NATURE'S NEW THEORY OF CLIMATE CHANGE

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I submitted a Brief Communication to *Nature* on 15th June 2009, pointing out that its issue of 30 April 2009, with no fewer than nine articles claiming that it is not the atmospheric concentration of carbon dioxide (i.e. [CO_2]) that is responsible for rising global mean temperature (GMT), as asserted by the IPCC, but the total cumulative volume of anthropogenic emissions of CO_2. I pointed out that this approach implied there are and have been no net uptakes of CO_2 by the global biospheres, both oceanic and terrestrial.

My rejection note from *Nature's* Michael White stated the articles had "implicitly" taken such net absorptions into account. In a second Brief Communication I responded as follows showing this not to be the case, but with the same result, rejection by Dr White (8th July 2009).

IMPLICIT ACCOUNTING OF CARBON UPTAKE

Nature's leading article "Time to Act" (30 April 2009)[8] supports the claim in Meinshausen *et al.*[1] that it is total cumulative or annual emissions that determine climate change, not the atmospheric concentration that emerges after taking into account net uptakes of carbon: "The 500 billion tonnes of carbon that humans have added to the atmosphere lie heavily on the world, and the burden swells by at least 9 billion tonnes a year (sic)" (p.1077), even though the actual increase in the atmospheric concentration of CO_2 (i.e. [CO_2]) recorded at Mauna Loa between May 2008 and May 2009 was only 1.68 parts per million by volume (ppm), equivalent to 3.56 billion tonnes of carbon (GtC), while the total increase in the atmospheric concentration since the pre-industrial era is only from 280 ppm to 390 ppm (May 2009). That 110 ppm equates to 233.2 GtC, somewhat less than the 500 GtC from which *Nature* claims it has "implicitly" subtracted the "net carbon uptakes".

This claim is in *Nature's* associate editor's (Michael White) comment to this author (pers. comm.), "the models used [by Meinshausen *et al.* and Allen *et al.* in *Nature* 30 April 2009] are in fact designed to represent the behaviour of more complex coupled models, which include a consideration of the full carbon cycle. Thus, the net uptake of carbon is implicitly simulated". So "implicit" accounting for net carbon uptakes apparently *raises* the actual net increase in CO_2 at Mauna Loa from 3.56 GtC since May 2008 to *Nature's* "at least 9 GtC a year"[6]. Or does White believe that net carbon uptakes are in fact zero or even negative as postulated by Allen *et al.*[2]?

It is true that in the Supporting Information (SI) to Allen *et al.*[2], various models are mentioned that do refer to the full carbon cycle, but only in a tendentious fashion.

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The projections of the net carbon uptakes in *all* models relied on by the IPCC's Solomon *et al*.[3] assume that the proportion of emissions taken up by oceanic and terrestrial sinks declines either monotonically (Bern) or asymptotically (MAGICC *et al*.). Allen *et al*. use the latter assumption (first introduced by Wigley)[4] and although it has never been validated empirically, it asserts that beyond a certain level of atmospheric concentration of CO_2 (or emissions), no further increase in net uptake of carbon will be possible, as the sinks will be "saturated"[4].

Allen *et al* state *explicitly* (SI, p.6) "the terrestrial carbon cycle model has both vegetation and soil components stores. The vegetation carbon content is a balance between global average net primary productivity (NPP) (*parameterized as a function of atmospheric carbon dioxide, which asymptotes to a maximum value* multiplied by a quadratic function of temperature rise in order to represent the effect of climate change) and vegetation carbon turnover" (my italics). Thus the Allen paper *explicitly* assumes that net carbon uptakes become first zero and then negative as allegedly "climate change" *reduces* NPP. Amongst other questionable features, this asymptotic assumption implies that after saturation, it will never again be possible either to plant new land to high yielding crops or to develop and grow new higher yielding crops with their automatic increased photosynthetic uptake of CO_2.

The asymptotic assumption conveniently generates projections that future emissions will result in more than doubling the observed rate of growth of $[CO_2]$ of 0.41% p.a. between 1958 and 2008 to 1% p.a. between 2000 and 2050 (e.g. ref.(1), p.1158).

Meinshausen *et al*.[1] state "limiting *cumulative CO_2 emissions* over 2000–50 to 1,000 Gt CO_2 yields a 25% probability of warming exceeding 2°C and a limit of 1,440 Gt CO_2 yields a 50% probability (my italics)". These authors do not explain why when cumulative emissions over the period 1958 to 2008 were actually 25% larger than their benchmark, at 1,253 Gt CO_2, for an observed warming of only 0.46°C over that period, a lower cumulative increase in emissions from 2000–50 than in 1958–2008 has 25% probability of raising warming by over 4 times more. Their paper's Fig. 2 also relates temperature changes only to total cumulative emissions and therefore *explicitly* makes no allowance for the net carbon uptakes that will reduce the impact of their emissions scenarios on the future level of the atmospheric concentration of CO_2 (i.e.$[CO_2]$). Allen *et al*.[2] concur: "We find that the peak warming caused by a given cumulative carbon dioxide emission is better constrained than the warming response to a stabilization scenario".

The underlying issue raised here has very serious implications for the emission reduction policies just adopted by the USA's House of Representatives (26 June 2009) which seeks to enact (if the Senate concurs) that the USA's emissions will be reduced by 88% from the 2005 level by 2050. If emulated and applied globally, this implies that by 2050 global emissions (mainly from burning fossil fuels) will be reduced to 1.16 GtC (including reductions in land use change), far below the global biospheric net uptakes of carbon, at 4.3 GtC in 2005, an El Niño year, and 6 GtC in 2006 (La Niña)[7].

Ironically, and contrary to the apparent beliefs of both *Nature* and the US Congress, there is an alternative to reducing total emissions below the current level of natural net uptakes of carbon, and that is to raise the net carbon uptakes (which have averaged

57% of total emissions since 1958[5], of which the terrestrial component rose from an average of 1.24 GtC in 1960 to 1969 to 2.32 GtC in 1998–2007) to say 80% of the ongoing rising level of emissions. That would imply raising food availability across the globe, a demonstrably more cost-effective solution than the geo-engineering solutions, like creating stratospheric sunshades, that Nature favours[8]. Why are *Nature*, its authors, and the US Congress opposed to this possibility?

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2. Allen, M.R., Frame, D.J., Huntingford, C., Jones, C.D. Lowe, D.A., Meinshausen, M. & Meinshausen, N. Warming caused by cumulative carbon emissions towards the trillionth tonne. *Nature*, vol. 458, 30 April 2009, doi:10.1038, 1163–1166 (2009).
3. Solomon, S. *et al*. (eds). *IPCC Climate Change 2007: The physical science basis*. (CUP, 2007)
4. Wigley, T.M.L. Balancing the carbon budget. *Tellus,* 45B, 409–425. (1993).
5. Canadell J.G., C. Le Quéré, M.R. Raupach, C.B. Field, E.T. Buitenhuis, P.Ciais, T.J. Conway, N.P. Gillett, R.A. Houghton, G.Marland. Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks. *PNAS,* 104.47, 18866–18870. (2007).
6. NOAA, http://www.esrl.noaa.gov/gmd/ccgg/trends/ (2009).
7. NOAA, www.ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/ (2009).
8. "A world slightly shaded from the Sun while its carbon levels are brought down by means of active capture would be a strangely unnatural place—but not necessarily a bad one, compared with the alternatives". *Nature*, vol. 458, 30 April 2009, doi:10.1038, 1077–1078 (2009).