

Written evidence to the Energy and Climate Change Committee

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The opinions expressed below represent my personal scientific views and do not represent those of NCAS.

Executive Summary.

A great deal of scientific effort has gone into the IPCC report and there is a lot of good science included. However, because of the make up of the group writing this report, I feel that there are several significant major inadequacies in the report, which undermine its quality.

- The role of clouds in the climate system is largely unresolved in climate models, with the physical processes largely underrepresented. For example, maritime stratocumulus (layer) clouds cover 30% of the oceans (and thus 20% of the planet). The effects of these clouds are misrepresented in climate models and therefore this is a significant flaw. The errors in the radiation fluxes are thus large and the error bars are NOT accurate.
- Methane is a “greenhouse gas” which is between 20-70 times more radiatively active than CO₂. Again its contribution is not adequately included, and is a major flaw in the report.
- Further, water vapour is an even more significant greenhouse gas, found mainly in the lowest kilometre (boundary layer) of the atmosphere. The concentration of this gas is very difficult to quantify, and thus its radiative effects are difficult to quantify in a warming climate.
- Much of the report has focused on gases and aerosols and has not given any true weight to meteorological processes. The rapid melting of the Arctic Ice fields is due to changes in poleward atmospheric Heat Fluxes and associated with a change in Northern Hemisphere circulation. i.e. “Climate is now a weather scale problem”. The reliance on climate models which do not include the important weather scale processes, is a serious inadequacy. Climate models, although a very useful first step, are unable to resolve the important meteorological processes that determine our climate.
- More blue skies and open research need to be completed, and that is vitally not reflected in this report.

Details and justification follows in the next section.

Discussion.

How robust are the conclusions in the AR5 Physical Science Basis report? What areas need further effort to reduce the levels of uncertainty?

I have concerns about some important science which seems to have been omitted in the report.

- (i) The report has chosen not to evaluate the contribution of clouds in the summary figure TS.7 attached below. There is an “aerosol-cloud” factor of $\sim 0.55 \text{ W/m}^2$ with a relative error bar up to $\sim 1.3 \text{ W/m}^2$. This is inadequate and underestimates the contribution of clouds to the radiation balance of the planet. (Double CO₂ forcing is $\sim 3.7 \text{ W/m}^2$)

Marine stratocumulus (layer) clouds cover 30% of the ocean surface, $\sim 20\%$ of the global planetary surface. Numerical Weather Prediction (NWP) models (i.e. weather forecasting models) have difficulty in getting sufficient and correct cloud fraction / cover. In 2008 there was a large VOCALS project which aimed at understanding the

processes, which generate and dissipate these clouds. NWP models improved, but these solve the equations on grids on 1 to 10km. Climate models have gridpoints every hundreds of kilometres, underestimate stratocumulus cloud cover. With incoming solar radiation of 1350 W/m^2 , and a change of reflection /albedo in the equator regions from 20% to 80% depending on non-cloud or cloud cover, combined with the under-representation of Marine Stratocumulus clouds in the climate models, then 3.7 W/m^2 is far smaller than the potential errors in the reflected solar radiation. Even a modest error in the cloud cover would lead to feedback uncertainties of 10's W/m^2 . The IPCC report gives a negative feedback of $\sim 0.55 \text{ W/m}^2$ up to $\sim 1.3 \text{ W/m}^2$ for the cloud contribution. This an underestimate of the cloud component forcing, which by far dominates the uncertainties provided by aerosols etc. (see Figure TS.7 below taken from a preparatory copy of the IPCC report)

The small error bars and the lack of discussion / application is a hugely significant oversight.

- (ii) The methane emissions from the melting sub-Arctic permafrost are well documented in the scientific literature. They are hugely important in the earth's radiation balance and yet of small contribution in the report. The UK NCAS research aircraft used by UK scientists has produced data and publications evaluating this. Many Scandinavian scientists are publishing results.
<http://www.theguardian.com/environment/2010/jan/14/arctic-permafrost-methane>.
 Methane is a gas which is arguably 20-70 times more effective as a greenhouse gas. However, in Fig TS.7 below, methane does not even appear as a gas of much importance and with associated small error bars.
- (iii) Furthermore water vapour is an important greenhouse gas. The amount of water vapour, mainly found in the lowest kilometer of the atmosphere very much depends on lower atmosphere temperatures and dynamical processes. This is a large contributor to global greenhouse warming that should be more carefully evaluated.

Has AR5 sufficiently explained the reasons behind the widely reported hiatus in the global surface temperature record? Does the AR5 address the reliability of climate models? Has AR5 sufficiently explained the reasons behind the widely reported hiatus in the global surface temperature record?

“Climate is now a weather scale process problem”.

- (iv) “Climate is now a weather scale process problem” and unless these weather processes are understood and included, then predictions are very likely to be incorrect (I consider that Prof Julia Slingo, Chief Scientist at the Met Office might agree with me on this point)
- (v) Climate models are unable to describe (resolve) some of the important processes which control the climate. The location of “blocking anticyclones”, high pressures in the Atlantic, largely determine the flux of warm moist air to the North Pole. Climate models cannot resolve these large scale meteorological features, basically because the smaller scale eddies in the atmosphere, which drive and maintain these large structures, are too small and cannot be seen or resolved by climate models. Thus the transport of heat to the poles (the main kinematic function of the atmosphere on the global scale) is misrepresented. The critical differences between the Northern Hemisphere circulation, where the frequency of “blocks” are under-represented and the Southern Hemisphere circulation, where blocks are far too frequent, is important. This inadequacy is of significant concern in the prediction of future climates. The increase in intensity of Southern North Atlantic hurricanes, observed, understood and predicted by meteorologists, and which have significant impact on the North American climate is not seen in climate models. The resolution in climate models is just not good enough to

produce them as they are driven from smaller scale convective systems and easterly waves, too small for these models.

- (vi) The overall Meridional Heat flux (MHF) in the climate models is, for the above reasons given in section (iv), not adequate to simulate the flux of warm moist air to Arctic regions. This issue is controversial and topical but getting these ideas into the mainstream scientific discussion is difficult partly due to the consequence (and a negative aspect) of the peer review process, which is by nature reticent towards new ideas. I would argue MHF is critically important to explain why the Arctic Ice melt is very much more rapid than the models have predicted. Tentatively I would suggest, that in just a few years time, the Arctic will be ice free in September. (Ice-free I define as < 15% broken ice). Arctic Polar ice retreats and advances each year, but Figure 1 below, shows that over the past 30 years the Arctic Ice volume has been very much significantly reduced. This process can be reversed (and hence why the climate sceptics and the climate green lobby both object to this hypothesis) Yet the overall assertion is that the sophisticated climate models do NOT replicate this rapid decline (elephant in the room) and the "climate modelling industry" largely ignore this.

Is the IPCC process an effective mechanism for assessing scientific knowledge? Or has it focussed on providing a justification for political commitment? To what extent did political intervention influence the final conclusions of the AR5 Physical Science Basis summary?

- (vii) The IPCC and the current structures are not an effective mechanism. The peer review system is excellent at ensuring a good level of scientific achievement. When new ideas and approaches appear, history has shown that peer review procedures are far from ideal to provide funding for blue sky thinking. IPCC is a consensus document.
- (viii) The question is not as simple as political intervention and control. Certainly governments have a vested interest in being re-elected and therefore not upsetting major commercial interests or electorate into a change in life style behaviour. In science, as above, accepted theories are difficult to change. History is full of such scientific challenges ((a) longitude measurement, (b) flat earth etc) which cannot be put down just to political intransigence. I would argue also, the scientific community is traditionally conservative, blinkered and self-preserving. (e.g. (c) when US satellites lost signals going into the Venusian atmosphere, the NASA scientists said it had hit a mountain 27km high, when every UK "A" level geology student knew a mountain that high would sink into the ground. Few scientists would accept the spectroscopic evidence of Sulphuric acid vapour. (d) the ozone hole was discovered by Joe Farnam (BAS) when he contradicted years of NASA satellite data which said there was no problem. Thus the scientific community (and the IPCC) should take some of the blame.

To what extent does AR5 reflect the range of views among climate scientists?

- (ix) Some would argue that the academic scientific establishment is unable to recognise rapid change, (e.g. AMEG group hypothesis). New ideas often threaten the scientific community. They consider bigger computers and satellites alone will provide the solution, rather than new scientific ideas. Although, I would not go as far as some climate scientists who say, that the IPCC (document and report) has now become a consensus document unable to see the "elephant in the room of very rapid climate change" and "a career gravy train for the scientists who have been promoted by being involved, and the lure of research grants and fame". The report, in my view, has omissions, two of which I have explained above. A major scientific criticism is that the report has ignored major meteorological processes which some would consider obvious and important. Blue sky research, needs to be funded by the government but spent wisely. The £3 million funding by EPSRC for the "SPICE" project was a classical example where government money was squandered on a project which had "good"

peer reviewed” and was “acceptable”, yet has resulted in a waste of valuable resources. Many scientists and engineers who understand basic meteorology and engineering, predicted failure yet, they were ignored because of the accepted “good peer review”.

Arctic Death Spiral - Evolution to July 2013

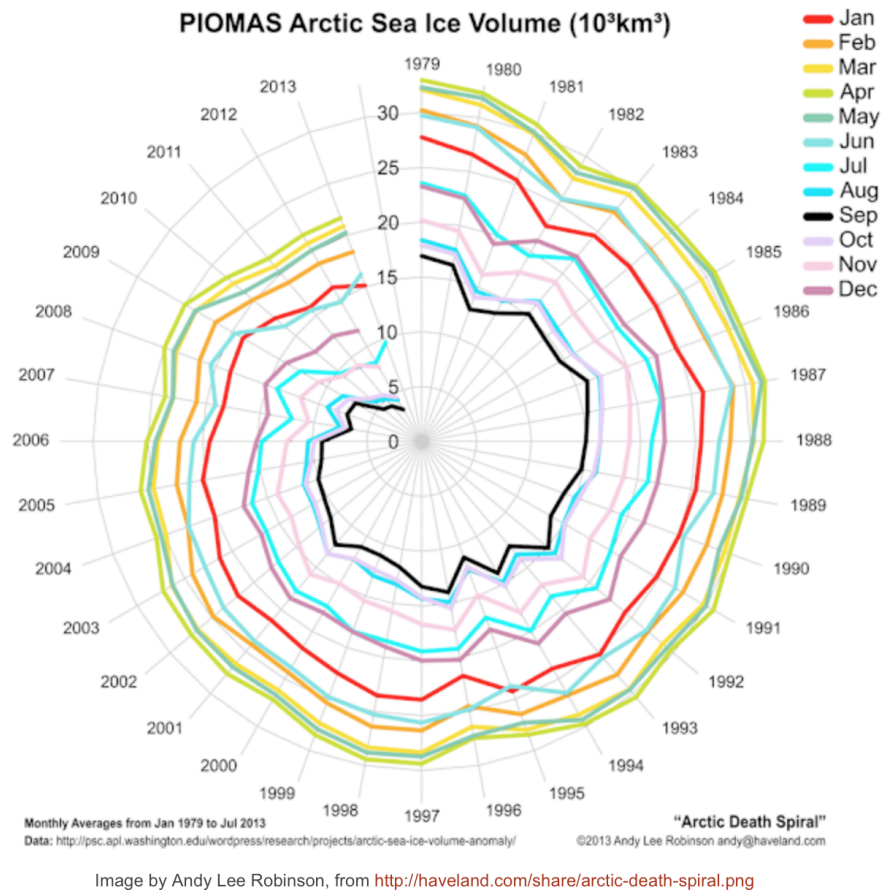


Figure 1.

A plot of the reduction in Arctic Ice volume since 1979. The September volume (black line) has decreased from 17 million cubic kilometres to 3.6 million cubic kilometres, and is the basis of my ascertainment that in just a few years, September Arctic Ice will disappear altogether (< 15% broken ice).

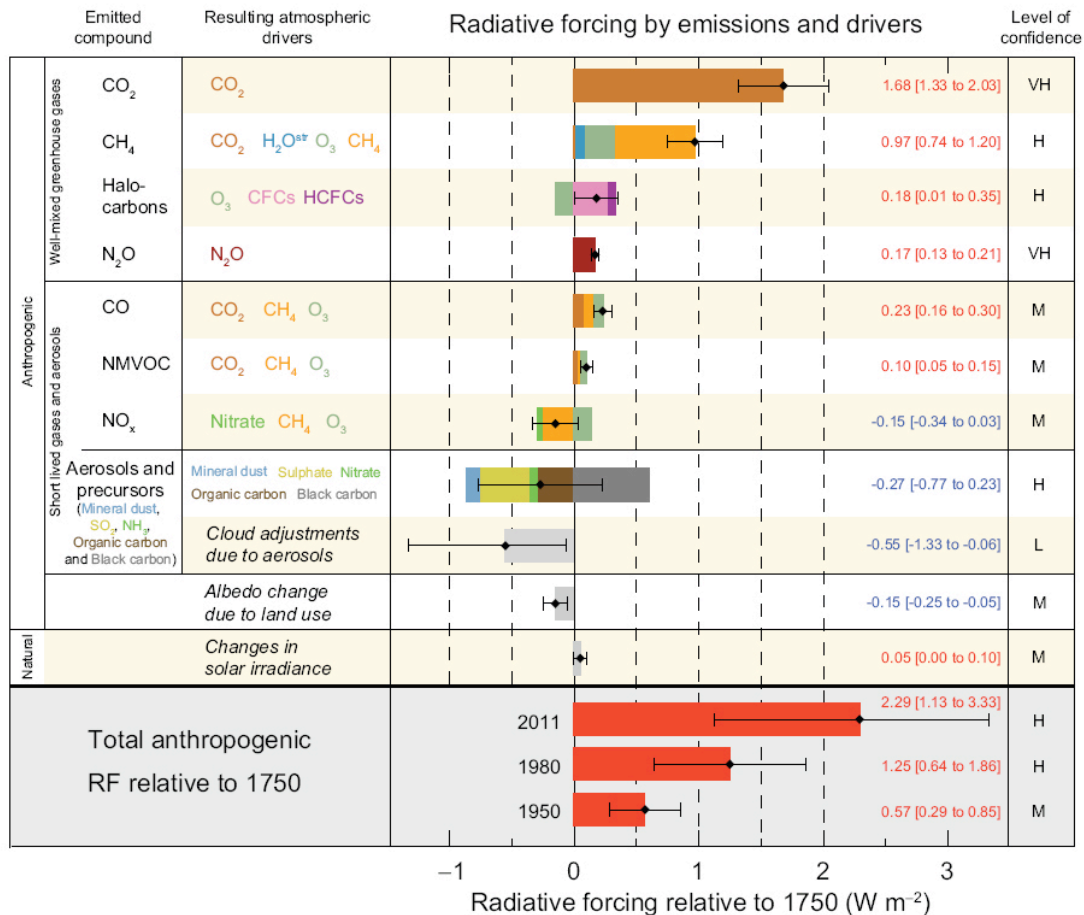


Figure TS.7.

This figure is taken from the draft report. Radiative forcing of climate change. The horizontal bars indicate the level of uncertainty.

I have several concerns regarding Figure TS7. Mainly that the importance of clouds in the system is totally misrepresented, and the “cloud” error bars are totally inadequate. Furthermore, methane is a very important greenhouse gas which has only been included as a small factor in the report. Similarly, the contribution to greenhouse warming by water vapour in the boundary layer although important has been underrepresented. The measurement of water vapour concentrations need to be improved and the critical meteorological processes better understood before such a diagram is complete.