Hurricane Applet Teachers Guide

This applet was developed by Tom Whittaker and Steve Ackerman with Weather Wise at the University of Wisconsin. The web page for all of their applets can be found at

http://profhorn.meteor.wisc.edu/wxwise/

The hurricane applet is available at http://profhorn.meteor.wisc.edu/wxwise/hurr/hurr.html

Benchmarks

SC.6.E.7.2 -Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.

SC.6.E.7.3 -Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation.

SC.6.E.7.4 -Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere

SC.6.E.7.5 -Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.

SC.6.E.7.7 -Investigate how natural disasters have affected human life in Florida.

SC.912.E.7.6 -Relate the formation of severe weather to the various physical factors.

SC.912.E.7.3 Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.

SC.912.E.7.8 Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and influence human behavior, both individually and collectively.

There are a variety of topics that you can illustrate with this applet

1. General hurricane movement—The applet starts with the hurricane originating from Africa and traveling west across the Atlantic Ocean--

Explain that many hurricanes originate as tropical waves of low pressure from Africa. There are many tropical waves every year, but only a few mature to become hurricanes.

Point out that hurricanes can travel across the Atlantic Ocean, but not all hurricanes do. Show students a map of hurricane tracks (http://www.nhc.noaa.gov/2005atlan.shtml other years are available) and point out that some hurricanes can curve Northward into the Atlantic Ocean. Some can form in the Caribbean Sea/Gulf of Mexico and move north into the United States.

2. Hurricanes are low pressure systems—The applet starts the hurricane off as a tropical depression (designated by the "L") and when it reaches category one it really starts to show the cyclonic circulation of a hurricane.

Go over the fact that hurricanes are low pressure systems. The atmospheric pressure inside of the

hurricane is lower, much lower than the surrounding atmosphere. Since they are low pressure areas their winds turn counter-clockwise. Since it is a low pressure system the winds will spiral inwards, converge, and rise. This rising motion is the trigger for thunderstorms and severe weather. Even if they are a good distance away they can bring severe weather. Tropical Storm Debby is a good case in point.

3. Hurricane Categories—If you reset the applet to fall you can get the hurricane to intensify to a category 5. Use the mouse to drag the hurricane into the warm pool of water in the Gulf of Mexico.

Go over tropical depressions, tropical storms, hurricanes, and the Saffir-Simpson Hurricane Intensity scale (http://www.srh.noaa.gov/srh/jetstream/tropics/tc_classification.htm). Explain that hurricanes start off as tropical waves of low pressure. If these waves become stronger they can become tropical depressions (L). If they have winds of 39 mph they become a tropical storm and get a name. If the winds reach 74 mph they become a category 1 hurricane. If the winds reach 96 mph they become a category 2 hurricane. Point out that hurricanes bring severe weather in the form of high winds, torrential rains (which lead to flooding), and tornadoes.

4. How hurricanes depend on the ocean for their moisture and energy--

a. How hurricanes depend on the water temperature---For the summer and fall seasons students will be able to see the hurricane intensify as it goes over warmer waters. You can illustrate how the hurricane loses its strength by dragging it to the colder waters of the North Atlantic (You can even drag the high pressure east and give the hurricane a gentle nudge with your mouse so it recurves north).

Explain to the students that the Sun warms the ocean. You can click on the seasons and see the changes in the Sea Surface Temperatures (the Applet develops hurricanes in Winter and Spring which doesn't happen that often in nature). The surface temperatures actually peak in Fall in the applet. This reflects the fact that SSTs peak in September in nature. The ocean has a high heat content and as the Sun warms the ocean over the summer and into September this heat builds up and peaks in the early fall.

b. How hurricanes depend on the ocean for moisture-When the hurricane passes over land it will weaken because it cannot draw its principal energy source, water vapor, from the oceans.

Connection to the Water Cycle, Hydrosphere, and Geosphere
Explain to the students that hurricanes draw their energy from the warm waters of the ocean. When the ocean water evaporates the water vapor has a special kind of energy called latent heat. When the water vapor condenses into clouds in the hurricane this latent heat is released. The latent heat warms the atmosphere and gives energy to the hurricane. Make the connection between hurricanes and the water cycle. Water evaporates from the ocean, rises and condenses into clouds, and falls back to the ocean as rain (precipitation). All parts of the water cycle are present in a hurricane. When a hurricane moves over land it will bring rain to the land, but the source of the evaporation is from the ocean. As a hurricane moves further inland it is further away from its source of water vapor and energy. You can click and drag the hurricane over warmer and colder water to demonstrate it getting stronger and weaker. Emphasize that hurricane season is between June and November when the ocean waters are warm enough for hurricanes to form.

5. How hurricanes are steered by the larger scale atmospheric circulations. You can move the position of the high pressure system in the Atlantic and use it to steer the hurricane.

Explain to the students that hurricanes are steered by the larger scale atmospheric circulations. The large high pressure system in the Atlantic Ocean is called the Bermuda High. It is a semi-permanent high pressure system. The location of the Bermuda High can influence the direction that a hurricane travels. You can demonstrate this by doing the following (hit reset after each one)

Move the high pressure system to the east (so that the H is over the Azores) The hurricane will travel towards Cuba and Florida.

Move the high pressure system to the west (so the H is just off of North Carolina). The hurricane will take a more southerly route into Mexico.

Try experimenting by moving the high pressure system to various locations as the hurricane crosses the Atlantic to see what happens. Try moving the High so it allows the hurricane to hit Florida.

*A special note—hurricanes are steered by more than just the Bermuda high. Troughs in the jet stream (another global circulation pattern) can pick up and steer hurricanes as well.

6. How hurricanes impact Florida—You can adjust the location of the high pressure system so that it steers the hurricane into Florida. Use this as a spring board into a the benchmarks about how hurricanes affect Florida (SC.912.E.7.8, SC.6.E.7.7).

1) east to west 2) Africa 3) low 4) 74 5) high winds, rains, tornadoes 6) ocean
7) stronger 8) false—evaporation from the ocean. 9) Bermuda 10) Summer, Spring

Name_____

Hurricanes

1. In what direction do hurricanes generally travel?

   *west to east *east to west

2. Where do tropical waves, which can eventually mature into hurricanes, originate from?

   *South America *Africa *North America

3. Hurricanes are (low/high) pressure systems.

4. The minimum wind speed for a hurricane is (39/74/115) miles per hour.

5. What types of severe weather are associated with hurricanes? Circle all that apply

   *High winds *Dust *Torrential rains *Snow *Tornadoes

6. The energy for hurricanes comes from the (land/ocean).

7. As the temperature of the ocean rises the hurricane will become (weaker/stronger).

8. True or False—The only parts of the water cycle in a hurricane are condensation and precipitation.

9. What is the name of the high pressure system that can steer hurricanes? (Africa/Bermuda) High.

10. What are the primary seasons for hurricanes?

    *Winter *Spring *Summer *Fall