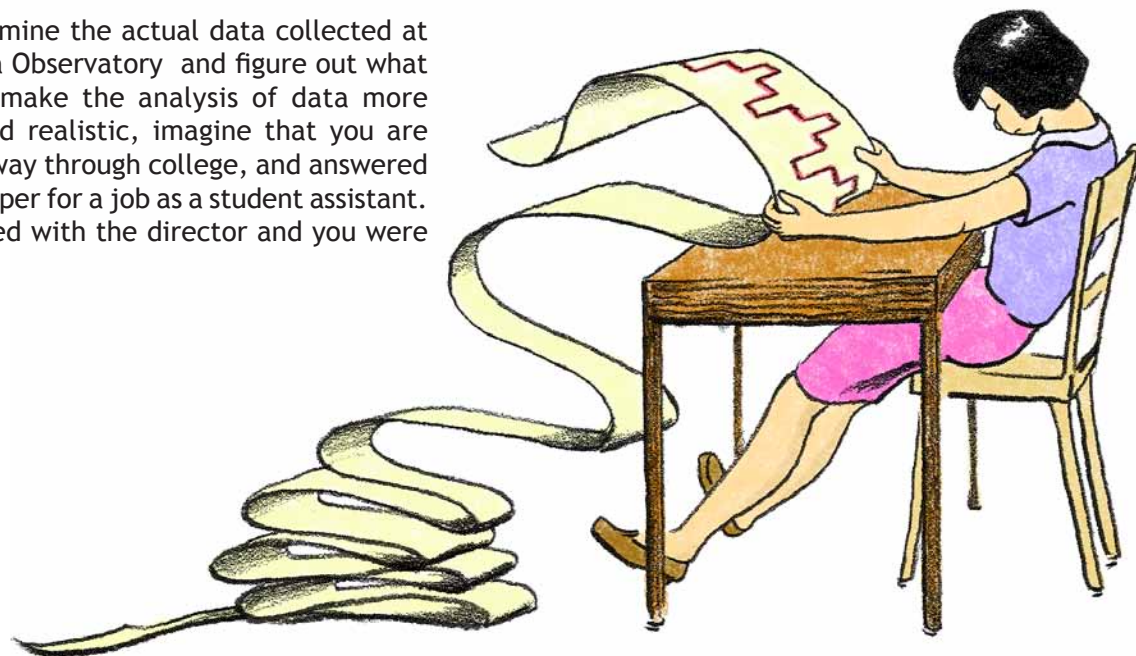


6. Is the Atmosphere Really Changing?

Let's examine the actual data collected at the Mauna Loa Observatory and figure out what it means. To make the analysis of data more interesting and realistic, imagine that you are working your way through college, and answered an ad in the paper for a job as a student assistant. You interviewed with the director and you were hired.



Investigation

The Findings from Mauna Loa Carbon Dioxide in the Northern Hemisphere

As a student assistant, your job is to analyze data from the strip chart recorder and to find the average concentration of carbon dioxide for each month. It takes many hours of measuring, recording numbers, and calculating to find a monthly average from all that data! You have summarized the monthly data averages from two years in two columns as below.

Looking at the table you realize it is difficult to interpret. Having the data in a graph rather than a table would enable you—and your supervisor—to readily see if changes occur over time, if there is a pattern, or an unusual variation. So, you decide to plot the data on a graph before giving the information over to your supervisor. Plotting data for 2006 and 2007 will show you how the atmosphere changed.

On graph paper, plot the data shown. Create a line graph, with the dates along the bottom, from January 2006 to December 2007. To show the pattern clearly, choose a vertical scale that does not start from zero, but which ranges from the lowest to the highest measurements of carbon dioxide. Draw a line connecting the data points so you can see the pattern easily. Be sure to label the axes of your graph.

Investigation (continued)

Concentration of Carbon Dioxide in the Atmosphere at Mauna Loa in Parts Per Million (PPM)

	2006	2007
Jan.	381.38	382.45
Feb.	382.03	383.68
Mar.	382.64	384.23
Apr.	384.62	386.26
May	384.95	386.39
June	384.06	385.87
July	382.29	384.39
Aug.	380.47	381.78
Sept.	378.67	380.73
Oct.	379.06	380.81
Nov.	380.15	382.33
Dec.	381.75	383.69

Sources: Scripps Institution of Oceanography

(http://scrippsco2.ucsd.edu/data/in_situ_co2/monthly_mlo.csv)

NOAA Earth System Research Laboratory

(<http://www.esrl.noaa.gov/gmd/ccgg/trends>)

QUESTIONS

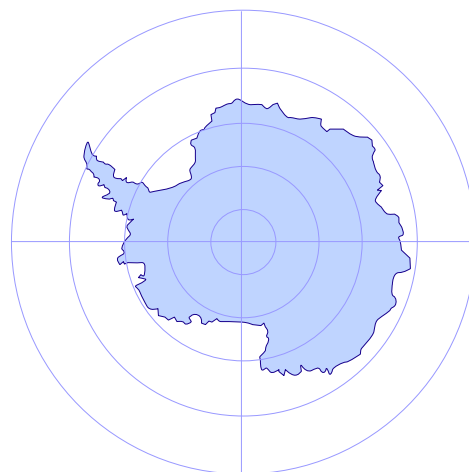
- 6.1 What pattern is shown in the data?
- 6.2 During which months does the concentration of carbon dioxide seem to increase? How might you explain this increase?
- 6.3 During which months does the concentration of carbon dioxide seem to decrease? How might you explain this decrease?
- 6.4 During which months would you expect plants to be most actively growing? Would they be absorbing or releasing carbon dioxide when they are actively growing? Why?
- 6.5 During which months would you expect leaves to be falling, and annual plants to be dying? Would plants absorb or release carbon dioxide when they lose their leaves, die, and decay?
- 6.6 Does the data support a connection between plant growth cycles and atmospheric concentration of carbon dioxide or some other causes? Explain your ideas.

The Findings from the South Pole: Carbon Dioxide in the Southern Hemisphere

“Hold it!” you might say. “Carbon dioxide levels seem to vary with the seasons. However, Mauna Loa is in Earth’s Northern Hemisphere. When we are having summer in the Northern Hemisphere, people who live in the Southern Hemisphere are having winter. I wonder if the yearly variation in the concentration of carbon dioxide is the same in the Southern Hemisphere as it is here on Mauna Loa?”

Before reporting your data, you log onto the computer and look for a file of data from a Southern Hemisphere station also assigned to monitor carbon dioxide concentration. Got it! There is a carbon dioxide monitoring station at the South Pole! According to the computer log, the South Pole observing station is on an ice- and snow-covered plateau over a mile and a half above sea level, and about 7 miles from the pole.

The South Pole station is at the center of the continent of Antarctica, where longitude lines cross. Data was collected in flasks and sent to a laboratory for analysis, except during 1960 to 1963, when a continuous sampling station was set up. Data collection continues today by the flask sampling method.



Investigation (conclusion)

QUESTIONS

Predict what you think the graph of carbon dioxide concentration measured at the South Pole and plotted each month will look like.

- 6.7. Will the graph be similar to or different from the Mauna Loa graph? Explain.
- 6.8. Will it be a straight line, with no peaks and valleys of carbon dioxide concentration?
- 6.9. If peaks and valleys do occur, will they occur at the same times as at Mauna Loa?
- 6.10. Will there be as big a difference between the maximum and minimum concentration at the South Pole as at Mauna Loa?
- Plot the South Pole data from the table below. Use the same chart that you used to plot the data from Mauna Loa. Use X's to plot the points so you can distinguish them from the Mauna Loa data. Draw a smooth line through the data points so you can see the pattern easily. Compare the results with your predictions.
- 6.11. Which of your predictions were correct?
- 6.12. Were you surprised by any patterns in the data? If so, by what?
- 6.13. How can you explain your findings?

Concentration of CO₂ in the Atmosphere at the South Pole in Parts Per Million (ppm)

	2006	2007
Jan.	377.81	379.16
Feb.	377.54	379.23
Mar.	377.53	379.20
Apr.	377.75	379.51
May	377.93	379.83
June	378.29	380.21
July	378.79	380.62
Aug.	379.19	381.11
Sept.	379.23	381.43
Oct.	379.25	381.59
Nov.	379.28	381.54
Dec.	379.36	381.58

Source: Scripps Institution of Oceanography
(<http://scrippsc02.ucsd.edu/data/spo.html>)