Natural Phenomena

Hurricanes, Tornadoes, and Other Weather

Teacher's Guide

Grade Level: 6-9	**Curriculum Focus:** Earth and Space	**Lesson Duration:** Four class periods

Program Description

Hurricanes, Tornadoes, and Other Weather —The dynamics of heat, air pressure, and water create much of the weather we experience around the globe, including hurricanes, tornadoes, and thunderstorms. All three types of storms need the same basic ingredients to form, but differences in location and environment create very different kinds of storms. This program explores how and why one storm becomes a simple thunderstorm, while another becomes a violent tornado, and another a huge hurricane. Spectacular footage accompanies the facts about these destructive yet fascinating weather phenomena.

Discussion Questions

- What is the difference between a hurricane and a tornado?
- What does a hurricane have in common with a simple thunderstorm?
- What basic ingredients are needed for all of these storms to form?
- How does the earth's shape and rotation help to create hurricanes and tornadoes?

Lesson Plan

Student Objectives

- Understand the differences and relationships between hurricanes, tornadoes, and thunderstorms.
- Learn why the three basic storm ingredients create different kinds of storms in different places.
- Research major storm occurrences: where they occurred, why they occurred, and the damage they caused.
- Write a report about a storm and record the storm's location and/or track on a map.

Materials

- *Hurricanes, Tornadoes, and Other Weather* video and VCR, or DVD and DVD player, or access to the program in downloadable or streaming format online
- Computer with Internet access
- Print resources about hurricanes, tornadoes, and weather in general

Procedures

1. Review with the class the three basic ingredients of storms: heat energy, differences in air pressure, and water.
2. Review how these ingredients, as well as the earth's rotation, contribute to the formation of hurricanes and tornadoes:
    - The spin of the earth and the Coriolis effect help mix the three basic ingredients together to create storms.
    - Hurricanes are large cyclonic storms that need huge amounts of heat energy to form and keep going.
    - Hurricanes absorb billions of tons of evaporating heated water and carry it in their clouds.
    - Tornadoes do not always carry large amounts of water, but they need a sharp contrast between hot air and cold air masses in order to form.
3. Ask students to consider the three basic storm ingredients and the specific requirements for the formation of hurricanes and tornadoes and then to identify places on earth where they think many tornadoes and hurricanes might form. Record their responses, which might include some of the following:
    - Florida (tornadoes and hurricanes)
    - Texas (tornadoes and hurricanes)
    - Kansas (tornadoes)
    - Hawaii (hurricanes)
    - Mexico (hurricanes)
    - Jamaica (hurricanes)
    - Cuba (hurricanes)
    - Japan (typhoons)
    - Oklahoma (tornadoes)
    - North Carolina (hurricanes)

4. Ask students why they think these places experience so many storms. Are they located near warm oceans that supply plenty of evaporating water? Do radically different air masses clash over these places, creating atmospheric spiraling and instability? Challenge students to learn more about where hurricanes and tornadoes have struck most frequently and why those places experience so many of these storms.
5. Using print and Web resources, have students research hurricane- and tornado-prone places. The following Web sites offer good information:
    - NOAA: Frequently Asked Questions About Hurricanes
      http://www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html
    - Weather Underground: 30 Deadliest Atlantic Tropical Cyclones
      http://www.wunderground.com/hurricane/deadly.asp
    - Weather Underground: 30 Costliest Atlantic U.S. Hurricanes
      http://www.wunderground.com/hurricane/damage.asp
    - Weather Underground: Hurricane Tracking Map Archive (scroll to mid-page)
      http://www.wunderground.com/tropical/
    - Worst Hurricanes
      http://hurricane.weathercenter.com/guide/history.htm
    - National Weather Service Tornado Page
      http://www.nssl.noaa.gov/NWSTornado/
    - U.S. Geological Survey Natural Disasters
      http://pubs.usgs.gov/fs/natural-disasters/
    - Oxford's Tornado Information Page and Occurrence Maps
      http://www.oup-usa.org/naturalhazards/meteorological/tornadoes/science.html#other
    - U.S. Tornado Risk by State
      http://www.disastercenter.com/tornado/rank.htm
6. Tell students to identify one tornado occurrence (or tornado cluster) or hurricane landfall event that they find particularly interesting and research it in greater depth. Where did it occur? On what date and at what time of day? What inhabited areas, if any, did it strike? What damage did the storm do? What mix of atmospheric ingredients created this particular storm? Did the storm break any records for wind speed, duration, or damage? Ask students to record anything unusual or notable about the storm.
7. Ask students to find and print a map from the Web on which they can then draw the location (and path, if applicable) of the tornado or hurricane landfall event they have researched. On this map they should also write the place, date, and time of the storm (and name of the storm, if applicable). Many storm-tracking and blank maps are available to download and print from the Web. The following Web sites are good places to find some of them:

- NOAA Hurricane Tracking Charts (at bottom of this Web page)
  http://www.nhc.noaa.gov/
- Outline Maps (PDF file)
  http://www.eduplace.com/ss/maps/pdf/world_country.pdf
- Outline World Map
  http://worldatlas.com/aatlas/woutline.htm

8. Ask students to present their storm research in a one-page report, which they can write in one of two styles: a straightforward, school-style report; or a newspaper-style report, as if they were journalists covering the storm. In either case, ask students to report how the storm affected land, water, property, and people, and to include a short section explaining what atmospheric elements (heat energy, differences in air pressure, water) were available in that location to help that particular storm form or intensify.
9. Ask students to read their reports to the class, using their storm location/tracking maps as visual aids.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students were highly engaged in class discussions and individual research; produced a complete report and map, including all of the requested information; enthusiastically presented their findings to the class.
- 2 points: Students participated in class discussions and individual research; produced an adequate report and map, including most of the requested information; presented their findings to the class satisfactorily.
- 1 point: Students participated minimally in class discussions and individual research; created an incomplete report and map with little or none of the requested information; were not able to present their findings satisfactorily to the class.

Vocabulary

anticyclone

Definition: Winds that spiral outward from a high-pressure center, sometimes acting as the heat exhaust system for tropical storms and hurricanes

Context: A storm needs the spiraling winds of an anticyclone to become a hurricane.

Coriolis effect

Definition: The phenomenon of perpendicular opposing forces on a rotating body, acting in the direction of motion and the axis of rotation, on Earth, deflecting moving bodies to the right in the Northern Hemisphere and to the left in the Southern Hemisphere

Context: The Coriolis effect contributes to the formation of various kinds of storms.

cyclone

Definition: Any violent, rotating storm or storm system; also, the term used for hurricanes when they occur in the Indian Ocean

Context: Cyclones form in the warm oceans of the world.

downdrafts

Definition: Cooled air falling downward quickly out of storm clouds

Context: Downdrafts during a thunderstorm can dramatically lower the air temperature near the ground.

eye of a hurricane

Definition: An area at the center of a hurricane, usually 20 to 40 miles wide, which serves as the axis on which the hurricane spins, where the weather becomes calm and blue sky may be visible

Context: As the eye of a hurricane passes, it seems as if the storm has ended.

eye wall

Definition: The dense wall of clouds surrounding the eye of a hurricane, where the storm energy concentrates and its worst conditions exist

Context: After the calm of the hurricane's eye passes, the violent storms of the eye wall move in.

hurricane

Definition: A severe tropical cyclone with sustained wind speeds of 74 miles per hour or more

Context: Hurricanes have caused great destruction in the eastern United States.

storm surge

Definition: The onshore rush of ocean water caused by the high winds of a land-falling tropical storm or hurricane

Context: Storm surge has killed more people during hurricanes than wind or flooding rain.

tornado

Definition: A localized, destructive windstorm on land, characterized by a funnel-shaped cloud that extends toward the ground

Context: Tornadoes can occur anywhere, even in cities and near mountains.

tropical storm

Definition: A severe tropical cyclone with sustained wind speeds ranging from 39 to 73 miles per hour

Context: Tropical cyclones become named storms as soon as they reach tropical storm strength, 39 miles per hour.

tropics

Definition: The region of the earth's surface lying between the parallels of latitude at 23°27′ north of the equator and 23°27′ south of the equator, which are the points farthest north and south at which the sun can shine directly overhead

Context: Most tropical storms and hurricanes form over warm water in the tropics.

typhoon

Definition: The term used for hurricanes when they occur in the western Pacific Ocean

Context: Typhoons tend to become larger and more powerful than most hurricanes.

vortex

Definition: The shape of something rotating rapidly, such as the funnel cloud of a tornado

Context: A tornado's vortex sucks up material from the earth's surface like a huge straw.

Academic Standards

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K–12 to promote scientific literacy. To view the standards, visit this Web site:
http://books.nap.edu/html/nses/html/overview.html#content

This lesson plan addresses the following national standards:

- Earth and Space Science: Structure of the earth system; Energy in the earth system; Geochemical cycles

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit
http://www.mcrel.org/compendium/browse.asp

This lesson plan addresses the following national standards:

- Science—Earth and Space Sciences: Understands atmospheric processes and the water cycle
- Science—Physical Sciences: Understands forces and motion
- Geography—The World in Spatial Terms: Understands the characteristics and uses of maps, globes, and other geographic tools and technologies; Knows the location of places, geographic features, and patterns of the environment; Understands the characteristics and uses of spatial organization of Earth's surface
- Language Arts—Viewing: Uses viewing skills and strategies to understand and interpret visual media

Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the DiscoverySchool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- http://school.discovery.com/teachingtools/teachingtools.html

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Credit

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