MY NASA DATA Lesson:

March of the Polar Bears: Global Change, Sea Ice, and Wildlife Migration

Purpose:

Students will use NASA satellite data to study temperature and snow-ice coverage in the South Beaufort Sea, Alaska. The data can be used to correlate with USGS ground tracking of polar bears, and to relate this to global change, sea ice changes, and polar bear migration. The data can be used to draw conclusions surrounding any migration patterns in the region.

Image courtesy USGS

Grade Level: 7 – 12

Estimated Time for Completing Activity:

Two 50-minute class periods

Learning Outcomes:

- Students will analyze maps and time series data to understand changes.
- Students will construct data-based explanations and conclusions.
- Students will better understand global change through a local case study.
- Students will consider the impact of environmental changes on wildlife.
- Students will consider the impact of human activities on life and the Earth.

Prerequisite

- Familiarity with locating places on maps using latitude and longitude
- Familiarity with understanding color palettes on maps and reading line plots

Tools

- Computer with Internet Access

- Color printer (optional)

AP Environmental Science Topics

- Atmosphere-ocean interactions

- Climate shifts

- Endangered species

- Greenhouse gases and the greenhouse effect

- Impacts and consequences of global warming

- Maintenance of biodiversity through conservation

- Ocean circulation

- Reducing climate change

- Species movement

Vocabulary:

- climate

- global warming

- greenhouse effect

- latitude

- longitude

- temperature

- trend

Lesson Links:

- Polar Bear Background Information (WWF)

- Polar Bear Catching, Tagging, and Tracking Animation (WWF)

- Polar Bear Migration – Sea Ice Change Animation (USGS)

- Live Access Server

- NASA Global Climate Change website

- Polar Bears International website

- Global Warming and Polar Bears

Background:

The polar regions of the Earth (Arctic and Antarctic) have some of the most extreme climates on Earth, with temperatures usually well below freezing all year. The Arctic polar region is mainly sea ice floating upon the Arctic Ocean, whereas the Antarctic region is a continent with permafrost, glaciers and surrounding sea ice.

Scientists expect and are observing that global warming due to the increase of greenhouse gases will first impact the polar regions and the expanse of sea ice. Even a few degrees increase in temperatures will cause sea ice to break away and float into warmer waters, or to melt in place. The melting of polar sea ice will not only prompt climate and weather changes, but will also impact the ecosystem in the Arctic.

Local impacts are already being seen in the study of the polar bear habitat, diet and migration patterns. In this lesson, you will explore the changes in temperature and sea ice coverage in the South Beaufort Sea, north of Alaska. You will then consider how the changes you observe in the data may affect the migration of polar bears in the region.

Procedure:

Background Activity: Examine the first three Lesson Links to learn about polar bears, their habitat and migration patterns. Discuss as a class what you have learned about polar bears and the Arctic climate.

Data-analysis Activity: Using the Live Access Server lesson link, you will construct six pieces of data to help you analyze trends in the Arctic.

Maps Part I: Monthly Near Surface Air Temperature Color Plots (June 1995 and June 2005)

1. If not automatically prompted with data parameter selections click on 'Choose Dateset' in the upper left corner of the screen. Then click as follows, Atmosphere, Atmospheric Temperature, Monthly Near Surface Air Temperature (ISCCP). Click Next.

2. Enter coordinates for region in the compass rose below the navigation map to the left of the screen: Lat 50 N to 78 N, Long 168 W to 142 W

3. change your date to: June 1995

4. Click the 'Update Plot' Radio button to see your changes.

5. Generate another Color Plot using the same parameters as in Steps 1-5, except use Select Time: June 2005. Print or save the map for later use.

Maps Part II: Monthly Snow-Ice Percent Coverage Color Plots (June 1995 and June 2005)

1. Repeat Procedure for Maps Part I (steps 1 – 6) except select Cryosphere, Monthly Snow-Ice Amount (ISCCP).

2. Print or save for later use. (Note: You should now have four total color plots.)

Line Plots Part I: Monthly Near Surface Air Temperature Time Series (June 1995 – June 2005)

1. If not automatically prompted with data parameter selections click on 'Choose Dateset' in the upper left corner of the screen. Then click as follows, Atmosphere, Atmospheric Temperature, Monthly Near Surface Air Temperature (ISCCP).

2. Click the 'Time Series' option to produce a Line Plot.

3. Change your coordinates to: Lat 74 N, Long 156 W

4. Change your time range to: June 1995, June 2005

5. Click the 'Update Plot' Radio button to see your changes and then print or save the plot for later use.

Line-plots Part II: Monthly Snow-Ice Percent Coverage Time Series (June 1995-June 2005)

1. Repeat Procedure for Line-plots Part I (steps 1-5), except select Cryosphere, Monthly Snow-Ice Amount (ISCCP).

2. Print or save the plot for later use. Note: You should now have a total of four color plots (maps) and two line-plots, for a total of six data images.

Questions:

1. Which year is warmer in the South Beaufort Sea region, 1995 or 2005? How many degrees warmer?

2. Which year has more snow-ice amount in the same region? By how much?

3. Using the line plots, examine the seasonal oscillations of the variables. Do you see any trends in the line plots?

4. Write a paragraph describing your findings and conclusions using the data results.

5. Would you expect to see any impact on the habitat and migration of polar bears based on your conclusions?

6. How will the changes that you study affect the people of Northern Alaska and Western Canada? What other information or data would help you answer this question?

7. Do you think there is a global change trend or just a local random variation? Explain your answer. What other information or data would help you answer this question?

Extensions:

1. Choose another animal species and consider the effects of climate change on their natural habitat and migration patterns.

2. Collect news articles and prepare a television news report to explain what is happening in the Arctic or Antarctic regions due to global warming. Refer to Lesson Links for additional information on climate change and global warming.

3. Plan a migratory trip from the viewpoint of a polar bear. For example: Where (location) does your polar bear character begin and end the journey? Describe what your polar bear character experiences along the journey. For additional information, use the Polar Bear International website and Global Warming and Polar Bears links in the Lesson Links section.

Lesson plan contributed by Venugopal Bhat, Seattle, Washington

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