

LESSON 1 Describing Hawai'i's Weather and Climate

Lesson at a Glance

This first lesson engages students in thinking about, and describing, their local weather and Hawai'i's climate. Using a simulation, students will observe how the Earth's rotation causes day and night while influencing seasonal changes.

Lesson Duration

Two 60-minute periods

Essential Question(s)

How do scientists distinguish the difference between weather and climate?

Why is Hawaii's climate different from the climate of other locations?

What are the factors that cause seasonal change?

Why is it important to control variables in a scientific investigation?

How do models and simulations teach us about features of objects, events and processes in the real world?

Key Concepts

- Weather is the short-term condition of the atmosphere, ocean, and land over hours or days.
- Climate is the long-term average of conditions in the atmosphere, ocean, ice sheets on land and sea ice.
- The overall climate of Hawai'i can be described as mild year round, moderately humid with predominantly northeasterly winds, and infrequent severe storms.
- Each island has a variety of smaller scale climate, which influences the way we live in Hawai'i.
- Variables are factors that affect the conditions and results of an investigation.
- In an experiment, you need to decide which variables to control or vary.
- Models and simulations are used to represent and investigate features of objects, events, and processes in the real world.

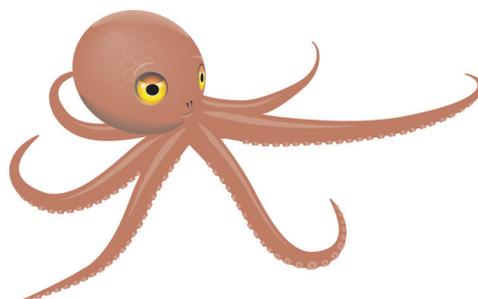
Related HCPSIII Benchmark(s):

Science SC 5.2.1
Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world.

Science SC 5.8.4
Earth in the Solar System:
Demonstrate that day and night are caused by the rotation of the Earth on its axis.

Instructional Objectives

- I can describe the difference between weather and climate.
- I can describe seasonal weather patterns in Hawai'i.
- I can describe how climate influences the way people live in Hawai'i.
- I can recognize the importance of controlling variables in a scientific investigation.
- I can use models and simulations to represent and investigate features of objects, events, and processes in the real world.



Assessment Tools

Benchmark Rubric:

Topic		Unifying Concepts and Themes	
Benchmark SC.5.2.1		Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Consistently select and use models and simulations to effectively represent and investigate features of objects, events, and processes in the real world	Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	With assistance, use models or simulations to represent features of objects, events, or processes in the real world	Recognize examples of models or simulations that can be used to represent features of objects, events, or processes

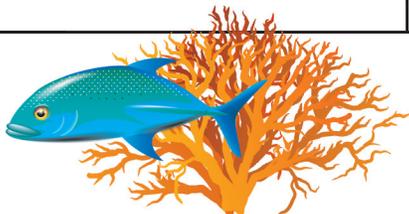
Topic		Earth in the Solar System	
Benchmark SC.5.8.4		Demonstrate that day and night are caused by the rotation of the Earth on its axis	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Use a model to demonstrate and explain how the rotation of the Earth on its axis causes day and night	Demonstrate the rotation of the Earth on its axis and how it causes day and night	Provide an example that the Earth rotates on its axis and causes day and night	Recognize that the Earth rotates on its axis and causes day and night

Assessment/Evidence Pieces

Lesson
<ul style="list-style-type: none"> • Student demonstration with globe

Materials Needed

Teacher	Class	Group	Student
<ul style="list-style-type: none"> • Method to project PowerPoint • Map of the Hawaiian Islands • Map of your island • Internet • Globe, inflatable or other type • Flashlight 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • None



Instructional Resources

PowerPoint Presentation: *Weather vs. Climate*

Teacher Reading: *Weather and Climate*

Children's books on weather and climate, some suggestions:

Padilla, Michael, Ioannis Miaoulis, and Martha Cyr. (2006). *Science Explorer, Weather, and Climate*. Boston: Prentice Hall Inc. (Gr.7/8 textbook)

Taylor, B. (2002). *Weather and Climate: Geography Facts and Experiments*. New York: Kingfisher.

Time Life Books. (1993). *Weather and Climate*. New York: Time Life Education



Student Vocabulary Words

climate: the long-term average of conditions in the atmosphere (weather), ocean, ice sheets on land and sea ice.

season: yearly periodic changes in weather. Hawai'i experiences a wet season, usually from November through March, and a dry season, usually from April through October.

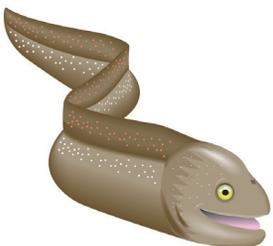
variable: anything that changes in an experiment, in order to find out the effect of that change.

weather: daily atmospheric conditions at a given location.

Lesson Plan

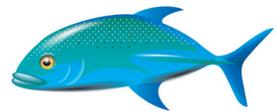
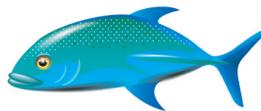
Lesson Preparation

- Review the Science Background provided in the Unit's Overview and the Teacher Reading *Weather and Climate*.
- Find a model of animation of the orographic effect for Part I Section C.
- Create a space in the classroom as a Word Wall. This could be a large piece of paper taped to the wall, or a section of the board. For each lesson in the unit, you will use the Word Wall to write vocabulary words that are important.
- Post a map of the Hawaiian Islands, and a map of your island. If you do not have such a map, look in the phone directory for page-sized maps that you can duplicate.
 - http://gohawaii.about.com/library/maps/blclickable_maps.htm (provides profile data for each island, such as size, population, industries, and climate)
 - <http://www.surftrip.com/image/maps/hawaii.gif> (includes latitudinal and longitudinal lines and more city/town names)
 - <http://www.worldatlas.com/webimage/countrys/namerica/usstates/lgcolor/hicolor.htm> (printable)
- Arrange for use of a computer with projector and Internet access.
- For Part II, have a copy of a recent weather report ready to show students. Either make copies of the weather report from a newspaper, or use an online source such as:
 - National Weather Service Forecast Office Honolulu, HI. Note: Use the *Get Point Forecasts for Specific Locations* menu to select the island or specific island zone forecast for your location. These reports can be obtained from <http://www.prh.noaa.gov/hnl/>



I. *How's the Weather in Hawai'i?*

- A. Write *weather* on the board. Ask the students to pretend that they just received a telephone call from a family member or friend who has never been to Hawai'i (perhaps a relative from the mainland or another country). The caller asks: How's the weather in Hawai'i? What would you say?
- 1) Ask students to turn to a partner and decide what they would say to the caller.
 - 2) Invite pairs to share their ideas with the class.
 - 3) As students describe the local weather, record their ideas, including such factors as temperature, rainfall, sunny/cloudy conditions, and so on.
 - 4) Conclude that everything listed is a description of weather. Define weather as a description of the atmospheric conditions at a particular location, our example Hawai'i. Explain that weather is a short-term description often examined over a period of hours or days.



- B. What would an official Hawai‘i weather report say? Suggest that the students check their weather descriptions with the local weather reports and forecasts that are available both in the newspaper and online.
- 1) If possible, show the students the current online weather report available from <http://www.prh.noaa.gov/hnl/> (printable forecast that’s kid friendly—easy to read & understand)
At the NOAA weather site, go to the Zone Forecast for your locale. (Otherwise, distribute a printed copy of a current, or recent weather report or weather forecast from the local newspaper.) Point out that the weather site or weather report includes detailed predictions of weather conditions that can be observed, measured, and recorded. These weather conditions include wind speed, percent humidity, dew point, barometer (air pressure) reading, heat index, UV index, and others.
 - 2) Ask students to compare the information from their list on the board with the official NOAA weather report. What chance of rain is it today? (state in percentage)
- C. Ask students whether they think that the weather in Hawai‘i today, or any day, is the same all over the state, and to predict where weather might be somewhat different elsewhere in Hawai‘i today.
- 1) Facilitate the discussion by referring to a posted map of the islands and by engaging students in identifying some of the major geographical differences on your island or other islands, including windward and leeward areas, *mauka* (upslope, toward, or on the mountains) and *makai* (coastal, often low lying) areas. Use a model of the orographic effect to help them to understand that Hawai‘i’s mountains significantly influence the wind, rainfall, and temperature patterns of the islands.
 - 2) Check the students’ predictions by selecting different Zone Forecasts (weather reports for other parts of Hawai‘i) at <http://www.prh.noaa.gov/hnl/> (e.g. Ewa Beach vs. Pearl City is a good example of difference in weather on the same island).
- D. Summarize the activity thus far by asking students to: (1) write down the definition of *weather*, and (2) make a list of weather conditions that can change from day to day. Invite students to share, and through discussions, help them understand the following:

Weather is the daily atmospheric conditions at any given location, including temperature, rainfall and winds.

Weather conditions can change very rapidly.

Weather refers to short-term change.

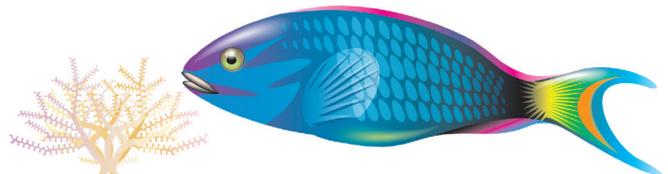
II. Are there Seasonal Weather Patterns in Hawai'i?

- A. Write the phrase *seasonal weather patterns* on the board. Begin by telling students that *season* refers to yearly periodic changes in the weather, caused by the tilt of the Earth. Ask the students to help you create a list of words associated with the phrase: “seasonal weather patterns.”
- B. Demonstrate how the sun’s energy drives the seasons. Using a globe of the Earth or drawing on the board, explain that the seasons are caused by the tilt of the Earth’s axis as the Earth orbits around the sun. Demonstrate how the northern hemisphere experiences summer when it is tilted toward the sun and the sun’s rays are most direct. At the same time, the southern hemisphere is tilted away from the sun and because the sun’s rays are less direct, this hemisphere experiences winter.
- 1) Use an inflatable globe and a flashlight to demonstrate how the Earth’s rotation on its axis causes day and night (SC 5.8.4). Then, demonstrate how the Earth’s tilt causes a difference between the number of hours of sunlight in the summer and in the winter. The teacher will demonstrate day, night, revolution, rotation, and tilt to the class. Explain that using a globe and a flashlight enable us to simulate processes such as day, night, and the Earth’s rotation on its axis.
 - 2) Ask the students whether the number of hours of daylight changes much between summer and winter in Hawai'i. Suggested guiding questions include: *When does it stay light the longest after supper? About what time does it get dark during the summer in Hawai'i? During the winter?* Establish that Hawai'i experiences approximately one hour more sunlight in summer than in winter. Explain to the students that Hawai'i is in the tropical latitudes where the length of day and the temperature change little throughout the year.
 - 3) Tell students that more northern areas experience four seasons: summer, fall, winter, and spring. Areas such as Portland, Oregon, or Seattle, Washington, or far northern Fairbanks, Alaska, experience much greater changes in the amount of sunlight between winter and summer, and much colder temperatures during the winter because of the decreased sunlight. Give examples of Hawai'i vs. Seattle temperatures in summer and winter.
 - 4) Time permitting, explore the sunrise and sunset times for Hawai'i, or other locations at <http://www.timeanddate.com/worldclock/astronomy.html>. Show different days/times in other countries which may help students to better understand time zones.

- C. Precipitation: Write the word *precipitation* on the board and explain that this is the general term for rain, snow, hail, and sleet. Have students brainstorm what precipitation is to activate prior knowledge.
- 1) Ask students where on planet Earth the seasons would be described as summer, fall, winter, and spring.
 - a. Examine the United States Climate Page, for temperature and rainfall patterns of various regions during fall and winter months, given at www.cdc.noaa.gov/USClimate/states.fast.html (provides data for Lihue, Barbers Point, Honolulu, Kaneohe, and Hilo).
 - 2) Make comparisons to the rainy season in Hawai‘i. Ask the students whether there is a pattern to when it rains in the Hawaiian Islands. Explain that, for most of Hawai‘i, there are only two seasons: dry summer months between May and October, and wet winter months between October and April. Point out that Hawai‘i does occasionally, get Kona (southern) rainstorms during the summer, and that some winters are drier and warmer than others, but that, generally, Hawai‘i experiences two seasons: wet (rainy) and dry.

III. What’s the Climate like in Hawai‘i?

- A. Introduce the term *climate* and write both the term and its definition on the board (Climate: all the weather that occurs over a period of years in a given place, including seasons and special weather events such as severe storms.).
- B. Show PowerPoint: *Weather vs. Climate*. Use the teacher’s notes located in the PowerPoint presentation.
- C. Now ask students to suppose that the caller who has never been to Hawai‘i had asked: *What’s the climate like in Hawai‘i?* Point out that the question is about climate (long-term), not weather (short-term).
 - 1) Ask students to discuss with their partner what they would tell the caller to describe Hawai‘i’s climate. Here is an opportunity to find out what students understand about the term *climate* and to help them understand that climate refers to average or long-term weather conditions, not the day-to-day weather changes:
 - a. Assist students, as needed, so they understand that when scientists talk about the overall climate of the entire state of Hawai‘i, they often describe mild temperatures, moderate humidity, the prevailing northeasterly trade winds, occasional Kona (southern) winds, rainy, and dry seasons of the year, and infrequent severe storms.
 - 2) Now, ask the students whether the scientist’s general description of the climate of all the islands accurately describes the climate or climates of their own neighborhood.
 - a. Give students data on conditions of Leeward vs. Windward.
 - b. Do the conditions in these two parts of the island match?
 - c. Do the conditions match the statewide climate conditions? Why or why not?
 - d. Help students conclude that, on their own island, there are many smaller climate areas.



IV. Does weather and climate influence the way that people live in Hawai‘i?

- A. Ask: *Does weather and climate influence the way people live in Hawai‘i?*
- 1) Prompt students’ thinking by asking them to think about their own daily activities, including going to school, or planning what they do on weekends, and what possible connections their activities have with weather and climate patterns (For example, warmer or rain-proof clothing during the winter rainy season; deciding where the driest place is on the island to go to the beach.).
 - 2) Where did the tourist industry build hotels, and is there a connection between hotels and weather or climate?
 - 3) Similarly, are there places particularly suitable for farming or ranching?
- B. If your friend who called earlier were coming to Hawai‘i, how could you help your friend plan activities or pack his/her luggage based on what you know about weather and climate on your islands?

V. Check for Understanding

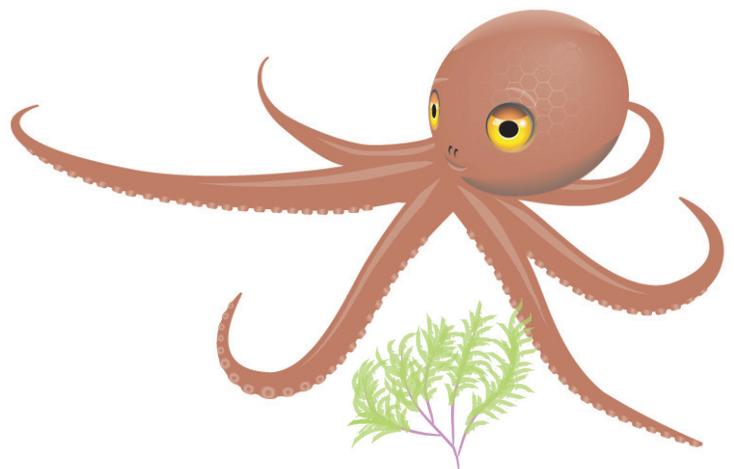
- A. Check for understanding of the terms *weather*, *seasonal patterns*, and *climate* in Hawai‘i by asking the students to either act out a telephone conversation during which they answer these questions, or write email messages to answer the questions.
- What’s the weather like in Hawai‘i?
 - Are there seasons in Hawai‘i?
 - What’s the climate like in Hawai‘i?
 - How does weather and climate influence the people of Hawai‘i?
- B. Have students demonstrate how day and night are the result of Earth’s rotation on its axis and how the tilt affects the length of night and day.
- C. Add important vocabulary concepts to the Word Wall.



Additional Activities

Science:

1. Watch TV weather reports and be ready to share what you learned from them with your classmates. If possible, record a TV report that shows the weather conditions on each of the islands, and share the video with the class.
(NOTE: If student does not have video technology available, a newspaper weather report could be shared.)
2. Interview adults in your family or in your neighborhood, and ask:
 - a. What's the most severe or memorable weather conditions you can recall in Hawai'i?
 - b. How would you describe the patterns of the weather in Hawai'i?
 - c. What was the weather like in Hawai'i when you were young (if they lived in Hawai'i for a long time)?
3. Create one, or more class bulletin board displays of weather and climate in Hawai'i and elsewhere around the world. Show how summer and winter are different in different parts of the world.



LESSON 1 - Teacher Reading

Weather and Climate

Weather and climate are ways of describing the atmosphere, ocean, and land conditions. Weather is a short-term description over a period of hours or days, while climate is a long-term description over a period of years. One popular way of looking at the distinction is to think of weather in terms of deciding what to wear outside, and climate as what crops to plant, when to water them, and when to harvest them.

Weather includes wind, temperature, moisture, air pressure, and cloud cover, and could include a heat wave, cold snap, hurricane, or blizzard. Weather may respond to climate changes by becoming warmer or colder, rainier or dryer, or developing more or fewer hurricanes.

Climate is the long-term average of conditions in the atmosphere, ocean, ice sheets on land and sea ice described by statistics, such as means and extremes. Hawai‘i’s climate has mild year-round temperatures with moderate humidity, northeasterly trade winds, and infrequent severe storms. Hawai‘i’s climate is also characterized by different amounts of rainfall in areas that are relatively close to one another. Hawai‘i has two very distinct seasons with different sorts of weather. Summer (dry) lasts between May and October, and winter (wet) lasts between October and April. Heavy rains occur in winter rather than in summer.

Source: http://www.prh.noaa.gov/hnl/pages/climate_summary.php

Download *Climate Literacy: The Essential Principles of Climate Science*

<http://climate.noaa.gov/education/pdfs/ClimateLiteracyPoster-8.5x11-March09FinalLR.pdf>

