



This is the print version of the [Skeptical Science](http://sks.to/co2) article '[Human CO2 is a tiny % of CO2 emissions](http://sks.to/co2)', which can be found at <http://sks.to/co2>.

How do human CO2 emissions compare to natural CO2 emissions?

What The Science Says:

The CO2 that nature emits (from the ocean and vegetation) is balanced by natural absorptions (again by the ocean and vegetation). Therefore human emissions upset the natural balance, rising CO2 to levels not seen in at least 800,000 years. In fact, human emit 26 gigatonnes of CO2 per year while CO2 in the atmosphere is rising by only 15 gigatonnes per year - much of human CO2 emissions is being absorbed by natural sinks.

Climate Myth: Human CO2 is a tiny % of CO2 emissions

"The oceans contain 37,400 billion tons (GT) of suspended carbon, land biomass has 2000-3000 GT. The atmosphere contains 720 billion tons of CO2 and humans contribute only 6 GT additional load on this balance. The oceans, land and atmosphere exchange CO2 continuously so the additional load by humans is incredibly small. A small shift in the balance between oceans and air would cause a CO2 much more severe rise than anything we could produce." ([Jeff Id](#))

Manmade CO2 emissions are much smaller than natural emissions. Consumption of vegetation by animals & microbes accounts for about 220 gigatonnes of CO2 per year. Respiration by vegetation emits around 220 gigatonnes. The ocean releases about 332 gigatonnes. In contrast, when you combine the effect of fossil fuel burning and changes in land use, human CO2 emissions are only around 29 gigatonnes per year. However, natural CO2 emissions (from the ocean and vegetation) are balanced by natural absorptions (again by the ocean and vegetation). Land plants absorb about 450 gigatonnes of CO2 per year and the ocean absorbs about 338 gigatonnes. This keeps atmospheric CO2 levels in rough balance. Human CO2 emissions upsets the natural balance.

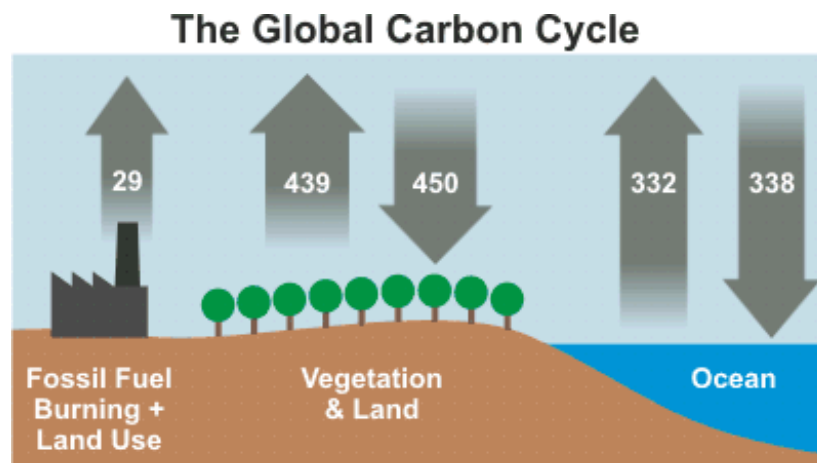


Figure 1: Global carbon cycle. Numbers represent flux of carbon dioxide in gigatonnes (Source: Figure 7.3, [IPCC AR4](#)).

About 40% of human CO2 emissions are being absorbed, mostly by vegetation and the oceans. The rest remains in the atmosphere. As a consequence, atmospheric CO2 is at its highest level in 15 to 20 million years ([Tripathi 2009](#)). A natural change of 100ppm normally takes 5,000 to 20,000 years. The recent increase of 100ppm has taken just 120 years.

Additional confirmation that rising CO2 levels are due to human activity comes from examining

the ratio of carbon isotopes (eg $\delta^{13}\text{C}$ carbon atoms with differing numbers of neutrons) found in the atmosphere. Carbon 12 has 6 neutrons, carbon 13 has 7 neutrons. Plants have a lower $\text{C}^{13}/\text{C}^{12}$ ratio than in the atmosphere. If rising atmospheric CO_2 comes from fossil fuels, the $\text{C}^{13}/\text{C}^{12}$ should be falling. Indeed this is what is occurring ([Ghosh 2003](#)). The $\text{C}^{13}/\text{C}^{12}$ ratio correlates with the trend in global emissions.

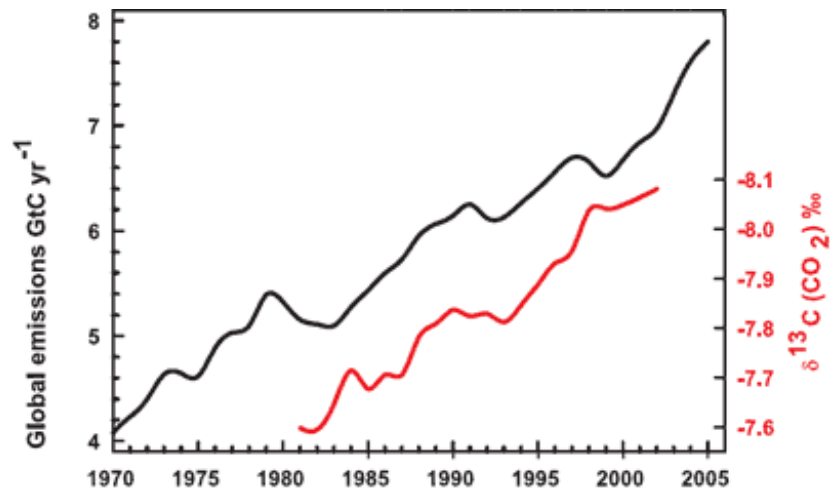


Figure 2: Annual global CO_2 emissions from fossil fuel burning and cement manufacture in GtC yr^{-1} (black), annual averages of the $^{13}\text{C}/^{12}\text{C}$ ratio measured in atmospheric CO_2 at Mauna Loa from 1981 to 2002 (red). The isotope data are expressed as $\delta^{13}\text{C}(\text{CO}_2)$ ‰ (per mil) deviation from a calibration standard. Note that this scale is inverted to improve clarity. ([IPCC AR4](#))

Intermediate rebuttal written by John Cook

Update July 2015:

Here is the relevant lecture-video from [Denial101x - Making Sense of Climate Science Denial](#)

Additional videos from the MOOC

Interviews with [various experts](#)

Expert interview with [Joanna House](#)



Skeptical Science explains the science of global warming and examines climate misinformation through the lens of peer-reviewed research. The website won the Australian Museum 2011 Eureka Prize for the Advancement of Climate Change Knowledge. Members of the Skeptical Science team have authored peer-reviewed papers, a [college textbook on climate change](#) and the book [Climate Change Denial: Heads in the Sand](#). Skeptical Science content has been used in university courses, textbooks, government reports on climate change, television documentaries and numerous books.



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