

"FOS is dedicated to providing the public with insight into Climate Change"

**Energy and Climate Change Committee,
House of Commons,
United Kingdom Parliament.**

Re: IPCC 5th Assessment Review

Executive Summary

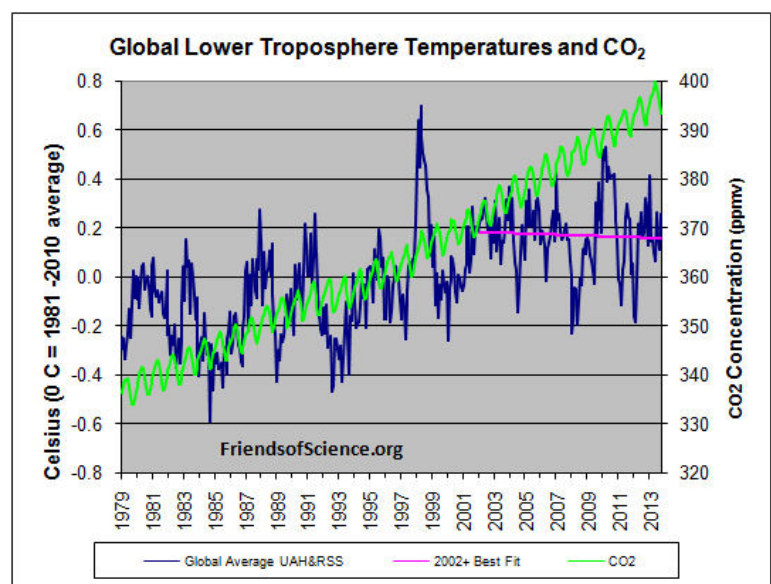
1. The Friends of Science Society's review of climate science shows that the sun is the main driver of climate change, not CO₂. Most datasets show a modest global cooling since 2001. The 20th century warming was small compared to previous warming episodes. Climate models fail to replicate the recent history of key climate parameters. The measured changes of the greenhouse effect show that the transient climate sensitivity is about 0.5 °C for a doubling of CO₂. The direct warming effect of CO₂ is offset by powerful negative feedbacks due to the response of clouds and upper atmosphere water vapour. The IPCC ignores a huge body of evidence that most climate change is natural. Many statements in the Summary of Policy Makers (SPM) of the International Panel on Climate Change (IPCC) fifth assessment report (AR5) Working Group I (WGI) are misleading. The SPM's explanation for the lack of warming over the last 16 years is false.

About Us

2. The Friends of Science Society has been reviewing climate science for eleven years. It is our opinion that the sun is the main driver of climate change. We operate a website [here](#) which contains much information on climate change. We also have a Facebook page [here](#) which hosts active discussions on climate science issues. We issue press releases and reports on climate issues, and hosts presentations by climate experts.

Our AR5 Review

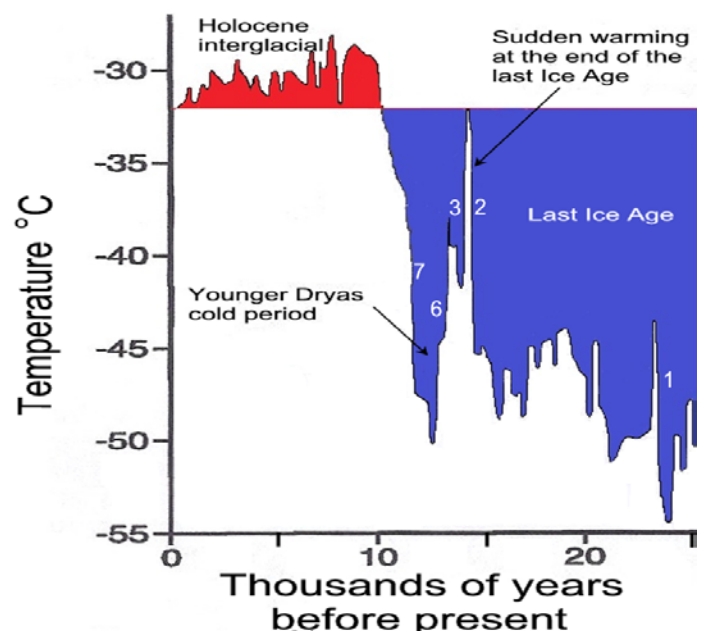
3. We address four questions in the Terms of Reference. **Question 1: "How robust are the conclusions in the AR5 Physical Science Basis report?"**
4. Top of page SPM-3 says "**Warming of the climate system is unequivocal and ...**". This phrase does not have an associated time frame, but the atmosphere has not warmed in 16 years according to satellite and surface measurements.



5. The average of two analysis of satellite temperatures and CO₂ concentrations are shown in the above graph. Surface HadCRUT temperatures from 1998 and the average climate model projection trend from 2002 are shown in a graph [here](#). From January 2002, the best fit linear trend of four global datasets are:

Data Set	Last Month of Data	Trend deg. Celsius/decade
Satellite TLT RSS	October 2013	-0.072
Satellite TLT UAH	October 2013	0.029
Surface HadCRUT3	September 2013	-0.064
Surface HadCRUT4	September 2013	-0.037

6. The data shows that temperatures have generally declined since 2001, so warming is not "unequivocal".
7. The SPM-3 continues "... **since the 1950s, many of the observed changes are unprecedented over decades to millennia.**" Global temperatures according to the HadCRUT3 dataset increased at a best-fit rate from 1964 to 1998, a 35-year period, at 0.152 °C/decade. The global temperatures increased from 1911 to 1945, also a 35-year period, at 0.158 °C/decade. The global warming rate in the early 20th century period was slightly greater than in the late 20th century, so the warming "since the 1950's" was not "unprecedented".
8. Dr. Don Easterbrook writes [here](#), "Temperature changes recorded in the GISP2 ice core ... show that the global warming experienced during the past century pales into insignificance when compared to the magnitude of profound climate reversals over the past 25,000 years. In addition, small temperature changes of up to a degree or so, similar to those observed in the 20th century record, occur persistently throughout the ancient climate record. At least three warming events were 20 to 24 times the magnitude of warming over the past century and four were 6 to 9 times the magnitude of warming over the past century."
9. SPM-10 says "**Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system.**" Human influence on climate can't be understood until natural causes on climate change are understood. The IPCC "understanding" is represented by climate models which utterly fail to match key observations of the climate system. The climate models assume that 98% of climate change from 1750 is due to greenhouse gases, whereas our review of climate science suggests that greenhouse gases have



caused only 21% of the 20th century warming.

10. The key failures of the climate models include:

- Failure to forecast the lack of warming during the last 16 years; [graph](#), [graph](#).
- Temperatures declined from 1944 to 1976, leading to the "Global Cooling Scare", but climate models show warming during the period; [graph](#).
- The actual northern hemisphere sea surface temperature rise for the period 1910 to 1944 was 4.5 times the modelled trend; [graph](#).
- The climate modelled temperature trend near the equator (5° N to 5° S) is 3.5 times the measured sea surface temperature trend from 1982; [graph](#).
- The average warming rate of 73 climate model runs of the tropical mid-troposphere from 1979 is more than five times the measured warming rate by both satellites and weather balloons; [graph](#).
- The mid-troposphere tropical temperature trend of the Canadian model CanESM2 is 560% of the average of the satellite and weather balloon trends; [graph](#).
- The CanESM2 modelled 50° S to 75° S surface temperature trend is warming at 0.35 °C/decade, but the surface was actually cooling at 0.07 °C/decade; [graph](#).
- Antarctic September sea ice extent is increasing at 1.1% per decade relative to the 1981 to 2010 average. Climate models predicted declining sea ice; [graph](#).
- The GISS modelled ocean heat content trend is 5.6 times the trend measured by the ARGO float system 2003 to 2011; [graph](#).

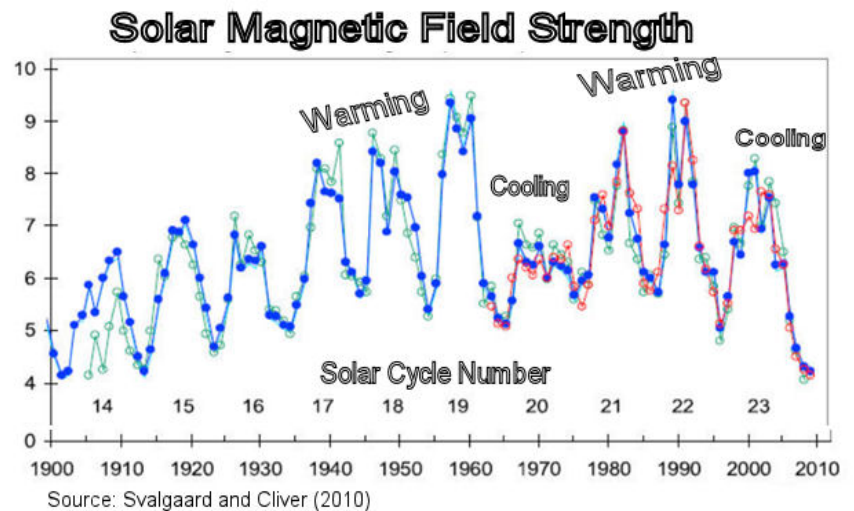
11. These dramatic failures are due to the climate models not including natural causes of climate change and over estimating the warming effect of greenhouse gas emissions. Scientist generally agree that the direct warming effect of CO₂ is about 1 °C/doubling, but the climate models falsely increases this by assuming positive feedbacks from water vapour and clouds. The evidence shows the water vapour and cloud changes cause a negative feedback, reducing the direct effect by about half. Water vapour is the most important greenhouse gas.

12. Line-by-line computer models show that a change in water vapour at the 200 to 300 mbar pressure layer in the atmosphere has 81 times as much effect on out-going radiation as the same change near the surface, so only upper atmosphere water vapour changes are important to the enhanced greenhouse effect; see [graph](#). Climate models forecast that relative humidity will remain constant with warming, but radiosonde data shows significant declining upper atmosphere relative humidity; [graph](#). Radiosonde data shows declining upper atmosphere water vapour, but climate models wrongly assume upper atmosphere water vapour increases with CO₂ concentrations and warming; [graph](#). The declining upper atmosphere water vapour allows heat to escape to space, so it provides a negative feedback to CO₂-induced warming.

13. Detailed analysis of satellite data shows that clouds also provide a strong negative feedback. Climate models assume that global cloud cover can change only in response to a temperature change, but satellite data shows ENSO causes cloud changes that cause temperature changes. A recent [paper](#) by Dr. R. Spencer and Dr. W. Braswell shows that incorporating the effects of ENSO on clouds reduces modelled climate sensitivity by 41%.

14. The Pacific Decadal Oscillation and the Atlantic Multi-decadal Oscillation are natural modes of climate variability that are not included in climate models. Like ENSO, we believe these solar-induced ocean oscillations affect cloud cover, explaining why there is a very strong correlation between these ocean cycles and temperatures; [graph](#).
15. The IPCC WGI Technical Assessment section 7.4.6 says **“Many studies have reported observations that link solar activity to particular aspects of the climate system. Various mechanisms have been proposed that could amplify relatively small variations in total solar irradiance, such as changes in stratospheric and tropospheric circulation induced by changes in the spectral solar irradiance or an effect of the flux of cosmic rays on clouds.”** This acknowledges that there is much empirical evidence that the sun strongly affects climate. The IPCC ignored 123 peer-reviewed articles published 2008 – 2012 that show the sun is a main driver; see [here](#). The IPCC ignored all this evidence because it did not believe the theory linking solar activity to climate was strong. The scientific method demands that empirical evidence is paramount, and theory must yield or be modified to agree with the evidence. The IPCC's action to reject the evidence because they were not satisfied with the theory is the exact opposite of the scientific method.
16. Here we mention only 3 studies showing strong correlations between solar activity and climate. A study of 400 years of Northern Hemisphere temperatures and solar irradiance by N. Scafetta and B. West shows a strong correlation. The correlation as shown in this [graph](#) suggests that the sun may have caused up to 70% of the 20th century warming.
17. Longer term, a study by U. Neff et al. used data obtained from a stalagmite in a cave in Oman to show a correlation of a solar proxy to a temperature proxy for a period of 3000 years. Values of carbon-14 (produced by cosmic rays hence a proxy for solar activity) correlate extremely well with oxygen-18, a temperature proxy; see [graph](#). The lower pane shows a particularly well-resolved time interval from 8,350 to 7,900 years BP.
18. A study by the Danish Meteorological Institute compares the Koch ice index which describes the amount of ice sighted from Iceland, in the period 1150 to 1983 AD, to the solar cycle length, which is a measure of solar activity. The study finds "A close correlation ($R=0.67$) of high significance is found between the two patterns, suggesting a link from solar activity to the Arctic Ocean climate." See [graph](#).
19. The strong correlations are due to changes in the solar magnetic field, not irradiance. The solar magnetic field has doubled from 1900 to 1991 causing warming. The maximum temperature response is delayed about 10 years to 2001 due to the large heat capacity of the oceans. The solar magnetic field strength has since declined as shown in the graph below.

20. The greenhouse effect is often given as 33 °C, which is the difference between the earth's surface temperature and the effective radiating temperature at the top of the atmosphere. The effective radiating temperature is calculated from the out-going longwave radiation as estimated by computer programs utilizing measured greenhouse gas concentrations or by direct satellite measurements. The changes in the greenhouse effect can be related directly to CO₂ climate sensitivity.

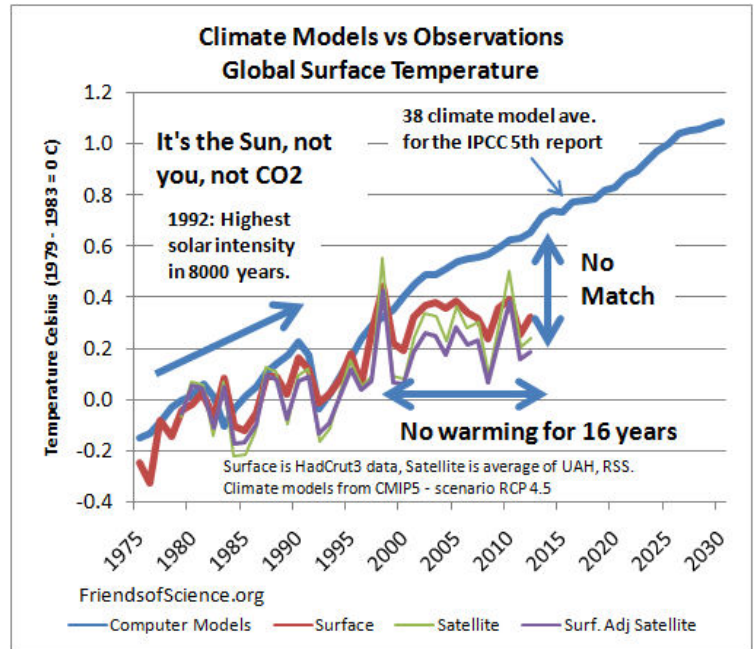


21. Using NOAA radiosonde humidity data and Mauna Loa CO₂ data from 1963, and a line-by-line radiation code, we calculate the greenhouse effect has increased by only 0.11 °C from 1963 to 2008. Extrapolating to a doubling of CO₂, we estimate the transient climate sensitivity to be 0.4 °C. See paper [here](#).
22. The CERES satellite data of outgoing longwave radiation is said to be of the highest quality, but the satellite is quite new so the dataset is short, starting in March 2000. We calculate the greenhouse effect anomaly by taking the difference of the HadCRUT3 temperatures and the radiating temperatures from the CERES data. This analysis shows the greenhouse effect is increasing at 0.039 °C/decade, [graph](#). Extrapolating to a doubling of CO₂, we estimate the transient climate sensitivity to be 0.5 °C, [graph](#). The temperature change from April 2013 to January 2100 due to CO₂ emissions would be 0.27 °C.
23. Note that the above two methods of estimating transient climate sensitivity do not require knowledge of the forcings and feedbacks operating in the climate system. Other methods relied upon by the IPCC to estimate climate sensitivity assume that greenhouse gases cause 98% of the forcing since 1750 (Figure SPM.5), and therefore ignore almost all solar forcing, despite the overwhelming empirical evidence that the sun is the main driver of climate.
24. SPM-10 says, "**Climate models have improved since the AR4.**" This is false. A computer climate models that fails to produce a good match to historical temperature data cannot be expected to give useful projections. None of the climate models match the lack of warming over the last 15 years, so the history match is much worse than in AR4.
25. SPM-12 says, "**It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.**" The IPCC WGI has presented no evidence that human influence has been the dominant cause of warming. The climate models divergence from the

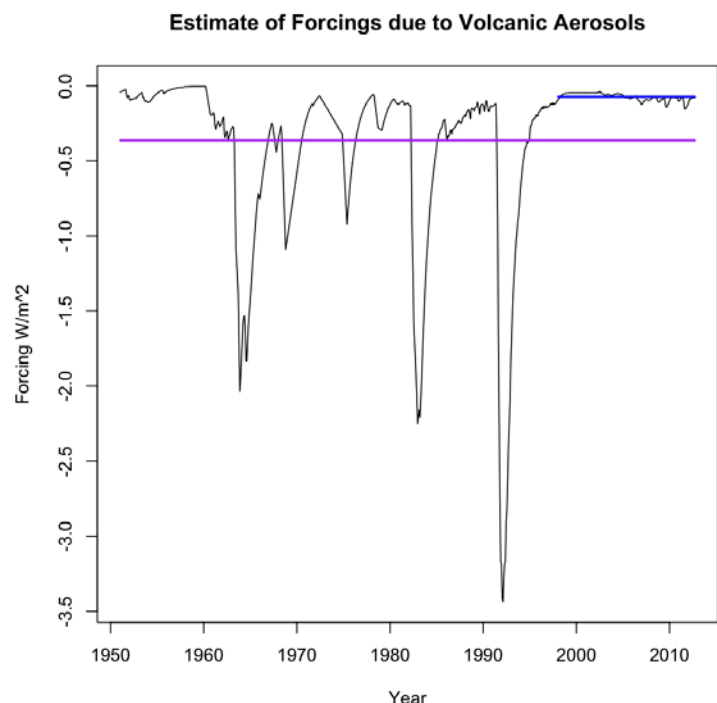
observations has increased greatly compared to AR4, therefore the certainty that humans are responsible for half of the warming is much less than 6 years ago.

26. SPM-14 says, "**Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system.**" The climate model forecasts are totally useless as the models badly fail to match the historical record of most of the key parameters. The IPCC has very likely overestimated climate sensitivity by a factor of six by ignoring natural causes of climate change.
27. **Question 2: "Have the IPCC adequately addresses criticisms of previous reports?"** No, the IPCC continues to ignore natural climate change.
28. **Question 3: "To what extent does AR5 reflect the range of views among climate scientists?"** There is a consensus of opinion among climate scientists who study the influence of the sun that the sun is the primary driver of climate change. The AR5 WGI Chapter 7 states that there is much evidence that the sun is a major driver of climate, but the rest of the report ignores this evidence.
29. There are several studies that show the surface temperature measurements are strongly contaminated by the urban heat island effect. These studies are ignored. A [paper](#) by McKittrick and Michaels showed that the spatial pattern of warming trends is tightly correlated with indicators of economic activity. They conclude "The average trend at the surface in the post-1980 interval would fall from about 0.30 °C per decade to about 0.17 °C per decade."
30. A [study](#) by Watts shows that in the USA, only 11% of the NOAA stations are in suitable locations and 69% are within 10 m of an artificial heat source. Watts et al 2012 evaluated the warming trends of NOAA compliant and non-compliant temperature monitoring stations using the recently WMO-approved Siting Classification System. The analysis demonstrates that reported 1979 - 2008 U.S. temperature trends are spuriously doubled. The new improved assessment, for the years 1979 to 2008, yields a trend of +0.155 °C/decade from the high quality sites, a +0.248 °C/decade trend for poorly sited locations, and a trend of +0.309 °C/decade after NOAA adjusts the data, as shown in this [graph](#).
31. **Question 4: "Has AR5 sufficiently explained the reasons behind the widely reported hiatus in the global surface temperature record?"** The draft summary delivered to the government representatives stated "Models do not generally reproduce the observed reduction in surface warming trend over the last 10–15 years." This accurate statement was deleted from the final summary for political reasons. The SPM report attempts to dismiss the significance of the failure of the climate models to reproduce the lack of warming from 1998. The SPM does not show any graph comparing observations to model projection during the period. To remedy that oversight, see the graph below.

32. The SPM-10 says, "The observed reduction in surface warming trend over the period 1998–2012 as compared to the period 1951–2012, is due in roughly equal measure to a reduced trend in radiative forcing and a cooling contribution from internal variability, which includes a possible redistribution of heat within the ocean (medium confidence). The reduced trend in radiative forcing is primarily due to volcanic eruptions and the timing of the downward phase of the 11-year solar cycle."



33. The IPCC assumes that the solar cycle can only affect climate by the changes in the total solar irradiance (TSI). The claim that volcanic eruptions and a reduced TSI during 1998 to 2012 could cause the pause in warming is false. NASA publishes satellite data that show a large reduction in the amount of volcanic aerosols during the recent period. Lucia Liljegren [here](#) reports that the average forcing from the lack of volcanic eruption during 1998 to 2012 is 0.28 W/m² more than the period 1951 to 2012 as shown in the graph. There were no volcanoes since 1992 that could have caused a cooling effect. The lack of volcanoes caused warming, not cooling, since 1998 compared to the previous period.



34. The TSI solar forcing is a trivial 0.018 W/m² less during 1998 to 2012 than 1951 to 2012. The sum of volcanic and solar forcing is shown in this [graph](#). The volcanic and solar forcing is 0.26 W/m² greater in the recent period, which would have cause increased warming, not a pause.

35. The claim that the lack of warming is due to "internal variability" is refuted by several studies. A team of German scientists say that the lack of warming implies the climate models overestimate the

warming effects of CO₂ emissions and underestimate natural causes of climate change at a 98% certainty. See [here](#). The climate models include processes to simulate both weather noise and ENSO processes, but these can't account for the lack of warming since 1998.

36. The IPCC makes a vague claim that a redistribution of heat within the oceans possibly contributed to the lack of warming. This is a reference to the speculation that heat may have gone into the deep oceans. Steve McIntyre [here](#) explains that pointing to the deep ocean doesn't resolve the discrepancy between models and observations since climate models did not include this effect. NOAA [data](#) shows that the global average ocean temperature from surface to 2000 m depth increased from 1998 to 2012 by only 0.058 °C. The temperature change in the layer from 700 to 2000 m increased from 2005 to 2012 by a trivial 0.02 °C. Ocean warming cannot explain the global warming hiatus. The climate model warming trend of the surface to 700 m layer is 4 times greater than the trend of the measurements as shown [here](#).

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