

Ocean Temperatures Activity Key

*** For ease of use during class the Teacher Key pages are numbered the same as the Student Activity Book pages.

I. Introduction

Air temperature and water temperature (WTMP) vary from season to season and with latitude. (Water temperature is sometimes called sea surface temperature, or SST.) A location at 60° N latitude (Alaska) is much colder than one at 17° N latitude (Hawaii). The lower the latitude, the higher the temperature. The warmest latitude is around the equator (latitude=0). Temperatures in areas that are near the water tend to be warmer than areas far away from water. The sea water helps to keep the land temperatures nearby warmer. During the year, air and WTMP warm and cool gradually. They are hottest in the summer and coldest in the winter. This is, of course, for the northern hemisphere. In the southern hemisphere it is cold in June and warm in December.

Get Info Objectives

1. List data collected by marine buoys.
2. Describe how data is transmitted worldwide.
3. Explain the differences between near-shore and offshore air and water temperatures.

Interpret Data Objectives

1. Collect information about marine buoy sites.
2. Record latitude and longitude of sites.
3. List times of most recent observations.
4. Read tables of current data and record information.
5. Interpret graphs of air and water temperatures (WTMP).

6. Calculate the differences in temperatures of locations at different latitudes.
7. Collect data for one week at a site closest to school and create a graph of the data.

Application Objectives

1. Predict air temperature changes based on past and current data.
2. Predict water temperature changes based on past and current data.
3. Correlate air and WTMP to the effects of El Nino nationwide and locally.

Before doing anything else, add the NOAA Research "Ocean Temperatures" page to Bookmarks or Favorites on your browser.

- From the Ocean Temperatures main page, click "Get Info."

II. Get Info

A. Air Temperature

- Click on the "National Data Buoy Center" site.
- Click on "Science Education" on the lower left side of the page.
- Click on "Are air temperatures the same over land and water?"
- Read the information and answer the following question.

1. What do you think causes the difference in air temperatures between two stations that are only 192 miles apart?

The heat in the water is radiating into the air making it warmer than the
station near the land.





- After you have answered the question click on Answer at the bottom of the page and compare it with what you wrote.
- Scroll to the bottom of the page and click "Return to Science Education Home."

B. Water Temperature



- Click on "Does water temperature differ between near-shore and offshore sites? Why or why not?"
- Read the information and answer the following questions.



1. Is the colder surface water close to shore or far from shore?

The colder water is closer to shore.

2. We know that water temperatures from near-shore sites differ from temperatures offshore. How does this occur?

River runoff, continental air masses' effects on water temperature, near-shore ocean currents and upwelling affect the near-shore water

temperature. Winds blow the warm surface water away from the shore, then water upwells to replace the warm surface water.

- After you have answered the question click on Answer and check what you wrote. Add anything you didn't think of.
- Scroll to the bottom of the page and click on "Return to Science Education home."
- Click on "FAQ" (Frequently Asked Questions) at the top of the page.



C. Buoy Sensors

- Click "Do NDBC's meteorological and oceanic sensors measure data for the entire hour?"

1. How long is data collected at the buoys?

12 minutes at moored buoys, 8 minutes at C-MAN buoys.

- Click "Back" to return to the main FAQ site.

- Scroll to "At what heights are the sensors located on the moored buoys?"

2. How high are the air temperature sensors located on the buoy at station 41004?

4 meters

- Click on "Can you describe the moored buoys?"

3. How many different kinds of moored buoys are there? 4

4. Sizes range from 3 – 12 meters

5. List the data moored buoys collect.

Barometric pressure, wind direction, wind speed, wind gusts, air

temperature, sea temperature, wave height, dominant wave period,

average wave period, wave direction.

- Click "Back" to return to the main FAQ site.

D. Data Transmission

- Click on "How do measured data get from the buoy or C-MAN site to the various users worldwide?"

1. How are the data transmitted? Buoys transmit information to one of NOAA's Geostationary Operational Environmental Satellites (GOES) which transmit it to collection centers.

2. How often are data transmitted? hourly

- Click "Back" to return to the NOAA Research "Ocean Temperatures" main page, or choose "Ocean Temperatures" from your Bookmarks or Favorites.

- Click "Gather Data."

III. Gather Data

- Click on the National Data Buoy Center main page that shows the world map.

Alaska

- Click on the box that covers Alaska.

- Find "46035" and click on the box.

A. Current data for Alaska

1. What is the latitude? 56° 54' 38" N longitude? 177° 48' 38" W

- Scroll down to "Conditions" and answer the following questions.



2. What time was the most recent observation? _____

Within an hour of the last observation

3. Current Meteorological Data:

Temperature answers will vary daily

Sea level pressure answers will vary daily

4. Wind and Sea State Data:

Sustained wind answers will vary daily

Gust answers will vary daily

Water temperature answers will vary daily

5. Detailed Wave Data

Significant wave height answers will vary daily

Average wave period answers will vary daily

B. Recent Observations for Alaska

- Scroll down to and click on "Real Time Data."
- Click on "description" to the right of "Real Time Standard Meteorological Data."

1. What does "ATMP" mean? air temperature

2. What does "WTMP" mean? water temperature

- Click "Back" to return to the "46035 Real Time Data" site.
- Click on "Real Time Standard Meteorological Data."

Times in the chart are given in 24-hour format like military time. If the hour (hh) is given as 1 through 12, the times are a.m. and 12 o'clock is noon. If the hour is given as 13 through 23, subtract 12 from the time. You now have regular time p.m. If the hour is given as 00, it is midnight.





3. Record the air temperature (ATMP) and water temperature (WTMP) for the last two days at 1 a.m. and 1 p.m. Record the unit of measure with your answers.

NOTE: all answers to questions 3, 4, 5, & 6 will vary daily.

Date _____	Air temp	WTMP
1 a.m.	_____	_____
1 p.m.	_____	_____

Date _____	Air temp	WTMP
1 a.m.	_____	_____
1 p.m.	_____	_____

4. What was the highest water temperature? _____

5. What was the lowest water temperature? _____

6. What is the difference between the lowest and highest water temperatures? _____



- Click "Back" to return to the world map on the NDBC main page.
- Click on the left box on the Gulf of Mexico/Texas Coast (not Florida.)

Mobile, Alabama

- Find station "42040" and click on the box.

C. Current Data for Mobile, Alabama

NOTE: all answers to questions 2, 3, 4 & 5 will vary daily.

1. What is the latitude? 29° 12' 36" N longitude? 88° 12' 00" W

2. Time of last observation? _____





3. Current Meteorological Data:

Temperature _____

Sea level pressure _____

4. Wind and Sea State Data:

Sustained wind _____

Gust _____

Water temperature _____

5. Detailed Wave Data

Significant wave height _____

Average wave period _____



- Click "Back" to return to the NOAA Research "Ocean Temperatures" main page, or choose "Ocean Temperatures" from your Bookmarks or Favorites.

- Click "Forward" at the bottom of the page to go to "Gather Data.2".

D. Recent Observations for Mobile, Alabama

- Scroll down to the bottom of the page and click on "Real Time Data."

- Record the air temperature (ATMP) and water temperature (WTMP) for the last two days at 1 a.m. and 1 p.m. Record the unit of measure with your answers.

NOTE: all answers to questions 1, 2, 3, & 4 will vary daily.

Date _____

Air temp

WTMP

1 a.m.

1 p.m.

Date _____

Air temp

WTMP

1 a.m.

1 p.m.





2. What was the highest water temperature? _____

3. What was the lowest water temperature? _____

4. What is the difference between the lowest and highest water temperatures? _____

E. Differences in Latitude

1. How many degrees latitude apart are Alaska and the Gulf Coast?

Bering Sea Buoy	<u>56° 54' 38"</u>	latitude
Mobile Buoy	<u>29° 11' 42"</u>	latitude
	<u>27° 42' 56"</u>	difference

(When you borrow, you borrow 60 seconds.)

2. How is temperature affected by latitude?

As latitude increases, temperature decreases.

- Click "Back" to return to the NOAA Research "Ocean Temperatures" main page, or choose "Ocean Temperatures" from your Bookmarks or Favorites.
- Click on "Application."

IV. Application

A. In Your Neighborhood - or Close By

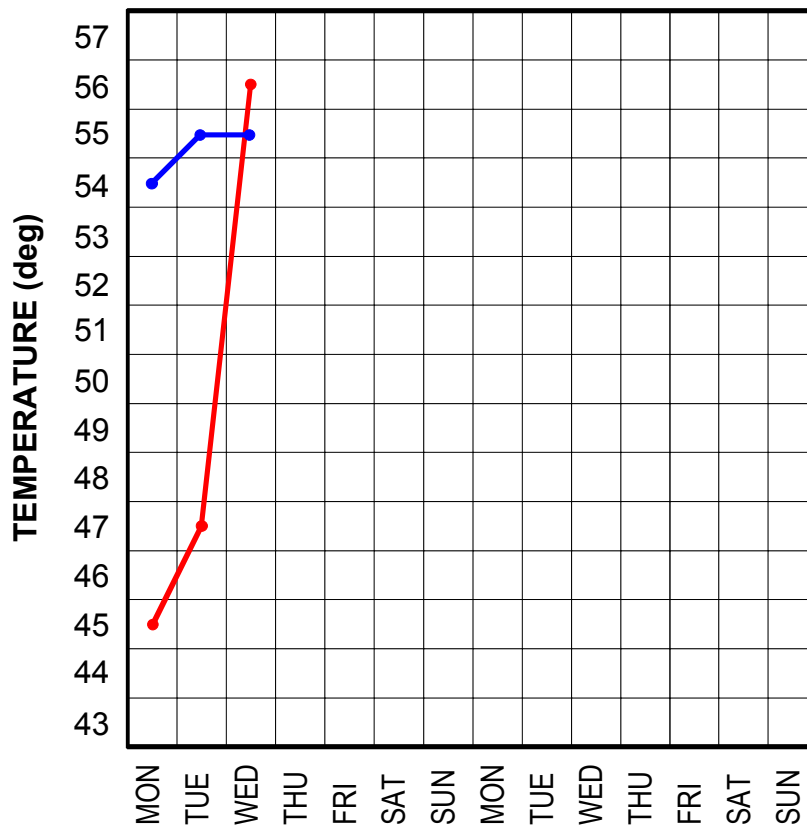
Pick a coastal area near where you live or one you have visited. Record the air and water temperatures for a week (or longer). Record your data in a chart like the one below.





Day	Date	Time of Observation	Air Temp	Water Temp
Monday	3/23/2004	9:00 a.m.	45°	54°
Tuesday	3/24/2004	9:00 a.m.	47°	55°
Wednesday	3/24/2004	9:00 a.m.	56°	55°

Graph your data on a graph like the one below. Fill in the temperature on the y (vertical) axis. Write the days on the x-axis like in the graph below. Start your temperatures about two degrees below your lowest reading. Fill in the dates of your observations. You will need to use two different color pens or pencils (one for air temperatures, and one for water temperatures).



(Student graphs will vary)



1. How do you think the information gathered from the system of buoys helps people who work on the water?

Buoy data is used to predict times of the year when maintenance tasks can be safely performed on oil rigs and other marine structures. Storm intensity can be gauged using buoy data. Buoys are used to predict weather patterns over the oceans and in coastal areas.

2. Who else might benefit from the information collected by these buoys?

People who live on the coast can use buoy data to predict the weather. Surfers, fishers, and people on vacation use the data to know when the weather will be nice. Climatologists use it to model weather patterns over the oceans and in coastal areas.

3. Based on data you collected about the site near where you live or have visited, what do you think the air temperature will be for

The rest of the week? _____

The rest of the month? _____

Three months from now? _____

4. If you have completed the El Nino site, what effect has El Nino had on the water and air temperatures in North America?

Water temperatures in the western Pacific have decreased. The air temperatures have increased in the winter.



5. What effect has El Nino had on the area where you live?

Rainfall increases have been reported in the South and in the Western states. Winter temperatures have been unseasonably mild.

6. Based on what you have learned about moored buoys in the ocean, design a buoy to collect data in outer space. Give it a name, list the measurements it will collect, and draw a diagram of it.

Answers will vary.



- Click "Back" to return to the NOAA Research "Ocean Temperatures" main page, or choose "Ocean Temperatures" from your Bookmarks or Favorites.
- Click "Enrichment."

V. Enrichment Activities

A. Research

1. Find out what the highest and lowest air and water temperatures are for the area where you live.





2. Interview local weather people. Find out where they get the information they use to forecast the weather.
3. Find out what marine animals live in cold water and which ones live in warm water. Divide your list into mammals, fish, and invertebrates. List the location and temperature range for each organism.
4. Investigate the Inuit people (Eskimos), how they live in cold weather and depend on the sea to live. Research their food, shelter, and clothing and how each relates to the sea.
5. Investigate Polynesians and how they live in warm weather and depend on the sea to live. Research their food, shelter, and clothing and how each relates to the sea.

B. Data Collection



1. If you live near the coast, keep a record of the air and water temperatures for a period of time. You can get this information from your newspaper or from the sites you visited in this activity. Graph the data you collect using a line or bar graph.
2. Collect news articles or search the web for information on El Nino and how it has affected air and water temperatures. Write a short report explaining what you found out.
3. Interview someone who fishes commercially. Ask what species are caught in warm water and what species are caught when it is cold. Make a chart listing what is caught when. Also indicate the amounts that are caught, if possible.

B. Related Web Sites

1. Interactive Marine Observations - Tides, Maps, Weather and Wave Conditions. (To use this interactive interface, JavaScript needs to be enabled on your browser.)
http://polar.wwb.noaa.gov/waves/main_int.html
2. Coastal Marine Weather
<http://www.wrh.noaa.gov/Portland/marine.html>
3. Buoy Locations, Information and Recent Data
<http://www.nodc.noaa.gov/BUOY/buoy.html>
4. Graphs of Monthly Averages of Data Collected from Buoys
<http://www.ndbc.noaa.gov/climate.phtml>
5. National Data Buoy Center Home Page
<http://www/ndbc.noaa.gov>