Exploring Ocean Observing Systems

Objective
To investigate the many uses of ocean observing systems (OOS).

Correlations
National Science Education Standards
Grades 5-8: A, B, D, E
Grades 9-12: A, D, E

California State Science Education Standards
Grade 6: 4a, d, e, 7b, h
Grade 7: 7a, b, c
Grades 9-12: Life Sciences 6b, Earth Sciences 5a, d, f, g, 6a, b, Investigations and Explorations 1a, h, i

Ocean Literacy Principles and Fundamental Concepts: 1 & 7

Introduction

The ocean covers more than 70% of the Earth's surface and has an average depth of about 4km. Surface waters are constantly in motion and the circulation patterns of these waters greatly affect global and regional climate and weather. Winds created by differences in solar heating of the earth, drive the ocean's surface currents. The Earth's rotation (Coriolis effect) and the continents shape global surface circulation. The deep circulation of the global ocean is driven by density differences between the cold polar regions and the rest of the ocean. Warm, salty water delivered to the polar regions is cooled, forming dense water that sinks to the depths and then spreads throughout the world ocean. The interaction between the atmosphere and the ocean creates year-to-year changes that can have strong effects on our weather. One of the better-known changes is the El Niño Southern Oscillation (ENSO), which results from fluctuations in wind and leads to changes in ocean surface temperature. Now scientists use real-time data and information from ocean observing systems to interpret the ocean conditions and make predictions about weather and climate.

The ocean observatory websites listed below can deliver ocean currents and circulation data in real-time. The purpose of this exercise is to a) provide an overview of major ocean circulation patterns, b) explore ocean observing systems and the types of information they provide, and c) investigate ENSO data from observing systems.

Exploring OOS Worksheet

Materials
- Computer
- Internet access

Procedure
Part A
Ocean Currents of the World
Look at a globe or world map and identify the major ocean basins. Are there any major ocean currents you have heard of? Where are they located?

Describe the prevailing wind patterns at the Earth's surface, including trade winds, westerlies, and the doldrums.

This site has an animation of global surface winds and currents:
http://www.classzone.com/books/earth_science/terc/content/visualizations/es2401/es2401page01.cfm?chapter_no=visualization

Visit the websites below for information on ocean circulation patterns.
http://www.windows.ucar.edu/cgi-bin/tour_def/earth/Water/ocean_currents.html
http://www.onr.navy.mil/Focus/ocean/motion/currents1.htm

Observe and record the flow direction of the major ocean currents, and answer the questions below.

Suggested questions:
1. Which current flows off the southeast coast of the United States? What is the temperature of this current? What direction does it flow?

2. Which current flows off the California coast? What is the temperature of this current? What direction does it flow?

3. What current is responsible for El Niño events off the coast of South America? Is it a warm or cold current?

4. What questions do you have about global ocean circulation?

Part B

Observing systems locations and information

As an introduction to ocean observing systems (OOS), you will explore the NOAA National Data Buoy Center website to familiarize yourself with OOS and the parameters they measure.

1A. Divide into teams. Each team will be assigned one of the following parameters:

Wind speed, gusts, and direction
Currents
Salinity
Temperature: air & water
Pressure: atmospheric, tendency
Waves: height, period, direction

1B. Visit http://apps.dataintheclassroom.org/water-quality/FormGenerator.aspx for data on these parameters from the National Estuarine Research Reserve System:

Chlorophyll A
Dissolved oxygen (DO)
Temperature: air & water
Salinity
Turbidity
Depth (tidal patterns)

2. With your team member(s), define your assigned parameter by using web resources. Be prepared to report out on your assigned parameter.
Notes on your assigned parameter:

3. Go to the NOAA National Buoy Data Center website: www.ndbc.noaa.gov
(For an easy–to-use map, click on http://www.ndbc.noaa.gov/rmd.shtml)

4. Click on the area of that interests you. Choose a buoy and click on it. Where is your buoy and what is its number?

5. Answer the questions below. If your buoy does not report your assigned parameter, go to back to the home page and locate another ocean observing system buoy to address the questions.

Questions:

1. List several types of information provided by your ocean observing system buoys.

2. What parameters are found at the buoys and what do they mean?

3. What is the ocean temperature (or choose another parameter) off the coast nearest your home or your favorite ocean area?

4. Compare the temperature or another parameter at 3 or more sites. Record the locations and values, with units labeled.

Location				
Parameter:				

5. What questions do you have about your ocean observing data? Can you find a way to answer them?

<u>Part C</u>

Ocean movement measurements using observing systems

In the Equatorial Pacific ocean, water movement is measured by an array of buoys which can predict events, such as El Niño. Visit the following website to investigate how data from observing systems can help predict changes in ocean circulation patterns and the resulting effects on climate and weather. http://www.pmel.noaa.gov/tao/index.shtml

Suggested critical thinking questions:

1. Are sea surface temperatures warmer in the eastern or western Pacific Ocean? What technology did you use to answer this question?

2. Explain how ocean temperatures and surface currents change during El Niño events. What effects could this temperature change have on local weather?