

Details



Completion Time: More than a week

Permission: Download

Ozone Data Comparison over the South Pole

Overview

This data plotting lesson compares different stratospheric ozone data collected at the South Pole in September 1969, September 1998, September 2008, January 1999, and January 2008. This ozone comparison activity allows students to make conclusions about the annual and seasonal ozone hole as well as overall ozone concentration changes over Antarctica. Students use authentic data collected at the South Pole in order to graph data for better annual comparison.

Objectives

The graphic analysis allows students to make the following conclusions:

1. The ozone hole over Antarctica is seasonal.
2. The ozone hole over Antarctica occurs during the southern hemisphere late winter and early spring, September – November (using September data in this activity).
3. The ozone hole is filled in again by January.

Lesson Preparation

Material to prepare:

Electronic copies of data tables to use with spreadsheet software. Copy columns from attached word documents to Excel.

Or:

Copy data tables for each student or prepare a class set of copies which can be reused by other students.

List or write brief paragraphs describing the steps needed to complete the lesson. Also list or include a paragraph describing the content that must be covered prior to the start of the lesson.

NOTE: This Ozone plotting activity can stand by itself, could be part of your own ecology section, or could be part of a special ozone/UV unit taking about one to two

Materials

- Computer and graphing software (Excel or other spreadsheet software)
- South Pole data tables (download)
- See Resources section for suggested data files to plot
- Internet access for further research
- For complete hands-on graphing (Graph paper, colored pencils, South Pole Data tables)

weeks.

These topics could be covered prior to the plotting lesson but are not necessary.

1. The layers of the atmosphere
2. The structure of ozone molecule (ozone has 3 oxygen atoms)
3. The role of ozone in our protection from harmful UV rays.
4. Causes and consequences of ozone depletion (harmful UV light will reach our troposphere)
5. Review dependent and independent variables for the plotting activity
6. View the VHS "Cancer in the Sky" (see Resources)

Procedure

1. Using the variables Altitude [Km] and Ozone concentration [mPa] choose the dependent and independent variable to plot on the axes.
2. Choose the scale for each variable: find the highest altitude and ozone data point and choose your scale for each axis.
3. Choose the key for each of the years to be plotted.
4. Plot the data of the different years on one graph using the key.
5. Title the graph.
6. Analyze the graph and outline your answers for each of the objectives.

Extension

1. Research the different types of harmful UV rays.
2. Research the difference between "bad" (ozone found in the troposphere) and "good" ozone (ozone found in the stratosphere)
3. Research the differences between ozone changes in the Arctic and those in the Antarctic.
4. Research how the ozone hole is "filled" again by January
5. If not viewed as class preparation, view the VHS "Ozone, Cancer in the Sky" (see Resources).

Resources

We suggest that you have the following selected data files for data plotting:

- September 1969
- September 1999
- September 2008
- The 1969 versus the 1999 and 2008 data would show the obvious change in the ozone layer due to the ozone hole formation.
- To discuss the annual filling of the ozone hole by January, the data files from January 1999 and January 2008 are provided.

Other Resources:

- South Pole Ozone Hole Monitoring at ESRL
- International Ozone-Layer Assessments

- Stratospheric Ozone Monitoring and Research at NOAA Background on the Ozone Layer (<http://www.esrl.noaa.gov/gmd/>)
- Twenty Questions and Answers about the Ozone Layer: 2006 Update (<http://www.esrl.noaa.gov/csd/assessments/2006/twentyquestions.html>)
- VHS “ Ozone, Cancer of the sky”, (45 minutes) the “Wild South” series, New Zealand

Assessment

1. Completion of the graph
2. Written summary of the “story” of the graph
3. Identification of the stratosphere on the graph
4. The graphic analysis allows students to make the following conclusions
 - a) that the highest concentration of ozone is located in the stratosphere
 - b) that the ozone hole over Antarctica is seasonal
 - c) that the ozone hole over Antarctica occurs during the southern summer and is still present in October based on the data provided
 - d) that the ozone hole is filled in again by January (reason can be researched)

Credits

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Content Standards, Grades 5-8

Content Standard A: Science As Inquiry

- b. Understandings about scientific inquiry

Content Standard D: Earth and Space Science

- a. Structure of the earth system

Content Standards, Grades 9-12

Content Standard A: Science As Inquiry

- b. Understandings about scientific inquiry

Content Standard F: Science In Personal and Social Perspectives

- d. Environmental quality
- f. Science and technology in local, national, and global challenges