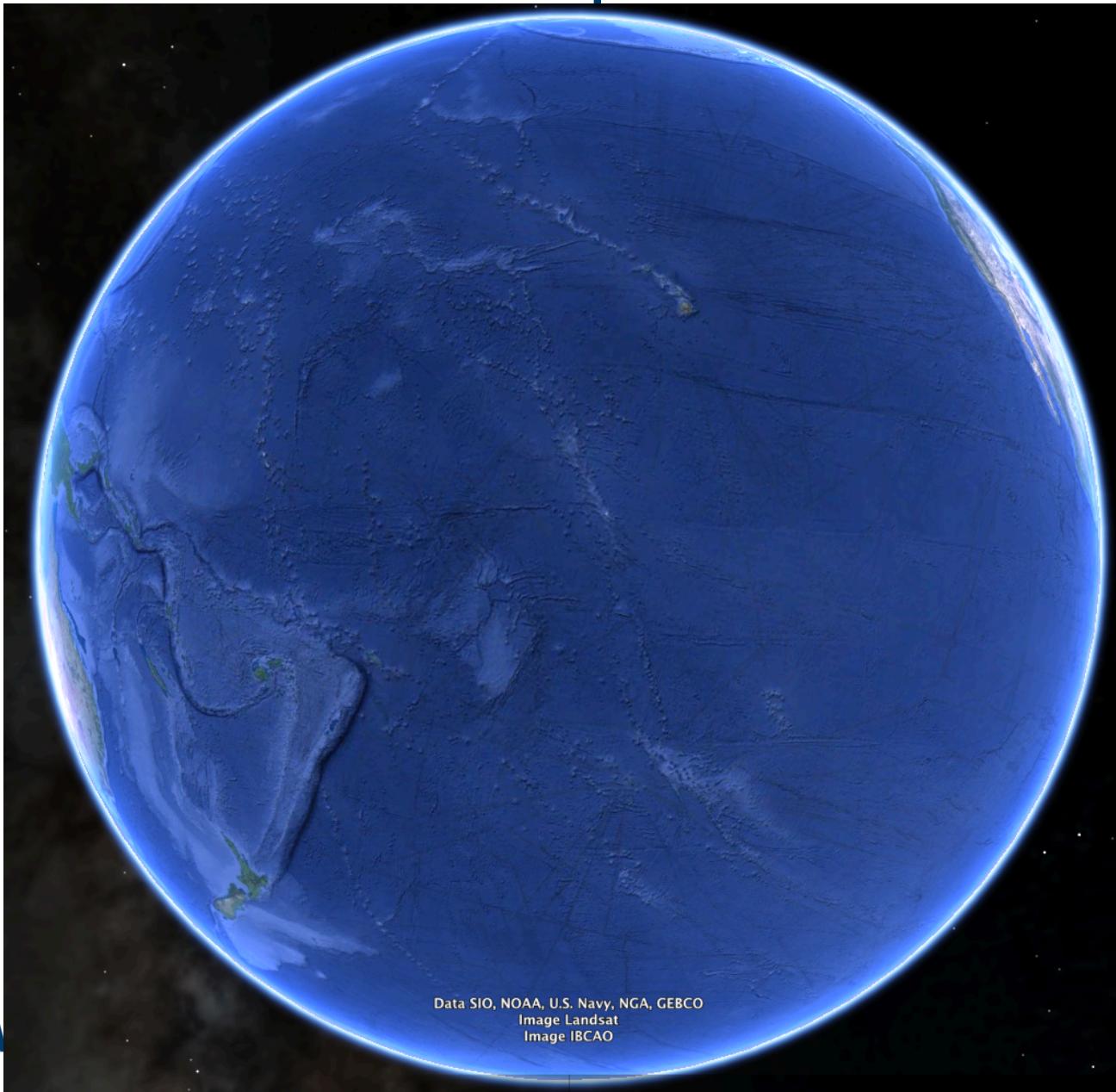
Hemispheres

the other 7%



Bigelow

Hemispheres

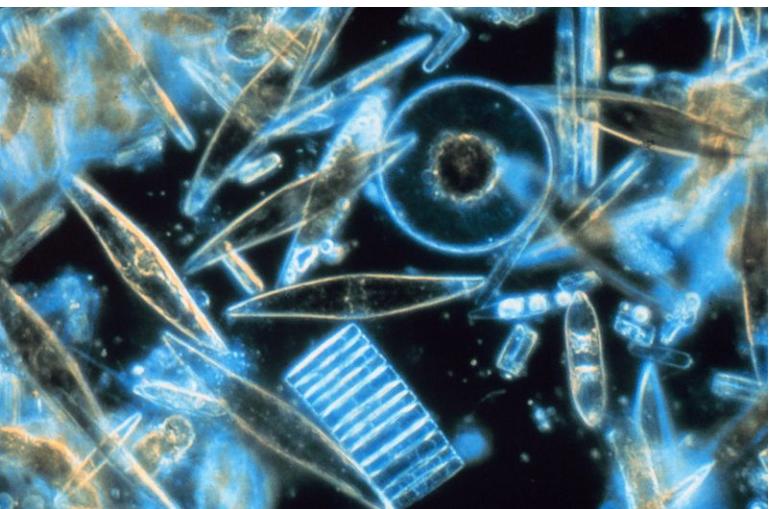


Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Image IBCAO

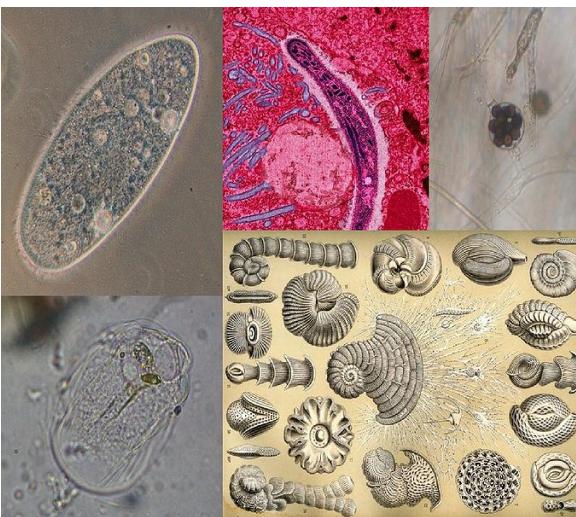
Bigelow



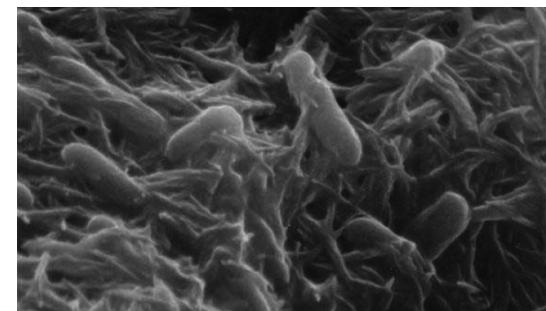
One liter of seawater can contain:



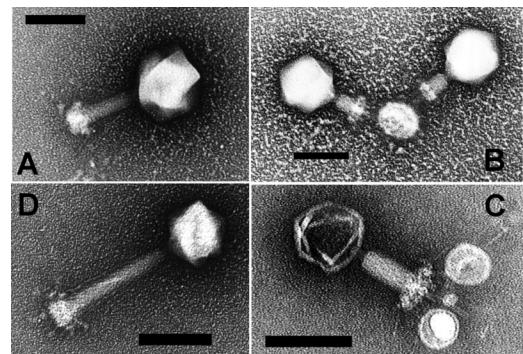
1,000,000 phytoplankton



1,000,000 protists



1,000,000,000 bacteria



10,000,000,000 viruses



And others...



Scientific Papers



Scientific Papers

"Probably what you should learn...is not a large number of facts, especially if they are in books, but what the important problems are, and to sense which experiments, work that has been done, probably aren't quite right."

- James Watson (of Watson & Crick)

- Before reading an article, ask yourself: *What am I looking for in this article?*

- **AUTHORS**

- Where and with whom are they working?
- What is their expertise?

- **TITLE**

- Read and digest the title.
- Is the “take-home message” in the title?

- **ABSTRACT**

- Read carefully and try to understand it. Take some time here.
- Does the abstract align with your expectations for the article?
- Take-home message(s)



Scientific Papers

- **FIGURES, TABLES, LEGENDS**

- What does each figure show?
- Reference the methods where necessary.

- **INTRODUCTION**

- In the first few paragraphs, the objective should be clear.
- What gap does this study fill? *Is it transformative or incremental?*
- Look for assumptions
- Generally, the Intro and Literature Cited sections go hand-in-hand.

- **RESULTS**

- Should align with figures

- **DISCUSSION**

- Authors should explain WHY they saw what they saw
- Beware of unfounded speculation
- ...though new hypotheses are okay
- Look for caveats to “take-home messages”



Scientific Papers

- **HYPOTHESIS**

- Is there a hypothesis?
- Some types of hypothesis

Simple: cause → effect

eg: smoking leads to cancer

Complex: multiple cause → multiple effect

Null hypothesis: no relationship

H_0 : There is no relationship between atmospheric CO₂ and global temperature.

Alternative hypothesis: an alternative to a discounted (usually null) hypothesis

H_1 : Increasing atmospheric CO₂ leads to increasing global temperature by trapping heat.

Statistical hypothesis: validated statistically

