LESSON 4 Extreme Forecasting

Lesson at a Glance

Using a PowerPoint presentation, the teacher introduces the concepts of tsunamis and hurricanes. Students individually complete a worksheet that compares and contrasts the basic characteristics of tsunamis and hurricanes, as well as how technology is used to monitor them. In small groups, students use the Internet to research how technology is used to monitor tsunamis and hurricanes that might affect anyone who lives, works, or plays in or near the ocean in Hawai‘i.

Lesson Duration

One 45-minute period

Essential Question(s)

What is a tsunami?
What is a hurricane?
How are tsunamis different from big surf or hurricane waves?
How are technologies used to detect, measure, and monitor the possibility of a tsunami or a hurricane?

Key Concepts

- A tsunami is a series of ocean waves caused by Earthquakes, landslides, or volcanic activity.
- A hurricane is a type of tropical cyclone in which the sustained surface wind is 74 miles per hour or more.
- While neither tsunamis nor hurricanes can be prevented, NOAA has the technology that can monitor and warn human beings about these natural forces.

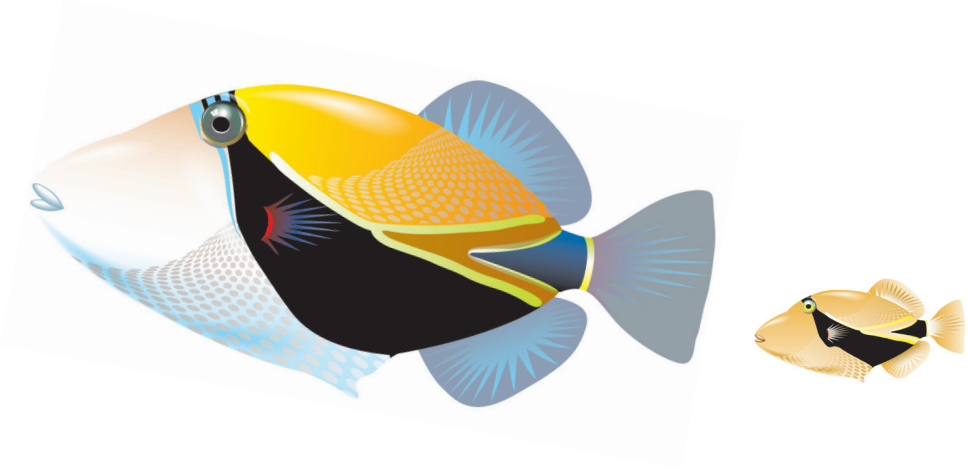
Related HCPSIII Benchmark(s):

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

Language Arts LA 4.1.1
Use new grade-appropriate vocabulary, including homophones and homographs, learned through reading and word study, including root words, affixes, and word origins.

Instructional Objectives

- I can define and describe a tsunami and hurricane.
- I can describe the technologies used to detect, measure, and monitor the possibility of a tsunami or a hurricane around Hawai’i?



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		**Vocabulary and Concept Development**	
Benchmark LA.4.1.1		Use new grade-appropriate vocabulary, including homophones and homographs, learned through reading and word study, including root words, affixes, and word origins	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Use new grade-appropriate vocabulary, including homophones and homographs, with fluency, accuracy, and precision	Use new grade-appropriate vocabulary, including homophones and homographs, with no significant errors	Use new grade-appropriate vocabulary, including homophones and homographs, with difficulty and a few significant and/or many minor errors	Use new grade-appropriate vocabulary, including homophones and homographs, with great difficulty and many significant errors or rarely use new vocabulary

Assessment/Evidence Pieces

Lesson

- *Hurricanes and Tsunamis* student worksheet
- Hurricane or tsunami flow chart

Materials Needed

Teacher	Class	Group	Student
• Method to project PowerPoint	• None	• None	• Internet access

Instructional Resources

Teacher Reading*: Tsunamis and Hurricanes*
Teacher Answer Key: *Tsunamis and Hurricanes*
Student Worksheet: *Tsunamis and Hurricanes*
PowerPoint Presentation: *Tsunamis and Hurricanes*
Local telephone book opened to the *inundation sites*
*Note: This information for the State of Hawai‘i can also be found online at http://www5.Hawaii.gov/tsunami/maps.asp
A good resource for tsunami safety information is the website: http://www.weatherwizkids.com/tsunami.htm

Student Vocabulary Words

hurricane: a type of tropical cyclone in which the sustained surface wind is 74 miles per hour or more.
tsunami: a series of ocean waves caused by Earthquakes, landslides, or volcanic activity.

Lesson Plans

Lesson Preparation

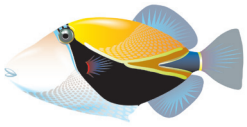
- Review the Science Background provided in the Unit Overview and the Teacher Reading **Tsunamis** *and* **Hurricanes.**
- Review and make copies of the Student Worksheet **Tsunamis** *and* **Hurricanes,** one per student.
- Preview the PowerPoint presentation **Tsunamis** *and* **Hurricanes** and make arrangements to project it.

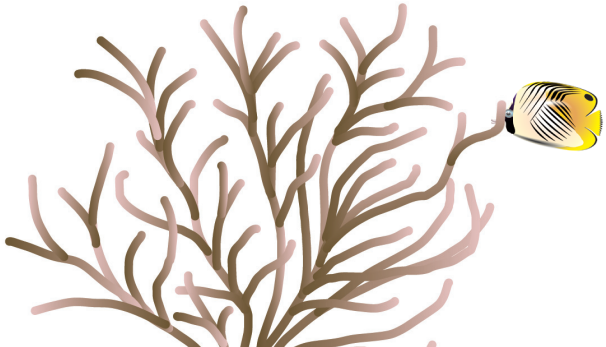
I. *Tsunamis and Hurricanes Introduction*

A. Refer back to the student generated questions from Lesson 1. Focus on questions that ask about extreme weather conditions.
*Note: Depending on the time of year this unit is introduced, students may have many questions about extreme weather conditions.
B. Distribute the student worksheet **Tsunamis** *and* **Hurricanes.** Explain to students that they will use the worksheet to take notes during the upcoming presentation.
C. Present the PowerPoint, **Tsunamis** *and* **Hurricanes,** to introduce the ideas of tsunamis and hurricanes to students. (Suggestion: To further reinforce tsunami formation show the remaining portion of the video from Lesson 3 found on the NOAA learning demo website starting at the point the announcer begins to discuss Tsunamis: http://www.learningdemo.com/noaa/lesson09.html.)
D. When you complete the PowerPoint presentation, review the vocabulary terms and write them on the board (or word wall) for students. Have the students verbally tell you the meaning for each vocabulary word and the technologies used to monitor each.
Option: Have students create drawings of the vocabulary words to be included on the word wall.
E. Discuss the inundation site maps in their local telephone book or on a website for your area.
F. Review the worksheet with students as a group. If time allows, you may want to allow students' access to the Internet in order to research additional information.

II. *Tsunami and Hurricane Monitoring*

A. Divide students into pairs. Tell students that you would like them to choose either a tsunami or a hurricane and create a flow chart of how the tsunami or hurricane is monitored from its origin to when it hits land. The Internet should be made available for students to use NOAA resources. Demonstrate on the board how you would like students to organize their work.
B. While students work, circulate throughout the room to make sure that students are writing down steps in order. Ask probing questions such as, *What do you think might happen next?* and *Who is monitoring the progress of the hurricane (or tsunami)?*
C. Ask student volunteers to draw the flow chart they created on the board and share it with the class.
D. To wrap up the lesson, discuss with the class whether waves created from hurricanes and tsunamis would be safe for surfing. Be sure they give you detailed reasons why these types of waves are unsafe to attempt surfing.





LESSON 4 Teacher Reading
Tsunamis and Hurricanes

A tsunami is a series of ocean waves. These waves are caused by movement of the sea floor, such as Earthquakes, landslides, or volcanic activity. These waves may begin in the open ocean as very small waves only a few inches high, but they travel very fast and have extremely long wavelengths. Once the tsunami comes in contact with shallow water, all the energy that is stored in their large wavelength forces a wall of water to form as high as 100 feet to break upon the shoreline.

A number of governmental agencies are responsible for tsunami monitoring and education of the public. The United States Geological Survey (USGS) is responsible for monitoring Earthquakes. NOAA uses bathymetry and topography to make models that forecast tsunamis. The National Weather Service educates the public on tsunami hazard preparedness. NOAA's Pacific Tsunami Warning Center is located in *Ewa, O'ahu, Hawai'i* and provides warnings to almost every country around the Pacific Rim and to most of the Pacific island states. Visit the center at: http://www.prh.noaa.gov/ptwc/

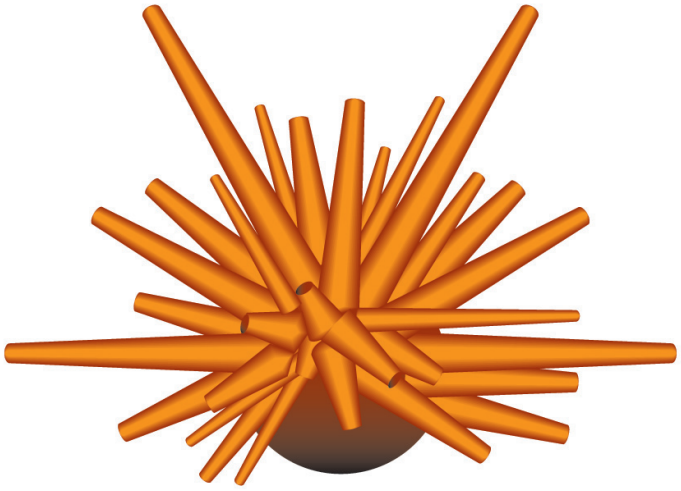
Hurricanes

A hurricane is a type of tropical cyclone in which the sustained surface wind is 74 miles per hour or more. The word **hurricane** is used in the Northern Hemisphere east of the International Dateline, while the word **typhoon** is used west of the International Dateline. The word cyclone is used in the Indian Ocean. All names refer to the same phenomenon.

Details on methods of weather and hurricane monitoring that are used to track the development and location of storms include the following:

Buoys – Buoys are stations in the ocean with equipment to measure different parts of the weather. Buoys can often measure wind speed and direction as well as wave height, atmospheric pressure, and air and sea temperatures.

Ships – Many ships at sea participate voluntarily in weather monitoring activities. Ship crews observe the weather at their ship location and send the data via satellite or radio to weather stations that make forecasts.

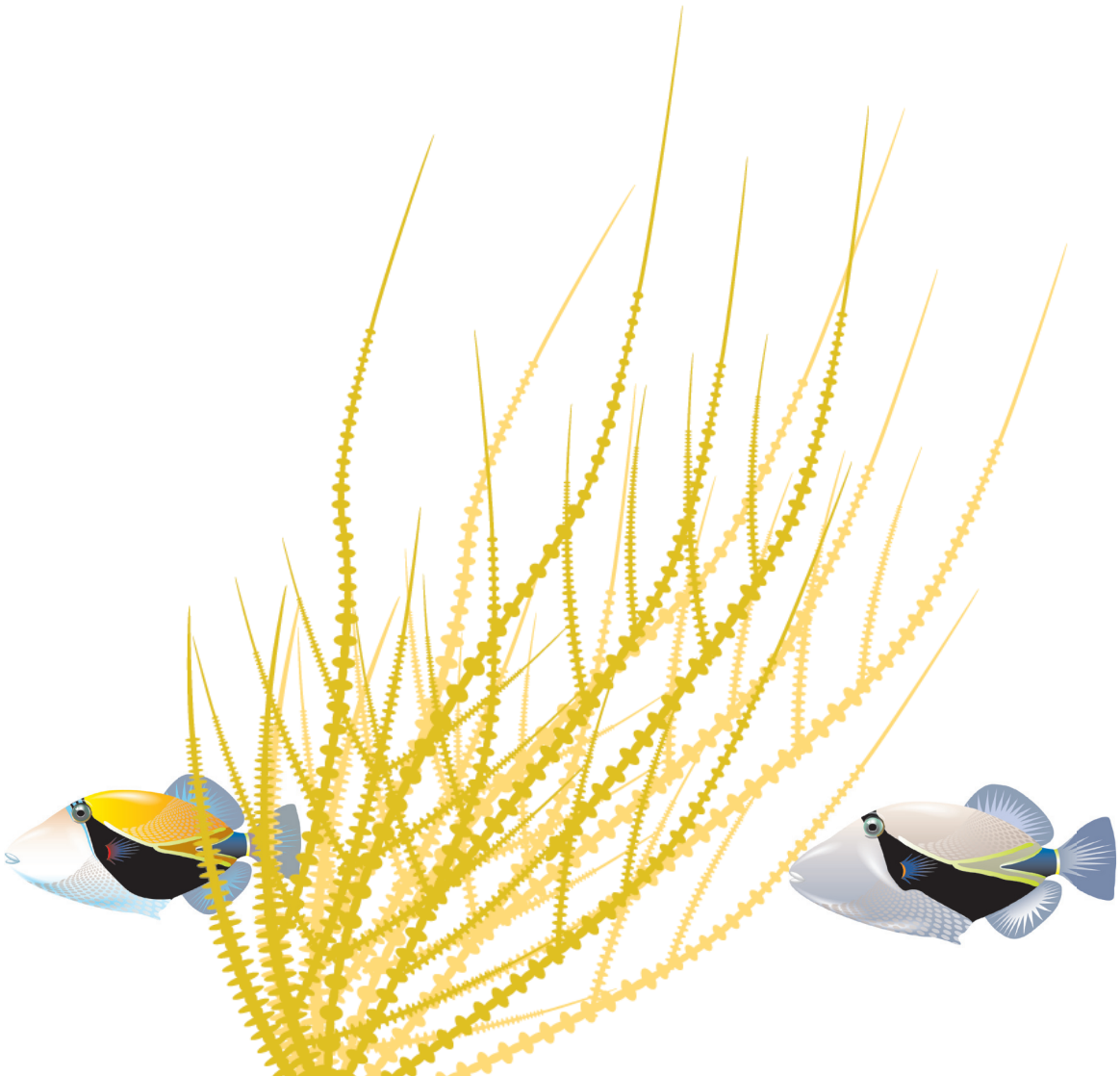


Satellites – Satellites used for monitoring weather orbit the Earth and take visual and infrared photographs. These photographs can tell scientists the temperature of the Earth's surface, type of cloud cover, presence of circulation, and height of moisture in the atmosphere.

Radiosonde – A radiosonde is a measuring device and radio transmitter which is attached to a balloon.

Reconnaissance Aircraft – Aircraft can be sent into the *eye* of a hurricane to take measurements directly when the hurricane is close to shore, but still over the ocean. These Hurricane Hunters are tasked by forecasters at the National Hurricane Center in Miami, Florida to investigate up to three potential hurricanes and typhoons at a time. Sometimes this means they stay airborne for as long as 14 hours. Hurricane Hunters determine the location, wind speeds, size, air pressure, cloud water content, direction, and traveling speeds of hurricanes.

Radar – Doppler radar is used to detect precipitation. Radio waves are sent out from radar stations on land. When the radio wave hits a raindrop, it is reflected back to the station. Scientists measure how long it takes for the wave to bounce off the raindrops and return to the station to determine distance from the station to the precipitation. They can also characterize the type of precipitation (snow, rain, hail, etc.) by analyzing how well the radio wave is reflected back to the station.
Source: www.tsunami.noaa.gov/ and http://www.nhc.noaa.gov/



LESSON 4 Student Worksheet
Tsunamis and Hurricanes

NAME: _____ **DATE:**_____

Directions: Answer the following questions based on what you learned during the presentation on Tsunamis and Hurricanes.

1. What is a tsunami?

Tsunami is a series of ocean waves caused by Earthquakes, landslides, or volcanic activity.

2. What kinds of technology are used to monitor tsunamis?

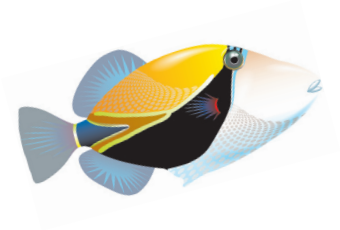
Tsunamis are monitored in several different ways; by monitoring Earthquake activity, the passage of tsunami waves at tide gauges, and DART buoys (Deep Ocean Assessment and Reporting of Tsunamis).

3. What is a hurricane?

Hurricane is a type of tropical cyclone in which the sustained surface wind is 74 miles per hour or more.

4. What kinds of technology are used to monitor hurricanes?

A variety of technological tools are used to monitor, evaluate, and predict hurricanes, including aircraft, satellites, and weather radar.



5. What is the difference between a tsunami and hurricane waves?

Tsunami waves are caused by Earthquakes, landslides, or volcanic activity.
Hurricane waves are caused by high winds.