Hurricanes: An Environmental Concern

Strand Scientific Investigation

Topic Investigating the planets in the solar system

Primary SOL

ES.12 The student will investigate and understand that energy transfer between the sun and Earth and its atmosphere drives weather and climate on Earth. Key concepts include

c) severe weather occurrences, such as tornados, hurricanes, and major storms.

ES.10 The student will investigate and understand that oceans are complex, interactive physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include

c) systems interactions.

Related SOL

ES.1 The student will plan and conduct investigations in which

c) scales, diagrams, charts, graphs, tables, imagery, models, and profiles are constructed and interpreted.

Background Information

Hurricanes are referred to by different labels, depending on where they occur. They are called hurricanes when they happen over the North Atlantic Ocean, the Caribbean Sea, the Gulf of Mexico, or the Northeast Pacific Ocean. Such storms are known as typhoons if they occur in the Northwest Pacific Ocean, west of an imaginary line called the International Date Line. Near Australia and in the Indian Ocean, they are referred to as tropical cyclones.

Hurricanes are most common during the summer and early fall. In the Atlantic and the Northeast Pacific, for example, August and September are the peak hurricane months. Typhoons occur throughout the year in the Northwest Pacific but are most frequent in summer. In the North Indian Ocean, tropical cyclones strike in May and November. In the South Indian Ocean, the South Pacific Ocean, and off the coast of Australia, the hurricane season runs from December to March. Approximately 85 hurricanes, typhoons, and tropical cyclones occur in a year throughout the world.

Hurricanes in the Northern Hemisphere usually begin by traveling from east to west. As the storms approach the coast of North America or Asia, however, they shift to a more northerly direction. All hurricanes eventually move toward higher latitudes where there is colder air, less moisture, and greater wind shears. These conditions cause the storm to weaken and die out. The end comes quickly if a hurricane moves over land, because it no longer receives heat energy and moisture from warm tropical water. Heavy rains may continue, however, even after the winds have diminished.

Materials

- Internet connection
- Live Action Server (LAS) - https://mynasadata.larc.nasa.gov/las/getUI.do

Vocabulary

atmosphere, biosphere, hurricane, hydrosphere, lithosphere, mitigation

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Provide a scenario to students that puts them in the role of a community hurricane mitigation team. They are to collect as much information about hurricane Katrina and its impact on the environment in order to prepare their hurricane mitigation plan.
2. Groups of students should be assigned a specific sphere to look at more closely in relation to hurricanes. When all groups are finished, each will present it's findings to the class for comparison and a closer look. Groups of students should be assigned to the following to observe data related to their sphere using the Live Access Server (LAS):
   - Hydrosphere;
     - Oceans
   - Lithosphere;
     - Land Surface
   - Biosphere; or
   - Atmosphere.

   Note: Make sure that all of the groups choose hurricane Katrina, time period, and approximate location before beginning the lesson.
3. Each group should create a color plot that is centered around the equatorial Atlantic. Be sure to use these plots to draw conclusions as to how the data set could impact a hurricane. Remember that an impact can be positive or negative. Select the date range for hurricane Katrina (August 20-30, 2005).
4. Go to the Live Access Server Advanced Edition found at https://mynasadata.larc.nasa.gov/las/getUI.do.
5. Depending on which sphere you are assigned, click on the following sequence: **Atmospheric Radiation**, then Surface, then Monthly Surface All Sky SW Downward flux. Be sure to click on the radio button next to 'Update Plot' found in the menu at the top of the page. Next, change the latitude and longitude location to 50N through 5S and 110W through 5W respectively then. Select your particular time.

   Biosphere, then Monthly Leaf Area Index (MISR), change the region to North America (this can be found by clicking on the double downward arrow found in the upper left-hand corner of the page above the navigation map), change the date to the appropriate time frame. Be sure to click on the radio button next to 'Update Plot' found in the menu at the top of the page. With this sphere you will be drawing connections between leaf area index and the factors that are present to arrive at the values seen on the color plot.

   Land Surface, then Surface Conditions and then Monthly Surface Pressure. Make sure to change the region to North America (this can be be found by clicking on the double downward arrow found in the upper left-hand corner of the page above the navigation map) and change the date to the time period being studied. Be sure to click on the radio button next to 'Update Plot' found in the menu at the top of the page.

   Oceans, then click on Weekly Sea Surface Temperature. Next, change the latitude and longitude location to 50N through 5S and 110W through 5W respectively then click go.

Select your particular time. Lastly, be sure to click on the radio button next to 'Update Plot' found in the menu at the top of the page.

6. Use the data that you have found in the Live Access Server along with the other information that you have collected to determine all possible pathways that a hurricane could impact the environment.
7. List some ways in which different spheres interact with each other.
    - What effect would there be if one of the spheres were missing from the Earth? For this question, choose a single sphere to be removed and list one or two things that might be a result of the removal of that sphere on a global and local scale.
    - With your specific sphere, is there any human influence that could change things?
    - What was a specific item that you learned from this lesson?
    - What steps could be taken to mitigate the potential impact on the sphere that you were studying?
    - What specific conclusions were you able to draw when looking at your Live Access Server Plot?
    - With regards to hurricanes, what direct impact is there on your sphere?
    - Based on the sphere you were assigned, does the sphere influence the hurricane or the hurricane influence the sphere to a greater degree?

Assessment

- **Questions**
    - What impacts does a huricane have on the various spheres?
    - What impacts could be put in place to mitigate against serious impacts?
- **Journal/Writing Prompts**
    - Write a letter to the Federal Emergency Management Agency (FEMA) to offer a hurricane mitigation plan.
- **Other**
    - After looking at your plot, were there any other questions that came up as a result of your data analysis? List the additional questions and your answers to those questions.

Extensions and Connections (for all students)

- Creating an interactive presentation (i.e., Google Earth Tour) of the region with descriptive tags for each of the points of interest described.
- Have students use maps, etc., to create a visual presentation (poster, PowerPoint, etc.) to show the spheres and their impact on the environment.

Strategies for Differentiation

- Have students utilize printed pictures rather than images from Web sites to analyze data.
- Have students create a graphic organizer, such as a concept map, to collect information on each of the spheres and the interactions amongst the spheres.