

Climate Data Module: Vostok Ice Core Data

Hundreds of ice cores have been extracted from polar ice because they contain valuable data on atmospheric chemistry over pre-historic time. These valuable data exist in tiny air bubbles that are trapped in the ice, which contain the same gases in the same ratios as the atmosphere at the time when the ice formed. The data you will be analyzing today are from ice cores extracted from the Vostok research station in Antarctica. The depth of the ice core is related to how old the ice is; deep ice is older. The ice cores can also be used to measure temperature, which is reflected by isotopic ratios in the ice of the core, as well as CO_2 concentration. We can use these data to see what rates of change were like during this pre-historic period, during which human activity has been minimal.

1. You can find plots of this data in the “Vostok” tab of the Climate data set EXCEL file. To better understand the data, answer the following questions:

- (a) What points in the scatterplot likely correspond to glacial periods? To interglacial (“between glaciers”) periods? Explain your thinking.

- (b) How long do the glacial periods appear to typically last? The interglacial periods?

- (c) Are we currently in a glacial period or an interglacial period?

- (d) How does atmospheric CO_2 concentration relate to the temperature record?

- (e) How do CO_2 concentrations recorded over time in the ice core compare to the current values for today, which you can see in the Mauna Loa data?

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2. We're interested in how fast temperatures have changed in the past. To do this, identify a section of your data where the temperature is changing very rapidly. If you hover your mouse over a data point, it will tell you the data values for that particular point. Make note of the data point values at the beginning and end of the time period segments that you think have the steepest slopes. Then make a new graph of only that time period, and determine the rate of change by fitting a trend line and looking at the slope.

Record the rate of temperature change (with units).

3. We're also interested in how fast CO_2 levels have changed in the past. Identify a section of your data where the CO_2 level is changing very rapidly. Then make a new graph of only that time period, and determine the rate of change by fitting a trend line and looking at the slope.

Record the rate of change for CO_2 levels (with units).

4. Compare the rates of change you found here with the rates of change in temperature and CO_2 levels that you previously found for the modern time period.