LESSON TITLE:
Cycloning out of Control: Climate Change Impacts on Natural Disaster

CLASS SUBJECT WHERE LESSONS COULD BE TAUGHT:
Geography, Physical Sciences, Earth and Environmental Science, Health, and

EDUCATION STANDARDS:
Look at Science, Math, Technology and Geography. Provide additional detail about science topics you think are discussed in this lesson that can be used to closely align with standards (i.e. ocean chemistry, wind patterns, access to food or other key concepts.

Common Core Standards: www.corestandards.org
(list specific standards after) i.e. Earth and Space Sciences/Physical Sciences/ Life Sciences
Geography Standard(s):
Other:

GRADE LEVELS:
The activity is appropriate for students in grades 9-12

TIME FOR COMPLETION:
45-50 minutes to complete
60-75 minutes with the background information

OBJECTIVES
Climate change has a profound impact on human health. After completing this activity, students will be able to:

- Understand the connections between climate change and extreme weather events such as hurricanes and populations potentially at increased risk of experiencing one of these natural disasters.
- Navigate the NASA WorldWind CHANGE Viewer; select layers for analysis in CHANGE Viewer; configure and launch CHANGE Viewer analysis tools;
- Visualize the patterns of where hurricanes currently occur and the variation of intensity at these locations;
- Estimate populations that are potentially at increased risk of exposure to more intense storms
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ACTIVITY: Natural Disaster

Cycloning out of Control: Climate Change Impacts on Natural Disasters

Hurricanes, cyclones, and typhoons are all the same weather phenomenon; we just use different names for these storms in different places. In the Atlantic and Northeast Pacific, the term “hurricane” is used. The same type of disturbance in the Northwest Pacific is called a “typhoon” and “cyclones” occur in the South Pacific and Indian Ocean.

Researchers are trying to determine if there is a link between climate change and an increased frequency and intensity of these tropical storms systems. While no one has yet shown a clear connection between climate change and an increased number of storms there is mounting evidence that there is a connection between climate change and the increased intensity of these storms.

In this activity, we will explore where tropical storms typically occur and the level of intensity at these locations. We will then explore the social and economic impact of these storms and look at where storm intensity may increase and estimate the populations that live within these regions.

Activity Procedure:

1. Click on the Activity tab and select the Natural Disasters - Cyclones tab.
2. To make a layer appear, you must turn the layer on by checking the box.
3. When a data layer is turned on in the Activity tab, the legend and data layer will display in the Map tab.
4. When a data layer is turned on in the Activity tab, the legend and data layer will display in the Map tab.
5. Data layers display based on the order they were turned on.
6. At times you will need to switch between the Activity tab and the Map tab to turn on and off layers.
7. At times you turn off a layer in the Activity tab and then turn it back on to display it as the top layer.

For information about the data, visit Help in the CHANGE Viewer and access the Data Reference.
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Part I: Where Do Tropical Storms Occur?
Instructions: Read the following steps to complete the activity. There will be questions to answer while you are going through the activity. Please answer all questions in the answer sheet provided at the end of the activity.

1. Turn on the Cyclone events based on the Saffir Simpson Categories for 1969 to 200 layer from Natural Disasters: Cyclones Activity tab.

2. Click on the Map tab to examine the legends.

3. Explore the globe to get an understanding of where are cyclones most common.

Question 1: Describe where Hurricanes, Cyclones and Typhoons occur.

Question 2: Why do Hurricanes occur on the east coast of North America but not on the west coast?

Question 3: Why do they not occur in the South Atlantic but do occur in the South Pacific and Indian Oceans?

4. Turn off all layers in the Natural Disasters: Cyclones Activity tab.

Part II: Understanding Impacts

1. Turn on the Cyclone Proportional Economic Loss layer.

This layer projects economic loss as proportions of Gross Domestic Product (GDP) per analytical unit from cyclones.

Question 4: Explore the places in the world that experience the highest levels of economic loss. List 3 counties in the eastern hemisphere that experience a high risk proportion economic loss.

Question 5: Can you explain why North Korea has a greater risk than the countries surrounding it?
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2. Turn off Cyclone Proportional Economic Loss layer.
3. Turn on the Cyclone Surge Frequency Category 1 layer.

Question 6: Use the Population Estimation tool to estimate the population subjected to storm surges along the New Jersey Shoreline. (~ 0.5 million people)

4. Turn off Cyclone Surge Frequency Category 1 layer.
5. Turn on the Global Cyclone Mortality Risk layer.

This layer estimates cyclone mortality based on the populations exposure to cyclones, historical losses in previous disasters and country wealth class (classification based on 2000 GDP) over the 20 year period from 1981-2000.

Question 7: List 3 countries in the eastern hemisphere that have a ranking in the 8th to 10th decile.

Question 8: List 3 countries in the western hemisphere that have a ranking in the 8th to 10 decile.

6. Turn off all layers in the Natural Disasters: Cyclones Activity tab.
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Part III: Populations at Risk of Exposure to Increased Storm Intensity


2. Zoom into Bangladesh. The categories we see within Bangladesh range from 1 to 4 running light to dark.

3. Click on the Population Estimation Tab.

4. Click on the Draw button

5. Draw a polygon around the region of Bangladesh that falls within the Category 3 level.

6. Click the Calculate button

Questions 9: What is the estimated population living in this region? (should be approx. 2.1 mil)

Now we will estimate the population if the region currently classified as level 2 were to increase to level 3.

7. Click on the Draw button again

5. Draw a polygon around the area classified as level 2.

6. Click the Calculate button

Questions 10: What is the estimated population living in this region? (should be approx. 2.5 mil)

Question 11: Now repeat this process for the southern tip of Florida. How many additional people would be at risk of a more intense storm if the category 2 region were to increase to category 3?
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Part IV: Creative Adaptation to Climate Change

One of the most important characteristics of the human species is its ability to adapt to change. Throughout our time on this planet, humans have had to meet the challenges posed by many serious environmental challenges including extreme changes in the climate. The threats to human health and prosperity from global climate change must be met with creative adaptations to local environmental changes.

Read the article found at the link below that describes how people in Bangladesh are working adapt their lifestyles and culture to overcome the problems they are encountering with increased flooding and storm surges.

http://www.iied.org/blogs/bangladesh-mangrove-island-reflects-peoples-creativity

Next go to the link below to see a map showing the locations of Mangroves throughout the world.

http://earthobservatory.nasa.gov/IO/TD/view.php?id=47427

Now use the Change viewer to identify other places in the world that have both a high mortality risk from cyclones and have a mangroves around their coastlines.

Question 12: Do you think people in these areas can use some of the techniques the people in Bangladesh are employing to help them adapt to climate change issues?
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Challenge Exercise!

Please look at the available layers in the CHANGE Viewer and find an area with frequent, intense, and economically damaging cyclones. Now do a Google search to find a specific recent destructive cyclone in your selected area. Write a paragraph on this cyclone’s effect on human health answering the following questions and also other interesting facts or observations. Please keep track of your references because you will be responsible for turning in a bibliography.

a. Name
b. Date range
c. Saffir-Simpson Hurricane Wind Scale
d. Extent of Storm Surge
e. Death Toll
f. Monetary Cost
g. Warning System
h. Could damages have been avoided?