Identifying Ozone Variations Over Different Locations

Adapted from: My NASA Data Lesson Plans

http://mynasadata.larc.nasa.gov/preview_lesson.php?&passid=77

Focus on Inquiry

Student will focus on inquiry by collecting and analyze data to determine if and when the ozone hole occurs over different cities. Students will create and use graphs to identify patterns in the data and propose explanations to their observations.

Lesson Overview

Students use real ozone data to answer questions about ozone levels over different locations, and to study the location and timing of the ozone hole. The students will study ozone variations over different cities to examine how ozone normally changes month to month.

Duration	Setting	Grouping	PTI Inquiry Subskills
90 minutes (1-2 class periods)	Classroom/computer lab	2 to 4 students per group	**2.1, 2.6, 3.1, 3.6, 4.2, 4.3, 5.2, 7.2, 7.3**

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	5 minutes		Computer with Internet Access (optional)	2	Students view a picture of ozone layer and generate a class discussion on reasons for the hole in the ozone layer.
Explore	30 minutes	2.6, 3.1, 3.6, 4.2	Computer with Internet Access	3	Students use the Internet to collect data and create graphs of ozone changes over various locations and throughout various times of the year.
Explain	20 minutes	4.3, 5.2, 7.2, 7.3	Computer with Internet Access	3	Students use graphs to analyze data and identify patterns in the data. Students answer questions and propose explanations based on their analysis.
Expand	30 minutes	2.1, 3.1, 3.6, 4.2, 4.3, 5.2, 7.3	Computer with Internet Access	3	Students design an experiment to test a hypothesis about the ozone in Australia. Students collect data and create graphs to determine if the hypothesis is supported.
Evaluate					Student answers to questions on Student Worksheet 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

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

National Science Education Standards – Earth Science

The atmosphere is a mixture of nitrogen, oxygen and trace gases that include water vapor. The atmosphere has different properties at different elevations.

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#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#12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
Gr. 8, Inquiry GLE#13. Identify patterns in data to explain natural events (SI-M-A4)

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, Inquiry GLE#27. Identify different air masses, jet streams, global wind patterns, and other atmospheric phenomena and describe how they relate to weather events, such as El Nino and La Nina.

Materials List (per group)

- Computer with Internet access
- Printer (optional)

Advance Preparation

1. Gather materials necessary to complete lab (have students bring in the necessary supplies).
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 Live Access Server, and that the pop-up blockers are turned off.

Other Information

Learning Objectives

- Students will interpret graphs and other data to make inferences
- Students will identify atmospheric phenomena
- Students will write reports detailing their scientific conclusions.

Prior Knowledge Needed by the Students

- Introduction to Ozone
- Familiarity with accessing websites on the Internet

Procedure

Engage

1. Show student picture of the hole in the ozone layer (http://www.thefreezergeezer.co.uk/images/ozone_layer.jpg) to engage the students in a conversation about causes of the hole in the ozone layer. Ask students, "What do you think causes the hole in the ozone layer?" Accept all answers.
2. Divide class into groups at each computer station.

Explore

1. Make sure computers are on the NASA Live Access Server: http://mynasadata.larc.nasa.gov/las/servlets/dataset.
2. Make sure pop-up windows are allowed on the computers' browsers.
3. Have students complete Parts 1 and 2 of the Student Worksheet **(Blackline Master #1)**.

Explain

1. Have students answer questions 1-6 on the Student Worksheet **(Blackline Master #1)**.
2. Have students review answers as a class and share their explanations and reasonings.

Expand

1. Ask students to write a paragraph and create graphs to support or deny the following statement: *The ozone hole comes over Australia for at least one month every year.* Students would repeat necessary steps in their student worksheet to find out whether this statement holds true.

Evaluate

1. Student answers to questions in the Explain section on the Student worksheet can be used for assessment.

Blackline Masters

1. Identifying Ozone Variations Over Different Locations

Supplementary Resources

Credits

Lesson plan contributed by Dr. Eugene Cordero

Name: _____ Date: _____

Identifying Ozone Variations Over Different Locations

Procedure:

Part I:

1. You should be connected to the NASA Live Access Server: http://mynasadata.larc.nasa.gov/las/servlets/dataset.
2. Click on Atmosphere, Air Quality, and then select Monthly Total Column Ozone (ISCCP). Click the Next on the right side of the screen.
3. Select time range for January of any year (i.e. Jan 2003). Click Next to view a map of the ozone data.
4. Save this data by printing it or clicking File → Save As. Enter "January Ozone" as your file name and save it to your desktop or another specified location.
5. Repeat this procedure for the months of April, July and October to get an idea of the ozone distribution throughout the year. Print or save files accordingly.
6. Answer questions 1-2 below.

Part II:

1. Go back to the main page of the NASA Live Access Server: http://mynasadata.larc.nasa.gov/las/servlets/dataset.
2. Click on Atmosphere, Air Quality, and then select Monthly Total Column Ozone (ISCCP). Click the Next link on right side of the screen.
3. Select View as "Time series (t)".
4. Click a location on the map to select a site to retrieve data. Ideas include cities in South America, Australia, or the South Pole.
5. Select a time range for a one-year span (i.e. Jan 2001 - Dec 2001). Click Next to view a line plot.
6. Save this data by printing it or clicking File → Save As. Enter "South America Ozone" as your file name and save it to your desktop or another specified location.
7. Repeat the selection of a location on the map to find another interesting site where you would expect a marked decrease in ozone occurs at some point during the year. Include the location around where you live, and at least one location near the North Pole (cities in Alaska, Canada, or Scandinavia, perhaps).
8. Select the same one-year time range you used before. Print or save your files accordingly.
9. Answer questions 3-6 below.

Questions:

1. Using your graphs from Part 1, during what season (i.e. Spring, Autumn, Winter or Summer) do the highest values of ozone occur over your site?

_____

_____

2. When do the lowest ozone values occur over your site? Why do you think ozone decreases?

_____

_____

_____

3. Using your graphs from Part 2, for which location does the ozone hole exist? (ozone hole is 220 DU or less)

_____

_____

4. How long does the ozone hole last?

_____

_____

5. When are ozone values normally the highest over the Southern Hemisphere?

_____

_____

_____

6. When are ozone values normally the highest over the Northern Hemisphere?

_____

_____

_____