



This is the print version of the [Skeptical Science](http://sks.to/significant) article '[Humans are too insignificant to affect global climate](http://sks.to/significant)', which can be found at <http://sks.to/significant>.

# Are humans too insignificant to affect global climate?

## What The Science Says:

Atmospheric CO<sub>2</sub> levels are rising by 15 gigatonnes per year. Humans are emitting 26 gigatonnes of CO<sub>2</sub> into the atmosphere. Humans are dramatically altering the composition of our climate.

## Climate Myth: Humans are too insignificant to affect global climate

To suggest that humanity is capable of impacting and disturbing forces of such magnitude is reflective of a self-centred arrogance that is mind numbing. Humanity is a subset of Nature. Nature is not a subset of humanity. We have travelled full circle. We are back in the mindset that prevailed when Society's leaders dictated what people in Copernicus' days may or may not think. The Earth is once again flat. (source: [Financial Sense University](http://www.financialsense.com))

Are humans too insignificant to affect global climate? After all, our planet is a big place. Isn't it arrogant to claim puny little humans could make a dent in such a huge climate? However, whether human activity might affect climate is not a question of arrogance. It's merely a question of numbers. In particular, there are two numbers to consider.

## Atmospheric CO<sub>2</sub> is rising by 15 Gigatonnes per year

The first on-site continuous measurements of atmospheric CO<sub>2</sub> were implemented by Charles Keeling in 1958 at Mauna Loa, Hawaii. This station provides the longest continuous record of atmospheric CO<sub>2</sub>. Currently, atmospheric CO<sub>2</sub> levels are being measured at hundreds of monitoring stations across the globe. For periods before 1958, levels of atmospheric CO<sub>2</sub> are determined from analyses of air bubbles trapped in polar ice cores.

What we observe is that in pre-industrial times over the last 10,000 years, CO<sub>2</sub> was relatively stable at around 275 to 285 ppm. Over the last 250 years, atmospheric CO<sub>2</sub> levels have increased by about 100ppm. Currently, the amount of CO<sub>2</sub> in the atmosphere is increasing by 15 gigatonnes every year.

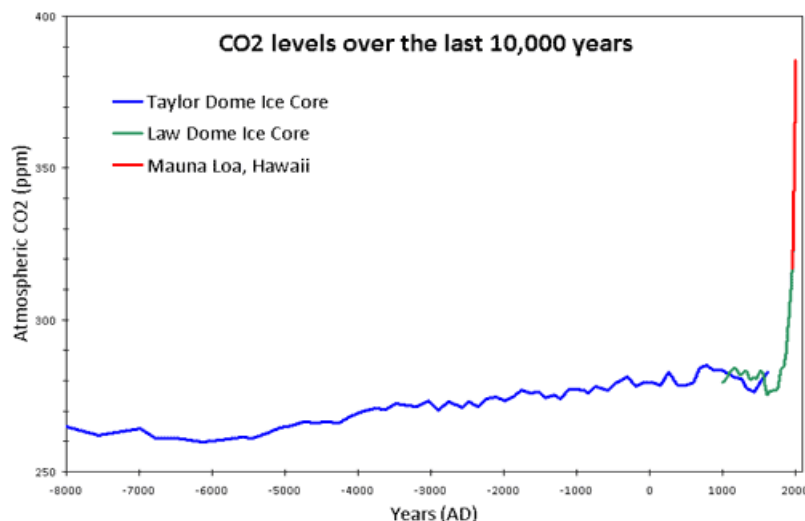


Figure Figure 1: CO<sub>2</sub> levels (parts per

million) over the past 10,000 years. Blue line derived from ice cores obtained at Taylor Dome, Antarctica ([NOAA](http://www.noaa.gov)). Green line derived from ice cores obtained at Law Dome, East Antarctica ([CDIAC](http://www.cdiac.gov)). Red

line from direct measurements at Mauna Loa, Hawaii ([NOAA](#)).

## Humans are emitting 26 Gigatonnes of CO<sub>2</sub> per year

Global CO<sub>2</sub> emissions are derived from international energy statistics, tabulating coal, brown coal, peat, and crude oil production by nation and year. This means we can calculate how much CO<sub>2</sub> we're emitting not only in recent years, using United Nations data, but also estimate fossil fuel CO<sub>2</sub> emissions back to 1751 using historical energy statistics. What we've found is fossil fuel and cement emissions have continued to increase, climbing to the current rate of 26 Gigatonnes of CO<sub>2</sub> per year.

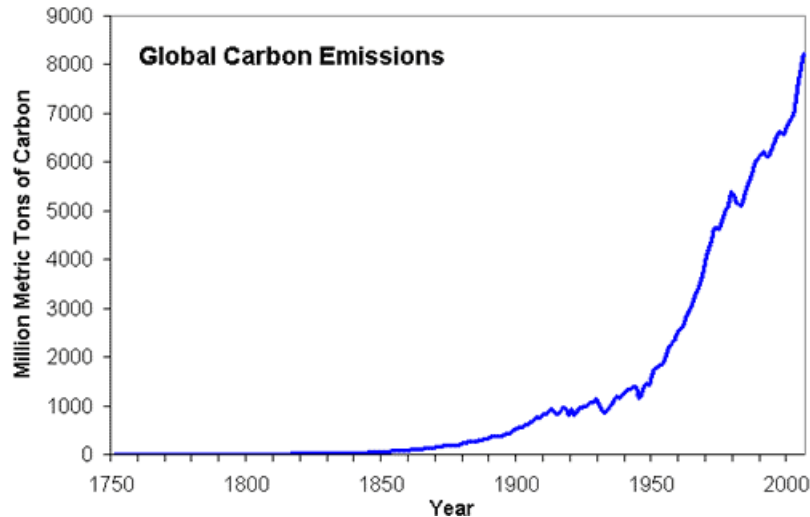


Figure 2: Total Global Carbon Emission Estimates, 1750 to 2006 ([CDIAC](#)).

In other words, humans are emitting nearly twice as much CO<sub>2</sub> than what ends up staying there. Nature is reducing our impact on climate by absorbing a large chunk of our CO<sub>2</sub> emissions. The amount of human CO<sub>2</sub> left in the air, called the "airborne fraction", has hovered around 55% since 1958.

## Detecting the human signature in atmospheric CO<sub>2</sub>

Further confirmation that rising CO<sub>2</sub> levels are due to human activity come by analysing the types of CO<sub>2</sub> found in the air. The carbon atom has several different isotopes (different number of neutrons). Carbon 12 has 6 neutrons, carbon 13 has 7 neutrons. Plants have a lower C<sup>13</sup>/C<sup>12</sup> ratio than in the atmosphere. If rising atmospheric CO<sub>2</sub> comes from fossil fuels, the C<sup>13</sup>/C<sup>12</sup> should be falling. Indeed this is what is occurring ([Ghosh 2003](#)) and the trend correlates with the trend in global emissions.

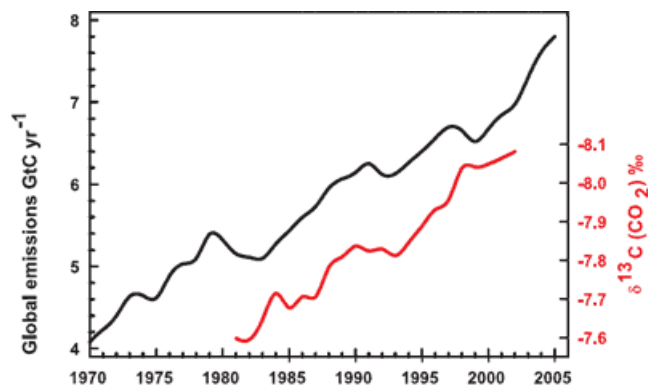


Figure 3: Annual global CO<sub>2</sub> emissions from fossil fuel burning and cement manufacture in GtC yr<sup>-1</sup> (black), annual averages of the <sup>13</sup>C/<sup>12</sup>C ratio measured in atmospheric CO<sub>2</sub> at Mauna Loa from 1981 to 2002 (red). ([IPCC AR4](#))

So we see that humans have indeed changed the composition of our atmosphere in dramatic ways. If anyone could be accused of arrogance, you might say it's more arrogant to think we can pollute without consequences.

Intermediate rebuttal written by John Cook

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**Update July 2015:**

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

[see video at [this link](#).]



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