

Carbon Dioxide: The Houdini of Gases

By Alan Siddons and Joe D'Aleo
September 05, 2007

How long does carbon dioxide linger in the air?

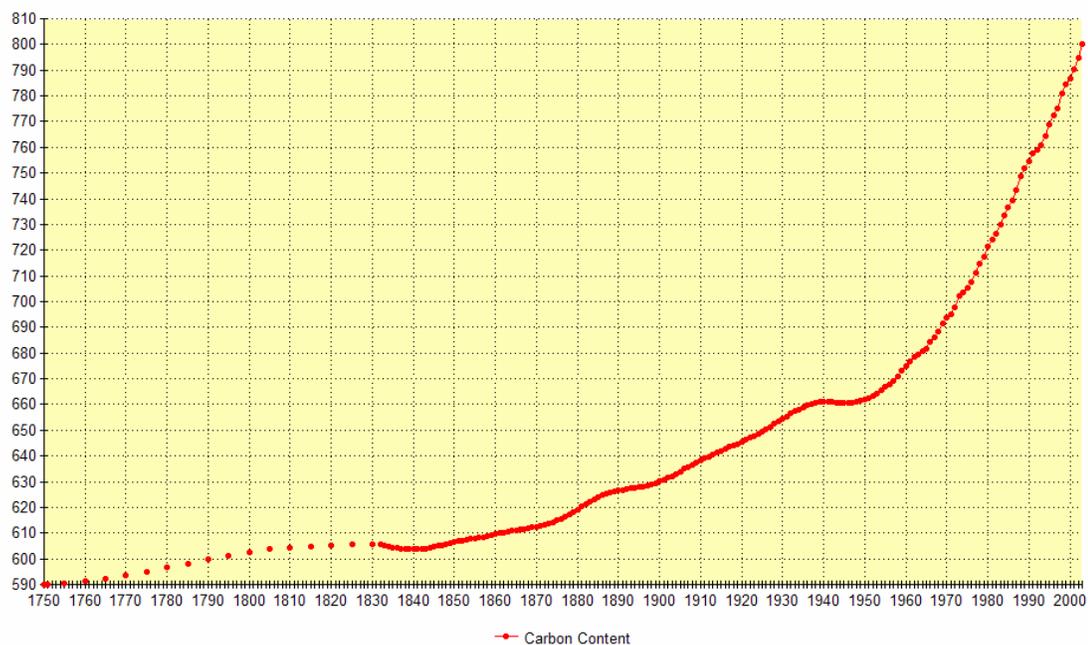
This is actually an important question, a question of so-called residence time. As previously discussed on this blog http://icecap.us/images/uploads/CO2_study.pdf, studies compiled by geologist Tom Segalstad rather convincingly show that earth's biological and chemical processes recycle CO₂ within a decade, meaning that a CO₂ molecule you're exhaling at the moment is bound to be captured by a plant or a rock or the ocean just a few years from now. Yet the Intergovernmental Panel on Climate Change and other authorities insist that carbon dioxide generally remains in the air for up to 200 years.

Who to believe? We'll present some evidence here and you be the judge.

Looking at the rising trend of carbon dioxide, the U.S. government's Carbon Dioxide Information Analysis Center - <http://cdiac.ornl.gov> - states the matter plainly: "Atmospheric CO₂ concentrations had not changed appreciably over the preceding 850 years, so it may be safely assumed that they would not have changed appreciably in the 150 years from 1850 to 2000 in the absence of human intervention."

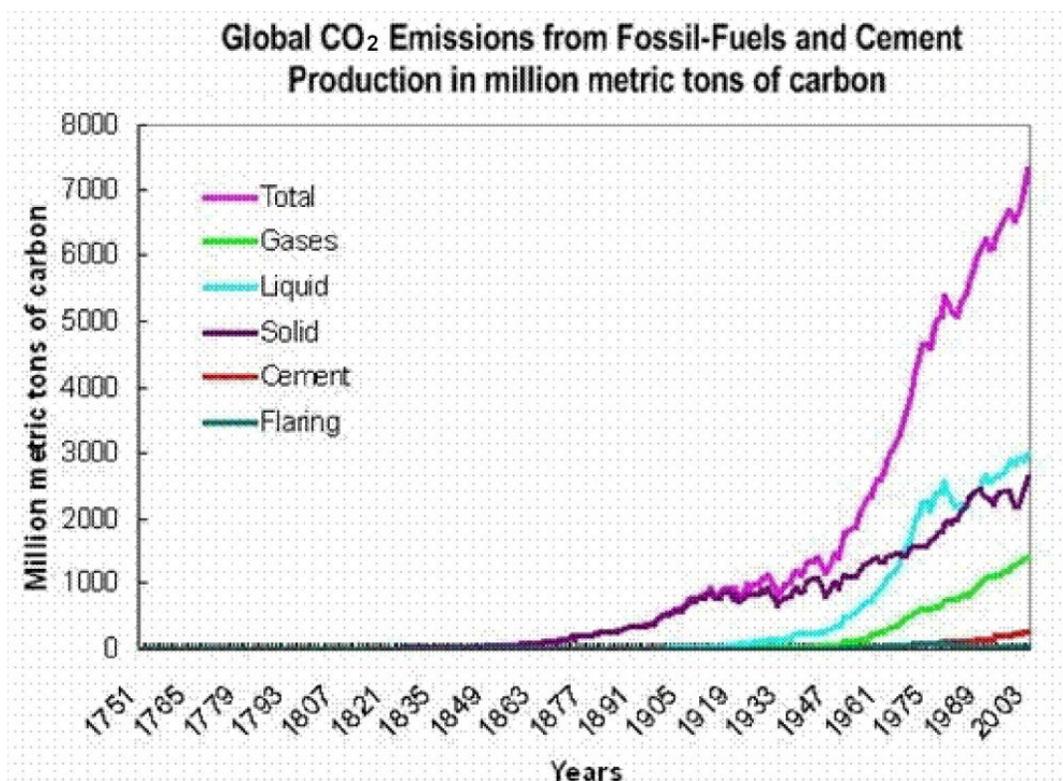
"Safely assumed."

In other words, what people were doing in 1850 is supposedly still exerting an effect today. Having nowhere else to go, the man-made CO₂ tally builds and builds in the air. Even if we all suddenly stopped driving cars and clearing forests and heating our homes - you name it - we'd have to wait more than a century to see the same CO₂ level that the 1850s saw. For here is what the historical trend looks like.

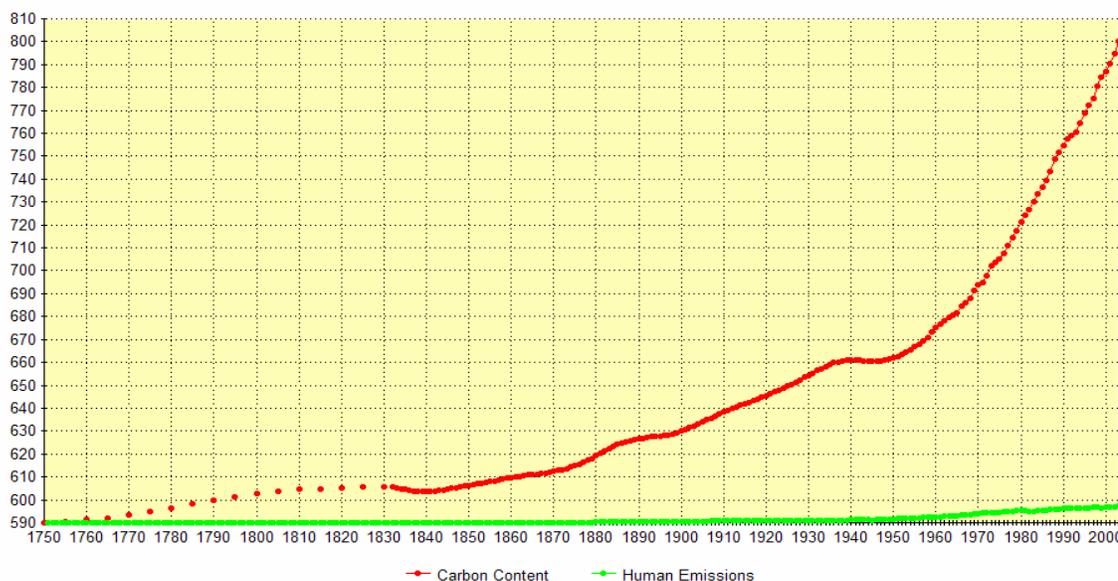


In 1750, carbon's weight in the atmosphere was 590 billion metric tons.
By 2000 it was about 790 billion.

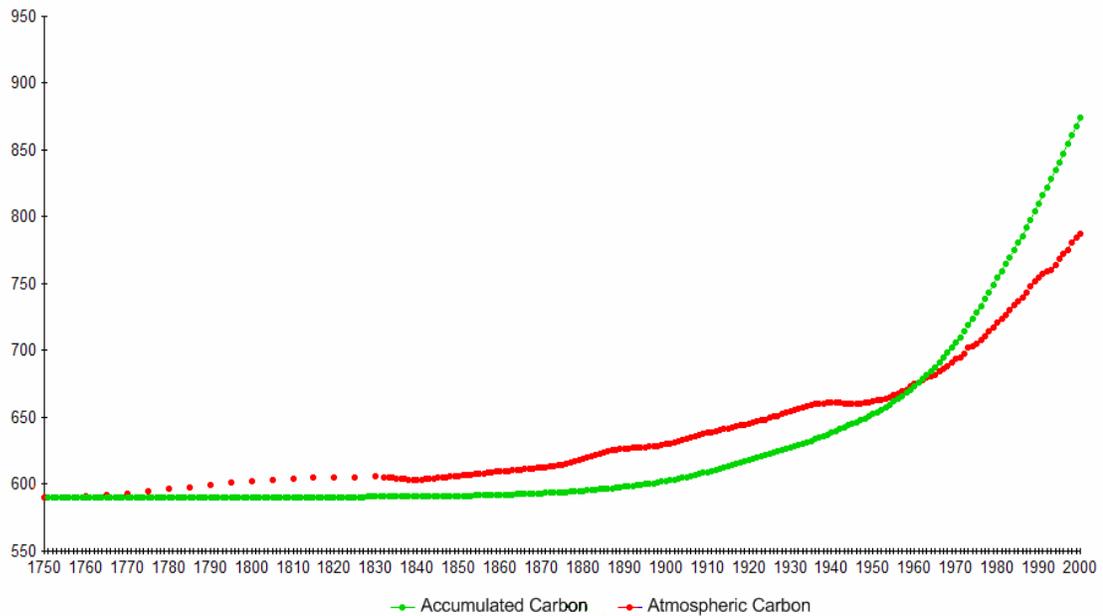
And here is CDIAC's year-by-year estimate of human emissions during that period.



But here are the two on the same scale.



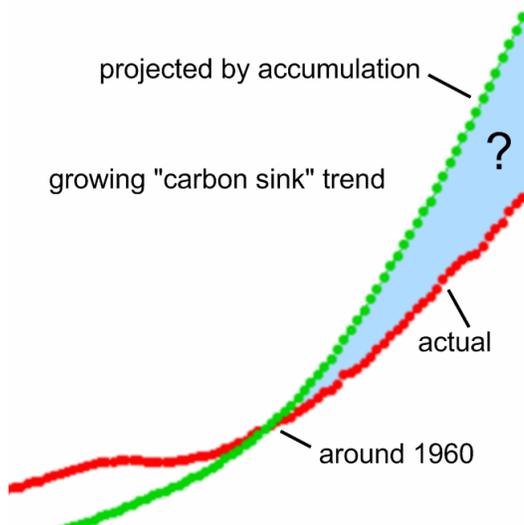
Only by proposing that carbon stagnates in the air, building up year by year, can one make the case that a molehill like that can spawn such an Everest. So let's take the figures that CDIAC uses for its estimate and mount them one on top of another to see what happens. The idea is that 2000's carbon level is due to 1999's carbon output going nowhere, and 1998's before that, and 1997's... and so on. All of those carbon atoms just pile up as we keep pumping out more. Here is what results by making CDIAC's figures accumulate, then.



"Safely assumed"?

Notice that even a grand total of CDIAC's numbers fails to mimic the atmospheric carbon curve. A hypothetical accumulation of anthropogenic carbon undershoots for more than 200 years, and then rapidly surpasses it. This extra amount would make carbon's weight in the year 2000 nearly 900 billion metric tons, much higher than the level we observe.

Climate Modelers are aware of this "missing excess" and they account for the discrepancy by saying that various "carbon sinks" mop most of it up, pulling atmospheric carbon to a lower level. Oddly enough, however, year by year these sinks must keep enlarging as accumulating man-made carbon steepens. In effect, nature finds a way to handle increasing spillovers with ever-bigger mops. How strange.



Yet "carbon sinks" were presumably active between 1751 and 1960, too, when the tally was *below* the actual curve. Since they were driving this hypothetical accumulation downward, the present slope shouldn't *show* an excess. So how do we know that this excess even exists? The fact is, we don't. It is merely "safely assumed."

Notice the inherent contradiction, though. Certain prominent authorities propose a very long residence time for CO₂, which creates a buildup. But as to why we don't see a buildup as gigantic as the figures predict, they propose that carbon sinks remove it. Thus a considerable amount of carbon dioxide is being recycled - which means it doesn't have a long residence time!

So let's rethink all this. Might it be a mistake to blame the rising carbon trend on human emissions alone? Though one could agree that long-lived emissions don't add up, maybe the problem isn't just one of adding carbon to our atmosphere - it might involve a loss of subtraction, too, the environmental damage we've inflicted which reduces earth's ability to recycle carbon. Thus, although emissions may not convincingly explain the curve, a damage factor can't be excluded and as a result we're probably still responsible.

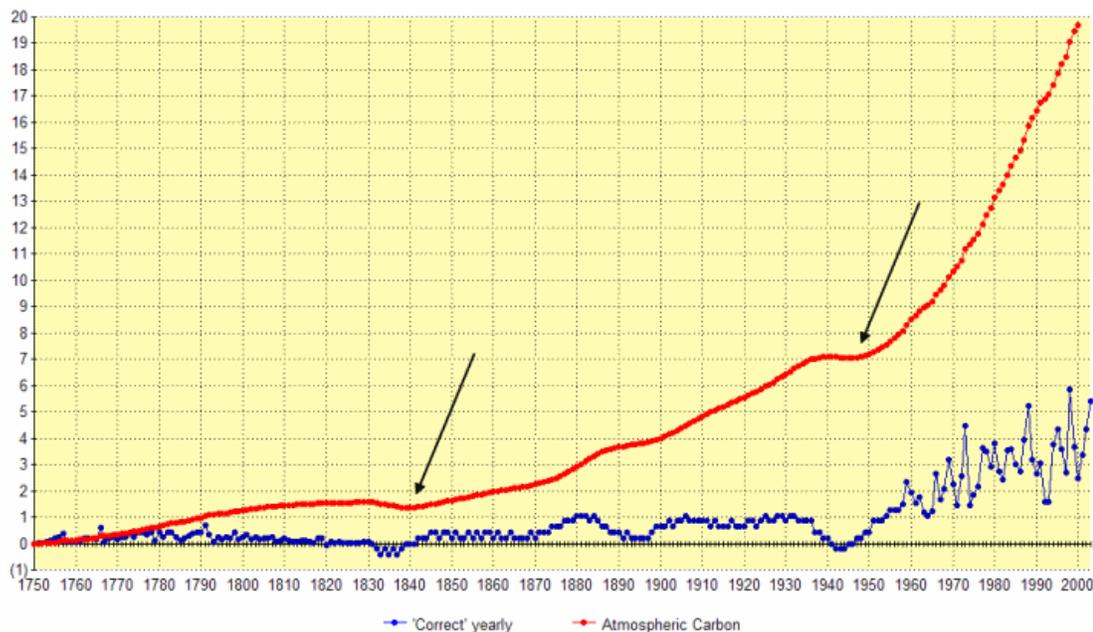
What this argument is saying is that anthropogenic carbon is part of the problem and environmental impact, often called land-use change, is another part. When you look at the carbon curve, then, you're seeing a combined effect. So how can one disentangle them?

Well, one doesn't have to

Just as we took yearly emission figures and saw the odd result of putting them in a big pile, we can do much the same with a "mixed blame" scenario. So let's go with the vague premise that "human intervention" - deforestation, bovine flatulence, carbonated beverages, whatever - has indeed caused a rising carbon trend. We don't have to know every detail of what we did to make it happen, only that we did it - and that the carbon trend is a portrait of our ecological sins.

Rather than a raw accumulation of carbon emissions in the air, it's an accumulating effect that we wish to measure this time, including non-emission aspects like land-use changes that also ruin the atmosphere. As the government's chief authority says, after all, it's a safe bet that atmospheric changes since the Industrial Revolution are due to human intervention. Logically, then, what's bad must stay bad if it is to echo across the centuries.

The record to track is right in front of us, therefore: the atmosphere itself. So when we determine the figures needed to account for an accumulated carbon curve, the result itemizes the damage we've done on a year-by-year basis. Here it is.



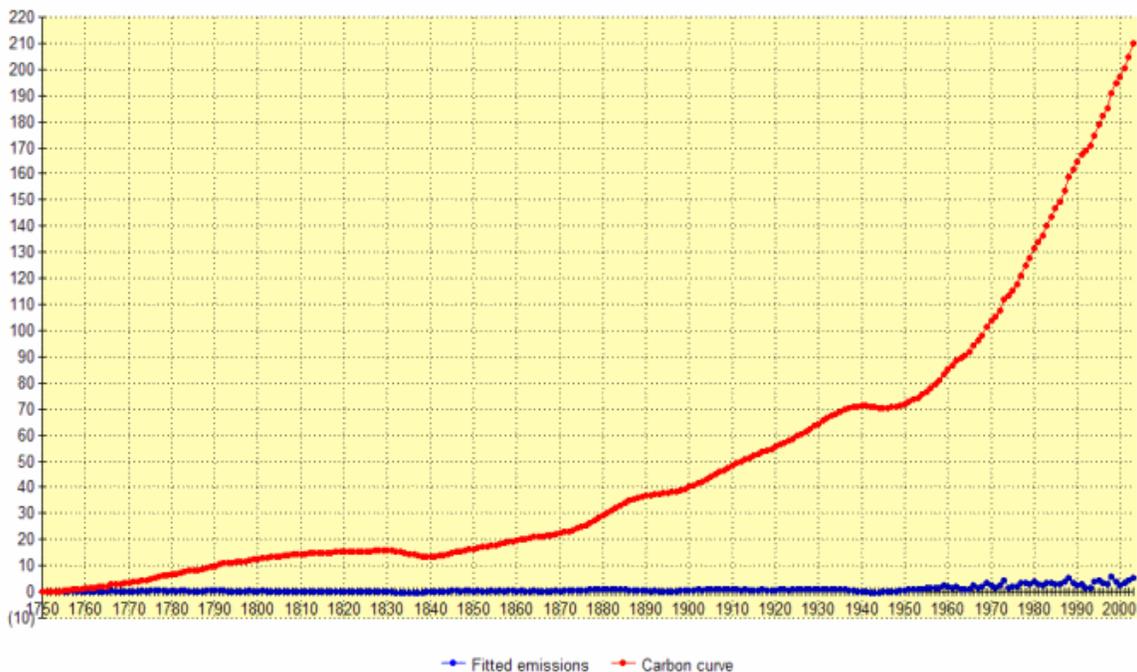
The atmospheric carbon slope is reduced to one-tenth scale for comparison. The blue line is the year-by-year damage estimate, the single profile that fits. Thus, adding 1750's generalized damage to 1751's, then 1751 to 1752, and onward to 2000, matches atmospheric carbon concentrations exactly. For remember, "it may be safely assumed that they would not have changed appreciably in the 150 years from 1850 to 2000 in the absence of human intervention."

Yet as you can see, at two periods in history all carbon-related human activity – smokestack emissions, cement production, forest clearing, cattle herding, rice cultivation, strip mining – would have to have fallen to *below zero* in order to manipulate carbon in the atmosphere.

Not to bore you by stating the obvious, but this is impossible.

The profile emerges from a 'safely assumed' scenario of 100% human impact. So once again, following the accumulation premise leads to a contradiction: in real-life, historically recent carbon-adding human activity has only risen, not declined in any significant way, and certainly never fallen below zero, whatever that might mean. Going by the profile, for instance, you'd have to believe that 1880 was equal to 1930 in terms of human additions to carbon in the atmosphere.

By the way, here the carbon slope and damage profile are on the same scale.

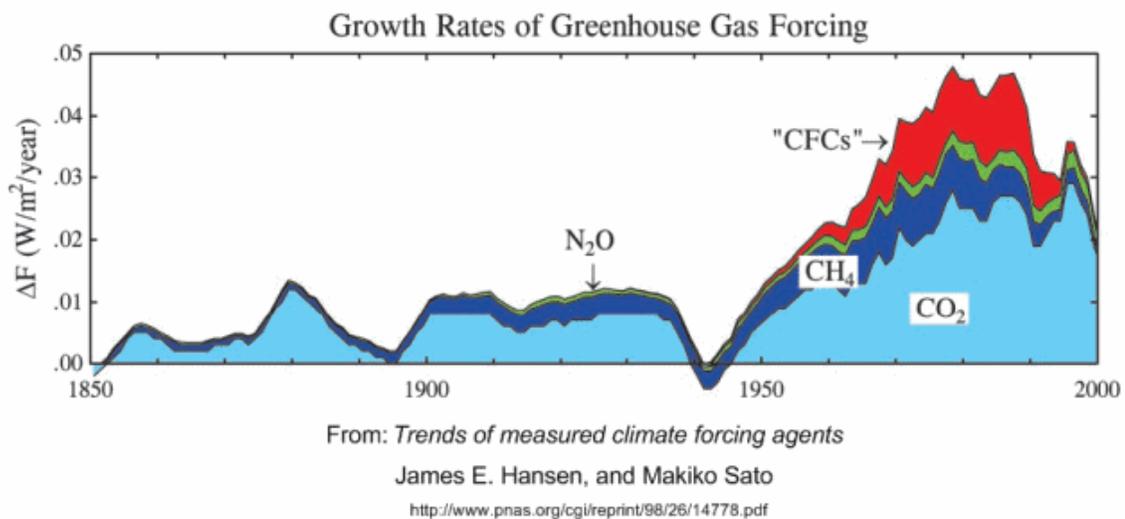


In summary, we have seen the following:

- Human emissions are far lower than the actual rise of carbon in the air
- Accumulated emissions exceed the actual rise
- Correcting for the excess necessitates that carbon sinks keep growing
- But an expansion of carbon sinks means that CO₂ is getting recycled
- A long-term accumulation profile for total carbon content leads to below-zero outcomes

That's the evidence, now you decide. Does the evidence support a long-term residence time for carbon dioxide? Does it support the assertion that changes in the atmosphere have been driven by human intervention?

As an amusing sidelight, this fictional "damage profile" that we've shown you has been published before, in another guise. It is duplicated in a 2001 publication of NASA's James Hansen: www.pnas.org/cgi/content/full/98/26/14778



Choosing 1850 as his starting point, Hansen does blame this profile on people, however, perversely convincing himself that the years between 1939 and 1944 must have marked a period of international unity. Read what he says:

"The growth rate of climate forcing by measured greenhouse gases peaked near 1980 at almost 5 W/m² per century. This growth rate has since declined to ~3 W/m² per century, largely because of cooperative international actions."

By this logic, World War Two was the best of times for greenhouse earth, when the whole world got together and drove the growth rate below zero. (Incidentally, global temperatures were climbing during that period.)

Yes, Hansen is that myopic, unable to notice the absurdity of his premise even when it's clearly laid out on a chart. But maybe he's correct, maybe we ought to drop bombs all over the planet to pull the CO₂ level down. Call it Kyoto Plan B.

Our conclusion: People are not responsible for the documented rise of carbon in the atmosphere. Not only do the numbers fail to match, the numbers can't be *made* to match.