All IPCC definitions taken from Climate Change 2007: The Physical Science Basis. Working Group I Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Annex I, Glossary, pp. 941-954. Cambridge University Press.

Abstract Only ! - includes Arguments > Feedback
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> IPPC V4 2015
Not necessarily the viewpoints of Chromtech !
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How do human CO2 emissions compare to natural CO2 emissions?

MOST USED Climate Myths
and what the science really says...

1 Climate's changed before
2 It's the sun
3 It's not bad
4 There is no consensus
5 It's cooling
6 Models are unreliable
7 Temp record is unreliable
8 Animals and plants can adapt
9 It hasn't warmed since 1998
10 Antarctica is gaining ice
View All Arguments...

IPCC FACTS | Guide to RCPs
the consensus project | TREND CALCULATOR
PRUDENT PATH | Lessons from Past Predictions
OA not OK | CLIMATE MYTHS FROM POLITICIANS
Interactive History of Climate Science | MISINFORMATION BY SOURCE

The natural cycle adds and removes CO2 to keep a balance; humans add extra CO2 without removing any.

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 atpmosphere contains 720 billion tons of CO2 and humans contribute only 6 GT additional load on this balance. The oceans, land and atpmosphere 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)

Before the industrial revolution, the CO2 content in the air remained quite steady for thousands of years. Natural CO2 is not static, however. It is generated by natural processes, and absorbed by others.

As you can see in Figure 1, natural land and ocean carbon remains roughly in balance and have done so for a long time – and we know this because we can measure historic levels of CO2 in the atmosphere both directly (in ice cores) and indirectly (through proxies).

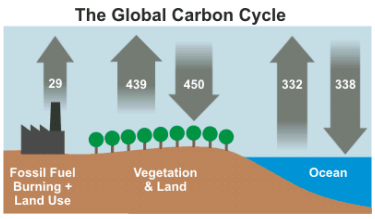

Figure 1: Global carbon cycle. Numbers represent flux of carbon dioxide in gigatons (Source: Figure 7.3, IPCC AR4).

But consider what happens when *more* CO2 is released from outside of the natural carbon cycle – by burning fossil fuels. Although our output of 29 gigatons of CO2 is tiny compared to the 750 gigatons moving through the carbon cycle each year, it adds up because the land and ocean cannot absorb all of the extra CO2. About 60% of this additional CO2 is absorbed. The rest remains in the atmosphere, and as a consequence, atmospheric CO2 is at its highest level in 15 to 20 million years (Tripati et al. 2009). (A natural change of 100ppm normally takes 5,000 to 20,000 years. The recent increase of 100ppm has taken just 120 years). *[Paragraph updated July 2022, to correct information on % of additional CO2 that is absorbed.]*

Human CO2 emissions upset the natural balance of the carbon cycle. Man-made CO2 in the atmosphere has increased by a third since the pre-industrial era, creating an artificial forcing of global temperatures which is warming the planet. While fossil-fuel derived CO2 is a very small component of the global carbon cycle, the extra CO2 is cumulative because the natural carbon exchange cannot absorb all the additional CO2.

The level of atmospheric CO2 is building up, the additional CO2 is being produced by burning fossil fuels, and that build up is accelerating.

Basic rebuttal written by GPWayne

Update July 2015:

Here is the relevant lecture-video from Denial101x - Making Sense of Climate Science Denial

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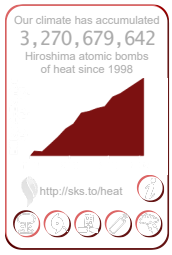
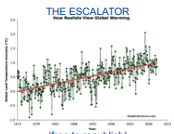


The Consensus Project Website



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Last updated on 5 July 2015 by gpwayne. View Archives

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Argument Feedback

Please use this form to let us know about suggested updates to this rebuttal.

Further reading

Both graphs from this page are taken from Chapter 2 of the IPCC AR4 report.

Real Climate goes in-depth into the science and history of C13/C12 measurements.

The World Resources Institute have posted a useful resource: the World GHG Emissions Flow Chart, a visual summary of what's contributing to manmade CO2 (eg - electricity, cars, planes, deforestation, etc).

UPDATE: Human CO2 emissions in 2008, from fossil fuel burning and cement production, was around 32 gigatoones of CO2 (UEA).

Comments

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Comments 1 to 25 out of 380:

1. **jurrytusa** at 00:39 AM on 19 December, 2007

   Some additional ball park figures. According to http://en.wikipedia.org/wiki/Carbon_dioxide 385 ppm corresponds to 3e12 tons of CO2 in the atmosphere, so we get: year ppm tons 1970 320 2.49E+12 2005 385 3.00E+12 5.06E+11 increase apparently the manmade carbon flux has risen from 4E+09 to 8E+09 tons from 1970 to 2005 so on average a flux of 6E+09 for 35 years is 2.10E+11 tons which is 42 % of the total increase and 7 % of the current total atmospheric CO2. That begs the question, what is the cause of the other 48 % ? And how can a manmade increase of 7 % be the main reason for a global increase in temperature?

2. **Yves** at 05:46 AM on 29 December, 2007

   "That begs the question, what is the cause of the other 48 % ?" The 5.06E+11 are tons of CO2 The (estimated) 2.10E+11 are tons of C which give 2.10*11/3 = 7.70E+11 tons of CO2. So, the net increase in the atmosphere is lower than the "manmade carbon flux". The difference have been taken up by mainly the oceans. "And how can a manmade increase of 7 % be the main reason for a global increase in temperature?" The pertinent figure would not be 7% (btw raised to 26% if C is converted to CO2) but 65/385 = 17%. However such reasoning is still not pertinent since the effect of CO2 is logarithmic and not linear. The preindustrial CO2 contributes to natural greenhouse effect (33°C) and the additional CO2 to enhanced greenhouse effect.

3. **Mizimi** at 21:42 PM on 27 August, 2008

   The schematic is misleading. Firstly, it is not representative of the actual processes going but only shows a snapshot in time. Secondly, there is no CO2 balance in biomass input/output: CO2 is constantly being locked up/ released at varying rates so there is no dynamic equilibrium. In (geologically)ancient times CO2 concentrations were as high as 6000ppm...for a long time high enough to preclude oxygen breathers evolving...until sufficent CO2 was locked up by plant life (the oceans would have been more or less saturated) and O2 levels raised by algae and cyanobacteria. There is no balance! Check out the Oxygen Cycle.

4. **Mizimi** at 04:48 AM on 1 September, 2008

   So warming oceans release CO2 (or absorb less, the end result is the same) thus causing a further rise in temperature which feeds back and so on. Except the glaciers/ice-caps start to melt and lower the ocean T and slow down (or maybe halt) feedback. Evaporation increases and more heat is lost to space in the upper atmosphere. Land Biomass begins to pick up. Oceanic CO2 release decreases the acidity of sea water and carbonate fixing biota do better and lock up more CO2 allowing more CO2 to enter the oceans. The climate has demonstrated historically that it is very stable despite quite large changes in the sub-systems modulating the Heat in - Heat out process. Life has equally demonstrated it can cope with large climatic changes and that it actually prefers it to be warmer .....

5. **Mizimi** at 22:24 PM on 3 September, 2008

   Some crude sums..... 85 - 90% of the 33C elevation of GMT is due to W.vapour. Thus the GG's are responsible for 10-15% (3.3 - 5C) MM CO2 emissions are ~27E9 tons so allowing for MM CH4 emissions (3.0E9tons CO2 equivalent), total MM GG's are around 30.0E9tons (2005) Total atmospheric CO2 = 3.0E12 tons (2005) Thus MM GG contribute 1% of 3.3-5C (.033-.05C) To double total atmospheric CO2 content from 3.0E12 to 6.0E12 solely from MM CO2 @ current increase of 30.E9/a requires 200years. (385ppm to 770ppm assuming all CO2 remains in atmosphere - wrong but never mind). Assume direct lineal warming effect (wrong but never mind)GG's would then contribute to a further GMT rise of 3.3-5C over 200 years. This is 1.65-2.5 C /century. or .17 - .25C/decade. GISS data for land/Oceans: 1980-1990 show a rise of .15C 1990-2000 show a rise of .15C 2000-2007 show a rise of .10C GISS data for met. stations: 1980-1990 show a rise of .15C 1990-2000 show a rise of .19C 2000-2007 show a rise of .12C So it looks like we can expect GMT to rise from around 14 to 15.5 by 2107 Numbers are fun.

6. **Dan Pangburn** at 16:31 PM on 11 September, 2008

   According to NOAA data (not their agenda-biased, thanks to Hansen, narrative reports), for the first 7 months of 2008 the AVERAGE GLOBAL TEMPERATURE IS LOWER than the average from 2000 thru 2007 by an amount equal to 13.5% of the total linearized increase during the 20th century. Since 2000, the CARBON DIOXIDE LEVEL HAS INCREASED by 13.6% of the total increase since the start of the Industrial Revolution.

7. **Mizimi** at 03:24 AM on 12 September, 2008

   Dan: That suggests CO2 increase = Temp decrease; could it be the AGW's have got it back to front? (tongue firmly in cheek). But now of course it will be the sun (no sunspots) whereas before it was NOT the sun. It's like pinning down mercury drops...the harder you try the more it splits up into smaller and smaller particles. I don't think anyone rejects that CO2 is a GG; but that is a whole different ballgame to suggesting it is causing global warming on a scale that we should be concerned with.

8. **Dan Pangburn** at 01:09 AM on 13 September, 2008

   The point is that added atmospheric carbon dioxide has no significant influence on average global temperature. Examination of the temperature data of the last and prior glaciations from NOAA as determined from Vostok ice cores reveals that temperature trends reversed direction irrespective of carbon dioxide level. This proves that there is no net positive feedback. Climatologists, who apparently don't know how feedback works don't realize this. Unaware of their ignorance, they impose net positive feedback in their GCMs which causes them to predict substantial warming from carbon dioxide increase. Without feedback, the GCMs do not predict significant Global Warming. Other assessments from entirely different perspectives also determine that there is no significant net positive feedback. They can be seen at http://www.climate-skeptic.com/2008/01/index.html and http://www.weatherquestions.com/Roy-Spencer-on-global-warming.htm

9. **Mizimi** at 01:42 AM on 14 September, 2008

   Dan: The real problem is that the climatologists are only too happy to research positive feedback and include it, but treat negative feedback as inconsequential, even though, as you point out, their own data clearly shows there are very strong negatives at work. And each time something in the overall system starts a +ve trend, something else wakes up and starts a -ve one. the system has had millions of years to evolve sub-systems to damp oscillations and maintain climate within life supporting limits. Also, nobody is really sure that we know what all the influencing factors are, so the model at the moment is like a cardboard box on wheels. (not a even a Ford let alone a Ferrari)

10. **Mizimi** at 02:15 AM on 18 September, 2008

    Another point on the schematic: It is estimated 90%+ of the earth's CO2 is locked up in ocean sediment http://earthobservatory.nasa.gov/Library/Phytoplankton/ and that process is STILL going on
    so how can there be any kind of a balance as the graphic indicates? The only way you can 'force' equilibrium like that is totally ignore other factors which simply destroys the basis of the argument.

11. **chris** at 07:10 AM on 8 October, 2008

    Re #10 Mizimi That's a massive non-sequiter unfortunately. It also contains an essential fallacy. The 90% of the Earth's sequestered carbon ISN'T "locked up in ocean sediments"...90% of the earth's sequestered carbon was originally DERIVED from ocean sediments (and is now oil/natural gas and so on...) Of course we know very well that the evidence indicates that the system described in the graphics in the top article is more or less in balance. This refers to the short term carbon cycle which describes the recycling of non-sequestered carbon through the biosphere, as well as some elements of the longer term carbon cycle involving slow sequestration of carbon and its reintroduction to the biosphere through (largely) ocean sedimentation of carbon fixing life-forms and volcanic activity, respectively. This is readily apparent in the paleoCO2 record. In the short term (last 10000 years), atmospheric CO2 has maintained a relatively steady CO2 concentration (270 ppm +/- 10 ppm)... e.g. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf lower resolution data indicate that this sort of level has been in the atmosphere for the last 20-odd million years before the 20th century (i.e. 180-350 ppm; the low values occurring during glacial periods). e.g. Pearson, PN and Palmer, MR (2000) "Atmospheric carbon dioxide concentrations over the past 60 million years" Nature 406, 695-699. So that equilibrium in the short/medium term carbon cycle exists and is readily apparent. Obviously once one starts digging up and burning carbon sequestered out of the cycle for many 10's and 100's of millions of years, the equilibrium is abruptly perturbed, and as we're seeing atmospheric CO2 levels are shooting upwards. Incidentally, which "other factors" that are being "totally ignored" were you thinking of Mizimi?

12. **Mizimi** at 08:15 AM on 26 October, 2008

    Depends what you define as 'short', 'medium' or 'long'. Yes, atmospheric CO2 levels have risen in the last 50 years or so
    is this short or medium? Climate-wise I suggest it is very short. Paleoproxy data shows atmospheric CO2 rising and falling by very much greater levels over longer periods of time. The system is clearly never in equilibrium. 'More or less in balance' is a cop out. How much out of balance does it have to be before you consider it not in equilibrium? How does all that CO2 locked up as carbonate sediment compare to the oil/gas/coal deposits? And that form of sequestration is still going on. Human population is expected to grow from 6 to 9 billion by 2100...which equals (roughly) 540 million tons of carbon locked up in people for say, 60 years? And yes, people die, but the release of carbon back to the environment is not immediate. No dynamic system can be in equilibrium...

13. **chris** at 09:11 AM on 31 October, 2008

    "More or less in balance" isn't "a cop out". There's a pretty good understanding of the short term and medium term carbon cycle that dominates the carbon flux between the atmosphere and biosphere, and on longer periods, the atmosphere and terrestrial environment. So to answer your first question: ["How much out of balance does it have to be before you consider it not in equilibrium?"] if atmospheric CO2 levels haven't varied much more than about 20 ppm (maybe 30 ppm according to some plant stomatal index analyses) around 280 ppm for the last 10,000 years before the 20th century, one can conclude that the system has been more or less in balance. It's not "a cop out" to state the obvious. The flux of carbon into the atmosphere has been reasonably closely balanced by the flux out of the atmosphere for vast periods of time before the 20th century. And if one considers the 10 million years before the 20th century, the atmospheric CO2 seems to have been pretty much near equilibrium. So if one considers only the interglacial periods, the atmospheric CO2 was below or around 300 ppm during this entire period according to the proxy record: e.g. Pearson, PN and Palmer, MR (2000) "Atmospheric carbon dioxide concentrations over the past 60 million years" Nature 406, 695-699. M. Pagani et al. (2005) "Marked Decline in Atmospheric Carbon Dioxide Concentrations During the Paleogene", Science 309, 600 – 603. T. K. Lowenstein and R. V. Demicco (2006) "Elevated Eocene Atmospheric CO2 and Its Subsequent Decline" Science 313, 1928. R. M. DeConto et al (2008) "Thresholds for Cenozoic bipolar glaciation" Nature 455, 652-656 Note that it's worth distinguishing the interglacial and glacial periods here, since the shift of atmospheric CO2 down to around 170-180 ppm during glacials is similarly part of the short term carbon cycle that relates to the distribution of carbon between the terrestrial biosphere, oceans and atmosphere. In this case it's the temperature-dependent element of the cycle and its response to very slow insolation variation (Milankovitch cycles). So we can talk about being "near equilibrium" or "more or less in balance" in quite explicit terms: (i) On the timescale of 1000-10,000 years, the relatively fixed amount of ACCESSIBLE carbon distributing between the atmosphere, oceans and biosphere has maintained an atmospheric CO2 concentration that has undergone relatively little variation (the overall variations during 1000's of years of the order of the changes now occurring in about a decade). (ii) on the timescale of 10 million years the longer term carbon cycle involving the sedimentation of carbon as carbonates in the deep oceans and the slow release of carbon from ocean plate subduction and volcanic activity has also been more or less in balance. The atmospheric CO2 record of the last 10 million years suppoorts that conclusion. (iii) On top of the equilibrium carbon distributions of the carbon cycle on the millions of years timescale, insolation variations (Milankovitch cycles) cause very slow requilibration of CO2 between the atmosphere and ocean/terrestrial environments. Now something quite different is happening. A massive store of excess carbon inaccessible to the carbon cycle for many 10's of millions of years is being rapidly reintroduced into the system in an extraordinarily short time period. Not surprisingly the atmospheric CO2 concentration is rising very rapidly indeed. The atmospheric CO2 concentration is out of equilibrium (there's a large nett flux into the atmosphere from previously long-sequestered sources), and the atmospheric CO2 concentration is being driven up towards some new equilibrium concentration. And the above also address your second question: ["How does all that CO2 locked up as carbonate sediment compare to the oil/gas/coal deposits?"] That's not quite a relevant question. Considering carbonate sediments and their formation, the long term paleoCO2 record of the last 10 million years or so indicates that carbonate sedimentation has been pretty much in balance with the return of CO2 from subducted carbonate back through volcanoes into the atmosphere. ...where the "out of balance" element has arisen is the awesomely rapid oxidation and return to the atmosphere of massive stores of carbon previously sequestered out of the short and medium carbon cycles for 10's and 100's of millions of years. Note that dynamic systems CAN be in equilibrium. In general they fluctuate around equilibrium states. Of course one can raise semantic issues about the extent to which a particular fluctuation constitutes a departure from equilibrium. But it's quite easy to be explicit and define exactly what one means by the particular equilibrium in question.

14. **Mizimi** at 05:09 AM on 19 November, 2008

    Dynamic: Characterized by continuous change, activity, or progress: a state of non-equilibrium. Equilibrium: . A condition in which all acting influences are canceled by others, resulting in a stable, balanced, or unchanging system. 'Dynamic equilibrium' is thus an oxymoron. Climate is a dynamic system and fluctuates,(sometimes quite severely as history shows)and for man's purposes we would like those fluctuations to be constrained within certain limits. To my knowledge, nobody has defined what those limits should be. (??) Neither do we have the ability to alter in any meaningful and expiditious way the major active components in the system without causing ourselves serious economic problems
    it will be interesting to see what effect the current global economic crisis has on fossil fuel consumption, CO2 concentrations and GMT.

15. **chris** at 09:20 AM on 21 November, 2008

    Not really Mizimi, Let's not get confused by semantics! Playing with words doesn't change reality. A thermostat is effectively a "dynamic equilibrium". Have a think about how a thermostat works to maintain the temperature in a room at an equilibrium temperature.

16. **Mizimi** at 04:34 AM on 27 November, 2008

    A thermostat 'cycles' around a predetermined temp within defined limits; design

2C. This curve can be limited by the use of predictive electronics, but not completely negated. Electronic and compressed air temperature controllers modulate continuously as the detected temp fluctuates and provide closer control, BUT still show a sinusoidal fluctuation around the set point even though much lower than a conventional thermostat (industrial standards of around 0.5C). There is no equilibrium. Semantics is about the meaning of words; once you start to misuse words then communication is degraded. Better to invent a new word than to misuse an existing one..and science is historically pretty good at inventing new ones.

17. **chris** at 09:17 AM on 3 December, 2008

    Not really Mizimi... Our understanding of the natural world is not defined by one individual's ignorance! If you don't know very much about a topic why not make an effort to inform yourself befoe sounding off? Try googling "dynamic equilibrium". Far from being an "oxymoron" it's a fundamental descriptor of phenomena that involve the summation of a number of (opposing) processes whose net effect constitutes a balance to an extent that is further definable by the amplitude of variation around the equilibrium position. When applied to reversible chemical reactions the variation around the equilibrium (concentration of reactants and products, for example) can be small small. When applied to Earth processes it can be somewhat larger .....it would be foolish to "invent a new word" for such a well-characterized phenomenon as "dynamic equilibrium". The temperature in a room that results from the opposing forces of heat loss and heat input controlled by a thermostat is an example of a "dynamic equilibrium". If one needed further description of the nature of the fluctuations around the equilibrium one could explore/measure these. Likewise with the Earth's atmopheric CO2 concentration. For millions of years the earth's atmospheric CO2 concentration has been in dynamic equilibrium between the forces of volcanic influx into the atmosphere and the efflux from weathering and carbonate "fixing" (supplemented during the last couple of million of years with glacial cycles that temporarily perturb the equilibrium CO2 concentration downwards during glacial periods). In other worlds, since the atmospheric CO2 concentrations haven't varied very much during this period as far as we can tell (apart from the ice age excursions), the evidence indicates that the atmospheric CO2 levels have been in "dynamic equilibrium" (until recently, when they've started progressing upwards at a very very fast rate). Incidentally your misinformed request for semantic rigour on the subject of equilibria is rather out of keeping with your craven acceptance of the most ludicrous and blatant tosh on plaeotemperature data or pre-present atmospheric CO2 data, and so on. You need to come to some decision about where your "standards" lie science/evidence-wise, and then apply these across the board!

18. **Mizimi** at 05:54 AM on 9 December, 2008

    "Likewise with the Earth's atmopheric CO2 concentration. For millions of years the earth's atmospheric CO2 concentration has been in dynamic equilibrium
    " So what is the 'equilibrium position' of CO2 over these millions of years? 200ppm? 1500ppm? 4000ppm?

19. **chris** at 06:27 AM on 13 December, 2008

    It hasn't been far-off 300 ppm (generally a bit lower)for millions of years (around 20 million years), apart from the glacial periods of the past few million years when atmospheric CO2 dropped towards 180 ppm. That's what the evidence indicates. see papers cited in post #13 above...

20. **Mizimi** at 04:34 AM on 18 December, 2008

    The paleo temp record at http://www.climateaudit.org/?p=835 indicates SST's ranging over 5C for the past 1.3 million years during which time the CO2 level has been 'more or less' around 300ppm. Air temps would have ranged even further. How do we reconcile this?

21. **chris** at 09:52 AM on 18 December, 2008

    come on Mizimi, pay attention... My post #19 was very short and easily readable. Surely you can't have missed the phrase: "
    apart from the glacial periods of the past few million years when atmospheric CO2 dropped towards 180 ppm." btw I made a tiny typo in post #19. "(around 20 million years)" should have read "(around 10 million years)" consistent with my post #13

22. **Patriot Vet** at 04:55 AM on 24 January, 2009

    chris, You say: "And if one considers the 10 million years before the 20th century, the atmospheric CO2 seems to have been pretty much near equilibrium." It appears that you are not up to date on the IPCC science. It has been higher in the past couple of million years. Chapter 6 Palaeoclimate http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter6.pdf "6.3.1 What is the Relationship Between Carbon Dioxide and Temperature in this Time Period? Pre-Quaternary climates prior to 2.6 Ma (e.g., Figure 6.1)were mostly warmer than today and associated with higher CO2 levels." http://www.ipcc.ch/graphics/graphics/ar4-wg1/jpg/fig-6-1.jpg It seems as though you have your facts wrong.

23. **Patriot Vet** at 06:14 AM on 24 January, 2009

    chris, You say: "And if one considers the 10 million years before the 20th century, the atmospheric CO2 seems to have been pretty much near equilibrium." It appears that you are not up to date on the IPCC science. It has been higher in the past couple of million years. Chapter 6 Palaeoclimate http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter6.pdf "6.3.1 What is the Relationship Between Carbon Dioxide and Temperature in this Time Period? Pre-Quaternary climates prior to 2.6 Ma (e.g., Figure 6.1)were mostly warmer than today and associated with higher CO2 levels." http://www.ipcc.ch/graphics/graphics/ar4-wg1/jpg/fig-6-1.jpg It seems as though you have your facts wrong.

24. **GMB** at 07:27 AM on 6 May, 2009

    "As for human CO2 emissions, about 40% is being absorbed, mostly by the oceans. The rest remains in the atmosphere. As a consequence, atmospheric CO2 is at its highest level over the past 800,000 years (Brook 2008). A natural change of 100ppm takes 5,000 to 20,000 years. The recent increase of 100ppm has taken just 120 years." Hang on a minute. Where are you getting THAT from? How are you assuming that? I've never found a CO2 proxy record that comprehensive? If we had such a record we could bring this racket to a close with a bit of luck. What are you going on for that hyper-confident statement? Is it the ice-cores? Or is it just some bogus model that someone plugged into the computer. Obviously if humans have contributed to higher levels thats a good thing. THAT is what the science says. And it doesn't say anything else.

25. **GMB** at 07:30 AM on 6 May, 2009

    We don't want the ocean to absorb all the CO2. If the oceans absorb it all the rest of the biosphere cannot get the benefit out of it. It would be a great tragedy if the oceans were just absorbing it all. But the good news is as you say. The oceans are only absorbing some of the excess. Thats good luck. Only a complete retard would say otherwise.

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