Week 4: Temperature Range Investigation

BACKGROUND INFORMATION
The differences in heat gain and loss in soil and water can tell us a lot about weather patterns. Inland areas usually have greater temperature extremes from day to night and from season to season because land absorbs and loses heat energy more quickly than water. Locations near the ocean or other large bodies of water usually have more moderate daily and seasonal temperatures. For this reason, forecasters in southern California often list three daily temperature ranges—coastal, inland, and valley.

THE BIG IDEA
Coastal cities have smaller temperature ranges than inland cities because the ocean moderates the air temperature along the coast.

OVERVIEW OF ACTIVITY (60 minutes)
Students use real-time data from the Southern California Coastal Ocean Observing System Web site to learn how air and sea temperature ranges vary. They use the data to make graphs and explain how the ocean affects air temperature ranges.

SCIENCE STANDARD
4.b. Students know the influence that the ocean has on the weather and the role that the water cycle plays in weather patterns.

PERFORMANCE OBJECTIVES
Students will be able to:
1. collect temperature data from a Web site.
2. represent and interpret data using graphs.
3. explain why locations near the ocean generally have smaller temperature ranges than inland locations.

RECOMMENDED ASSESSMENT STRATEGY
Use the CONCLUSION section and the LINE OF LEARNING discussion to assess conceptual comprehension and investigation strategies.
MATERIALS (*included in kit)

- Overhead projector
- Science Notebook transparencies (optional)
- Screen capture transparencies (optional)
- (1) Set of Science Notebook pages per student
- (3) Colored pencils for each student
- Computer(s) with Internet access
- Digital projector (optional)

ADVANCE PREPARATION

1. Make copies of the Science Notebook pages for each student.

2. Make transparencies of the Science Notebook pages and screen capture pages. (Optional)

3. Turn on the computers and make sure that you have access to the Southern California Coastal Ocean Observing System Web site at: http://www.sccoos.org/outreach/dana/mets.

4. Bookmark the Web site on each computer.

5. Divide students into investigation teams based on the number of available computers.

TEACHING TIPS

1. If it is not possible to do this activity in the computer lab as a student investigation, you can do this as an all-class activity if you have a computer with Internet access connected to a digital projector.

2. Remind the students that the date is listed as year, month, day (e.g., 2006-10-26 is October 26, 2006).

3. Remind the students to record the local time. The local time is listed in military time, and the students can use the table on the Science Notebook page to convert the time to standard time.

4. Remind students that they should plot one point for every hour in each location, so they should have a maximum of 24 points for each location.

5. The activity is written so that the students graph the temperature in Celsius. If you would prefer that the students graph the data in Fahrenheit, let them know this when you distribute the Science Notebook pages.

6. You may want to have each team choose an inland location that is a different distance from the coast so that you can see how temperature ranges vary with distance from the coast.
PROCEDURE (60 minutes)
1. Show the students the map on the Southern California Coastal Ocean Observing System Web page, and ask them if they can predict which general location will have the largest temperature range. Discuss their predictions. Can they prove their prediction by using data from the Web site? (5 minutes)

2. If you have a digital projector, show the students how to access the data on the Web site. You can also show them the screen capture transparencies. (10 minutes)

3. Hand out the Science Notebook pages to each of the students. Review the inquiry question and the testable question with the students. Tell the students to write their prediction in their Science Notebooks. Direct the students to follow the steps in the procedure to complete the investigation. While the students are collecting the data, walk around the room to help them navigate the Web site. (35 minutes)

4. After the students have completed their investigation, they will answer the following questions in the CONCLUSION section of their Science Notebooks. (10 minutes)
   • Which location had the smallest temperature range? (The water temperature (SST) should have the smallest temperature range.)
   • Which location had the largest temperature range? (The inland air temperature location should have the largest temperature range.)
   • How did the air temperature range at the buoy compare with the air temperature range at the inland location? (The air temperature range at the buoy should be smaller than the air temperature range at the inland location.)
   • Think about where you live. Is the location in a land-locked area or is there a large body of water nearby? Would you expect greater or smaller differences between the high and low temperatures of the day? (For land-locked areas, greater differences; for areas near water, smaller differences.)

5. Line of Learning: As a class, discuss the answers to the CONCLUSION questions. Remind the students to record any additional questions that are generated or information that is learned below the LINE OF LEARNING in their Science Notebook. You can use this section to assess student progress.

6. Looking Ahead: What other variables affect weather patterns?

EXTENSION
Have the students view the wind speed and wind direction channel on the Web site. Is there a correlation between the air temperature differences between the buoy and the inland locations and the presence or absence of a sea breeze along the coast?
RESOURCES

Web Site
Southern California Coastal Ocean Observing System
http://www.sccoos.org/commclass.html
**Temperature Range Investigation**

A. Scientist: ____________________  
   Date: ____________________  
   Time: ___________(include AM or PM)

B. INQUIRY QUESTION  
How does the ocean affect the air temperature on land?

C. TESTABLE QUESTION  
Which will have the largest temperature range, the water at the ocean’s surface, the air at an ocean buoy, or the air at an inland location?

D. PREDICTION  
I predict that…

____________________________________________________
____________________________________________________

E. MATERIALS  
☐ Computer with Internet access  
☐ Pencil  
☐ (3) Colored pencils

F. PROCEDURE  
1. Go to http://www.sccoos.org/outreach/dana/mets

2. Scroll down the page and look below the map at the “Now Showing” section. Click on the arrow next to the channel to view the menu of options. Select “Air & Sea Temperature” from the menu.
3. Select a land station (circle) by clicking on it.

4. Click on “Download Recent Temperature Data” to view the last 24 hours of air temperature data from this inland station.

5. Click on the “Printer Friendly” icon that appears above the data table to print the data. After you have picked up the page from the printer, label the page as a land station. Close the data window by clicking on the “close” icon in the upper corner of the window.

6. Close the window for the land station by clicking on the “x” in the upper right hand corner of the white box.

7. Select a buoy station (triangle) by clicking on it.

8. Click on “Download Recent Temperature Data” to view the last 24 hours of data from this station. This data will include air temperature at the buoy and sea surface temperature (SST). Sea surface temperature is the temperature of the water at the surface of the sea.

9. Click on the “Printer Friendly” icon that appears above the data table to print the data. After you have picked up the page from the printer, label the page as a buoy station. Close the data window by clicking on the “close” icon in the upper corner of the window.

10. Close the window for the buoy station by clicking on the “x” in the upper right hand corner of the white box.

11. Convert the Pacific local time from military time to standard time, and write the converted time next to the military time on both of the data tables that you printed. Use the Military Time
Converted to Standard Time table on the following page to help you make the conversion.

12. Create line graphs that show the temperature in Celsius for the water temperature (SST), the buoy air temperature, and the inland air temperature for each hour over the last 24 hours. Make sure that you start with the earliest date and time from the data table. Use a different colored pencil for each location, and complete the key beneath the graph.

13. Complete the data table by entering the highest and lowest temperature for each location. Calculate and record the temperature range for each location in the data chart. Calculate the temperature range by using this equation.

Highest Temperature ___°C – Lowest Temperature ___°C = Temperature Range ___°C
G. DATA AND OBSERVATIONS

Graph Key

* * Water Temperature

* Buoy Air Temperature

* Inland Air Temperature

Graph: Temperature vs. Time

Time

Temperature °C

Graph: Temperature vs. Time
<table>
<thead>
<tr>
<th>Location</th>
<th>Highest Temperature</th>
<th>Lowest Temperature</th>
<th>Temperature Range</th>
</tr>
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<tbody>
<tr>
<td>Water Temperature (SST)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Buoy Air Temperature</td>
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<td></td>
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<tr>
<td>Inland Air Temperature</td>
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</tbody>
</table>

Calculate the temperature range by using this equation.

Highest Temperature ___ °C – Lowest Temperature ___ °C = Temperature Range ___ °C

<table>
<thead>
<tr>
<th>Military Time Converted to Standard Time</th>
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</table>
H. CONCLUSION

Today I learned that…
Be sure to include the answers to the following questions.

1. Which location had the smallest temperature range?

2. Which location had the largest temperature range?

3. How did the air temperature range at the buoy compare with the air temperature range at the inland location?

4. Think about where you live. Is the location in a land-locked area or is there a large body of water nearby? Would you expect greater or smaller differences between the high and low temperatures of the day? Why?
I. LINE OF LEARNING

J. NEW VOCABULARY
List any new vocabulary words you learned from doing this investigation. Use the glossary to write the definitions of each word.
Screen Captures for
Southern California Coastal Ocean Observing System Web Site

Choose “Air & Sea Temperature” in the “Now Showing” section.

Inland Weather Station (circle)

Buoy Weather Station (triangle)
Click here to see the temperature data for the last 24 hours.

Click here to print the data.

Local Time Column

Temperature Columns