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22 July 2009, 13:30

Warming earth



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Inherent in any attempt at challenging published scientific theories is the need to conduct research, or advance discussions, submitted to the peer-reviewed scientific literature: the core of the scientific process allowing discrimination between credible scientific work and ambit claims.

While many papers do not succeed to be accepted, serious scientists proceed with further research which, when found consistent with measured data and with basic physical and chemical principles, constitutes a contribution in the respective discipline.

Not so the so-called "climate change sceptics" who, rather than follow scientific procedures, mostly publish in politically friendly media channels.

"Climate change sceptics" scan the field for real or imagined, major or minor errors, inferring such errors undermine major databases, theories, or even an entire branch of science.

A classic example of this approach is the eternal search for errors and gaps in Darwin's evolution theory by creationists, based on their belief in a supernatural creator.

In a similar vein "climate change sceptics" make the assumption climate change either is not occurring or, alternatively, is of a natural rather than anthropogenic origin, repeating long-discarded arguments indefinitely.

To explain their reluctance or inability to publish in the peer-review scientific literature the "sceptics" invoke a conspiracy theory on the part of journal editors, reviewers, climate research organisations, the IPCC, indeed of the entire scientific community.

Some specialise in ad-hominem expressions. The "sceptics" commonly use qualitative or semi-quantitative expressions, avoiding up-to-date data-based arguments.

In an article [A new trend in climate alarmism](#) David Evans claims "global cooling" from about 2003, implying errors in earlier measurements of ocean and land temperature, questioning the role of infrared absorption/emission resonance of well-mixed long-lasting greenhouse [gases](#) (CO₂, N₂O, O₃, CFC) [2] and the role of human emissions as triggers of climate change.

Below I indicate these arguments are incorrect.

(A) "Global Cooling": The article claims the earth has been cooling since 2003, overlooking the [role](#) of the ENSO cycle (El Nino Southern Oscillation) and of the 11-year sunspot cycle and aerosol albedo effects which are superposed on the overall warming trend since about 1975.

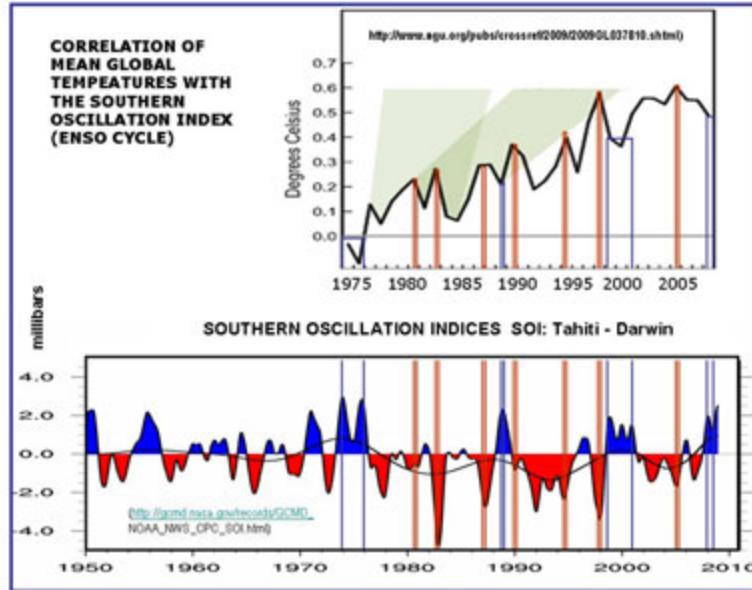


Figure 1 Correlation of mean global temperature changes from 1975-2008 with the ENSO cycle, showing close relationships between warm peaks and the El-Nino (red) and cool periods and the La-Nina (blue) within an overall global warming trend.

Prior to the mid-20th century the CO₂ greenhouse effect and enhanced solar radiation effects almost coincided, but from about 1975 the trends are decoupled.

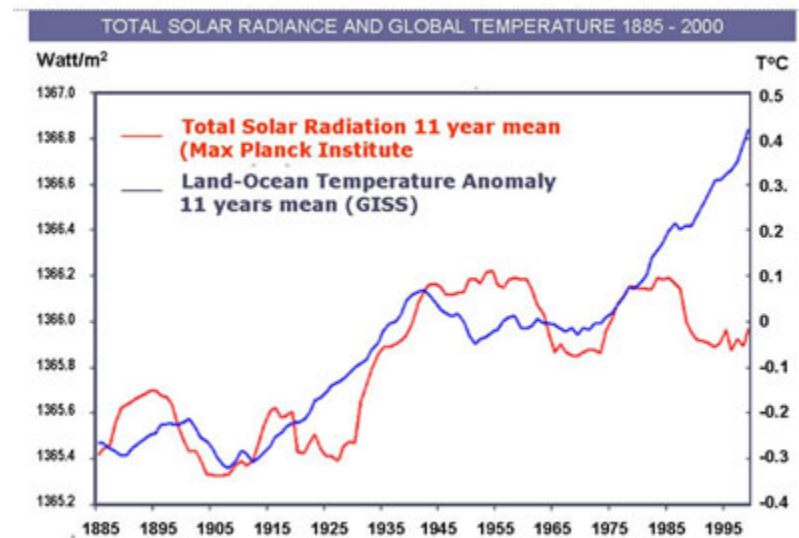


Figure 2 1885–2000 global land-Ocean temperatures (NASA/GISS) and total solar radiation (Max Planck Institute) [4]. Note the decoupling of the solar effect and the land-ocean temperature anomaly from about 1970-1975.

Solar effects continues to oscillates affecting about +/-0.1 degrees C [changes](#), whereas the greenhouse effects results in global temperature rise of near +0.5 degrees C. Additional warming by near-1.2 Watt/m² due to fossil fuel-emitted sulphur aerosols mask further committed [warming](#).

Further, yet unspecified, warming ensues from albedo loss due to ice melting and infrared absorption by exposed ice-free water, in particular the Arctic Sea ice. The 1998–2008 period (Figure 3) represents peak temperatures over the last two millennia (Figure 4) and since the early Holocene about [10,000 years ago](#).

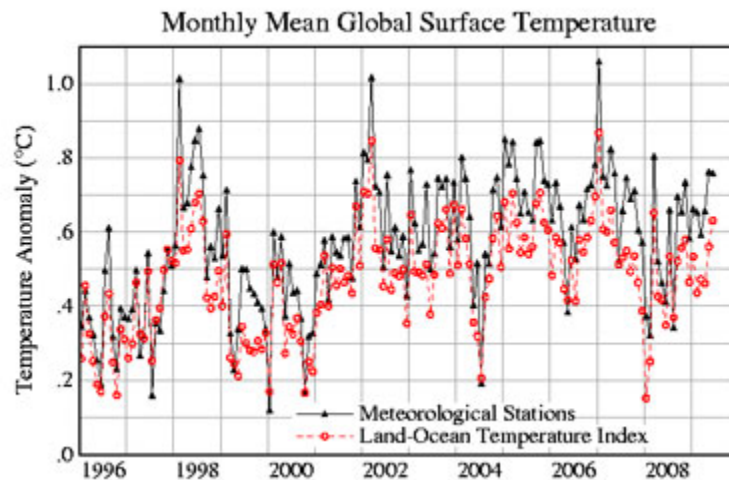


Figure 3 Mean global surface temperatures. Black line - meteorological stations; red dots – satellite land-ocean temperature index.

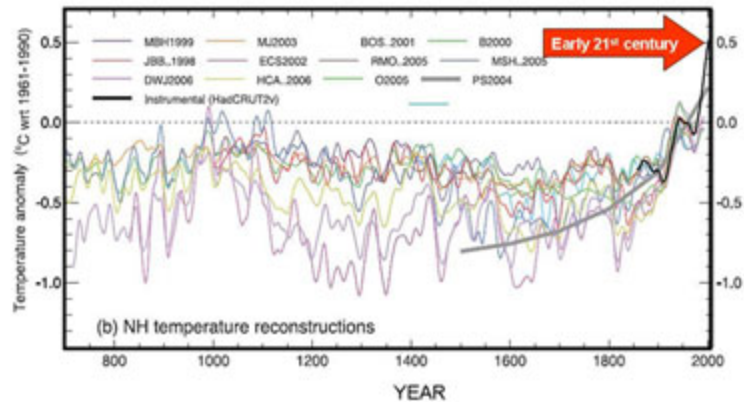


Figure 4 Mean global temperature reconstructions using multiple climate proxy records reported in the 3rd IPCC Assessment Report. The HadCRUT2v instrumental temperature record is in black.

(B) The Little Ice Age (LIA) and Medieval Warm Period (MWP). Climate change sceptics often refer to qualitative rather than quantitative observations, for example warm Greenland climate during the MWP. Evans's article claims: "once the effects of the little ice age have finally passed, the temperature will get back to where it was in the medieval warm period".

However, multiproxy-based paleo-temperature evidence for the Northern Hemisphere for 700–2000 AD (Figure 4) indicates MWP temperatures were lower than 2000 AD temperatures by at least 0.4 degrees C (Figure 4). The LIA (about 0.3 – 0.5 degrees C cooler than mid-20th century) correlates with low sunspot [activity](#).

(C) Validity of ocean temperature records. Evan's article claim's that ocean temperature measurements by XBT bathythermographs prior to 2003 (sunk to depth of up to 2000 [metres](#)), were less accurate than the current Argo network (sunk to depths of 1000 metres or more), dismissing pre-2003 ocean temperature data. However, this claim is refuted: As shown by the NOAA/AMOL [report](#) comparisons between ocean and satellite-based measurements of ocean heat storage to 400 metres (1997-2005) are in close agreement (correlation coefficient of 0.9; RMS difference of 0.04 1010 J/m²) (Figure 5).

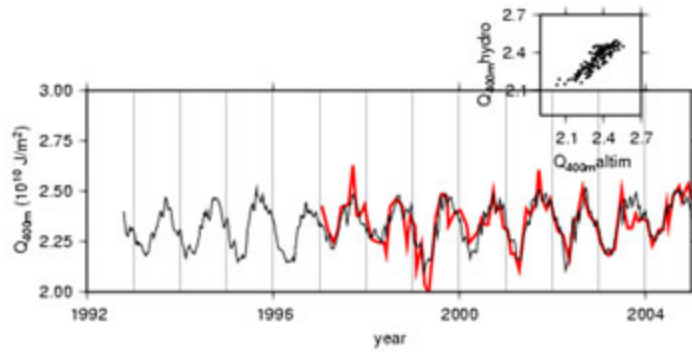


Figure 5 Comparison between in situ-based and satellite-based estimates of time series of heat storage in the upper 400 m of the ocean. In situ observations (red); satellite altimetry (black). 5° by 1.5° box centered at 27.5°W , 5.25°N . The correlation coefficient between the two time series is 0.9 and their rms [measurements](#) (Figures 3 and 6) and the global distribution of weather [station](#) (Figure 7).

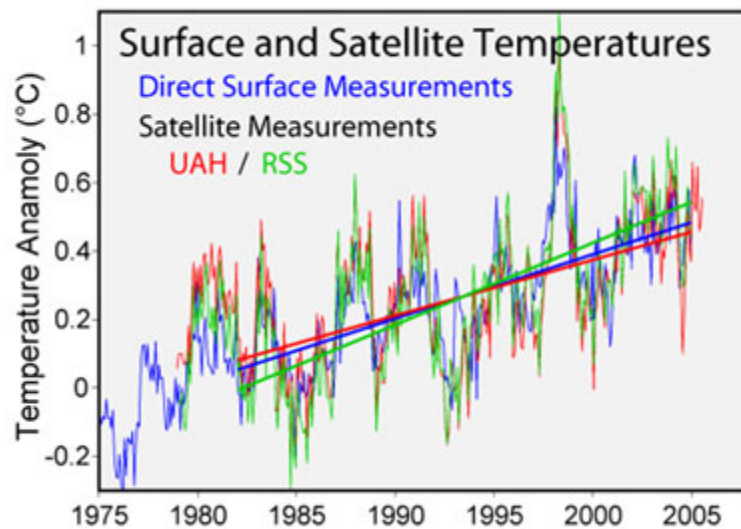


Figure 6 Comparison of 1982–2006 ground-based (blue) and satellite based (red) temperature measurements. UAH - University of Alabama. RSS - Remote Sensing Services [10]



Figure 7 Global distribution of weather stations.

(E) The carbon dioxide – temperature relationships. The article states "...there is no actual evidence that carbon dioxide was the main cause of recent warming — it's only an assumption, and the calculations of future temperature rises derive most of their warming from an assumed water vapor feedback".

Here the article denies the overwhelming evidence for cause and effect relationships between CO₂ and atmospheric temperatures, demonstrated by numerous experimental [studies](#) and paleoclimate [observations](#).

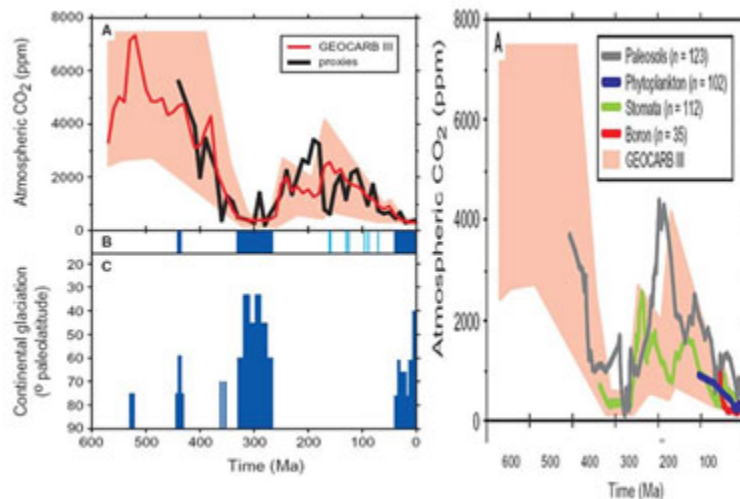


Figure 8 CO₂ and climate correlations. A: Comparison of model predictions and proxy reconstructions of CO₂. B: Intervals of glacial (dark blue) or cool climates (light blue; see text). C: Latitudinal distribution of direct glacial evidence (tillites, striated bedrock, etc.) throughout the Phanerozoic (Crowley, 1998). A (right hand) Proxies used in CO₂ estimates. After Royer [13].

Water vapor, which constitutes powerful feedback effects in the tropics, are of low concentrations over deserts and near-nil concentrations over the poles – which constitute the loci of fastest warming, up to 5 degrees C since about [1975](#).

Earlier Evans questioned the greenhouse effect due to an alleged absence of a tropical troposphere ["hot spot"](#), the loci of rising warm air [plumes](#), stating "If there is no hot spot then an increased greenhouse effect is not the cause of global warming. So we know for sure that carbon emissions are not a significant cause of the global warming".

Not so. First, the hotspot is not a signature of the greenhouse effect but of warming from any source. Second, a hot spot has been [reported](#).

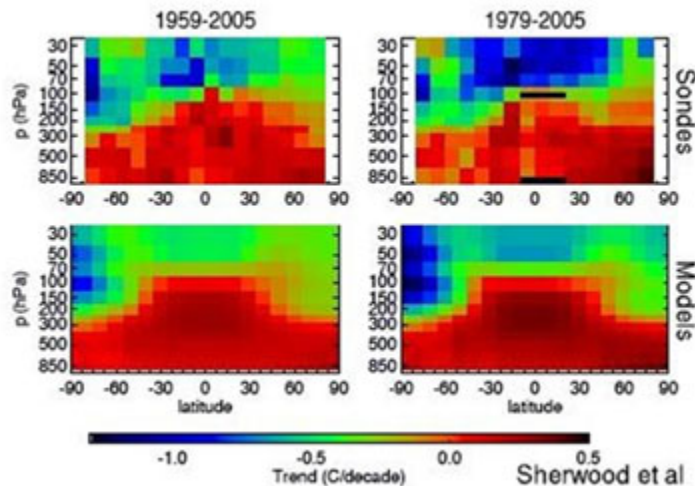


Figure 9 Radiosond (weather balloon) measurements and models of the equatorial troposphere hot spot trend, seen to intensify from

1959-2005 to 1979-2005 [15].

Evans's arguments do nothing to disprove the evidence of the effects of more than 310 billion ton of carbon emitted by human industry since 1750, near half the original CO₂ inventory of the atmosphere and raising the levels to 388 ppm by 2009 – near 40 percent higher than levels recorded for the last 2.8 million years. CO₂ continues to rise at a rate of 2 ppm/year, faster than at the last glacial termination by two orders of magnitude, endangering the climate conditions which allowed the emergence of large mammals (34 million years-ago), humans (5 million years-ago), and civilization (about 7000 years ago).