

## HOW DOES LATITUDE CORROLATE WITH SEA SURFACE AND AIR TEMPERATURE?

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**OVERVIEW:** This lesson can be used to reinforce previously learned concepts of latitude and longitude and to apply these concepts to new learning about how latitude and ocean and air temperature at different latitudes influences weather and climate.

**TIME:** 1-2 class periods

**OBJECTIVES:** Students will use real time data from ocean buoys to determine the relationship between latitude and sea surface and air temperature. They will also compare sea surface and air temperature to understand how the difference between ocean temperature and air temperatures affects weather patterns.

**SCIENCE STANDARDS:** Grades 9-12

### **Earth Science:**

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

As a basis for understanding this concept:

- a. Students know how differential heating of earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.

6. Climate is the long-term average of a region's weather and depends on many factors.

As a basis for understanding this concept:

- b. Students know the effects on climate of latitude, elevation, topography and proximity to large bodies of water and cold or warm ocean currents.

### **Investigation and Experimentation:**

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:

- d. Formulate explanations by using logic and evidence.
- h. Read and interpret topographic and geologic maps.
- i. Analyze the locations, sequences, or time intervals that are characteristics of natural phenomena.
- k. Recognize the cumulative nature of scientific evidence.
- l. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

### **MATERIALS:**

- Computer with Internet access.
- Student worksheets supplied for this lesson.

PROCEDURE:

- **Launch the Internet and type** the following address into the address window, or the search window of your internet browser (e.g Google); <http://marine.rutgers.edu>



This is the web site of the Rutgers University Institute of Marine and Coastal Sciences.

- **Click on Education and Outreach** on the left side of the screen, then
- **Click on Using Ocean Observing Systems in K-12 Education** on the right side of the screen.
- **Click on To the Sea**



- **Click** on the first bullet – What is an Ocean Observing System

This link will take you to a short video clip with the narration written below.

(NOTE: Students can watch this as a group before, or individually as part of this lesson.)

**Watch** the video and then answer the following questions.

1. Describe three ways that scientists can collect data from the ocean.
    - a. \_\_\_\_\_
    - b. \_\_\_\_\_
    - c. \_\_\_\_\_
  2. Describe three kinds of information that scientists can collect about the ocean?
    - a. \_\_\_\_\_
    - b. \_\_\_\_\_
    - c. \_\_\_\_\_
- **Click** on the back button on your computer screen to go back to the previous page.
  - **Click on Current Ocean Systems data resources;** (the second bullet).
  - **Click on #4 – Buoys and Shore Stations.** (Note - The real time data resources available at the other links on this list are incredible! Check them out!)
  - **Click on National Data Buoy Center;** (the third bullet)
  - **Hold** your mouse pointer over the rectangular box that includes the area in which we live. A box which says “Southwest” should pop up.
  - **Click** on this rectangle and a map of the ocean off our coastline will appear.
  - **Click** on the square in the upper right hand corner of the screen. An easily recognizable map of our coastline and ocean will appear.

- **Choose** one of the moored buoys (Blue square).
- **Click** on the number to get the buoy information. (You may go back and check out several other buoys before choosing one to write about). Answer the following questions about the buoy you have chosen:

Number \_\_\_\_\_ Location \_\_\_\_\_

Type of Buoy \_\_\_\_\_ Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

Water Temperature \_\_\_\_\_ Air Temperature \_\_\_\_\_

We will follow the above procedure at four additional locations.

- **Go back** four times to the map of the world.
- **Chose another blue buoy, click on it and record the information as above.**

Number \_\_\_\_\_ Location \_\_\_\_\_

Type of Buoy \_\_\_\_\_ Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

Water Temperature \_\_\_\_\_ Air Temperature \_\_\_\_\_

- **Go back** to the world map and click on a box that includes the equator. (Don't click on TAO). Try to find a buoy (red circle) that is right on the equator! (0° latitude). Record the buoy information.

Number \_\_\_\_\_ Location \_\_\_\_\_

Type of Buoy \_\_\_\_\_ Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

Water Temperature \_\_\_\_\_ Air Temperature \_\_\_\_\_

(Buoys below the equator do not have the data we need for this activity)

- **Click** on a new box above the equator that you haven't checked out yet.
- **Chose** a buoy and record the data below.

Number \_\_\_\_\_ Location \_\_\_\_\_

Type of Buoy \_\_\_\_\_ Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

Water Temperature \_\_\_\_\_ Air Temperature \_\_\_\_\_

- **Click** on another new box above the equator that is at a different latitude.
- **Chose** a buoy and record the data below.

Number \_\_\_\_\_ Location \_\_\_\_\_

Type of Buoy \_\_\_\_\_ Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

Water Temperature \_\_\_\_\_ Air Temperature \_\_\_\_\_

Use the information above to fill in the chart below.

**BUOY DATA TABLE**

	Date	Time	Location *	Latitude	Sea Temp	Air Temp.
1.						
2.						
3.						
4.						
5.						

\*Arrange your buoy data by latitude with the northern most buoy on the top (#1) and the equator buoy on the bottom (#5).

**ANALYSIS:** Answer in complete sentences.

1. Was the sea temperature or the air temperature warmer at each location?

\_\_\_\_\_

2. Why do you think that this was the case?

\_\_\_\_\_

\_\_\_\_\_

3. Where were the sea and air temperatures the closest together? \_\_\_\_\_

4. Where were they the most different? \_\_\_\_\_

5. Do you think that the temperatures would have been different at a different time of day?

Explain. \_\_\_\_\_

\_\_\_\_\_

6. How do you think that the temperatures at the five buoys would change at different times of the year?

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CONCLUSIONS:

1. How does latitude affect sea and air temperature?

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2. What is the relationship between sea and air temperature at different latitudes?

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3. Do you think that these findings would be the same for the Southern Hemisphere? Why or why not?

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COMMUNICATION: Write a clear and concise abstract describing your investigation, findings, and conclusions for other scientists. Describe what you did, what you found out and what you learned.

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EXTENTIONS: (Or ideas for future lessons!)

**Go back** to one or more of the buoys and look for historical data sets.

1. Compare the sea and air temperatures to each other at different times of day. Has the relationship between air and sea temperature changed? Explain.

2. Look at sea and air temperatures at the five buoys at different times of the year. What patterns do you see?

ASSESSMENT QUESTIONS:

Use the following **answers** to fill in the blanks:

Equator	Latitude	30°N latitude	60°latitude	90°N latitude	Longitude
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1. Which location has the warmest water? \_\_\_\_\_
2. Which location has the coldest water? \_\_\_\_\_
3. Which location is at 0° latitude? \_\_\_\_\_
4. Which location is closest to where you live? \_\_\_\_\_
5. At which location is closest to the North Pole? \_\_\_\_\_
6. Which location is closest to the South Pole? \_\_\_\_\_
7. These imaginary lines run east/west and are parallel to the equator. \_\_\_\_\_
8. These lines run north/south through the poles. \_\_\_\_\_
9. Which location has air and ocean temperatures that are the closest to each other? \_\_\_\_\_
10. Which location has air and ocean temperatures most different from each other? \_\_\_\_\_