

## *Earth Science*

### *Earth's Atmosphere, Weather, and Climate*

## Teacher's Guide

**Grade Level:** 6–12

**Curriculum Focus:** Earth Science

**Lesson Duration:** Two class periods

### **Program Description**

Earth's atmosphere is made up of many layers, and without it, life could not exist. Explore the characteristics of the atmosphere, how it interacts with the sun to give us the seasons, and why we must reduce pollution so we can preserve it. Learn about the features of Earth's climate zones and how animals and plants have adapted to these varied conditions. See how local conditions affect weather and why hurricanes, tornadoes, and other extreme weather can be so destructive.

---

### **Onscreen Questions**

- What are the layers of Earth's atmosphere?
  - How does the sun affect weather and seasons?
  - How are the world's climates classified?
  - What local conditions influence climate?
  - What causes extreme weather?
  - What are the different forms of air pollution?
- 

### **Lesson Plan**

#### *Student Objectives*

- Understand how hurricanes, typhoons, and cyclones form.
- Explain the impact on the land and people after a storm hits.
- Develop a weather-forecast style report on a storm's development, impact, and aftermath.

#### *Materials*

- *Earth's Atmosphere, Weather, and Climate*
- Computer with Internet access
- Maps, atlases, and/or geography books with locations of several major hurricanes, typhoons, and cyclones noted

## Procedures

1. Explain to students that they will be acting as weather forecasters for a local, national, or global weather service.
2. Divide the class into groups and use the maps and atlases to help identify and choose a major hurricane, typhoon, or cyclone that has occurred in the past 10 years.
3. Have students research their assigned storm, including its formation, strength, impact, and results. The following sites are good starting points for exploring extreme weather systems online:

<http://www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html>

<http://www.nhc.noaa.gov/HAW2/english/history.shtml>

<http://www.ifrc.org/news/subcat/hurric.asp>

<http://www.nhc.noaa.gov/aboutsshs.shtml>

<http://www.fema.gov/hazards/hurricanes/tshstry.shtm>

<http://web-jpn.org/kidsweb/calendar/september/typhoon.html>

[http://www.weather.gov.hk/informtc/historical\\_tc/htcahk.htm](http://www.weather.gov.hk/informtc/historical_tc/htcahk.htm)

<http://www.disaster.qld.gov.au/disasters/cyclones.asp>

4. Students should look for answers to the following questions:
  - Where and when did this storm develop?
  - How strong were its winds? If it was a hurricane, what was its rating on the Saffir-Simpson scale?
  - How big was it (area)?
  - Where and when did this storm make landfall?
  - How many people were affected by the storm?
  - What kinds of damage did the storm do?
  - What did regional or local governments do to warn people in advance?
  - What did federal, regional, and/or local governments or agencies do to help communities and individuals prepare for the storm?
  - What did governments or agencies do to help following the storm?
  - How can communities and individuals better prepare for future storms?
  - What can governments do to help minimize a storm's impact on communities and individuals?
5. After students have completed their research, have each group compile their information and develop a five to eight minute weather report. Students can pretend they are reporters for a TV or radio weather channel, the National Weather Service, or a global weather information service. They can use visual aids such as photographs, drawings, and maps to further illustrate the storm's location and impact.

6. Have each group present its forecast to the class. The group can choose one person to make the presentation, or it can be divided among several students.

## Assessment

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

**3 points:** Students were highly engaged in class discussions; conducted thorough research; presented a creative and highly informative weather report.

**2 points:** Students were somewhat engaged in class discussions; conducted adequate research; developed an acceptably detailed and adequately informative report.

**1 point:** Students were not engaged in class discussions; did not conduct adequate research and presented a poorly thought out, minimally detailed report.

## Vocabulary

### acid rain

*Definition:* Rainfall contaminated by acidic pollutants, such as sulfur dioxide

*Context:* Acid rain is harmful to trees, plants, soils, and marine life and can contaminate drinking water.

### horse latitudes

*Definition:* The areas of calm wind and seas in both the Northern and Southern Hemispheres, at about 30 degrees latitude

*Context:* The horse latitudes are high pressure areas containing air that is so dry it produces a belt of deserts in both hemispheres.

### Köppen system

*Definition:* The widely used climate classification system based on one introduced in 1900 by the Russian-German climatologist Wladimir Köppen

*Context:* The Köppen climate classification system divides Earth into regions that are identified by a unique letter system for the five major climate groups.

### rain shadow

*Definition:* A dry region on Earth's surface that is leeward, or behind, a mountain with respect to the prevailing wind direction

*Context:* The rain shadow effect creates dry plateaus and valleys that receive very little precipitation, such as the area east of the Cascade Mountains, or Death Valley in California.

### Saffir-Simpson scale

*Definition:* The method of classifying hurricanes in the Atlantic and North Pacific by the intensity of their sustained winds, ranked from one to five

*Context:* A category one hurricane on the Saffir-Simpson scale will do minimal damage, but a category five storm will cause tremendous devastation.

### **tornado alley**

*Definition:* The area of the United States in which tornadoes are most frequent, encompassing the Plains area between the Rocky Mountains and Appalachians

*Context:* Kansas and Oklahoma are in the heart of tornado alley and are subject to frequent, violent funnel clouds.

### **smog**

*Definition:* a photochemical haze created when ultraviolet radiation from the sun reacts with pollution in the atmosphere

*Context:* Smog is common in large cities such as Los Angeles, and can lead to many serious health problems including asthma, lung problems, and heart disease.

## **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
- Science in Personal and Social Perspectives: Risks and Benefits

### **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; Understands Earth's composition and structure
  - Geography: Physical Systems – Knows the physical processes that shape patterns on Earth's surface
  - Geography: Environment and Society – Understands how human actions modify the physical environment; Understands how physical systems affect human systems
-

## 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>

---

## How To Use the DVD

The DVD starting screen has the following options:

**Play Video** – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

**Video Index** – Here the video is divided into sections indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

**Curriculum Units** – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

**Standards Link** – Selecting this option displays a single screen that lists the national academic standards the video addresses.

**Teacher Resources** – This screen gives the technical support number and Web site address.

## Video Index

### I. The Atmosphere (4 min.)

Layers of gases surround the Earth creating the atmosphere that makes the planet habitable. Explore the composition of the atmosphere and its different layers.

*Pre-viewing question*

Q: What is the importance of Earth's atmosphere?

A: Without it life on the planet would not exist. It blocks harmful radiation from the sun, while trapping some of the sun's energy to warm the Earth.

*Post-viewing question*

Q: What are the layers of Earth's atmosphere?

A: Troposphere, stratosphere, mesosphere, thermosphere, and exosphere

**II. The Sun and the Seasons (5 min.)**

The sun's energy does more than just warm Earth. Discover how the sun affects seasons, weather patterns, and temperatures.

*Pre-viewing question*

Q: How does the sun affect weather and seasons?

A: Answers will vary.

*Post-viewing question*

Q: How would life on Earth be different without seasons or weather patterns?

A: Answers will vary.

**III. Global Climate Zones (6 min.)**

Plants and animals adapt to Earth's many climates. Learn more about the different climate zones and their unique characteristics.

*Pre-viewing question*

Q: What determines the climate in a region?

A: Answer may include distance from the equator, amount of sunlight, proximity to large bodies of water, and elevation.

*Post-viewing question*

Q: To which climate zone and subcategory does our community belong?

A: Answers will vary

**IV. The Effects of Local Conditions on Weather (5 min.)**

Regional weather is dependent of a number of local conditions. Learn how large bodies of water, mountains, or ocean currents affect local weather, regardless of the climate zone.

*Pre-viewing question*

Q: What local conditions influence climate?

A: Answers will vary.

*Post-viewing question*

Q: How does water, wind, or land affect local climate?

A: Answers will vary, but should mention water's ability to moderate temperatures, the Gulf Stream, the mountain rain shadow effect, monsoon winds, and the size of the Eurasian land mass creating high and low pressure systems.



### **V. Cyclones, Hurricanes and Tornadoes (5 min.)**

When the right atmospheric elements combine the results can be devastating. Learn how hurricanes and tornadoes form and see weather at its fiercest.

*Pre-viewing question*

Q: Have you ever experienced a hurricane or tornado?

A: Answers will vary.

*Post-viewing question*

Q: Where are extreme weather systems most likely to occur and what kinds of damage can they cause?

A: Hurricanes occur in the Atlantic and eastern Pacific; typhoons in the western Pacific, and cyclones in the Indian Ocean. Tornadoes are prevalent in the Plains area of the United States, in a region known as "tornado alley."

### **VI. Air Pollution (5 min.)**

The effects of air pollution harm humans, animals, and plants. Explore the causes of air pollution and its impact on the environment.

*Pre-viewing question*

Q: What are the different forms of air pollution?

A: Answers will vary.

*Post-viewing question*

Q: What are some of the effects of air pollution?

A: Air pollution can have health effects such as asthma and lung conditions; if the ozone hole in the atmosphere grows bigger it could let in more harmful UV radiation from the sun; it leads to a build up of greenhouse gases that could cause global warming, and creates smog and acid rain.