

Session 1 edited 2007 by Sharon Anthony and E.J. Zita

SESSION 1



Is the climate changing? Introduction

Exploration 1A: Is the Climate Changing?

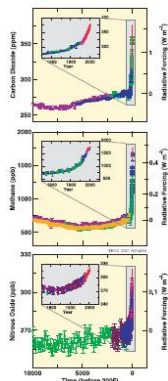
Creating the Context

Is the Earth warming? What other evidence of climate change is there? What are the potential consequences of climate change? These questions have sparked a great deal of debate over the last decade. The United Nations brought together the Intergovernmental Panel on Climate Change (IPCC) to study climate change and to inform the global community about the potential consequences of climate change. The IPCC consists of some of the most respected climate change experts in the world. They study current climate data and create models to predict future consequences. They publish their results every five years, and it is their data that we will examine in this Exploration. Find the IPCC report online at <http://www.ipcc.ch/> and download the Working Group I SPM (Summary for Policymakers).

Gathering Information

The following worksheet refers to the Summary for Policymakers of the IPCC report *Climate Change 2007: The Scientific Basis* (Working Group I). You will need to read the Summary for Policymakers in its entirety to answer the questions below. You may also need to consult the library or world-wide-web for certain definitions.

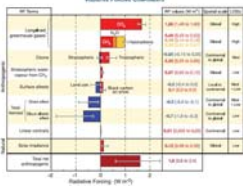
1) Describe the findings of Figure SPM.1. Look at the original document for more detail.



2) How were the data in Figure SPM.1 collected? Do you trust the long-term or short-term data more? Why?

3) What is the IPCC's official stand on whether/how much global warming has been observed?

4) Examine Figure SPM.2 in the original document and carefully read the caption. What does it mean for something to have a positive radiative forcing? A negative radiative forcing?



5) What is an aerosol? Give an example of a natural and an anthropogenic aerosol.

6) Which of the factors shown in Figure SPM.2 have a warming influence on climate? Which of these factors are anthropogenic in origin?

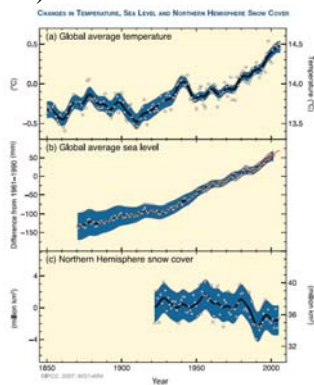
7) Which factor has the single-most influence on global warming?

8) Which factors have a cooling influence? Which of these factors are anthropogenic in origin?

9) Summarize how certain IPCC scientists are about the different radiative forcings.

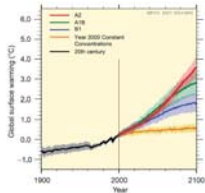
10) Temperature is one important factor related to climate, but there are many others. Aside from temperature, what other changes in the climate system has the IPCC measured and reported (e.g. rising sea level)? Be specific.

11) Summarize the findings of Figure SPM 3.



12) What factors are causing the sea level to rise?

13) Summarize Figure SPM.5. How were the graphs created (where did the data come from)?



14) What does each of the scenarios represent?

15) In addition to warming temperatures, what does the IPCC predict the future consequences of global warming will be?

What's the connection between greenhouse gases and global temperature?

Use the following graphs to explore possible connections between CO₂ and global temperatures.

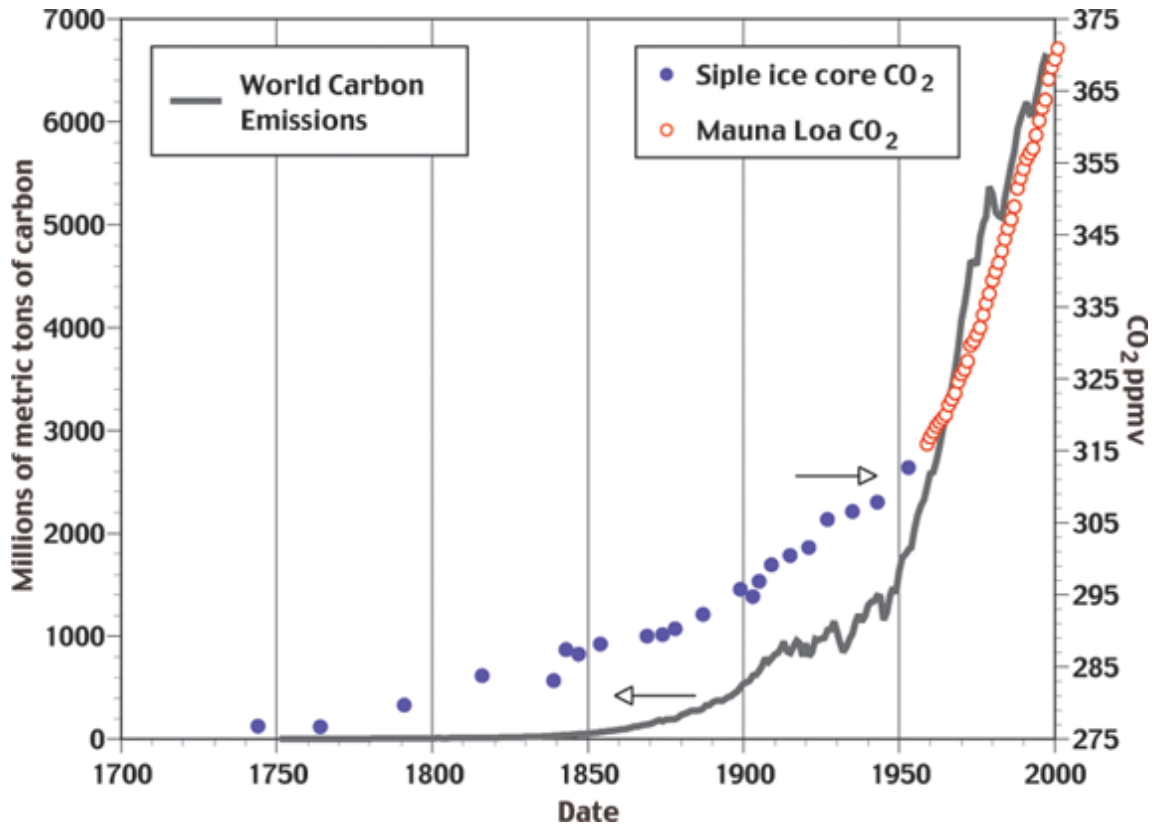


Figure 1: World carbon emissions (millions of metric tons) as a function of date, with CO₂ concentration (ppmv) as a function of date for the Siple Ice Core and Mauna Loa. *Global, Regional, and National CO₂ Emission Estimates from Fossil Fuel Burning, Cement Production, and Gas Flaring: 1751-1995* (revised January 1998) G. Marland, R. J. Andres, T. A. Boden, and C. Johnston.

For each of the following questions, support your answer with evidence from the preceding graphs.

- 1) Describe the trends in temperature on both short and long time scales.

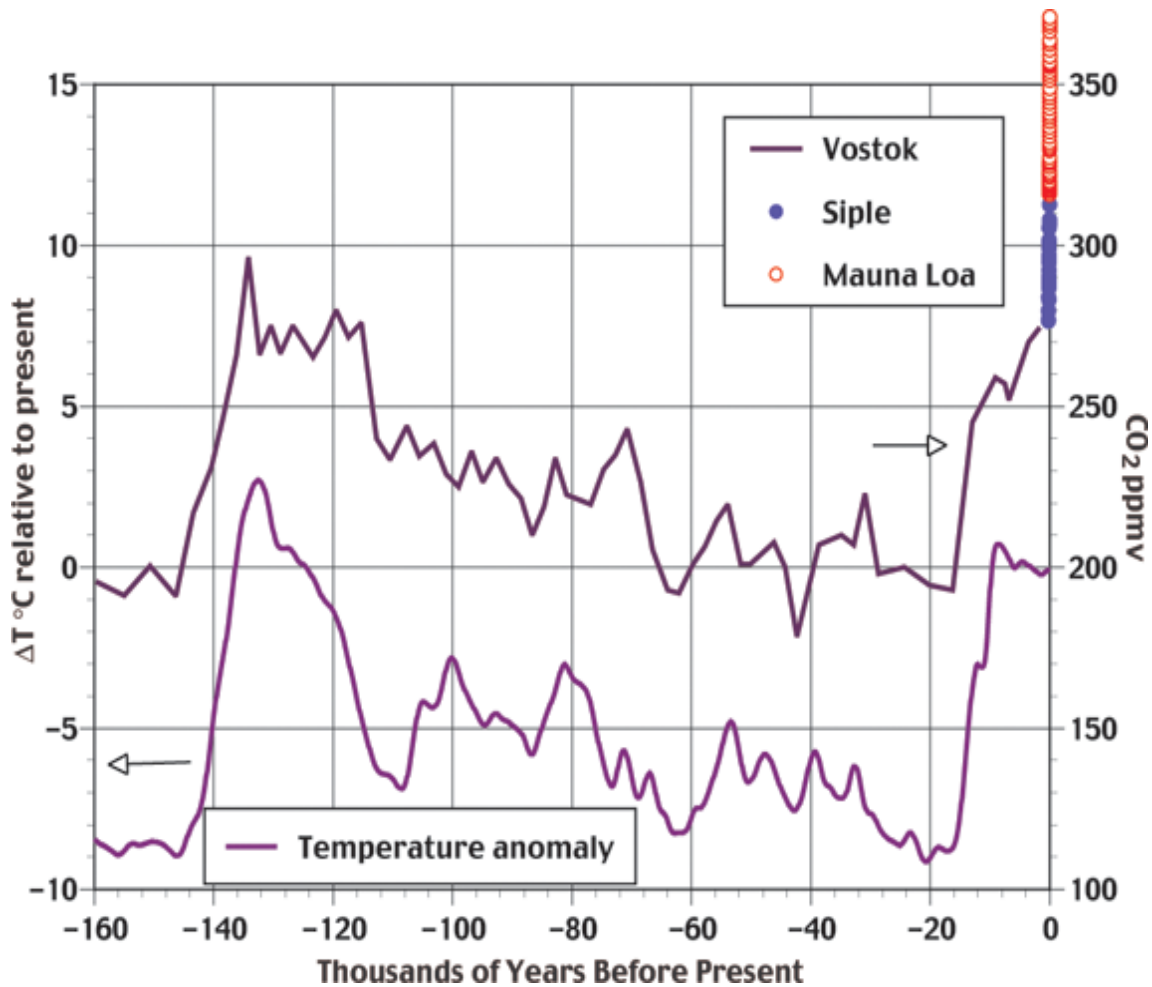


Figure 2: CO₂ concentration (ppmv) for the Vostok and Siple Ice Cores, Antarctica and Mauna Loa, Hawaii as a function of time (thousands of years before present), with the Vostok temperature anomaly as a function of time. Siple data from: Historical carbon dioxide record from the Siple Station ice core 1734-1983. A. Neftel, H. Friedli, E. Moor, H. Löttscher, H. Oeschger, U. Siegenthaler, B. Stauffer. Physics Institute, University of Bern, CH-3012 Bern, Switzerland. Mauna Loa data from Keeling, C.D., J.F.S. Chinn, and T.P. Whorf (1996), Increased activity of northern vegetation inferred from atmospheric CO₂ measurements, *Nature*, Vol. 382, pp. 146-149. Vostok CO₂ data from Barnola et al., *Nature*, 329, 408-414 (1987). Vostok temperature data from J. Jouzel, C. Lorius, J. R. Petit, C. Genthon, N. I. Barkov, V. M. Kotlyakov and V. M. Petrov, Vostok ice core: a continuous isotope temperature record over the last climatic cycle (160,000 years), *Nature*, 329, 1987, 402-408.

2) Describe the trends in CO₂ concentration on both short and long time scales.

3) Is there a correlation between CO₂ concentration and temperature? Explain.

4) From these data, can you determine whether rising CO₂ concentrations have caused temperatures to rise? Explain.