Patterns in High Cloud Coverage

Adapted from: My NASA Data Lesson Plans

http://mynasadata.larc.nasa.gov/preview_lesson_nostds.php?&passid=87

Focus on Inquiry

The students will focus on inquiry by collecting and analyzing cloud coverage data on a specific location, by creating graphs to display the data, and by explaining and discussing their observations and looking for patterns in the data.

Lesson Overview

The students will collect the latitude and longitude data for their school location, plot this data on the Internet and collect real NASA cloud coverage data for this location. Then they will import this data into Excel and create a chart to display the cloud cover percentage over a ten-year timeframe. They will finally analyze the data for high cloud coverage and determine whether or not a pattern exists.

Duration	Setting	Grouping	PTI Inquiry Subskills
1-2 50-minute class periods	Classroom/computer lab	Small groups of 2 or 3	1.3, 2.1, 3.1, 3.7, 3.8, 4.2, 4.3, 5.3, 7.2, 7.3

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	10 minutes		Computer / Internet	2	Students view pictures and videos of cloud formation and interact in a class discussion about cloud formation.
Explore	40 minutes	3.1, 3.7, 3.8, 4.2	Computer / Internet	3	Students collect GPS data on their school location and then use the Internet to collect cloud coverage data on that location and create a graph in Excel.
Explain	15 minutes	4.2, 4.3, 5.3, 7.2, 7.3		2	Students analyze the cloud coverage data on their location and answer questions regarding their observations. Students discuss observations as a class.
Expand	50 minutes	1.3, 2.1, 3.1, 3.7, 3.8, 4.2		3	Complete the experiment using three locations and find out which locations are affected by high or low cloud coverage.
Evaluate					The Excel charts and answers to questions can be used for assessment.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Design and conduct a scientific investigation
Use appropriate tools and techniques to gather, analyze and interpret data
Develop descriptions, explanations, predictions, and models using evidence
Think critically and logically to make the relationships between evidence and explanations
Communicate scientific procedures and explanations

National Science Education Standards – Earth Science

Clouds formed by the condensations of water vapor, affect weather and climate.
Global patterns of atmospheric movement influence local weather.

Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
Gr. 8, Inquiry GLE#6. Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
Gr. 8, Inquiry GLE#7. Record observations using methods that complement investigations (e.g. journals, tables, charts) (SI-M-A3)

Gr. 8, Inquiry GLE#9. Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3) Gr. 8, Inquiry GLE#11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4) Gr. 8, Inquiry GLE#13. Identify patterns in data to explain natural events (SI-M-A4) Gr. 8, Inquiry GLE#16. Use evidence to make inferences and predict trends (SI-M-A5) Gr. 8, Inquiry GLE#19. Communicate ideas in a variety of ways (e.g. symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) Gr. 8, Inquiry GLE#22. Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)
Louisiana Grade Level Expectations Earth Science Gr. 8, GLE#24 – Investigate and explain how given factors affect the rate of water movement in the water cycle (e.g., climate, type of rock, ground cover) (ESS-M-A10)

Materials List (per group)

- Computer with Internet access
- Microsoft Excel software

Advance Preparation

1. Gather materials necessary to complete lab.
2. Before implementing the lesson with students, it is strongly recommended that you check to see that the browser being used is compatible with the NASA Live Access Server, and that the pop-up blockers are turned off.
3. Also, it may help if you run through the student procedure to get acclimated with the website and with importing your data results into Excel. The Excel directions listed may vary based on the version of Excel that is on the computer. So by running through the activity, you familiarize yourself with the procedure in order to better answer student's questions.

Other Information

Learning Objectives

- Students will locate real NASA satellite data resources on the Internet.
- Students will be able to create and use a graph to read and analyze data.
- Students will be able to conclude information based on the graphs they produce.

Prior Knowledge Needed by the Students

- Accessing websites on the Internet
- Using GPS or resources to find location
- Basic spreadsheet knowledge
- Graphing skills

Procedure

Engage

1. Show students pictures of clouds (using internet).
   Here are some good websites with cloud pictures:
   http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/cldtyp/home.rxml
   http://www.acclaimimages.com/search_terms/cloud_formation.html
   http://www.weatherquestions.com/Cloud_formation_convective.gif
   And if time, here are a few short web videos from YouTube of cloud formation:
   http://www.youtube.com/watch?v=_EvpJ5ILX84
   http://www.youtube.com/watch?v=vUcB8trxIkk
2. Engage the class in a discussion on cloud formation: Clouds are collections of water vapor in the atmosphere. Moisture collects in the atmosphere due to the evaporation of water, thus evaporation plays an essential role in the water cycle. The oceans are huge sources of water for evaporation. Clouds form when moisture rises, cools, and changes to water or ice. Ask the class: But what makes the moisture rise into the sky? It can happen three ways:
   a. Sunshine: the heat of the sun can cause the air to rise, taking water vapor with it high into the sky.
   b. A Front: a cold front will bring cold air under warm air, forcing it to rise, and a warm front will force warm moist air up over the cold air.
   c. Mountains: When winds blow against mountains, the moist air is forced upward.

Cloud cover fraction (percentage) represents the fractional area covered by clouds as observed from above by satellites. It is estimated by counting the number of satellite fields-of-view (called pixels, about 5 km across for ISCCP) that are determined to be cloudy and dividing by the total number of pixels in a region about 280 km across.

Explore

1. To access the location of your school site to use with the Live Access Server, go to the Maporama website: http://world.maporama.com/Default.aspx. Have computers defaulted to this website. Provide your students with the school address and have them enter it into the Maprorama website under "Maps". If the address cannot be found, have students enter only the city and state or possibly a point of interest (like LSU) in Baton Rouge and search on that criteria instead.
2. Have students work through the student procedure in the **Blackline Master 1**. You could have another window of each computer connected to the NASA Live Access Server (http://mynasadata.larc.nasa.gov/las15/servlets/dataset) and make sure that pop-up blockers are turned off.

Explain

1. Have students work through the questions on their **Blackline Master 1**.
2. Review the answers as a class and generate a class discussion on the students' observations.

Expand

1. As a class, pretend you are all on a team that wants to start an airline company. Have the students pick three airports for which you might want to offer flight service. Then, ask the class: Which type of cloud coverage do you think will matter most to airline company pilots?
2. Use the NASA Live Access Server and the student procedures in the Blackline Master 1 to determine which airport location has the least high cloud coverage. Also look at which airport has the least low cloud coverage.

Evaluate

1. The charts that the students generate and the answers to the questions on the Blackline Master 1 can be used for assessment.

Blackline Masters

1. Patterns in High Cloud Coverage

Supplementary Resources

Credits

My NASA Data Lesson Plans
Lesson plan contributed by Shay Vanderlaan, Norwalk, California

Name: _____ Date: _____

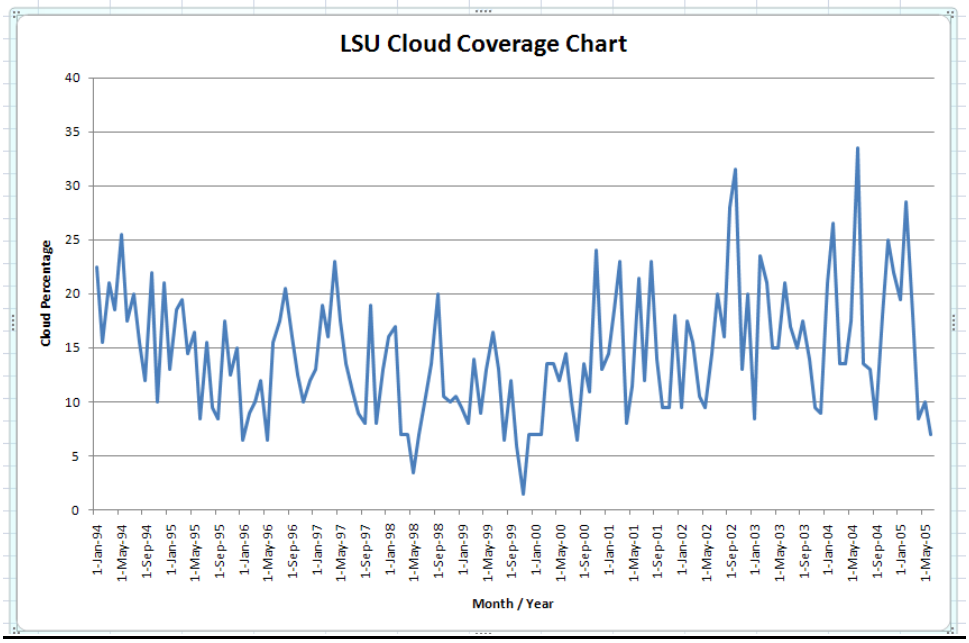
Patterns in High Cloud Coverage

Student Procedure:

1. Your computer should be connected to the Maporama website: http://world.maporama.com/Default.aspx. Under Maps, enter your school address, city and zip code, then click the orange and white arrow to submit.
2. Look for the box on the left side of the screen that is labeled Information. The address and GPS location should be displayed there. Write down the GPS location (latitude and longitude) here:

   Latitude: _____ Longitude: _____

3. Now, navigate to the NASA Live Access Server: http://mynasadata.larc.nasa.gov/las/servlets/dataset.
4. From the home page, select Atmosphere, then select Clouds, then select Cloud Coverage, and finally check the box next to Monthly High Cloud Coverage (ISCCP). Click the red Next link.
5. On the next page, select the following:
   Select view: Time series (t)
   Select output: ASCII file
   Select region: Full region
   Then, on the right of the map, enter your GPS location.
   Select time range: Jan 1994 thru Jun 2005.
   Click Next.
6. Click on the "Your ASCII file" link that opened in a new pop-up window.
7. Save this data as a text file by clicking File → Save As. Enter "Your School Name + Cloud Coverage" (for example, "LSU Cloud Coverage") as your file name and save it to your desktop or another specified location. Close this pop-up window.
8. Open Microsoft Excel. Click on the Data menu at the top, then under the Get External Data section, click on Import Text File or From Text. Choose your file and click Import to retrieve data. *Note: These directions may vary based on the version of Excel you have.*
9. The Import Wizard opens. Choose delimited. For Start Import at row, enter 9. Choose Tab and Space as Delimiters. Click to Finish and import data. *Note: Again, these directions may vary based on the version of Excel you have.*
10. If column B is full of 0's, highlight column B, right click, and select Delete to remove this column. All you need is the two columns that contain the date and the cloud coverage.
11. To create a chart displaying this data, first highlight columns A and B, then click on the Insert menu at the top. Under the Chart section, select the 2-D Line graph. *Note: Again, these directions may vary based on the version of Excel you have.*
12. Your chart should appear. You can format it by resizing it to make it bigger. Delete the legend on the right of the graph if preferable. You can also use the Layout menu at the top to enter a Chart Title and to label the X and Y axes as "Month/Year" and "Cloud Percentage". *Note: Again, these directions may vary based on the version of Excel you have.* Here is an example of a completed Cloud Chart:



13. If possible, print out your data chart or save by clicking File → Save As. Enter "Your School Name + Cloud Chart" (for example, "LSU Cloud Chart") as your file name and save it to your desktop or another specified location.
14. Answer the two questions below.

Questions:

1. Describe how the graph of cloud cover changes throughout the year. When is the coverage of clouds the greatest? Where is the coverage of clouds the least?

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2. Looking at the multiple years of data, is there a stable seasonal pattern?

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