MY NASA DATA Lesson:

See notes at the end of the lesson for data updates with the new Earth System Data Explorer

Evidence of Change Near the Arctic Circle

Purpose:
To analyze graphs as evidence and make a conclusion about polar climate change

Grade Level: 8 – 12

Estimated Time for Completing Activity:
Two 50 minute class periods

Image courtesy NASA

Learning Outcomes:

- Students will produce graphs using graphing software.
- Students will observe graphical changes in parameters.
- Students will identify relationships between parameters.
- Students will make and defend conclusions based on evidence.

Prerequisite

- Familiarity with Excel or other graphing software
- Familiarity with coordinates of latitude and longitude
- Familiarity with reading line graphs and components of a graph
- Introduction to Climate Change and Temperature Scales

Tools

- Computer with Internet access
- Microsoft Excel or other spreadsheet software
- Printer
- Index cards

AP Environmental Science Topics

- Impacts and consequences of global warming
- Latitude
- Weather and climate

Vocabulary:

- altitude
- atmosphere
- climate
- global warming
- Kelvin
- sea surface temperature
- snow and ice

Lesson Links:

- Introduction to Polar Ice
- Live Access Server
- Importing Data to Excel
- Compare Earth and Mars Ice Caps (Extension)
- Surface Scene Type information

Background:

While you may be more familiar with daily weather patterns, scientists are more concerned with climate patterns and the changes that may be foreshadowed. Many claims have been made about the evidence for or against global warming, yet whether the interpretation of the data points leans towards fact or fiction, a more descriptive term to use is global climate change. The most hard-hit area where global climate change is apparent is within the Arctic Circle. In this lesson, you will explore data from the Arctic, develop relationships between parameters and make conclusions based on the collected evidence.

This lesson makes use of a method called card sorting. A typical card sort is an activity in which you are given a set of index cards with a single concept written on each card and asked to organize the cards by grouping related concepts. The method fosters critical thinking and adds elements of inquiry as you use them to analyze and interpret data.

The data will be pulled from the Live Access Server where a host of data relating to climate may be explored.

Procedure:

1. Click on the Live Access Server link above to access the data for each of the four parameters:
If you are not automatically prompted with parameter choices click on 'Choose Data Set' in the upper left hand corner of the screen then, click on
a. Cryosphere, Monthly Snow Ice Amount (ISCCP)
b. Oceans, Daily Sea Surface Temperature (GHRSST)
c. Atmosphere, Atmospheric Temperature, Monthly Near-Surface Air Temperature (ISCCP)
d. Land Surface, Surface Cover, Surface Scene Type (CERES SARB)

For each of the first three data sets, you will be viewing Time Series plots. This option can be selected by clicking on the 'Time Series' radio button and then the radio button next to 'Update Plots'. For location, select a location in the Greenland Sea, coordinates (79 N, 1 W) or other location of interest in the Arctic Circle. This can be completed by entering in your latitude and longitude values in the compass rose below the navigation map to the left of your screen. As an output method we will be importing ASCII files into Excel. To do this click on 'Save AS' from the menu at the top of the screen select 'ASCII' from the drop down menu, verify the time range (January 1998 through December 2008) and then click on OK. Click Next to view output. Save each file for use later. Note: If selecting another location, verify that data are available for all three parameters for the selected coordinates.

For the fourth data set, we will be using the Latitude-Longitude map option. Choose the region in the Arctic 60 N to 85 N, and 30 W to 30 E. Choose Time Period February 2006 (default). Note: A surface scene type map will be generated. Save the file for later use. See Links section for additional information on interpreting scene types shown on the map.

2. Import the three text data files and graph each data set in Excel to make a line-plot. For instructions on how to do this, please see the lesson link, Importing Data to Excel, in the Links section. Note: If time is limited, you may generate the line-plots directly in the Live Access Server. You will have four plots: three line-plots and one color- plot.

3. Change the size of your graphs so all four fit neatly onto one page, then print it. Cut out the graphs if you wish for easier manipulation.

4. Write your own summary for each data set on an index card. Also write each of the four questions below on a separate index card.

5. Analyze each graph and use your analysis to answer the question on the card.

6. Using your cards, prepare a written conclusion relating amount of sea ice, sea surface temperature, near surface air temperature and surface type. Conclude whether the Arctic is experiencing climate change and how this may or may not affect the rest of the planet.

Questions:

1. How much of the Arctic Circle is ice or water? How much is land?
2. How do the amount of sea ice and sea surface temperature compare?
3. How do the amount of sea ice and near surface air temperature compare?
4. How do the sea surface temperature and near surface air temperature compare?

Extensions:

1. Explore why the Arctic might warm faster than other parts of the Earth.
2. Compare Earth and Mars Ice Caps (see lesson link).
3. Summarize, analyze and compare LAS data sets on greenhouse gas amounts.

Lesson plan contributed by Lynee Zajac Beck, Arvada, Colorado

Click here for Teachers Notes

View lesson without Standards

Data Notes from Dr. Brad (12/2018):
Up-to-date data can be found for this lesson in the Earth System Data Explorer at the following locations:
Snow/Ice Extent: Cryosphere->All Data->Changes in Snow and Ice Extent->Monthly Snow/Ice Percent Coverage.
Sea Surface Temperature: Hydrosphere->All Data->Sea Surface Properties->Daily Sea Surface Temperature
Near-Surface Air Temperature: Atmosphere->All Data->Temperatures->Monthly Surface Air Temperature (temperature anomaly data can also be used)
Scene Type: Geosphere->Land Cover Classification-> Surface Scene Type