

GREENHOUSE GASES

Table of Greenhouse Gases

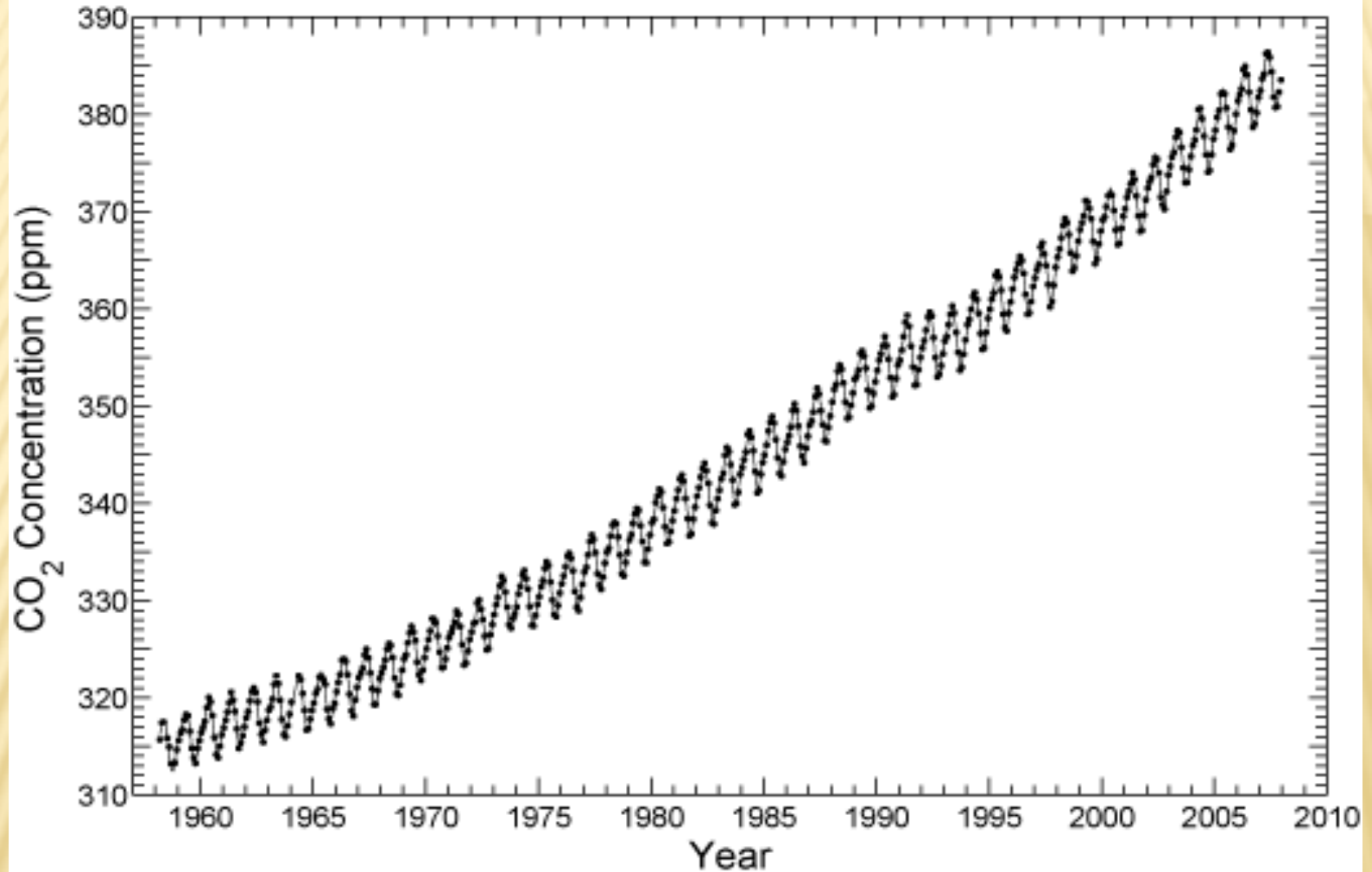
Type	Pre-1750 tropospheric concentration	2008 tropospheric concentration	Atmospheric lifetime	Global warming potential	Increased radiative forcing (W/m ²)
CO ₂	280 ppm	383.9 ppm	≈ 100 years	1	1.66
Methane CH ₄	700 ppb	1857/1735 ppb	12	25	.48
Nitrous oxide N ₂ O	270 ppb	321/320 ppb	114	298	.16
Ozone O ₃	25 ppb	34 ppb	Hours-days	N.A.	.35
Sulfur hexafluoride SF ₆	0	3.6 ppt	3,200	24,000	
Water vapor	0-3x10 ⁴ ppb	0-3x10 ⁴ ppb	Days	?	?

Source for rows 1-4, Carbon Dioxide Information Analysis Center, cdiac.ornl.gov

Global warming potential is the amount of IR absorbed by one kilogram of a gas over 100 years compared to the IR absorbed by one kilogram of CO₂ over 100 years.

**The GWP of CO₂ is
arbitrarily taken to be 1.**

Mauna Loa Record

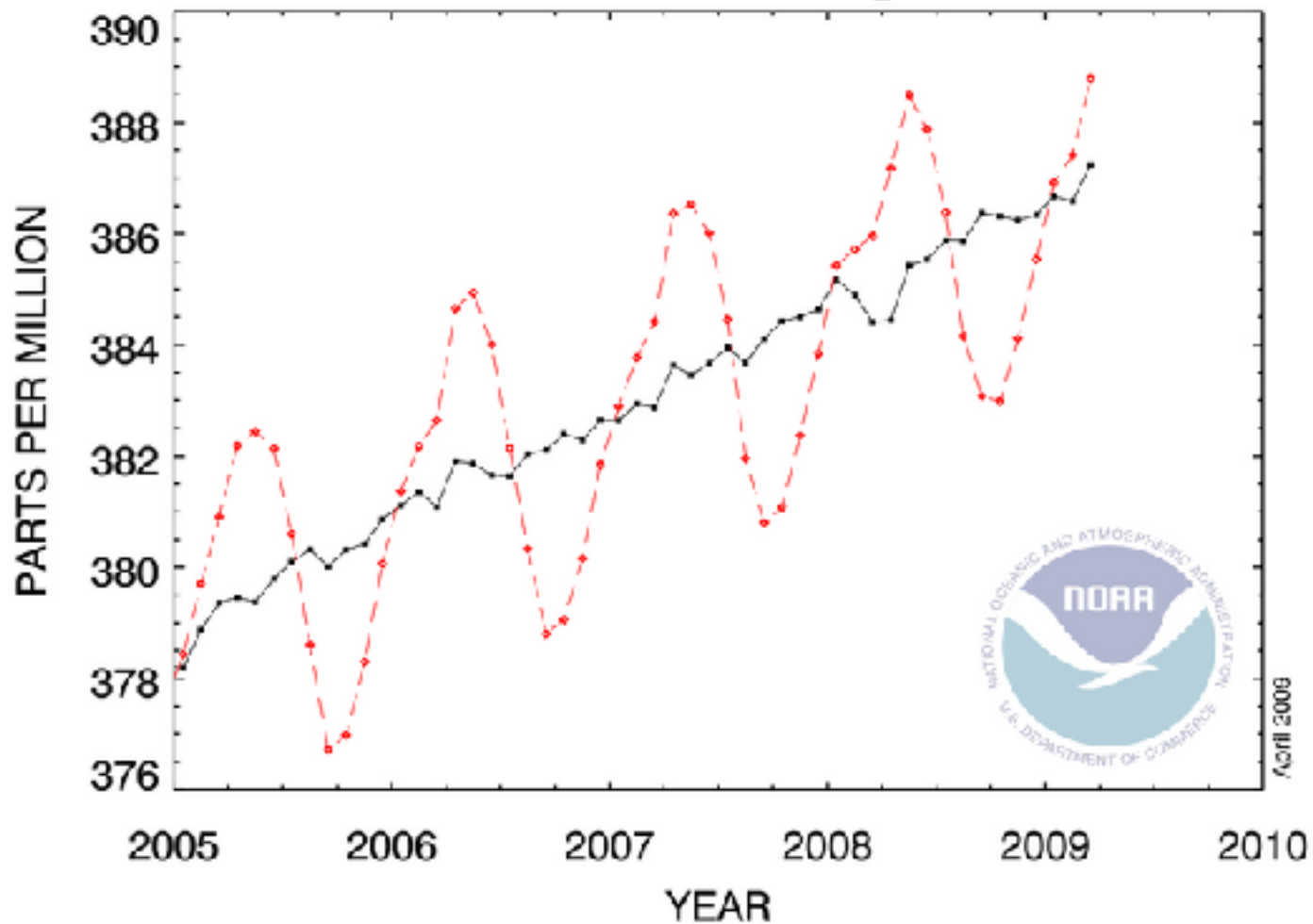


Source: Scripps CO₂ Program, scrippsco2.ucsd.edu



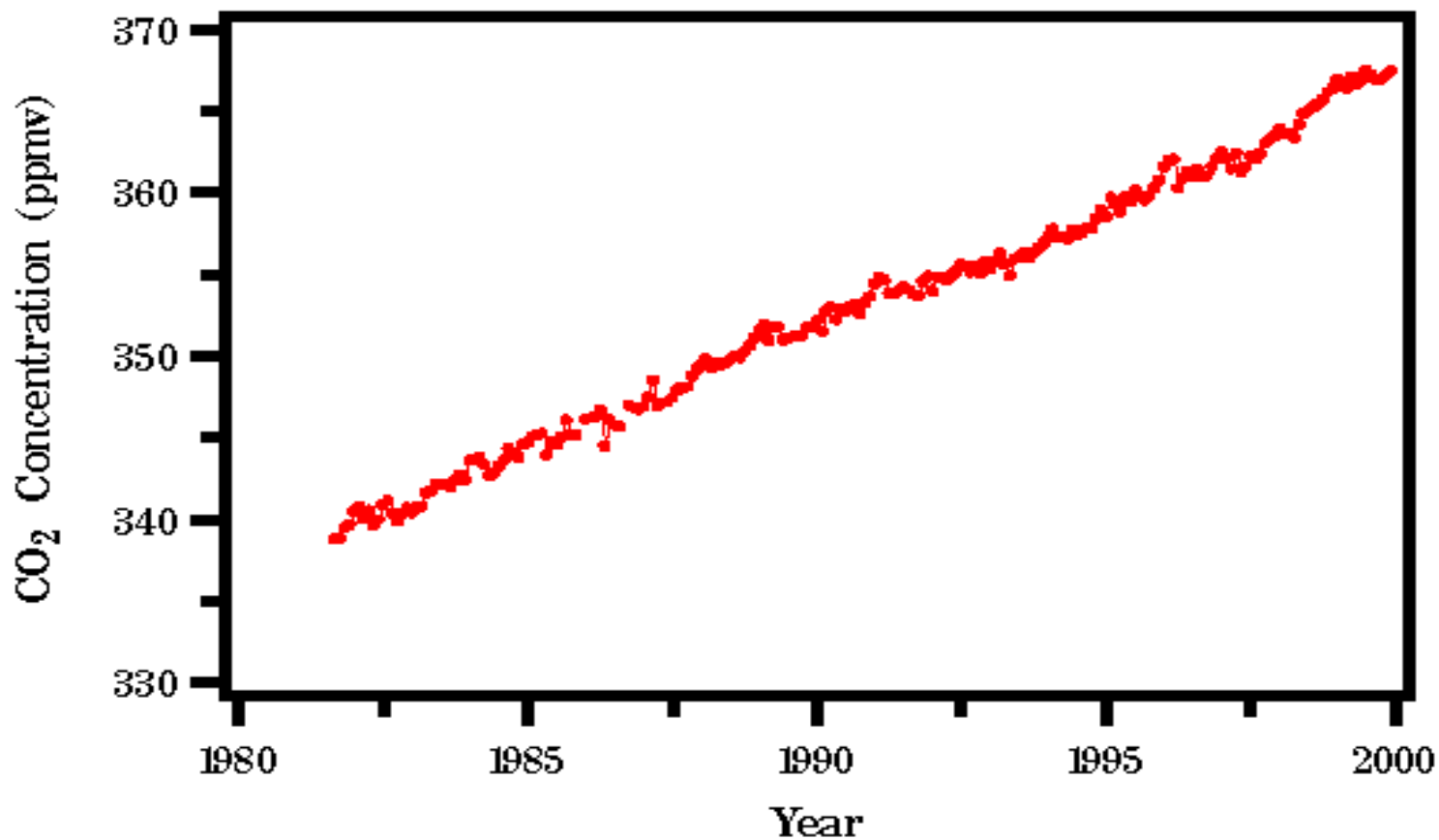
<http://www.mlo.noaa.gov/webmuseum/timeline/1986construction.html>

RECENT MONTHLY MEAN CO₂ AT MAUNA LOA



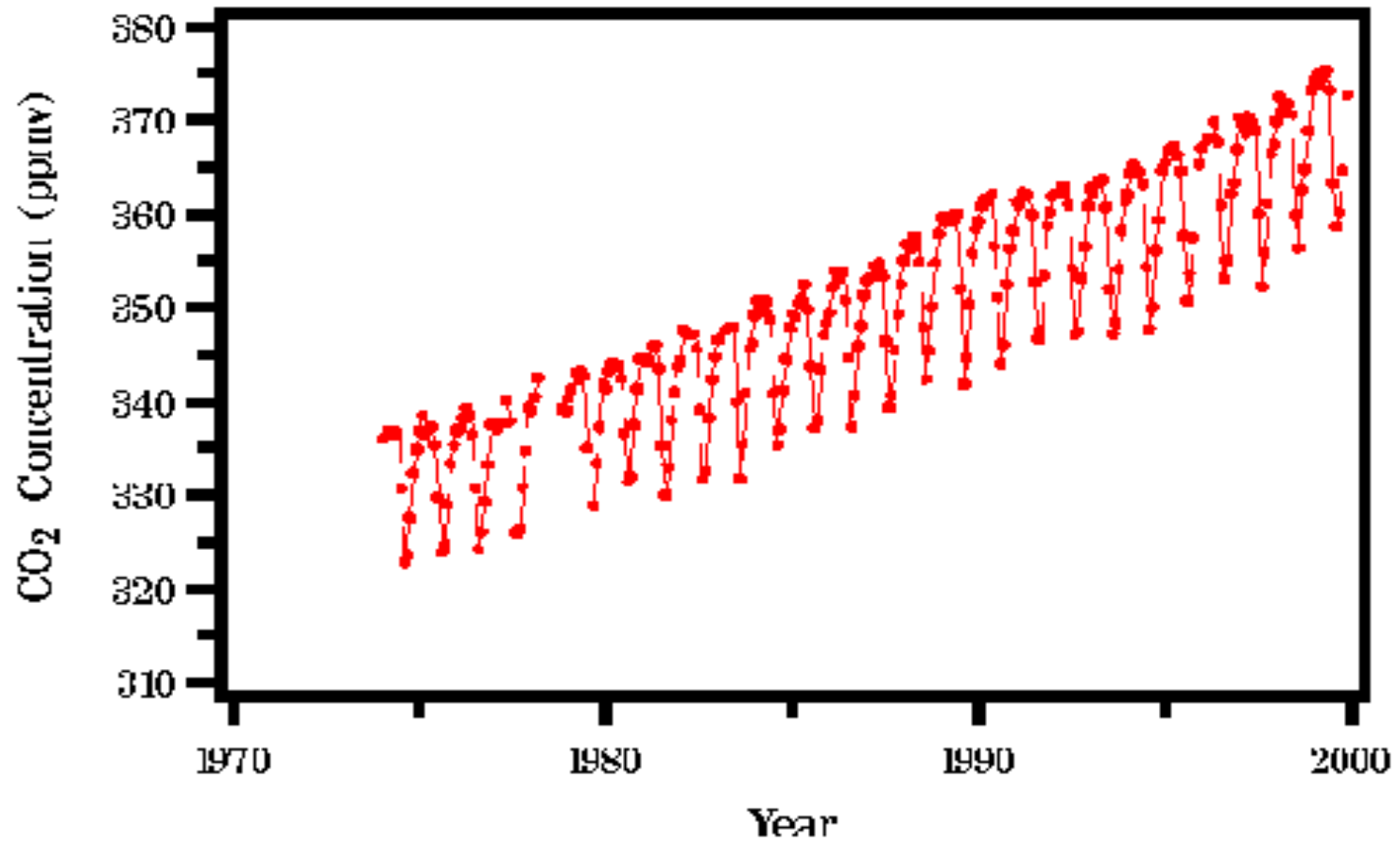
<http://www.mlo.noaa.gov/livedata/livedata.html>

American Samoa



Source: Dave Keeling and Tim Whorf (Scripps Institution of Oceanography)

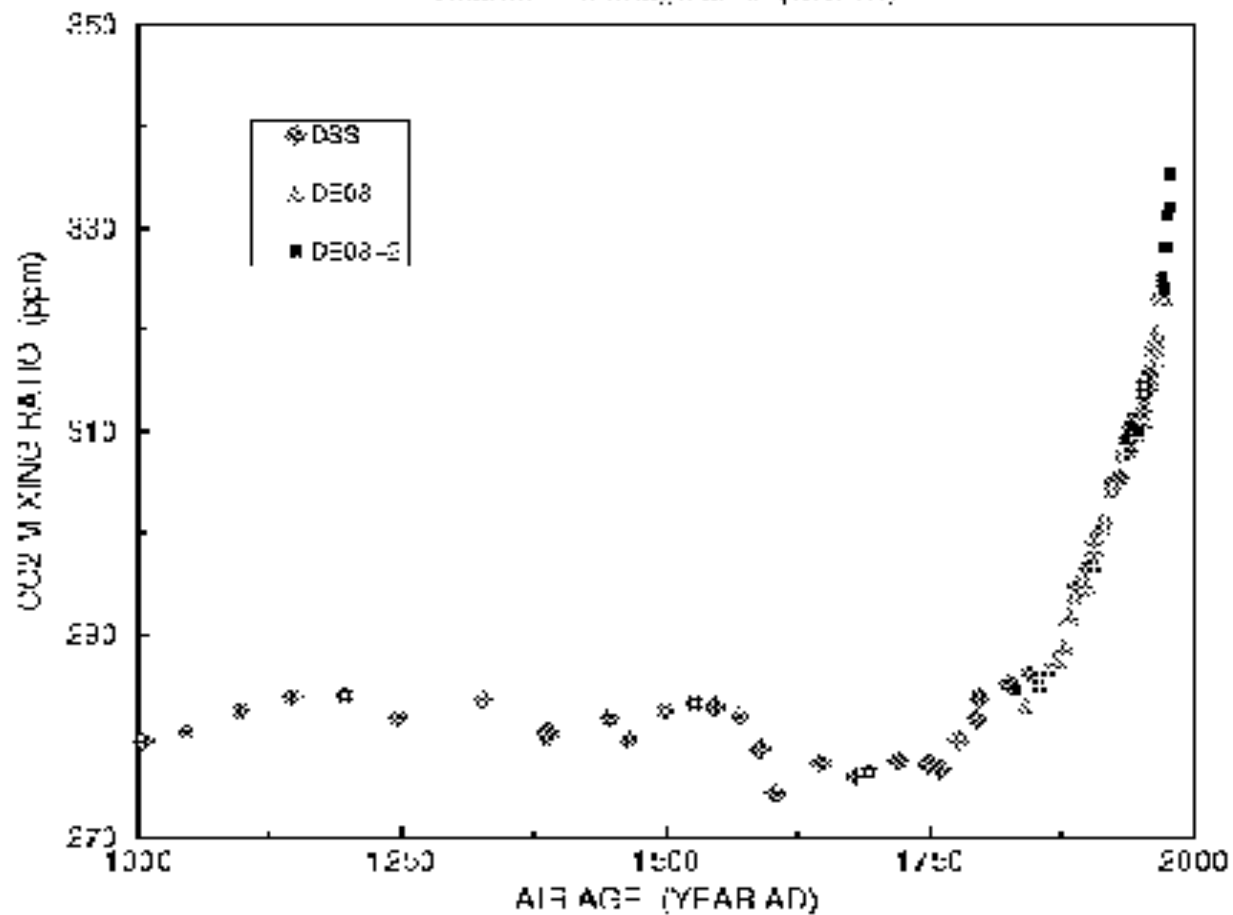
Barrow, Alaska



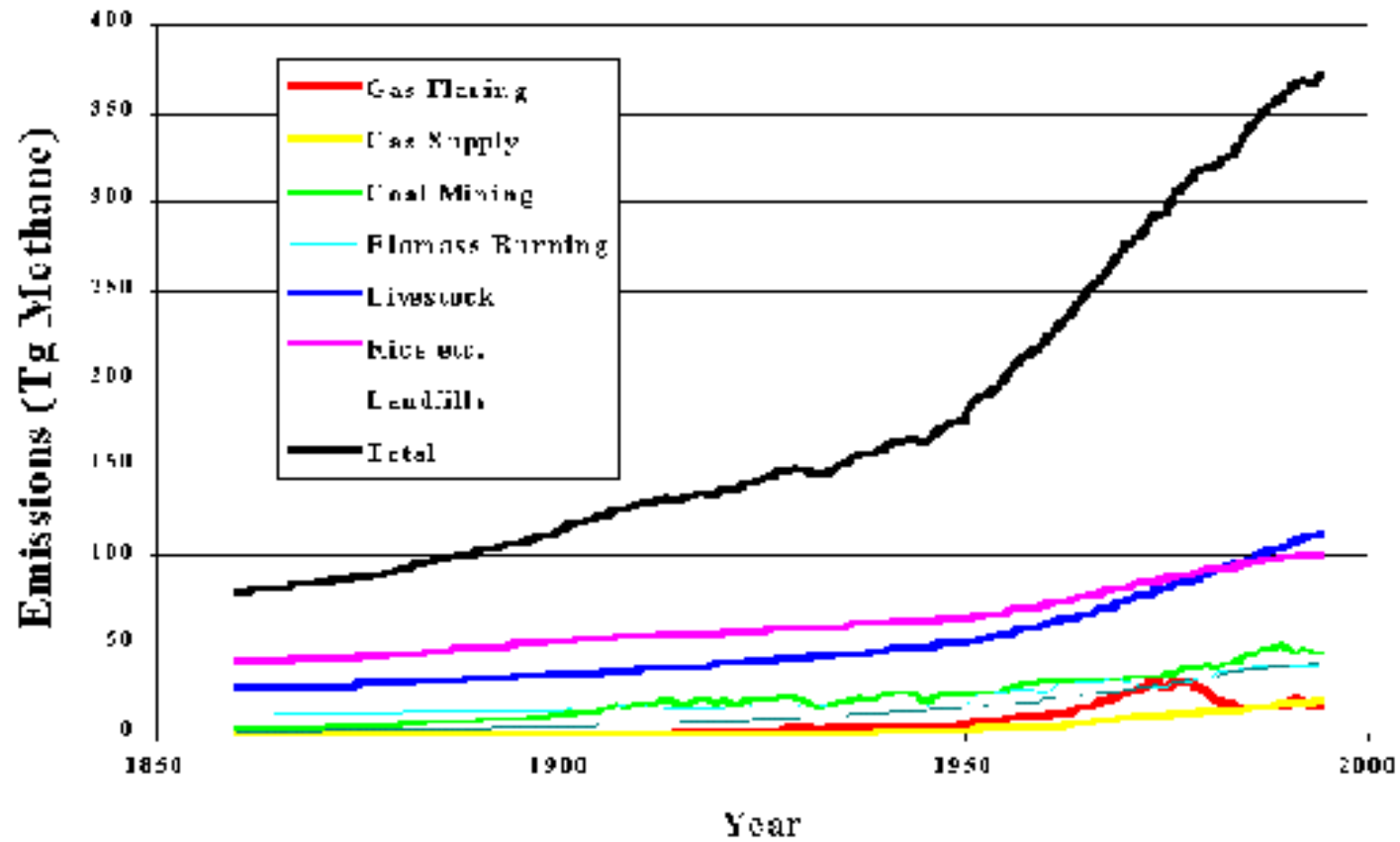
Source: Dave Keeling and Tim Whorf (Scripps Institution of Oceanography)

LAW DOME, ANTARCTICA ICE CORES

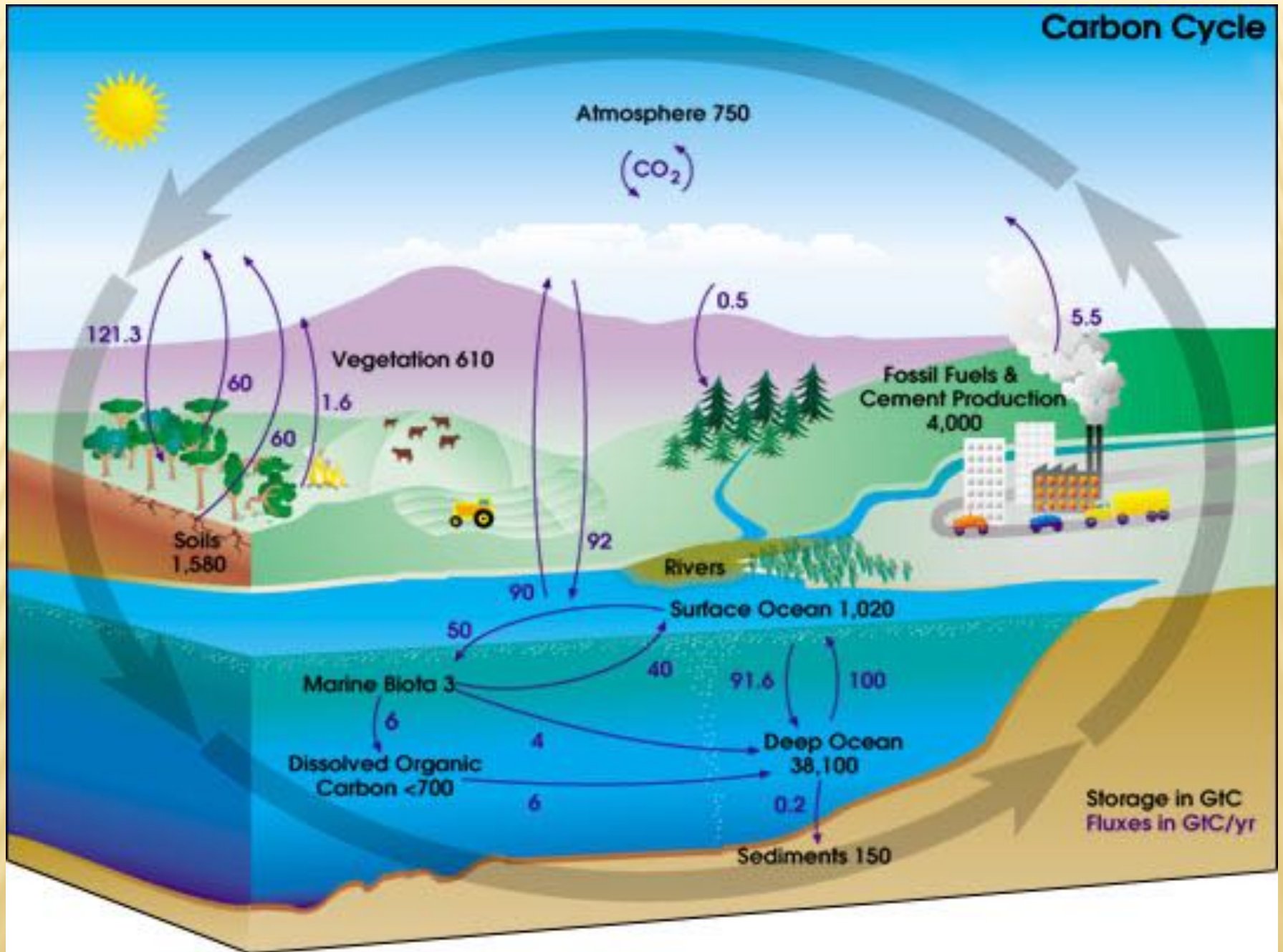
Source: Etheridge et al (CSIRO)



Global Anthropogenic Methane Emissions: 1860-1994 (Stern & Kaufmann)



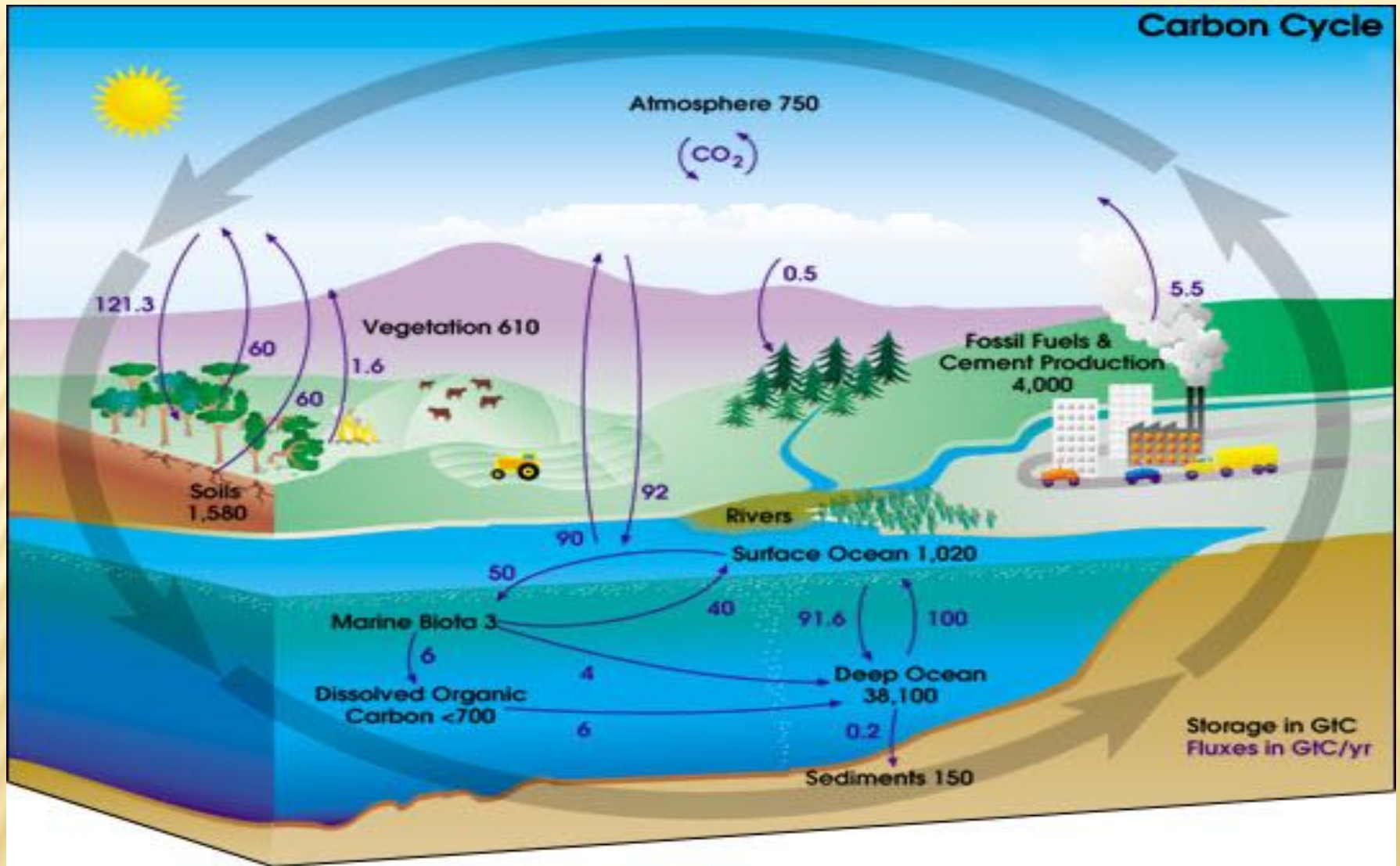
Carbon Cycle



The main things to notice about the carbon cycle is that the natural cycle is almost in balance. The oceans and vegetation are both sources and sinks of CO₂.

- The oceans put out 90 GtC/yr and absorb 92 GtC/yr
- The soil and vegetation put 121.6 GtC/yr and absorb 121.3 GtC/yr.
- The oceans, soil, and vegetation absorb 1.7 GtC/yr more than they put out.

Humans put out 5.5 GtC/yr but absorb **no** CO₂. Thus the CO₂ we put into the atmosphere builds up except for the small net absorption by other means.



Source: earthobservatory.nasa.gov/Features/CarbonCycle/carbon_cycle4.php