

Details



Completion Time: Less than a week

Permission: Download

Temperature Profile above the South Pole

Overview

This data plotting lesson is about temperature changes throughout the atmosphere. The data was collected together with the ozone data in January 2008.

The temperature vs. altitude profile allows students to make conclusions about annual and seasonal temperature changes in the atmosphere up to about 35 kilometers in the stratosphere. The best part of this lesson is using authentic data collected at the South Pole which initiates interest in further research about our atmosphere. The challenging part of this lesson is trying to computer plot or hand-plot the data in only one graph for better annual comparison.

The lesson was created by Elke Bergholz and Brian Johnson, who went to the South Pole with the NOAA/ESRL/GMD team in 1998/99 and 2007/08 to participate in the stratospheric ozone data collection at the Clean Air Facility at the South Pole, Antarctica.

Objectives

The graphic analysis allows students to make the following conclusions:

1. The temperature in the troposphere decreases
2. The temperature in the stratosphere is increasing

Lesson Preparation

1. The layers of the atmosphere
2. Review dependent and independent variables for the plotting activity
3. Review general temperature vs. altitude graph:
<http://www.srh.noaa.gov/jetstream//atmos/atmprofile.htm>

Material to prepare:

- Electronic copies of data tables for each student,
- Computer with spreadsheet software

Or:

Materials

- Computer
- Microsoft Excel program
- South Pole atmospheric temperature data tables
- Internet access for further research

or

- For complete hands-on graphing:
 - Graph paper
 - colored pencils.
 - South Pole atmospheric temperature data tables

- prepare a class set of data table copies which can be reused by other students.
- Graph paper or computer with excel program

Procedure

1. Using the variables Altitude [Km] and Temperature [C] choose the dependent and independent variable for each of the axis.
2. Choose the scale for each variable: find the highest altitude and temperature 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 objective.

Extension

1. Research the variables that could affect the temperature in the atmosphere
2. Research special events that changed the temperature and affected the ozone concentration in the stratosphere.
3. Research the method of data collection (using an ozone sonde)

Resources

Standardized Temperature Profile (NOAA) (<http://www.srh.noaa.gov/jetstream//atmos/atmprofile.htm>)

Assessment

1. Completion of the graph.
2. Written summary of the "story" of the graph.
3. Correct description of the temperature profile-changes in the stratosphere and troposphere.

[See attached Temperature vs. Altitude graph plotted by scientists]

[See also temperature profile web-link under resources for comparison: Standardized Temperature Profile (NOAA) <http://www.srh.noaa.gov/jetstream//atmos/atmprofile.htm>]

Credits

Elke Bergholz, Biology Teacher, United Nations International School, New York, N.Y.
ebergholz@unis.org

Bryan Johnson, Ozone group leader, NOAA/ESRL/GMD, Boulder, Colorado,
Bryan.Johnson@noaa.gov

National Science Education Standards (NSES):

Content Standards, Grades K-4

Content Standard A: Science As Inquiry

- b. Understandings about scientific inquiry

Content Standard D: Earth and Space Science

- c. Changes in earth and sky

Content Standard E: Science and Technology

- b. Understandings about science and technology

Content Standard G: History and Nature of Science

- a. Science as a human endeavor

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 Standard E: Science and Technology

- b. Understandings about science and technology

Content Standard F: Science In Personal and Social Perspectives

- e. Science and technology in society

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

Other Standards:

N/A