

Name:
Student ID:

ATOC 1060: Our changing environment

Homework assignment 5

The Carbon Cycle

Due: 1:45 pm, Thursday 12 November 2009

The amount carbon in the atmosphere associated with CO₂ is about 750 GtC (gigatonnes of carbon). Below is a table filled with estimated global carbon fluxes to and from the land surface and the ocean. Both annual and seasonal means are shown, and fluxes are given in units of GtC/year

<i>Global Flux (Gt/yr)</i>	<i>Dec, Jan, Feb</i>	<i>June, July, Aug</i>	<i>Annual Mean</i>
<i>Land photosynthesis uptake</i>	90.8	212.3	126.8
<i>Land respiration source</i>	91.1	183.4	123.0
<i>Ocean uptake uptake</i>	100.7	98.8	98.4
<i>Ocean out-gassing source</i>	97.8	97.5	96.2

1a) Fill in the table below by calculating the net exchange from the land to the atmosphere and from the ocean to the atmosphere for winter months (DJF) and summer months (JJA) and over the entire year. (Use sign convention that positive is adding to the atmosphere)

<i>Global Flux(Gt/yr)</i>	<i>Dec, Jan, Feb</i>	<i>June, July, Aug</i>	<i>Annual Mean</i>
<i>Land</i>			
<i>Ocean</i>			
<i>Fossil fuel use</i>	–	–	7.2
<i>Biomass burning</i>	–	–	2.1
<i>Total</i>	–	–	

1b) Do you expect the average of DJF and JJA to equal the annual mean? _____

1c) Which component has the largest seasonal variation in net fluxes? _____

1d) What aspect of the climate system might this be associated with? _____

1e) Use your annual mean net fluxes for land and ocean, as well as the fluxes from fossil fuel consumption (7.2 GtC/year) and biomass burning (2.1 GtC/year), to calculate the total net flux to the atmosphere, and fill in this value as the total in the table. (Careful with signs!)

1f) Often the amount of CO₂ in the atmosphere is measured in parts per million by volume (ppm). Use your total flux to annual flux to a change in concentration in units of ppm/year. (Hint: 1 ppm = 2.11 GtC)

_____ ppm/year

1g) Assuming CO₂ levels were 330 ppm in 1975, use your answer from part 1f to calculate CO₂ concentrations in 1975, 1985, 1995, 2005, 2009 and expected for 2050.

<i>Year</i>	1975	1985	1995	2005	2009	2050
<i>CO₂</i>	330					

1h) Go to NOAA's interactive CO₂ plotting page (<http://www.esrl.noaa.gov/gmd/ccgg/iadv/>) and create a (time-series) graph of the CO₂ observations at Mauna Loa (it should already be set-up to do this, so you can just hit the submit button). Also make a similar time series plot for the South Pole station. Make printouts of your two graphs and attached them to this page with a staple.

1i) With a pen or pencil plot your answers from 1g onto your graphs. Do they match-up well with what was observed? _____

1j) You should notice that there is a maximum and a minimum for each year. What is the size of the seasonal variations (i.e. maximum minus minimum) at:

Mauna Loa _____ ppm

South Pole _____ ppm

1k) From the graphs, what was the average CO₂ concentration in 2008 at

Mauna Loa _____ ppm

South Pole _____ ppm

End