LESSON 2 How do we make predictions?

Lesson at a Glance

This lesson begins by having students revisit the questions they generated at the end of Lesson 1. Students will participate in small group internet research to learn about the buoys and satellites that provide data to the Hawaiian Islands that is used in weather and surf predictions.

Lesson Duration

Two 45-minute periods

Essential Question(s)

How does technology enable scientists to predict weather and surf conditions?

Key Concepts

- Technology enables us to gather information that helps people to understand the environment.
- Forecasting Hawai‘i’s weather and surf depends on data from buoys and satellites.

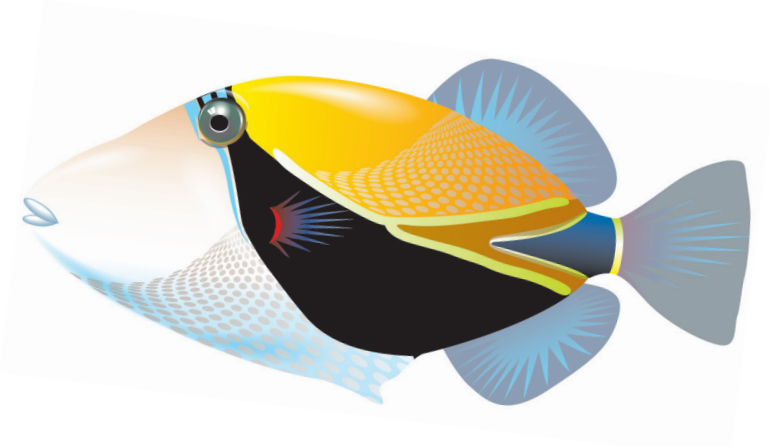
Related HCPSIII Benchmark(s):

Science SC.4.2.1
Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i.

Language Arts LA 4.2.5
Summarize main points found in informational texts.

Instructional Objectives

- I can describe NOAA monitoring technologies, including the types of data from buoys and satellites that are used to determine weather and surf conditions.
- I can give examples of how technology for monitoring weather and wave conditions has helped people who live, work, or play near or in the ocean which makes Hawai‘i a safer place to live.



Assessment Tools

Benchmark Rubric:

Topic		Science, Technology, and Society	
Benchmark SC.4.2.1		Describe how the use of technology has influenced the economy, demography, and environment of Hawai'i	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Explain how the use of technology has influenced the economy, demography, and environment of Hawai'i and suggest ways to conserve the environment	Describe how the use of technology has influenced the economy, demography, and environment of Hawai'i	Give examples of how the use of technology has influenced the economy, demography, and environment of Hawai'i	Recognize that the use of technology has influenced the economy, demography, and environment of Hawai'i

Topic		Constructing Meaning	
Benchmark LA.4.2.5		Summarize main points found in informational texts	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Summarize the main points and describe their connection to the main idea or focus in informational texts	Summarize the main points found in informational texts	Produce a summary that mixes insignificant points with main points	Summarize information not necessary to understanding the main points of informational texts, or repeat original text rather than summarize

Assessment/Evidence Pieces

Lesson

- *Buoy and Satellite Data* student worksheet
- Checking It Out: Summary on data needed to create predictions

Materials Needed

Teacher	Class	Group	Student
• Method to project PowerPoint • Computer with internet access	• None	• None	• Computer with internet access • Recent surf report • Copies of student worksheets • Copies of student reading

Instructional Resources

Student Reading: *Buoy and Satellite Technology How does it help?*
Student Worksheet: *Buoy and Satellite Data*
Student Worksheet: *Checking It Out*
PowerPoint Presentation: *Worldwide Buoys*

Student Vocabulary Words

buoy: a floating device in the ocean which may gather and transmit data**.**
swell: waves that have moved away from their origin after the sustained winds have blown over the ocean surface for long periods of time.
tides: the rising and falling of Earth's ocean surface caused by the tidal forces of the Moon and the Sun acting on the oceans.
weather satellite: a device that orbits the Earth, equipped with instruments to measure and transmit data about weather features.

Lesson Plans

Lesson Preparation

- Review the Science Background provided in the Unit Overview.
- Review and make copies of Student Worksheets *Buoy and Satellite Data* and *Checking It Out* as well as Student Reading *Buoy and Satellite Technology How does it help?,* one for each student.
- Preview PowerPoint Presentation *Worldwide Buoys* and make arrangements to project it.
- Print out copies of a recent surf reports for each student, from http://www.prh.noaa.gov/hnl/pages/surfreports.php
  Optional sites for other forms of surf reports can be found at:
  http://www.prh.noaa.gov/hnl/pages/SRF.php
  http://www.surfnewsnetwork.com/

I. *Activating knowledge*

A. Introduce the lesson by revisiting the students' questions from the end of Lesson 1 with focus on questions about how weather and waves are predicted.

B. Hand out the Checking It Out worksheet. Have students write a short narrative that would include all that they know about predicting the weather up to this point.
*Note: if this is the first time the students are writing a narrative, this activity can be done as a class or in groups. Collect the worksheets when they are done.

C. Present the day's weather report to the students.
Suggestion: Using the same source for weather report(s) as Lesson 1 may help students as they may find the format familiar.

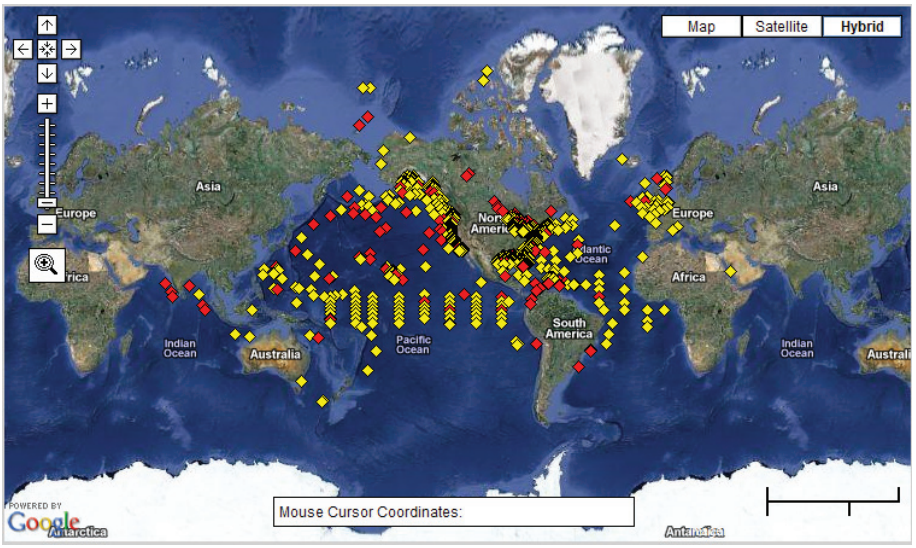
II. *Buoys and Satellites*

A. Explain to students that the information used in the weather report they look at comes from a variety of sources. Tell students that they are going to learn about two pieces of technology that are used to create weather and surf reports. On the board write the words "BUOYS" and "WEATHER SATELLITES".

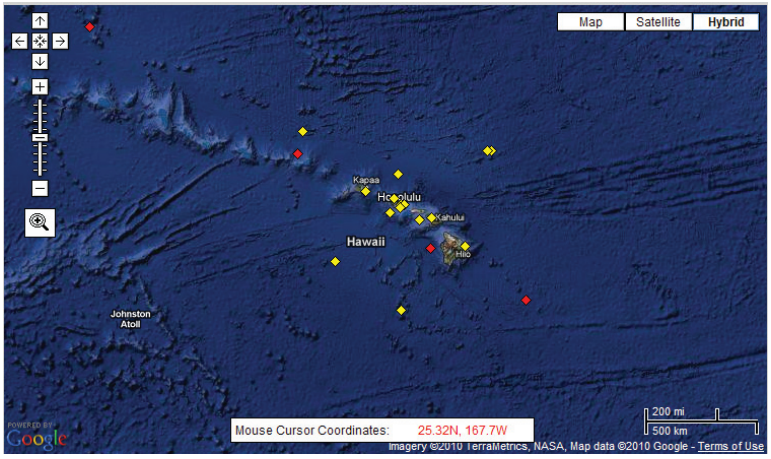
B. Hand out Student Reading *Buoy and Satellite Technology How does it help?* Have students take turns reading out loud. (**NOTE**: Stop at the end of the buoy paragraph and show the one slide of the PowerPoint *Worldwide Buoys*.) Briefly discuss the article after the class reads the entire selection.

- What is a buoy?
- What kinds of information does it record and transmit?
- What is a satellite?
- What can satellite images tell us?
- Who uses buoy and satellite data?
- How does this kind of data help people?

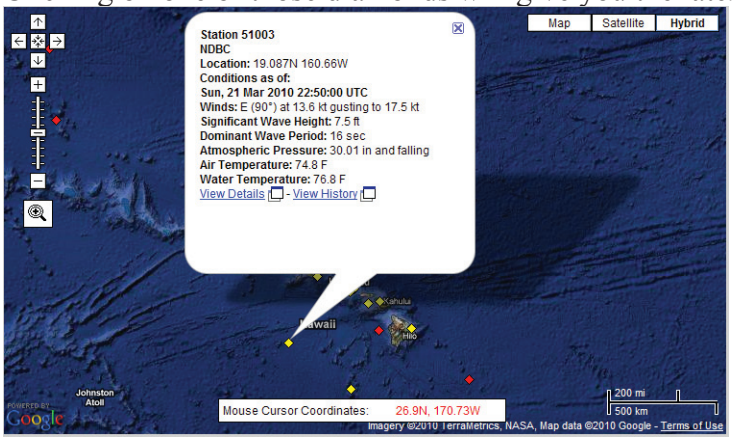
C. Divide students into 6 groups and explain to them that the groups are going to study information from satellites and buoys installed around Hawai‘i. Information about these Hawaiian buoys can be found at: http://www.ndbc.noaa.gov/obs.shtml This page shows buoy sites on a Google Map.



1) Click on the (+) to zoom into your area. When you have zoomed into your location, you will see individual colored diamonds. Do not click on the red diamonds.



2) Clicking on one of those diamonds will give you the latest information from the buoy



This callout may include:

- Station Number
- Latitude/Longitude
- Date when data taken
- Winds
- Wave height
- Wave period
- Atmospheric pressure
- Air and water temperatures

3) By clicking on "View Details" at the bottom of the callout, students will be redirected to a page with detailed information of that particular buoy.
*Note: There is a lot of information here and the students may become overwhelmed with the terms. Focus them on the types of data that they can understand and use from the website. Also note that some buoys will have more information than others.

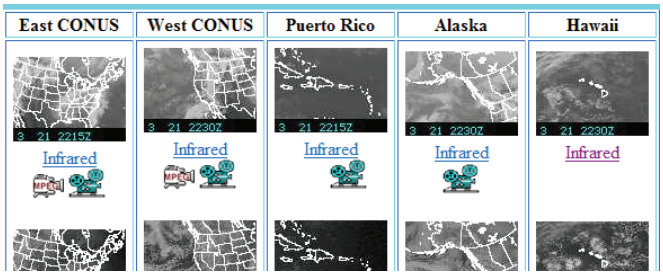
D. Project the website and click a buoy to demonstrate to students how to use the site and where to find the information that they will need to complete the activity. **Explain to students that for this lesson they will focus on wind speed, wind direction, air/water temperature, wave height and distance between waves.**

E. Hand out the Student Worksheet *Buoy and Satellite Data.* Have the students pick a buoy from the map as "their group's" buoy.
Suggestion: If students have a hard time picking a buoy, an alternative is to have them search for any of the following buoys: 51002, 51003, 51201, 51202, 51203 and the first group that finds it will research it.

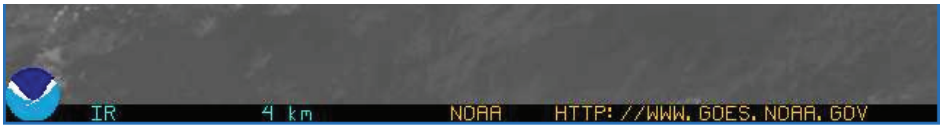
F. Go over the directions for the Student Worksheet *Buoy and Satellite Data*. Remind the class that from the website indicated on their worksheet they will need to click on the buoy number assigned to their group in order to locate information on their buoy.

G. **Satellites** – Students will go to the following website: http://www.goes.noaa.gov/

1) If looking at Hawai'i wide data, there is no video camera icon.



2) To see a loop of images for Hawai'i maps
   a. Click on an image you would like to see. (For example: "Infrared")
   b. At the bottom of the image, click on "More Hawai'i images and loops are available here"



Hawaii (IR Ch 4, Mercator Projection)

More Hawaii images and loops are available here

   c. You will be directed to a new page. Click on any of the satellite picture types in the "Flash Loop" column to see a loop of several images.

Single Image		Flash Loop (Toggle Lat/Lon)
With Lat/Lon	Without Lat/Lon	
Visible	Visible	Visible
Shortwave (IR2)	Shortwave (IR2)	Shortwave (IR2)
Water Vapor (IR3)	Water Vapor (IR3)	Water Vapor (IR3)
Infrared Channel 4 Enhancements		
None	None	None

*Note: these steps only need to be taken for the Hawai'i images. Other maps have a video camera image that can be clicked for images in motion.

III. *Check for Understanding*

A. When students have completed the *Buoy and Satellite Data* worksheet, review it as a group. Students should come away from this research understanding that:
   1) Buoys around the Hawaiian Islands measure and transmit data on wave height, the distance between waves, wind speed, and water/air temperature.
   2) Satellites are man-made devices orbiting the Earth, equipped with instruments to measure and transmit data about weather features.

B. Ask students what sorts of information would people be interested in before heading to the beach. This is a question that will become important in the culminating lesson when students will be asked to create a pamphlet or poster to educate about ocean/weather safety.

C. Hand out the *Checking It Out* Student Worksheet. Instruct students that they will now do a five-minute summary, using the following questions to guide them:
   - What data is needed in order to create a prediction?
   - What sources or technologies provide this data?
   - Who uses this data and why?

   Explain that students should also give an example of how technology for monitoring weather and surf conditions has helped people who live, work, or play near or in the ocean, which makes Hawai‘i a safer place to live.

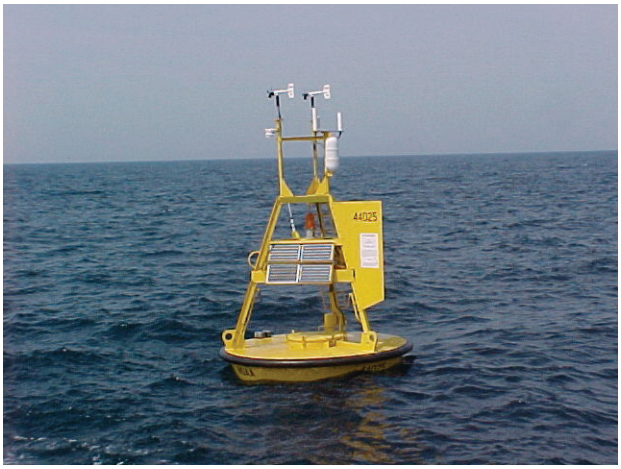
Extended Activities

1. Have students write a position paper on whether surfers should be fined when they ignore surf reports or weather reports and have to be rescued.
2. On a family outing go to the beach, a sand break, and a reef break and watch the waves. Sandy Beach and Makapu’u are sand breaks. Students can also look at webcams as well at SurfNewsNetwork.com. Ask students to make at least three observations at the beach as well as three inferences. Tell students to ask themselves questions such as, Is this an observation? Is it something I can see, smell, hear, touch, or taste or is this an inference? Or is it a conclusion or explanation based on an observation?

LESSON 2 Buoy and Satellite Technology How does it help?

In order to forecast the weather and surf reports, meteorologists need data. Forecasters use the data from buoys and satellites to predict weather patterns, and local storms, which drive surf conditions. These two forms of technology are essential tools for the creation of weather and surf reports that are as accurate as possible.

Buoys are floating devices in the ocean which may gather and transmit data. In the oceans around the world are many different types of buoys that gather different kinds of data. Buoys used for the purpose of tracking weather data record hourly observations about wind speed, air and sea temperatures, as well as wave height and period (time between arrivals of consecutive waves). This kind of data can help to determine surf or wave conditions. NOAA maintains a network of weather buoys off both coasts of the United States and in the waters surrounding the Hawaiian Islands.



NOAA Weather Buoy

Weather Satellite

Weather Satellites are man-made devices orbiting the Earth, equipped with instruments to measure and transmit data about weather features. When you watch the news and the meteorologist shows the map of Hawai'i with the moving clouds across it, you are seeing data from NOAA's satellites. These infrared images shot from space help meteorologists track the development of storms and hurricanes.

Information from buoys and satellites is of great help to the general public, as well as to tourists, fishermen and surfers who need to be aware of weather and water conditions. Knowing about major storms, hurricanes and high surf allows people to prepare for these conditions and take the appropriate precautions, which will minimize the damage to property and reduce the loss of lives.

LESSON 2 Student Worksheet
Buoy and Satellite Data

NAME: _____ DATE:_____

Directions

Answer the following questions about satellite images and buoy data. Use the following buoy link to assist your group in gathering information about your assigned buoy: http://www.ndbc.noaa.gov/obs.shtml
Satellite Images link: http://www.goes.noaa.gov/ (Click on the movie cameras to see the images in motion.)

Group Buoy#: _____

1.) List the types of data your buoy records and transmits.

2.) What is the current air temperature and wave height around your buoy?

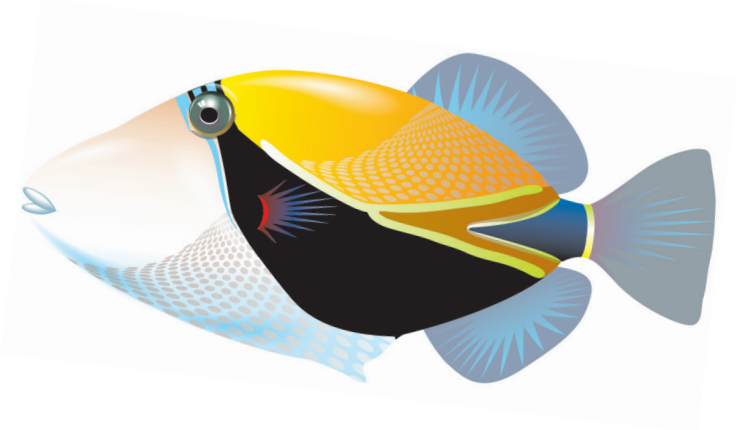
3.) What type of information does the buoy tell you that might be helpful?

4.) Describe what you see as you watch the satellite images.

5.) These satellite images tell us what kind of information?

6.) Who uses the data transmitted by buoys and satellites?

7.) Why do you think buoy and weather satellite data is so important to the people who live in or visit Hawai‘i?



LESSON 2 Student Worksheet

NAME: _____ **DATE:**_____

Checking It Out

What You Know Up to This Point About---predicting weather and wave heights?

Checking for Understanding

Write a short summary using the following questions to guide you:

- What data is needed in order to create a prediction?

- What sources or technologies provide this data?

- Who uses this data and why?

Also, give an example of how technology for monitoring weather and surf conditions has helped people who live, work, or play near or in the ocean, which makes Hawai‘i a safer place to live.