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Climate Change

Posted by **Dr Roger A. Pielke, Sr.**

Filed under : Scitizen >> Earth & Environment >> Climate Change >> Scientific Errors With the IPCC Statement for Policymakers
Key words : climate change,

[OPINION] Scientific Errors With the IPCC Statement for Policymakers

9 Mar, 2007 10:52 am

The 2007 IPCC Statement for Policymakers (SPM) was released in early Febuary with extensive media attention. However, what has not been discussed are the errors and selective use of data in the presentation of this Report. Policymakers are being mislead in terms of the actual scientific community understanding of climate science. Examples of the errors in the IPCC SPM are discussed in this column.

As reported in Climate Science there are major errors and selective use of climate monitoring data in the IPCC 2007 IPCC Statement for Policymakers. The first weblog is entitled

Several Science Errors (Or, At Best Cherrypicking) In the 2007 IPCC Statement For Policymakers and reads

In even an overview of the section in the 2007 IPCC Statement For Policymakers on "Direct Observations of Recent Climate Change" there are errors, or at best selective information, in their findings. I am summarizing four on this weblog:

1. The IPCC SPM writes on page 7

"… snow cover have declined on average in both hemispheres."

The Rutgers University Global Snow Lab Northern Hemisphere Snow Cover Anomalies plot through January 2007, however, shows that the areal coverage in the Northern Hemisphere has actually slightly increased since the later 1980s!

Since the inference from the IPCC SPM is that global warming is the reason for these changes, this is at best a clear example of selecting a time period that conforms to their conclusion rather than presenting an up-to-date description of snow cover trends.

2. The IPCC SPM writes on page 7

"Observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been absorbing more than 80% of the heat added to the climate system."

It is correct that the ocean is where most of the heat changes occur, but the finding conveniently neglected to report on the significant loss of heat in the period from 2003 to at least 2005;

Lyman, J. M., J. K. Willis, and G. C. Johnson (2006), Recent cooling of the upper ocean, Geophys. Res. Lett., 33, L18604, doi:10.1029/2006GL027033.

As stated in that paper,

"The decrease represents a substantial loss of heat over a 2-year period, amounting to about one fifth of the long-term upper-ocean heat gain between 1955 and 2003 reported by Levitus et al. [2005]."

In addition, even with the earlier ocean warming, this is what was found in the paper

Willis, J. K., D. Roemmich, and B. Cornuelle (2004), Interannual variability in upper ocean heat content, temperature, and thermosteric expansion on global scales, J. Geophys. Res., 109, C12036, doi:10.1029/2003JC002260.

" Maps of yearly heat content anomaly show patterns of warming commensurate with ENSO variability in the tropics, but also show that a large part of the trend in global, oceanic heat content is caused by regional warming at midlatitudes in the Southern Hemisphere. "

They report that,

"……a strong, fairly linear warming trend is visible in the Southern Hemisphere, centered on 40°S. This region accounts for a large portion of the warming in the global average."

Also,

"……..the warming around 40°S appears to be much steadier over the course of the time series, as seen in Figure 7. In addition, this warming extends deeper and is more uniform over the water column than the signal in the tropics. "

Thus the actual global ocean warming reported in the IPCC SPM over the last several decades occured

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in just a relatively limited portion of the oceans and through depth such that the heat was not as readily avaiable to the atmosphere as it would be if the warming was more spatially uniform.

Moreover, if the ocean has been absorbing “more than 80% of the heat added to the climate system”, why does the SPM use the surface air temperature trends to define what is a warm year? The IPCC SPM makes such a claim on page 5, where it is written that

“Eleven of the last twelve years (1995 -2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850).”

If the ocean absorbs most of the heat (which Climate Science agrees with), than that is the climate metric that should be reported on with respect to global warming, rather than the global average surface temperature trend data.

3. The IPCC SPM writes on page 7,

“The average atmospheric water vapour content has increased since at least the 1980s over land and ocean as well as in the upper troposphere. The increase is broadly consistent with the extra water vapour that warmer air can hold.”

This conclusion conflicts with the finding in

Smith, T. M., X. Yin, and A. Gruber (2006), **Variations in annual global precipitation (1979–2004), based on the Global Precipitation Climatology Project 2.5° analysis**, Geophys. Res. Lett., 33, L06705, doi:10.1029/2005GL025393,

where they write for the period 1979–2004 that precipitation tends

“have spatial variations with both positive and negative values, with a global-average near zero.”

The global average precipitation has not changed significantly in the period.

If greater amounts of water vapor were present in the atmosphere, the evaporation/transpiration of water vapor into the atmosphere and thus the precipitation would have to increase when averaged globally and over a long enough time period.

4. The IPCC SPM writes,

“Mid-latitude westerly winds have strengthened in both hemispheres since the 1960s.”

This is perhaps the most astonishing claim made in the report. First, peer reviewed papers that have investigated this subject,

Pielke, R.A. Sr., T.N. Chase, T.G.F. Kittel, J. Knaff, and J. Eastman, 2001: **Analysis of 200 mbar zonal wind for the period 1958-1997**. J. Geophys. Res., 106, D21, 27287-27290.

did find a

“….tendency for the 200 mbar winds to become somewhat stronger at higher latitudes since 1958.”

However, what this means from basic meteorology, is that if the mid-latitude westerlies increase, this indicates a greater north-south tropospheric temperature gradient! This is why the westerlies are stronger in the winter; the troposphere becomes very cold at the higher latitudes, but the tropospheric temperatures change little in the tropics. Thus a statement that the westerlies have become stronger, in the absence of significant warming in the tropical latitudes, indicates a colder troposphere at higher latitude on average.

There is, therefore, an inconsistency in the IPCC SPM. It cannot both be the case that the troposphere in the arctic is warming high while the westerlies in the midlatitudes are increasing in speed. There is a fundamental inconsistency in these trends, which goes unaddressed by the IPCC.

These four examples illustrate the apparent selection of papers and data to promote a particular conclusion on climate change. The science community, and even more importantly, the policy community is ill-served by such cherry picking.

A second weblog is entitled

An Error In The 2007 IPCC Statement For Policymakers On The 2005 Global-Average Radiative Forcing and reads

The 2007 **IPCC Statement for Policymakers** has a significant error that I have yet to see discussed.

The SPM reports on a “Total Net Anthropogenic” global average radiative forcing for 2005 of +1.6 [0.6 to 2.4] Watts per meter squared. When one converts the units, this means that the Earth’s climate system should be accumulating Joules at a rate of 2.61*10**22 Joules per year [0.98*10**22 Joules to 3.91*10*22 Joules per year] in 2005.

The data, however, show quite a different accumulation of Joules in recent years, and in 2005 in particular. We have often argued that the ocean data has been shown to be an effective way to diagnose the radiative imbalance (**see** and **see**). Jim Hansen, for example, has used the accumulation of heat in the upper oceans in the 1990s to bolster his claim of multi-decadal global climate prediction skill (**see**), where Jim Hansen wrote,

“The Willis et al. measured heat storage of 0.62 W/m2 refers to the decadal mean for the upper 750 m of the ocean. Our simulated 1993-2003 heat storage rate was 0.6 W/m2 in the upper 750 m of the ocean. The decadal mean planetary energy imbalance, 0.75 W/m2, includes heat storage in the deeper ocean

and energy used to melt ice and warm the air and land. 0.85 W/m2 is the imbalance at the end of the decade."

He further writes with respect to the radiative forcing record,

"As the record lengthens, the energy imbalance will provide an invaluable metric defining the task that humanity faces if it wishes to stabilize global climate."

Well the radiative forcing data record is now longer, and it presents quite a different perspective than a more-or-less monotonic increase in the global radiative forcings as claimed by Jim Hansen. As shown in

Lyman, J. M., J. K. Willis, and G. C. Johnson (2006), **Recent cooling of the upper ocean**, Geophys. Res. Lett., 33, L18604, doi:10.1029/2006GL027033.

"We observe a net loss of 3.2 (±1.1) × 10**22 J of heat from the upper ocean between 2003 and 2005. Using a broad array of in situ ocean measurements, we present annual estimates of global upper-ocean heat content anomaly from 1993 through 2005. Including the recent downturn, the average warming rate for the entire 13-year period is 0.33 ± 0.23 W/m2 (of the Earth's total surface area)…."

See their Figure 1 where the accumulation and loss of heat as measured in Joules for the period 1993 to mid-2005 is shown.

This loss of heat from the upper oceans is also consistent with little if any heating in the troposphere over the last several years (e.g. **see the last several years in Figure 7** where the trends in the global average tropospheric and stratospheric temperatures are essentially zero). Even if the heat has been transported deeper into the ocean than the about 700m depth analyzed by Lyman et al, the radiative forcing that is available to alter the global average surface temperature trend is much less than reported in the 2007 IPCC SPM, and, indeed, for at least the period from 2003 to 2005 is a negative forcing! Thus, the data indicate a very different picture than presented by the IPCC.

The global average surface temperature trend in the 2007 SPM (see Figure SPM-3 top in **the IPCC SPM**) continues to show warming, but as has been summarized in

Pielke Sr., R.A., C. Davey, D. Niyogi, K. Hubbard, X. Lin, M. Cai, Y.-K. Lim, H. Li, J. Nielsen-Gammon, K. Gallo, R. Hale, R. Mahmood, S. Foster, J. Steinweg-Woods, R. Boyles, S. Fall, R.T. McNider, and P. Blanken, 2007: **Unresolved issues with the assessment of multi-decadal global land surface temperature trends**. J. Geophys. Res. in press,

there is a significant warm bias in the construction of a global average surface temperature trend.

What these observations mean is that the statement in the IPCC SPM that there is a positive radiative forcing of 1.6 [0.6 to 2.4] Watts per meter squared **in 2005** (when this was not true based on real data) is a particularly egregious error. Rather than relying solely on model based estimates to calculate a global radiative forcing, the authors of the IPCC Report should have also used real world data for the assessment of the net radiative forcing.

A claim that a time period of several years is too short to assess the radiative heating is spurious as long as the sampling of the ocean heat content is sufficiently dense. As discussed in

Pielke Sr., R.A., 2003: **Heat storage within the Earth system**. Bull. Amer. Meteor. Soc., 84, 331-335,

"A snapshot at any time documents the accumulated heat content and its change since the last assessment. Unlike temperature, at some specific level of the ocean, land, or the atmosphere, in which there is a time lag in its response to radiative forcing, there are no time lags associated with heat changes."

The IPCC finding that the total 2005 net anthropogenic radiative forcing has a best estimate of +1.6 Watts per meter squared and that the total 2005 net radiative forcing has a best estimate of +1.72 Watts per meter squared is inconsistent with the observed changes in upper ocean heat content. The omission of a discussion of the conflict between real world observations and the model estimates of radiative forcing is a serious error in the IPCC SPM.

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Preview

[1]I believe that this post is badly biased: the title itself is in error, since as the author admits his only real complaint is cherry picking (not that I agree with that, either).

I've written http://scienceblogs.com/stoat/2007/03/scientific_errors_with_the_ipc.php but to summarise:

- picking on snow since 1989 is cherry picking par excellence

- point 3 is simply wrong

I notice that you claim your articles are reviewed before publication. You appear to be asserting 4 reviewers for this article. Would you be so kind as to confirm that all 4 reviewers were contacted and were happy with this article, because I find that rather hard to believe
Comment by **William Connolley** - 10 Mar, 2007 10:21 pm

[2]William - Your comments below are not scientific rebuttals. If you disagree, an effective response would not be, for example, just that "point 3 is simply wrong".

In terms of the views that I present, there is wider acceptance than perhaps you realize.
Comment by **Roger A. Pielke Sr.** - 11 Mar, 2007 12:17 am

[3]I would like to point out that these supposed 'errors' are in fact nothing of the sort, as was pointed out very clearly to Roger on his own blog the first time that he made them:

http://climatesci.colorado.edu/2007/02/15/science-errors-or-at-best-cherrypicking-in-the-2007-ipcc-statement-for-policymakers/
and
http://climatesci.colorado.edu/2007/03/05/an-error-in-the-2007-ipcc-statement-for-policymakers-on-the-2005-global-average-radiative-forcing/

It is curious therefore that he should choose to repeat them verbatim.

I would also like to make clear that at no point did RealClimate or anyone associated with us review this posting and any impression that we did or that we endorse this comment in any way should be removed from this page.
Comment by **Gavin** - 11 Mar, 2007 06:15 am

[4]Gavin- As I replied to you on my weblog Climate Science this evening, your comments are constructive but not persuasive. Also, I have no idea where you obtained the idea that you or Real Climate are claimed to have had any prior review of the column.

Quite frankly, readers of Scitizen would benefit from you (and William) commenting specifically on the substance of each of the findings of errors in the IPCC SPM that are reported above, rather than on general comments.

I have replied in some detail to a comment by Issac Held on Climate Science (and these comments also relate to our earlier interchanges of comments on Climate Science), and I repeat it below [from http://climatesci.colorado.edu/2007/03/10/scitizen-column-published-entitled-scientific-errors-with-the-ipcc-statement-for-policymakers/#comment-150177];

Hi Issac - Thank you for your comment on Climate Science.

My comment on the error in the IPCC SPM is with respect to the claim that,

“The average atmospheric water vapour content has increased since at least the 1980s over land and ocean as well as in the upper troposphere. The increase is broadly consistent with the extra water vapour that warmer air can hold.”

As stated even by Overpeck and Trenberth, the precipitation averaged globally is expected to also increase (see comment #4 above).

I agree with you that the models (e.g. as you discussed in “An Assessment of Climate Feedbacks in Coupled Ocean–Atmosphere Models” by Soden and yourself) predict a constant relative humidity change in a warming world. However, these are model results with a simulated global warming.

However, where is the observation evidence for such a global average increase of the mass of water in the atmosphere in the last several decades (i.e. the real world evidence of this increase in the observed tropospheric data)?

If the reservoir (i.e. the atmospheric residence time of water vapor) increases for any reason, this will be evident in an increase in global average atmospheric water content (water vapor and clouds). I agree that for periods of time this certainly can occur. However, as your research indicates, this requires that the global precipitation efficiency progessively becomes less, but this cannot be sustained over a long time period.

The current ocean sea surface temperature anomaly (from a 1982-2001 average) is actually close to zero (it was about 0.4C in 2003 and has not changed significantly since than at least through mid 2006; from Figure 4.4 in the first CCSP report and from personal communication with Dick Reynolds. In 1990, the global average sea surface anomaly was about 0.2C.

Thus from the observations, we should not expect to see much of an increase in water content since the ocean surface warming has actually been quite modest. The finding that the global average precipitation is close to zero should be expected at present, and is in fact observed. The lack of a trend in the average precipitation is inconsistent with the finding in the IPCC SPM regarding a claim of an increase in water vapor content.

As a side comment, we are looking at a global analysis where sea surface temperatures are being weighted by an exponent of the temperature (i.e. using the Clausius-Clapeyron relationship with respect to temperature) to compute a global anomaly map which will be more informative on this issue than the SST anomalies by themselves.

With respect to data, we have analyzed the North American Regional Reanalysis for its period of record, and while we see regional variations over time, there is no long term trend in precipitable water. This research will be submitted soon for publication, and while it is not a global average, it does not support an increase in water vapor content over this region.

Finally, the models clearly do not have all of these effects properly modeled as shown, for example, in Danny Rosenfeld’s March 9 2007 paper in Science ["Inverse Relations Between Amounts of Air Pollution and Orographic Precipitation"].
Thus evaporation and precipitation are not determined just by the radiative energy fluxes, but also by a myriad of other influences such as the vertical temperature and humidity profiles, and the cloud condensation/ice nuclei concentrations.

The Climate Science conclusion that

“If greater amounts of water vapor were present in the atmosphere, the evaporation/transpiration of water vapor into the atmosphere and thus the precipitation would have to increase when averaged globally and over a long enough time period.”

must be true since you can not continue to accumulate water vapor in the atmosphere (i.e extend its residence time) indefinitely as a result of the variety of cloud/precipitation feedbacks. If you can falsify this hypothesis, please present observed tropospheric data that supports a contrary view. "

Comment by **Roger A. Pielke Sr.** - 11 Mar, 2007 07:09 am

[5]

Updated: 12 march 2pm
There is also a very succinct answer to the question. The issue is that P-E [where P is precipitation and E is evaporation] must be zero when averaged over a long time period (certainly on multi-year time scales). Thus if E

increases (such as due to a warmer sea surface), P must increase. There is no way that the input of water (E) can be larger than the output (P) over long time periods. If P is not increasing (as has been observed), then E must not be increasing either, which implies that the atmospheric amount of water vapor must be close to a constant when averaged over this time scale. The lack of evidence of an increase in total atmospheric water (unless you have evidence to the contrary) also supports the view of less of a change in the global average hydrologic cycle than indicated in the IPCC SPM.

Comment by **Roger A. Pielke Sr.** - 11 Mar, 2007 04:00 pm

[6]Just a thought, and I do have many a stray one, if oceanic temperatures have increased so as to increase average atmospheric water vapor, then that should be measureable and have a number of confluent results. First of those is planetary albedo as the increased amount of water vapor will have a dynamic impact on cloud formation and duration over time. If you are adding energy into the planetary system, increased evaporation will do that and will also increase the total volumetric flow of the entire hydrologic cycle. Globally a noticeable uptick in all precipitation, although local downticks will still happen, should be a plainly visible result. I have no idea if anyone has gone through the precipitation records on a global basis nor done a long-ranging planetary albedo study, because these are just stray ideas...

Another area of impact is the transport increase of streams and rivers on a global basis as higher precipitation and outwash will also increase sediment entrainment and transport. Here a major rivers study of leading river systems by climate zone and continent would do, and coring the deltas or other outwash areas to examine annual sediment amounts should be a relatively low cost analytical tool. Similarly land-locked water bodies should demonstrate this and here, again, a cross-section of climate and continent would be necessary to demonstrate impact. Of course that needs to be compared to man-made utilization of same, so the Aral Sea may not be a good indicator due to heavy agricultural use on incoming rivers.

Arctic varves would be a very good place to look on this as the clear annual deposit typification will clearly show an increase in sediment, a change in sediment type and give some idea as to evaporation rates in those climates. Speaking of which, those varves would also do for getting an idea of season length, plant growth and such, so an annual spore analysis would indicate if new plant types were showing up due to climactic change.

Finally if evaporation is increasing, then the global oceanic isotope mix in the oceans would be influenced as lighter isotopes of various elements, with oxygen being the leading one, would change that balance with heavier isotopes increasing in the ocean basins over time as lighter isotopes would be evaporated preferentially due to global warming. Again that would be reflected in stream and river runoff, so an over-time analysis would demonstrate a shift in balance to lighter isotopes of oxygen in water on a terrestrial basis and heavier isotopes in the oceanic basins.

That is how the overall global system would be impacted and is a key over-time test to do actual global temperature analysis via carbonate deposits. That said the question is if global rising temperatures are causing increased oceanic temperatures so it is a lagging indicator, not a leading one and the data needs cross-comparison to historical data during other inter-glacial periods. These periods are highly meta-stable as systems go and have this tendancy to swing between a range of relative highs before something finally moves the planet back into a cold spell. This entire glaciation set-up only started after the KT extinction and the multiple factors of that, including large continent break-up and the draining of shallow inland sea basins due to increased continental drift speed, point to the lack of large shallow bodies of water as a global cliimate moderator. Once those were removed, average global temperature dropped and we started to see the current arrangement of long glacial periods with short, meta-stable interglacial periods. That much larger system of increased volcanic activity, the continental plates increasing in eleveation due to lower density with regards to the denser oceanic plates, orogeny changing multiple levels of atmospheric wind patterns and antarctica moving into the south polar region and being lost as a part of the thermal retention system, all point to larger factors influencing global temperatures. Any climate model that cannot address these factors to accurately give long-term climate outcomes and how they change as these factors change has very little chance of telling us what is going on now in an era of meta-stable climates.

Somehow a billion years or so of global climates and the factors changing them have gotten lost in the shuffle and by the oversampling of modern times. If we cannot address the long term system and the data that goes with it, then we are not addressing how the planetary climate changes over time based on those long term factors nor able to isolate key factors in those long term changes. And as the climates and climate changes over the last billion years have a decent average catalog and understanding, that entire knowledgebase should start to show what those drivers are and why they are important. One would think it would be a good thing to find those first and their overall scale in comparison to each other before arguing what their relative weight is *now* and why they are important. If you can't understand what the drivers have been for a billion years or so of life on this planet, then asserting anything in the absence of that data is mere assertion, no matter how many measurements you have. By not addressing scale of importance the actual importance of readings themselves is not being addressed. That is what science as a process teaches us: if we can't define what it is we are measuring then we are taking readings. We have lots of readings. No one wants to address the long term process and the readings that *it* has beyond the period of industrialization. If we cannot process and define what has been the major factors for climatological change over Earth's history, then our chances of isolating the impact of mankind are nil.
Comment by **ajacksonian** - 12 Mar, 2007 02:48 am

[7]RE #6: Comment by ajacksonian - 12 Mar, 2007; said: “If we cannot process and define what has been the major factors for climatological change over Earth's history, then our chances of isolating the impact of mankind are nil.”, my primary concern is that science is unable or unwilling to define the term CLIMATE in the first place. What is climate science worth if it cannot define what they are talking about? In so far it does not matter very much, whether the “2007 IPCC Statement for Policymakers (SPM)” is ‘selective’ or has ‘errors’. The lack of a reliable term ‘climate’ is a complain for a long time as the following excerpt from 1994 demonstrates (FN 1):
What is Climate?
A simple definition of climate (FN2) is average weather (FN 3). Surprisingly, the Convention on Climate Change (FN 4) has no definition of the term climate at all, but defines "climate change" and "climate system." These terms contribute little to understanding the meaning of climate. The definition of "climate change"(FN 5) is flawed in two ways. First, it states that "'climate change' means a change of climate" and, second, it compares two things that have nothing in common: atmospheric pollution by humans and statistical weather records. (FN 6) The definition of "climate system" (FN 7) is also nonsensical as its meaning boils down to "interactions of the natural system." (FN 8) Climate is a matter of water (in the air, ice, soil, and ocean) and its thermal efficiency and heat contribution. The factors related to quantity, aggregate, and temperatures of water are the most influential ones. In every respect the sea governs the global natural commons. Thus, climate is the blueprint of the oceans (FN 9), or as the speaker before me, Dr. Hans-Jurgen Krock, put it: The ocean is the principal actor in the global climate and weather drama. (FN 10) A simple definition could therefore be:

Climate is the continuation of the oceans by other means. (FN 11)

The oceans run the global climate system, while the continents do little more than slow down "climatic dynamics." Land areas, in particular if dry, are anti-climate. A simple demonstration is the well known sea wind emerging only a few hours after sunset. Correspondingly, the oceans could have kept the climate and temperature stable after Krakatoa erupted in 1883 and reduced average global sun radiation by 10 percent over 3 years. (FN 12) The basic factors for the development of the global climate are sketched in the sea on a time scale ranging from a few seconds to many hundreds of years. Thus, the oceans are like a magnifying glass for long-term tendencies.

FN 1: Extract from: “Ocean Governance: Strategies and Approaches for the 21st Century”, Conference paper, Honolulu/Hawaii, 1994 (FN 2); The full essay on at: http://www.oceanclimate.de/English/Sea_Law_1994.pdf , or http://www.oceanclimate.de
FN: 2: Actually, to Kenneth Marc, climate is a layman's word not used professionally until recently. Cf. Kenneth F. Hare, The Vaulting of Intellectual Barriers: The Madison Thrust in Climatology," Bulletin American Met. Society, 60 (1979): 1171-1174, and H.H. Lamb, The New Look of Climatology," Nature, 223 (1969): 1209-1215.
FN: 3; J.T. Houghton, GJ. Jenkins, and JJ. Ephraums, (cds.), Climate Change - VieIPCC Scientific Assessment (Cambridge: Cambridge University Press, 1990), p. xxxv (hereafter

cited as Houghton, Climate Change}.. According to W. Scherer ct al., "Approach to GOOS," WMO Bulletin, climate may also be defined as: "the synthesis of weather conditions in a given area, characterized by long-term statistics (such as mean values, variances of the variables of the state of the atmosphere in the area." Cf. for further climate definitions: Landolt-Bornstein, Meteorology/Climatology, Vol.4, subvol.c, (Berlin: 1987): 1-5.
FN: 4; United Nations Framework Convention on Climate Change, May 9, 1992 (UN Doc. A/AC 237/18 (Part It) Add.l), (hereafter cited as UN Framework); in 311.L.M. 849; in Robinson, (ed.), Agenda 21 & UNCED, Vol.3, pp. 1685-1713.
FN: 5; Ibid., Article 1, para. 2: "Climate change" means a change of climate, which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
FN: 6; The background of the "new" climate change definition follows the first World Climate Conference 1979 definition of climate change as "the difference between long term mean values of a climatic parameter or statistic, where the means is taken over a specified interval of time, usually a number of decades," see W. John Maunder, Dictionary of Global Climate Change (London: Chapman & Hall, 1992), p. 34. Now "one long term mean value" was replaced by "a human activity that alters the atmosphere." While the 1979 definition was clear but useless, the 1992 definition is nonsensical and ridiculous.
FN: 7; Article 1, para. 3 of the UN Framework Convention on Climate Change, "Climate system" means the totality of the atmosphere, hydrosphere, biosphere, and geosphere, and their interactions.
FN: 8; A. Bernaerts, "Climate Change," Nature 360 (1992): 292. A. Bernaerts, "Warming up-Science or Climate," in L.O.S. Lieder, Vol-5, No.5., Honolulu 1993, p. 6. http://www.oceanclimate.de/English/LOS_1993.pdf
FN: 9; Ibid.
FN: 10; Cf. Victor D. Phillips, ct al., "Oceans - A Global Thermostat," Sea Technology, (September 1992): 29-35. R.W. Stewart, The Role of the Oceans in Climate and Climate Change," in K. Takeuchi and M. Yoshino, The Global Environment, (Berlin: Springer-Verlag, 1991), pp.118-126.

FN: 11; A. Bernaerts, "Climate Change," Nature 360 (1992): 292. http://www.oceanclimate.de/English/Nature_Letter_1992.pdf
FN: 12; A. Bernaerts, "Voraussetzungen fur den globalen Klimaschutz aus der Sicht eines Nautikers und Juristen," Heft 4, Freunde und Forderer dcs GKSS-Forschungszentrums e.V. (1992): 1-42. in English: http://www.oceanclimate.de/English/Climate_GKSS_1992.pdf

Comment by **Adrianne** - 12 Mar, 2007 11:40 am

[8]With 165 comments in two days, the rush to web-log REALCLIMATE on the recent Channel 4, subject: "Swindle" (Reporting on climate), shows that the previous comments No. 6 and No. 7 rightly demand to come up with clear terms, to prevent such chaotic debate as one can see on REALCLIMATE. Good terms would presumably have also prevented disagreement between the topic: "Scientific Errors With the IPCC Statement for Policymakers" and Comment (1) by William Connolley. An accumulation of weather data is a statistical means and remains statistics regardless how they are named, and how useful they might be in one or the other case. Why do we not listen to such statesman as the British Prime Minister S. Disraeli (1804-1881): There are lies, dammed lies, and then there are statistics. Statistics are an important tool, but CLIMATE defined as statistics is nonsense and prevents a reasonable debate.
Comment by DonGri - 12 Mar, 2007 03:55 pm

[9]In response to a series of e-mails on Climate Science [http://climatesci.colorado.edu/] with Issac Held, the bottom line conclusion is that my comment on the IPCC SPM text with respect to the statement

"The average atmospheric water vapour content has increased since at least the 1980s over land and ocean …..",

remains, as this is inconsistent with the global average precipitation trend data; i.e.

"If greater amounts of water vapor were present in the atmosphere, the evaporation/transpiration of water vapor into the atmosphere and thus the precipitation would have to increase when averaged globally and over a long enough time period."

We agree that the troposphere will increase its water vapor content as a result of warmer sea surface temperatures, which results from larger evaporative fluxes from the surface. Your research, and that of others, is quite definitive on this.

However, despite your discussion (and others) that the strength of the atmospheric circulation must weaken as the climate warms, or, alternatively, that the mean residence time of water vapor in the atmosphere is increasing with increasing temperature, the use of this argument to claim that precipitation will not be equal to evaporation over long average times cannot be correct.

To illustrate why, assume that on the GLOBAL scale the evaporation increases by delta E due to an increase of the sea surface temperature. This value of delta E transfers an additional mass of water vapor into the atmosphere in kilograms than occurred before the warming. With the warmer troposphere, the kilograms of water in the atmosphere will also increase (this is the larger volume that you refer to).

As long as the additional kilograms of water in the atmosphere equal that added by the evaporation, precipitation would not change from its value prior to the surface warming.

When the kilograms of water added to the atmosphere are less than the input of water vapor from the surface, however, the excess MUST fall as precipitation. Where else would it go?

My question to you is whether you have computed on the GLOBAL scale the mass of water vapor input from the surface per year, the mass change of water in the atmosphere per year, and the precipitation per year. This simple diagnostic would address the specific question that you and I are debating.

With respect to your paper, Figure 1 presents a tropical-mean column integrated water vapor anomaly estimate. For the period since about 2002, the anomaly is flat. This means for this region of the troposphere that there was no further accumulation of water. The evaporation from the surface either fell as precipitation or was transported to higher latitudes, but there was no net addition of water to the atmosphere in the latitude band from 30N and 30S during this time period. Clearly, the 1998/99 time period had the largest anomaly, but this excess water was lost in 2000 to this latitude band by precipitation and/or export to higher latitudes.

I hope this comment clarifies the issue. The computation of the mass budget GLOBALLY from your models of the input, storage and output of water from the atmosphere in units of kilograms would be quite informative in resolving this.

Comment by **Roger A. Pielke SR.** - 12 Mar, 2007 04:01 pm

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