Project 4. Global Carbon and Temperature Trends

Due: Thursday 4/17/08

1. Download the following three data files from the Carbon Dioxide Information Analysis Center at Oak Ridge National Laboratory:

   - Global CO2 Emissions Estimates from Fossil Fuel Combustion (1751-2004)

     Choose the fixed format or comma delimited ASCII files, whichever you prefer.

   - Global CO2 Concentrations Measured at Mauna Loa Observatory (1958-2003)

     Choose the "Annual" column of data.

   - Monthly and Annual Temperature Anomalies (1856-2000)

     Choose the "Annual" column of data.

2. Plot the following three temporal trends (carbon emissions, atmospheric concentration, and temperature), either by hand or by importing the data into a spreadsheet (much quicker). Graph paper can be downloaded, if necessary. You do not need to plot every data point – just sufficient to see the correct trends.

   Tip: *Highlight* and then *Copy* the numbers (only) in the data file into a simple text editor like Word Pad. Save this new file then start Excel and use *File*, *Open* to import the data from the new file you just saved.

   Carbon Emissions

   a. Plot "Total" carbon emissions (listed in the second column of data) on the vertical axis labeled "million metric tons of carbon" versus the year (listed in the first column of data) from 1751 to 2004 on the horizontal axis. You can check your graph with the trend graph published on the web.

   b. Estimate the global CO_2 emission rate over the period 1975-2004. Do this by "eye-balling" a straight line through the data over this time period and calculating the slope:

      (amount of carbon emitted in 2004 – amount carbon emitted in 1975)/(2004 – 1975)

      Make sure your units come out as "millions of metric tons carbon/year".

      Write the answer on your graph and be sure to show your calculation.

Atmospheric Concentration

c. Plot "Annual" CO_2 concentration at Mauna Loa (listed in the penultimate column of data) on the vertical axis labeled "ppm carbon dioxide" versus the year (listed in the first column of data) from 1958 to 2003 on the horizontal axis plot. You can check your graph with the graphical trend published on the web.

d. Estimate the rate of increase in global CO_2 concentration over the period 1975-2004. As before, do this by "eye-balling" a straight line through the data over this time period and calculating the slope:

(CO_2 concentration in 2004 – CO_2 concentration in 1975)/(2004 – 1975)

Make sure your units come out as "ppm CO_2/year".

Write the answer on your graph and be sure to show your calculation.

Average Temperature

e. Plot "Annual" global temperature anomaly (listed in the last column of data) on the vertical axis labeled "temperature anomaly (degrees C)". On the horizontal axis plot the year (listed in the first column of data) from 1856 to 2004). You can check your graph with the graphical trend published on the web. The term "temperature anomaly" simply means the difference between the temperature for a particular year minus the average temperature for some long term period. It allows one to focus on the *change* from the average, which is important, rather than the actual temperature.

f. Estimate the rate of increase in global temperature anomaly over the period 1975-2000. As before, do this by "eye-balling" a straight line through the data over this time period and calculating the slope:

(temperature anomaly in 2004 – temperature anomaly in 1975)/(2004 – 1975)

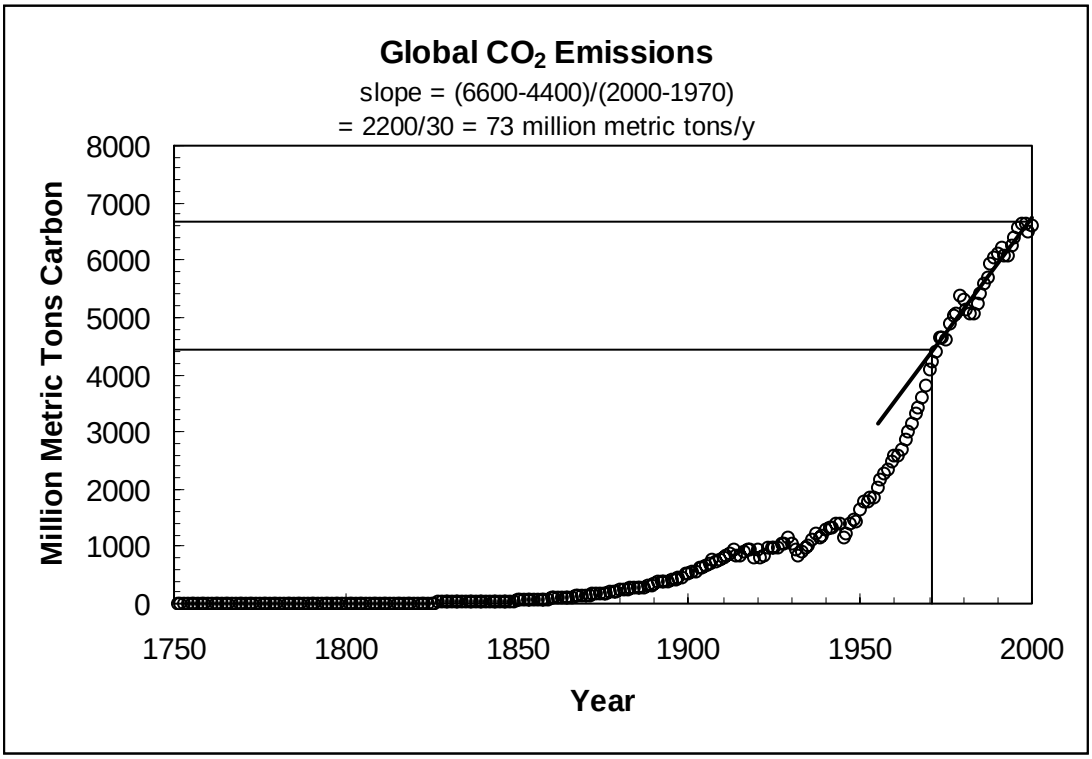
Make sure your units come out as "degrees C/year".

Write the answer on your graph and be sure to show your calculation.

3. Discuss the possible links between these three trends (no more than one page is allowed for this answer).

4. Staple together the three graphs, and the answer to question 3 and hand in your completed project during class on or before the due date (Wednesday, 4/20/05). Points will be subtracted for longer write-ups.

Example:


Global CO_2 Emissions
slope = (6600-4400)/(2000-1970)
= 2200/30 = 73 million metric tons/y
Million Metric Tons Carbon
8000
7000
6000
5000
4000
3000
2000
1000
0
1750
1800
1850
1900
1950
2000
Year