

Total points: 100
ATOC 1060-001 Homework #1
Due Thursday Sep 16, 2010

INSTRUCTIONS: Make sure that you answer all of the questions for maximum credit. Use appropriate units on all numerical answers and answer non-numerical questions with complete sentences. Please write neatly when completing this assignment – if we can't read your answer you will not get credit for it.

1. Global Change: Concepts (20pts)

- 1a. Write down the three major global environmental changes that are occurring today. (6pts)
- 1b. What is global warming? (2pts) What is greenhouse effect? (2pts)
- 1c. What are the four fundamental components of the Earth system? (4pts)
- 1d. Name four anthropogenic greenhouse gases that are currently increasing in concentration in the Earth's atmosphere. (6pts)

2. Global change: observational evidence (70pts)

Figure 1 shows the measurements of atmospheric CO₂ concentration from year 1850 to 2000, as determined from the ice cores data and from direct atmospheric measurements.

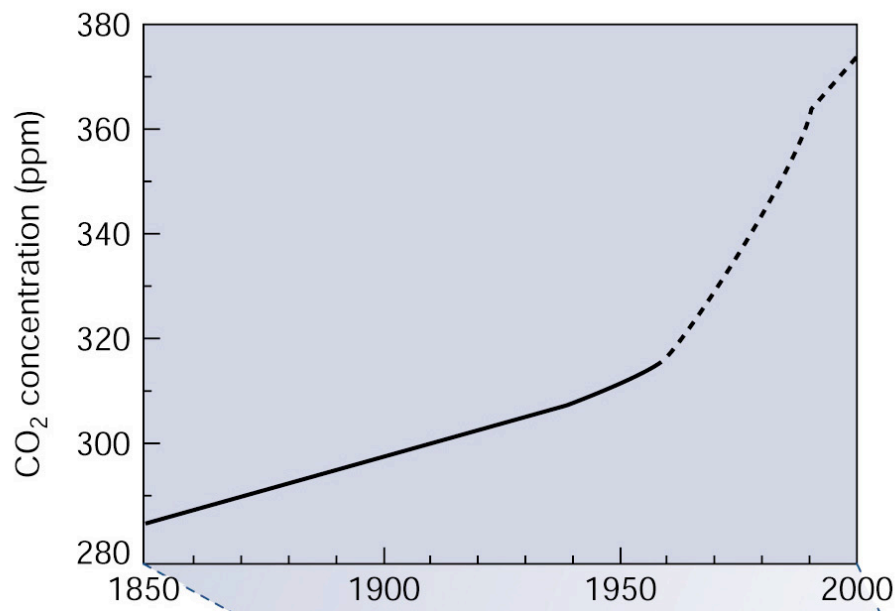


Figure 1.

- 2a. Label the “Keeling Curve” and “ice core data” in Figure 1. (4pts) According to figure 1, by how much had the Earth's atmospheric CO₂ concentration increased from 1850 to 1950? (2pts)

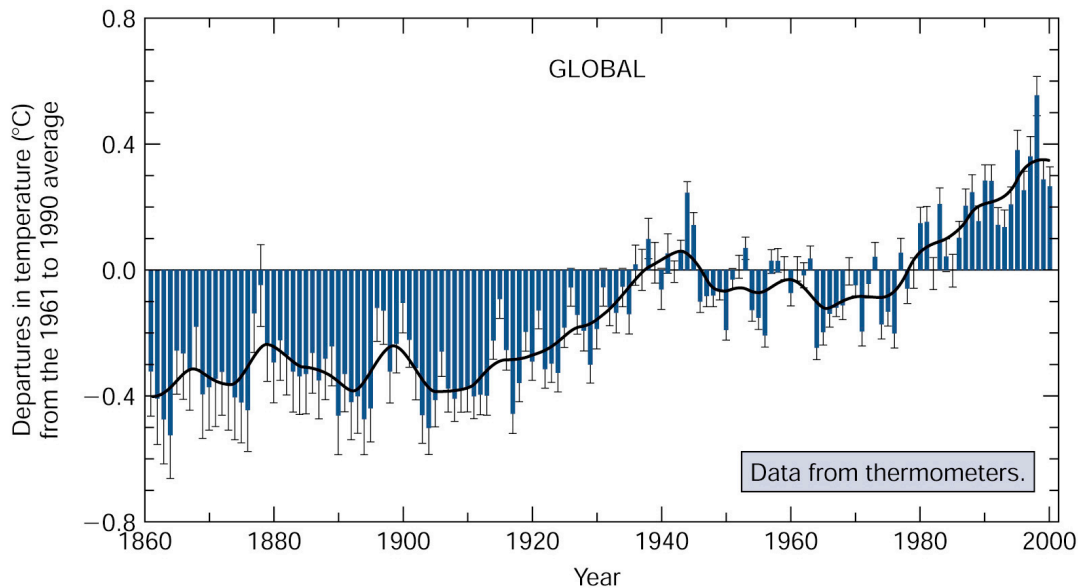
2b. Based on figure 1, by how much had the Earth's atmospheric CO₂ concentration increased from 1950 to 2000? (2pts)

2c. Comparing the CO₂ increasing rates that you have obtained from 2a and 2b, during which period CO₂ increased faster, 1850-1950 or 1950-2000? (3pts) What is the main cause for the faster CO₂ increasing rate? (5pts)

2d. Figure 1-3 of the textbook also shows a CO₂ increase during 1800-1850. State the major cause of the CO₂ increase during this time period. (4pts)

2e. Figure 2 shows observed anomaly of global average surface temperature since 1861. Negative values indicate temperature below the average and positive values indicate temperature above the average. *Based on the mean curve (dark solid line), by how much the temperature had changed from 1861 to 2000? (2pts). Is there a warming or cooling trend? (3pts) Was the temperature during 1950-1975 below or above the average (2pts)? What was the possible cause for the below or above average temperature during 1950-1975? (3pts)*

Note: Answers with numbers should be accurate to 2 decimal points for this question.



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Figure 2.

2f. What are thought to be the primary causes of the temperature-changing trend in figure 2 and why? (10 pts)

2g. Observations show ozone depletion over the Antarctic region (figure 1-6 and figure 1-7 of the textbook). State how anthropogenic forcing can cause the ozone hole. (10pts)

2h. How does tropical deforestation affect global warming and biodiversity? (8pts)

2i: According to the data shown in Figure 1-10 of the textbook, in the past 800,000 years, how does the Earth's temperature have been changing? (4pts) When is the most recent glacial maximum (the coldest time of the last glacial period)? (3pt) At 350,000 years ago, the Earth was in glacial or interglacial period? (3pt) Our current climate is in glacial or interglacial period? (2pts)

3. Daisyworld Climate Systems: positive and negative feedbacks (10pts)

In the Daisyworld climate system, there are mutual influences between average surface temperature of the Earth and the daisy coverage. Assume that an increased surface temperature will increase the daisy coverage.

Draw a schematic diagram (as figure 2-1 panel c of the textbook) showing the feedback loop in responding to a small perturbation - initial increase of the Earth's temperature. In the diagram, use arrows with normal arrowhead to represent positive coupling, and arrows with circular arrowhead to represent negative coupling. (6pts)

Is the feedback loop you draw in positive or negative, and why? (4pts)