

2.011 Homework #2

Out: 14 February 2006 (Tues)

Due: 28 February 2006 (Tues)

Problem 1: Isolate a phenomena of interest to you, either in the ocean or atmosphere.

- Design a feasible observational strategy you think would be useful to study such phenomena (and indicate why your strategy is good).
- Describe what type of instrumentation you need, what spatial and temporal scales you are looking at, and what type of results you expect.
- Try to find out or Guess how much it would cost!

Problem 2: Ocean Properties

- The deepest part of the ocean is the _____ m deep. It is located at _____° Longitude and _____° Latitude (approximately) in the _____ Ocean.
- One degree latitude is equal to _____ km. Longitude is related to latitude by the following relation: 1° Longitude = _____ km.
- Speed of sound in water is a function of the following properties: (circle all that apply) [Temperature] [Chlorophyll] [Light penetration depth] [Depth] [Salinity] [Oxygen].
- Explain the concept of a Sound Channel in the ocean, where it occurs and what its significance is.

Problem 3: Later in the course, we will study the *El Niño* in the Pacific Ocean. It helps if we have a good idea of the size of the equatorial Pacific.

- What is the width of the Pacific (in degrees of longitude) along the equator?
- Where did you get your information?
- How accurate is your information?
- How do you know the information is accurate? I am looking for an answer with an accuracy of about one degree (111 km).
- Airplanes flying nonstop from Los Angeles to Tokyo go almost north from Los Angeles. Assuming there are no air-traffic control reasons, why do they go north?

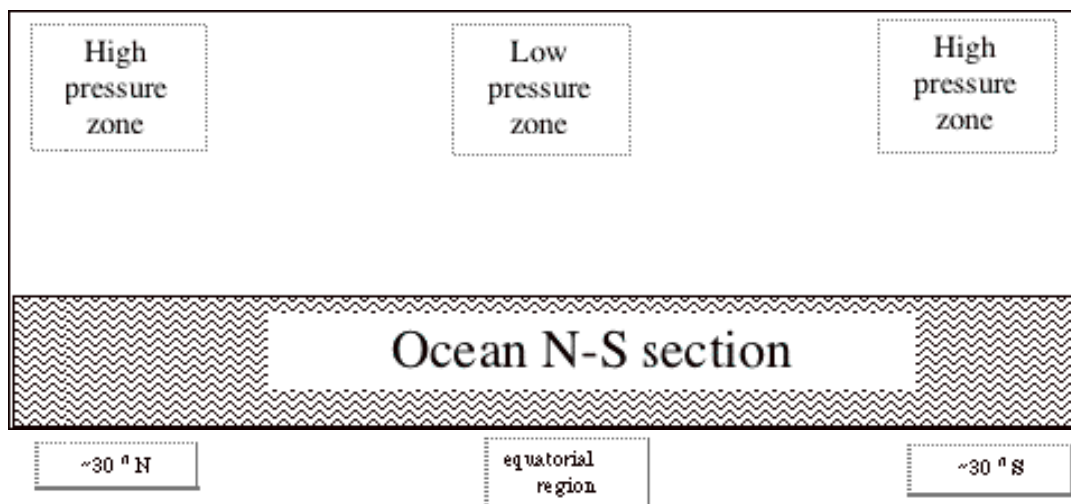
Problem 4: Light and Light Propagation in the Ocean

- a. Why is the sky blue?
- b. Why does the sky look a different color near the horizon at sunset or sunrise?
- c. Light and Sound propagate in waves. What is the relationship between the wave speed (meters/second), the wave length (meters), the wave frequency ($\text{Hz} = 1/\text{second}$)?
- d. What are the wavelengths of blue, green and red light?
- e. Which wavelength of light from the sun propagates the furthest in water?

Problem 5: Wind

The flow of surface winds affects evaporation and moisture in the air. On the figure below, draw

- a) the direction of air flow (winds),
- b) locations with highest evaporation from the sea surface, and zone(s) of maximum precipitation.



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From "Question of the Day" resourceEarth Education Online, <http://earthednet.org/>

Problem 6: Describe and interpret the global average sea surface temperature (SST).

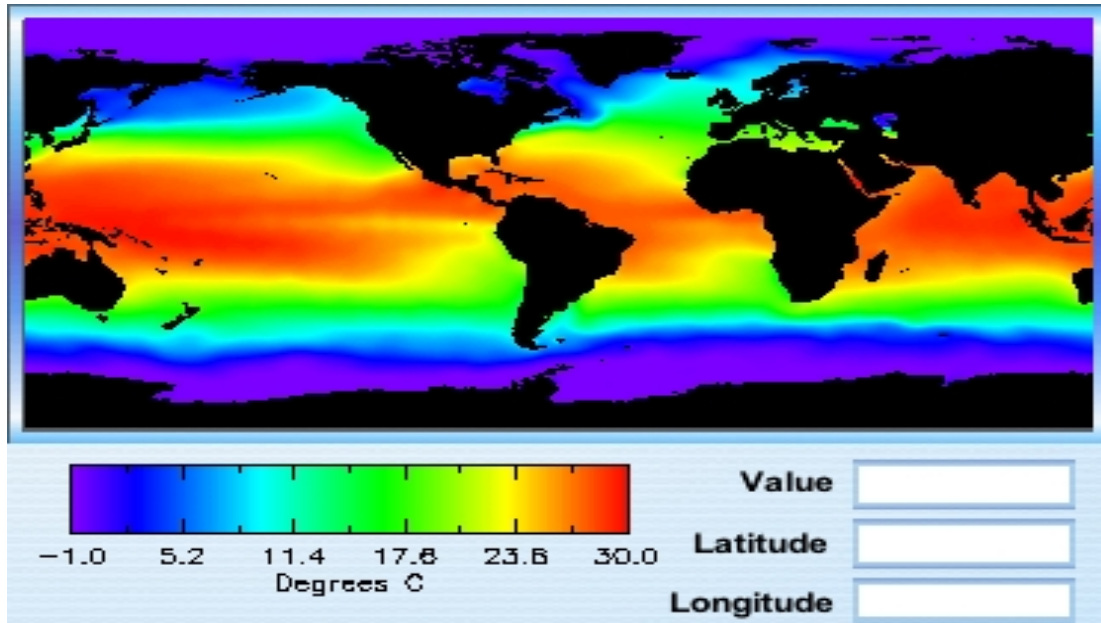
Courtesy of William Prothero. Used with permission.

From "Question of the Day" resource Earth Education Online, <http://earthednet.org/>

The data to describe: The image with data below is from Global Ocean Data Viewer. It represents the ocean temperature averaged over many years. This means that the variations that naturally occur during the year and during different years are not represented in this one plot. This kind of plot is very useful when the purpose of the investigation is to determine the long-term patterns that persist for many decades, without being confused by shorter-term variations.

The task: Your job is to write a short scientific discussion of the data shown in the figure above and to develop a model explaining this data.

Average Annual Sea Surface Temperature



- a. **Describe:** Describe the data found in the image above. Be brief, but don't miss important features. Look at the most obvious temperature variations. Possible references, for descriptive purposes, are the geographic position such as latitude, longitude, size of the body of water, or distance from a continent. Look for smaller variations in the major pattern. When you write down your observations, use data values and locations to illustrate your statements. Be as quantitative as possible.

(continued...)

- b. ***Interpret:*** Look for patterns and relationships that explain the overall distribution of the ocean temperatures and write a short paragraph. Also, explain any variations from the overall pattern. Use simple drawings to support your explanation(s). Draw and/or write on the figure if it will clarify your explanation. You should begin your description by mentioning the main phenomena that affect the temperature of the ocean's surface.

Note: an interpretation requires a theory or model

- c. ***Model:*** Develop a model to explain the most dominant pattern of sea surface temperature (SST). A helpful hint is to consider factors that contribute to heat input. Diagrams and sketches can be very useful. Describe how the data fits the model. Also, discuss any data that do not correspond to the model (i.e. it does not support the model). You may also want to suggest other data that could help with developing your model.

Problem 7: Briefly indicate what you are most interested in learning about in this course.