IPCC claims are proven False?

Address to Economic Society of Victoria, 9 October 2013

By Des Moore

The IPCC's 36 page *Summary for Policy Makers* published on 27 September sets out a series of claims about what has been happening to various aspects of the climate and offers assessments of the connection between human activity and the changes in climate, particularly temperatures. The economic implications remain much the same as in the 2007 report - that is, unless our governments take urgent action to reduce ever increasing emissions of greenhouse gases –usually limited to mentioning only CO2 emissions – higher and higher temperatures will destroy life and plants, even threaten human existence. Although there has been some increase in scepticism about this threat, almost all political leaders, science bodies, international organisations and media outlets still seemingly accept the dangerous warming thesis in one form or another. One of the originators of the scare, economist Nicholas Stern, has declared that "what is coming from [sceptics] is just noise..."

My intention today is to argue that no definitive causal correlation can be established between past changes in measured temperatures and in atmospheric concentrations of CO2. In short, I assert there is no substance to the basic thesis adopted by the fifth IPCC report. I will examine the more important assessments of this Summary component of the report but I start by pointing out that the main conclusions on temperature increases and human activity are decidedly unclear in terms of detail and bewildering even to the intelligent layman.

On the one hand it claims as *extremely likely* that more than half of the temperature increase between 1951 and 2010 was caused by the anthropogenic increase in greenhouse gas emissions. This purports to give human activity a 95 per cent certainty tick. Despite the ongoing predictive failure of the modelling of temperatures, it is greater than the 90 per cent certainty offered in the IPCC's 2007 report. On the other hand the current report also claims that "*the best estimate* of the human induced contribution to warming is similar to the observed warming over this period". But it does not say what it means by "similar to" or whether the "best estimate" has greater or less certainty than 95 per cent.

This may sound like nit picking but the uncertainties about specific assessments on a range of climate happenings has created widespread confusion. This has occurred despite the claim that the IPCC's assessments derive from "observations" of the climate system which provide a comprehensive view of the variability and long term changes in the atmosphere, the ocean, the cryosphere and the land surface". This supposedly allows the IPCC to conclude at the start that "warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over the millennia".

The difficulties of interpreting IPCC assessments extend to both what has actually happened to temperatures as well as to the future temperatures the IPCC models predict.

As to actual temperatures, the graph published in the report, which is similar to Figure 4 in the graphs I have circulated, suggests global average temperatures increased about half a degree between the early 1950s and the period since 1997. However the IPCC report claims that, of the "observed warming of approximately 0.6C to 0.7C ", greenhouse gases contributed 0.5C to 1.3C. This invented temperature appears to be an attempt by the IPCC to explain the pause in temperature increases after 1997 - that is, it seems to be saying that if there had not been *temporary* forces operating to reduce temperatures, the actual increase might have been as high as 1.3C! It is little wonder that expert sceptic Professor Richard Lindzen has written that "the latest IPCC report has truly sunk to (the) level of hilarious incoherence".

A similar incoherence arises in regard to temperature predictions. We are left in no doubt that they will increase, but by how much? Whether temperatures increase by more than 2C is supposed to be very important because that is said to be a tipping point beyond which it will be impossible to stop temperatures increasing to dangerous levels. Indeed, the UN Secretary General has said political commitment is needed to keep the temperature rise below 2C and, surprise surprise, an international conference is being planned for 2015 in Paris. US Secretary of State Kerry proclaimed "this is science, these are facts and action is our only option". But is this another red line like Copenhagen which the US Administration will allow to be crossed?

In the IPCC report there is modelling of possible future temperatures but no offer of one possible outcome. Instead we see four possible ranges for the period from 2081 to 2100, with the lowest being 0.3 to 1.7C and the highest 2.6C to 4.8C. These possible increases are from the average in the period 1986 to 2005 and their extent seems to be dependent on the corresponding extent of (cumulative) fossil fuel emissions, the possibilities of which are set out in a Table and have an enormous range from 140 to 1910 GtCs (Gigatonnes of Carbon).

Given the absence of any one preference, it is not surprising that commentators have offered differing suggestions about the IPCC's temperature prediction to 2100. But there is also dissatisfaction with the failure of the IPCC to present any alternative view of the underlying science. For example, Professor Judith Curry of the School of Earth and Atmospheric Sciences in Georgia, USA has published an article headed "Kill the IPCC: after two decades and billions spent, the climate body still fails to prove humans behind warming" (Financial Post, 1 October 2013). She postulates that there is "paradigm paralysis" involving a "refusal to see beyond the current models of thinking".

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Economic Implications

Before examining "the science", let me refer to the wide differences among experts on the economic implications of eliminating fossil fuels or, as the case may be, of *not* eliminating them.

In 2008 two major reports were commissioned by the previous government, one from economist Ross Garnaut[i] and one from Treasury,[ii] which was released by then Treasurer Swan and then Climate Change Minister Wong. Although Garnaut acknowledged that there were different perspectives on the science, these reports accepted the IPCC version without questioning. Their basic message was that our great-grandchildren would be saved **and** their GDP in 2100 would even be higher as a result of the elimination of fossil fuels.[iii] However, according to the Garnaut report, even if there is no reduced usage of fossil fuels between now and 2100, "Australian material living standards are likely to grow strongly through the 21st century, **with or without** mitigation"[iv] (my emphasis).

By contrast, Climate economist Professor Richard Tol, a former IPCC lead author, estimates the cost of mitigatory action by 2100 would be about 40 times greater than the benefits.[v]

An important question here is the extent to which other countries take mitigatory action. For a country adopting mitigatory action which is more intensive than in most other countries, an OECD report[vi] (with a Treasury official's input) published in September assesses adverse economic effects from the loss of international competitiveness. This report indicates that, unless the developing world also implemented a carbon tax, Australia would see considerable de-industrialisation, moderated only by protectionism. And the competitive pressures would have further adverse effects if other major OECD countries did not adopt a comparable carbon tax.

As the OECD report acknowledges that "the prospects for a globally harmonised carbon market are weak", this effectively justifies the decision by both major Australian political parties to abolish the current carbon tax. However, even if the carbon tax is abolished, the subsidies to wind and photovoltaics remain through the 20 per cent Renewable Energy Target. Although less onerous than the carbon tax, the RET still undermines Australia's competitiveness in energy-intensive industries where our energy resources should make us world leaders.[vii]

In existing circumstances the most important economic question is why not wait before restricting usage of fossil fuels and subsidising alternative sources of energy. At the very least there is no point in Australia becoming a leader. Nuclear power is already close to being economically efficient and historical experience suggests continued technological advances will improve the economics of other renewable energy sources.

Assessing the Science – New Evidence & Doubts about Existing Evidence

The dangerous warming thesis adopted by the IPCC is based on the widely held belief that a proportion of CO2 emissions is added to the atmosphere and the extra heat then radiated back to earth by the CO2 causes a temperature increase at the surface of the earth. But is there a causal connection between the increasing concentrations and any increase in temperatures? In considering this I draw on important new research by physicist Tom Quirk.

Let me first note that an internationally accepted standard for atmospheric calculation shows that the increases in C02 concentrations do *not* result in a *commensurate* increase in radiation back to the surface of the earth. In fact, an example calculation shows that if concentrations doubled from existing levels of about 400ppm to 800ppm, there would only be a 10 per cent increase in radiation back to the earth's surface (see the left axis of the graph in **Figure 2).**[viii] [ix].

The effect of this radiation on temperatures is open to serious debate. Bill Kininmonth, the former head of the Climate Centre of our Bureau of Meteorology, argues persuasively that the evaporation from the oceans (which constitute 70 per cent of the earth's surface) has an offsetting effect on upwards temperatures from radiation. Accordingly, although the fifth IPCC report re-affirms its view that there will be a positive effect on temperatures, the evaporation may involve sufficient temperature dampening to significantly reduce the temperature increasing from the radiation. This is a major uncertainty about the proposition that we face dangerous warming unless countervailing action is taken.

A further important uncertainty arises from the acceptance by the climate establishment of the estimate that 55 per cent of CO2 emissions from fossil fuels remain in the atmosphere. This estimate reflects an investigation made some 30 years ago on the basis of very limited observations. But important recent research by Tom Quirk suggests that the 55 per cent estimate of concentrations is far too high and it may be only about 16 per cent (see **Figure 3**). If this is correct, it means the fossil fuel emissions contribution is only a third of what has been assumed in the analysis used by the IPCC.[x]

It is important also to examine what might be termed supporting evidence.

Temperatures and Concentrations of CO2 – More New Evidence

Moving to the relationship between temperatures and emissions, look first at **Figures 4, 5 and 6**.

Figure 4 shows both annual averages and ten year averages for *global* temperatures from 1900 as published by the Hadley Centre of the UK's Met Office and used by the IPCC. This demonstrates the considerable climate variations from year to year[xi] but it is not easy to detect the major change-points indicating changes in the trend. However **Figure 6** shows global temperatures with major red dot points in the ten year averages and this statistical analysis shows major change points in the early 1920s, late 1940s, mid 1970s and late 1990s.

For Australia, **Figure 5** shows annual averages from 1910 as published by our Bureau of Meteorology with its supposedly high quality data. This Figure has a black line showing a major change point in the mid 1970s. The jump then in Australian temperatures of about 0.4 of a degree reflects an ocean temperature change known as the Pacific Decadal Oscillation.

This Pacific Decadal Oscillation effect is important because it reflected *natural* causes arising from a sudden replacement of cold water with warm water along the western Pacific coast of the North Americas. That had no causal connection with fossil fuel emissions.

This analysis suggests about half of the published temperature increase over the past 100 years of about 0.8 of a degree reflected natural causes, *not* increased emissions of fossil fuels.

Figure 7 allows a comparison of changes in concentrations with the changes in temperatures shown in **Figure 6.** The lack of any continuing connection between the two seems obvious.

This leads to **Table 1 s**ummarising these changes in the different periods. First, there have been two periods during which temperatures were relatively stable but CO2 concentration levels increased quite strongly (except for a brief period in the 1940s). Those two periods are from 1948 to 1977 and from 2000 to the present. Second, the period from 1977 to 2000 shows both temperatures and CO2 concentration levels increasing. This is the period when the Pacific Decadal Oscillation clearly made a major contribution to the temperature increase.

Third, only the 1922 to 1947 period suggests a possible causal connection between changes in concentrations and temperatures. But **Figure 7** shows that period had only a small increase in concentrations.

Considering all this analysis, how can there be any definitive conclusion that a causal correlation exists between changes in temperatures and changes in CO2 concentration levels?

Accuracy of Temperatures, Comparisons with the Past and Modelling of the Future

Other reasons for questioning any definitive conclusion include serious doubts about the accuracy of the temperatures published by official agencies and used by the IPCC. These published temperatures are calculated by averaging only the minimum and maximum recorded for the day. But if the daily averages are calculated more properly by averaging temperatures *every 30 minutes* a vastly different picture emerges.

Such data is available back a few years and Tom Quirk has done the calculation for 101 days in March to June 2013 in two locations **(see Figure 8)**. For a location on the east coast (Cairns), the result is an average markedly lower than the *published* average. In short, the existing maximum and minimum method of calculating averages produces a systematic upward bias, probably as much as 0.3-0.4C of a degree.[xii]

If Australian published temperatures have an upward bias so too will any modelling of our future temperatures. These systematic errors also apply to other continents where maximum and minimum thermometers are used for land temperatures[xiii].

Another upward bias in published temperatures arises from failing to take account of the urban heat island effect. In urban areas temperatures recorded include the effect of heat retained by buildings. Tom Quirk has tested this by comparing the Bureau of Meteorology recording site in Melbourne with that at Laverton for the period from 1940 to 2010 **(see Figures 9-10)**. Given the commonalities apart from buildings, urban heating is clearly the main reason for the significantly larger increase in the minimum recorded for Melbourne.

However the BOM's published temperatures appear to make no allowance for the effects of urban heating and there also appear to be other upwards bias influences in its published data.

But what about the oft-made claim that temperatures are higher now than they were a century ago? As soon as August finished we were told that Australia's eastern coast had experienced the highest winter temperature since 1910. Yes indeed, our 2013 winter temperature was 0.03 higher than in 1973 – clearly a signal of danger!

Temperature records such as this do not establish a need for government action. The test is whether a causal relationship exists between increased CO2 concentrations and increased temperatures – and whether published data are correct.

What is the most credible conclusion about the total published temperature increase of around 0.8 of a degree over the last century? My view is that about half is incorrectly calculated and the other half reflects natural causes.

Bear in mind also that during past periods when fossil fuels usage was very small, the IPCC now acknowledges that humans experienced temperatures as high as now during the Medieval Warming Period (about 800-1,100AD). This acknowledgement is made grudgingly by relating it only to "some regions" and no mention is made of the similar experience during the Greco-Roman period (600BC – 200 AD).

Finally on temperatures, the fifth IPCC report claims that climate models have improved since the 2007 report and it appears to rely on models for predictions to an even greater extent. Importantly it claims that, while "there are differences between simulated and observed trends over periods as short as 10-15 years (eg 1998 to 2012)", the long term simulations show "a trend in global-mean surface temperatures from 1951 to 2012 that agrees with the observed trend". The pause over the period 1998-2012 is said to be 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. 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".

Whatever the claimed "long term" trend calculation produces for the 1951-2012 period, we can see from analysis by a US climate scientist of the very extensive modelling **(Figure 11)** that none of the many predictions has coincided with actual published temperatures. Moreover, as already noted, the pause from 1998-2012 is not the only one over the period since 1900. There was a much longer pause (actually a slight decline) from 1948 to 1977 but this is not explained by the IPCC. Nor is any mention made of the very little change in temperatures (as published by the Hadley Centre) from the mid 19th century to 1920 and no explanation is attempted for the upward trend from the early 1920s to the late 1940s when CO2 concentrations increased by only just over 3 per cent over about 25 years. In essence the IPCC dangerous warming thesis appears to be based on the increase in temperatures that occurred over the 1977 to 2000 period but was due primarily to natural causes

Overall, it is difficult to see that temperatures are at all sensitive to changes in CO2 concentrations.

Other Greenhouse Gases

Figures 12 and 13 show a sharp increase in the contribution of methane gases to atmospheric concentrations between 1940 and 1980 and then a subsequent sharp drop. The CSIRO-BOM State of the Climate report, published in 2010, asserted that methane has shown similar increases to carbon dioxide. But both the rise and fall reflect initial leakages from pipelines and the subsequent fixing of those leakages. This is just one of many examples of the failure of the CSIRO to properly identify events which influence climate – and those that don't.

Droughts and Rainfall

Another part of the dangerous warming scare is that below average rainfalls and droughts are a sign that higher temperatures and more droughts are on the way. The IPCC fifth report acknowledges that precipitation has increased since 1901 and, while it predicts more frequent hot and fewer cold days, and more extreme precipitation events, there is no prediction of an increase in droughts or for that matter floods. Past Australian droughts occurred when global temperatures were lower than now and wet years occurred when such temperatures were rising. Annual rainfall records for the Murray Darling Basin **(Figures 14 and 15)** do not suggest any threat from persistently lower rainfalls or that there is a close connection between changes in average temperatures and in rainfalls.

Antarctic and Arctic Ice Sheets –Sea Levels and the Reef

The IPCC report claims a "substantial" anthropogenic contribution to the sea level increase since the 1970s and asserts this comes from thermal expansion and glacier mass loss. It predicts that sea levels will *very likely* increase at a faster rate during the 21st century and offers a range from 26cms to almost 82 cms. As might be expected, the top of this range is higher than the 57cms given in the 2007 report.

Satellite measurements of global sea levels (**Figure 16**) show that from 1994 the rate of increase has averaged 3.2mm a year but from 2002 it fell to a rate of about 2.6mm a year. This reduction is not mentioned in the IPCC report. If the average rate of increase of 3.2mm a year were to continue average sea levels in 2100 would be about 30cms, which is slightly above the IPCC's lowest prediction. Such an increase hardly signals danger and most sea-side property owners would have time to take appropriate preventive measures.[xiv]

As to the Arctic **(Figure 17, Top Half)**, there is a downward trend in ice extents. The IPCC report claims it is *very likely* it will continue to shrink but does not say disappear. Recent reports indicate that some re-icing is now in progress and extensive Arctic meltings have occurred in the past when CO2 emissions were very much lower.[xv] The IPCC report makes no mention of the fact that meltings in the Arctic have no effect on sea levels because the ice there is already in the sea.

As to the Antarctic, the IPCC acknowledges that the total ice area has been increasing but with *low confidence* it projects a decrease in extent and volume by 2100 because of temperature increases. No mention is made of the fact that satellite data covering the past thirty years show a distinct cooling of the Antarctic region.

Turning to the Great Barrier Reef, a major concern relates to possible bleaching caused by global warming. However, most of the reef recovered from the bleachings of 1998 and 2002 and any action by Australia to reduce emissions would not help there unless there is an effective international agreement by major emitters.

Possible Errors in Estimated Influences on Warming/Cooling

The foregoing has suggested errors in analysis but did not refer to the wide margins of error which the IPCC itself suggests as applying to the estimates of the ten various possible warming and cooling influences on temperatures. These are important because the combined effect of the various influences determines what the IPCC decides is their total effect on temperatures.[xvi] (**Figure 18**) shows that the estimated total of these influences from the 2007 report amounts to 1.6 watts per square metre, with an error margin ranging from 0.6 to 2.4 watts. This estimate is not included here in order to comment on the various influences but to illustrate the very wide potential for error.

Conclusion

In summary, many uncertainties emerge from a careful assessment of claims that a danger exists of ever increasing temperatures and the claim in the fifth IPCC report of increased certainty does not hold water. No substance can be established for that claim because no definitive causal correlation can be established between past changes in temperatures and in atmospheric concentrations of CO2. Some past temperature increases are clearly due to natural causes and new research shows published temperatures have a significant upward bias. New research also suggests that, as the extent of CO2 concentrations in the atmosphere is much smaller than previously thought, any danger from rising temperatures is much diminished. Once account is taken of naturally caused increases, of the much smaller CO2 concentrations, and of the upward bias, the need for action to reduce fossil fuel emissions disappears.   Of course, some argue that precautionary government action should be taken just we insure our houses and buildings against damage we know will occur. But the various deficiencies in the dangerous warming thesis suggest any risk that might exist from higher temperatures could well be handled by preventative action by businesses and individuals.

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[i] The Garnaut Climate Change Review Final Report, 30 September 2008

[ii] *Australia's Low Pollution Future: The Economics of Climate Change Mitigation, 30 Oct 08.*

[iii] After the move to less efficient energy reduces annual growth for the next 50 years or so, there would then be a lift in growth rates and the "the main benefits of mitigation (would) accrue in the 22nd and 23rd centuries and beyond" (Garnaut Report p249)

[iv] Ditto p565

[v] "*Climate folly before failure", Alan Wood, The Australian, 1 Oct 09.*

[vi] OECD Environment Working Papers No 58, "Addressing Competitiveness and Carbon Leakage Impacts Arising from Multiple Carbon Markets", 11 Sept 2013. The report acknowledges that "the prospects for a globally harmonised carbon market are weak", that "country-level experiences with greenhouse gas emissions related taxes remain fairly limited", and that there are no international linkages between emission trading schemes.

[vii] For further consideration of the implications for Australia of the OECD report of 11 September, see article on "Energy costs continue to dog industry", Alan Moran, The Australian, September 25, 2013.

[viii] The graph shows an increase in the level of radiation of only about 3 watts per square metre – from 29 to about 32 watts.

[ix] This *analysis comes from an online calculator of energy in the atmosphere (MODTRAN) and, as indicated, it provides an internationally accepted standard for atmospheric calculation.*

[x] By way of background, it should be noted that CO2 emissions into the atmosphere are continuously exchanged with sources and sinks in the ocean and on land. That is, there are various sources of emission and absorption. In fact, the overall CO2 imbalance is only 1-2 per cent of the annual atmosphere-land-ocean exchanges of CO2. In the ocean CO2 is absorbed and dissociated in water and it is also removed by ocean plant life, like phytoplankton. The amount of CO2 exchanged (absorbed or emitted) with the oceans varies with water temperature: the higher the water temperature, the less CO2 is absorbed or the more is emitted and conversely for a lower water temperature. Also, the behavior of oceans varies. There is absorption taking place in the North and South of the Atlantic and Pacific oceans whereas the tropical oceans are emitters of CO2. Overall, the oceans are net emitters of CO2. For the land the sources of CO2 emissions are plant decay and fossil fuel usage. The sinks are plants that with photosynthesis absorb CO2, with the extent of absorption by forests being very high: they are net absorbers of course.

[xi] Including from El-Ninos.

[xii] For example, a 10 minute 1degree fluctuation that increased the temperature would give a 0.5 degree increase in the average calculated by the maximum and minimum method whereas it would only give an increase of 0.01 degree in the average calculated by taking temperatures every 30 minutes.

[xiii] *As ocean temperatures are measured in a quite different manner, this means there are additional systematic uncertainties when land and ocean temperatures are combined to give a global temperature.*

[xiv] The 2007 IPCC report predicted an increase in average global sea levels to 2100 ranging between 18 and 59 cms (about 2 feet). The satellite measurements of sea levels from 1994 show an increase of about 3mm a year or 20cms by 2100.

[xv] *Canada's North West passage has in fact been navigated in periods when fossil fuel usage was low*

[xvi] According to the IPCC, this estimate of 1.6 watts explains the temperature increase since 1750.

Why Global Warming Does Not Threaten Dangerous Temperatures

"Truth is the daughter of time, not of authority."
Francis Bacon (1561-1626)

Compiled September 2013

Tom Quirk MSc, MA DPhil (Oxon), SMP (Harvard)

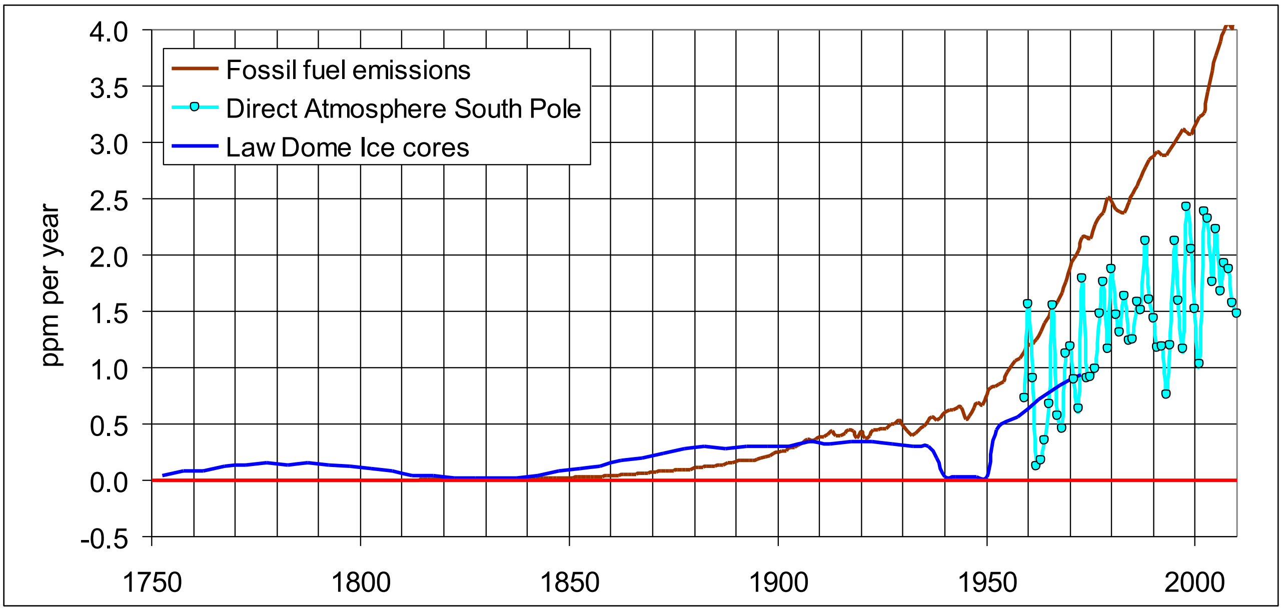
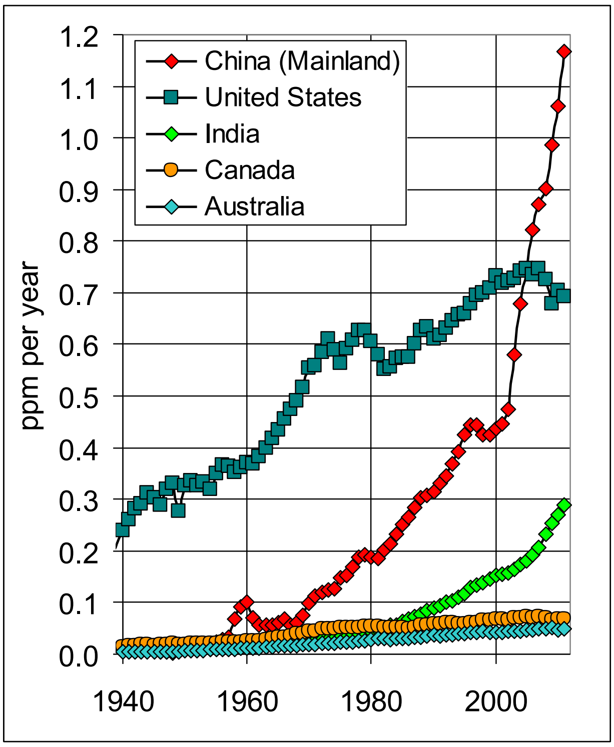
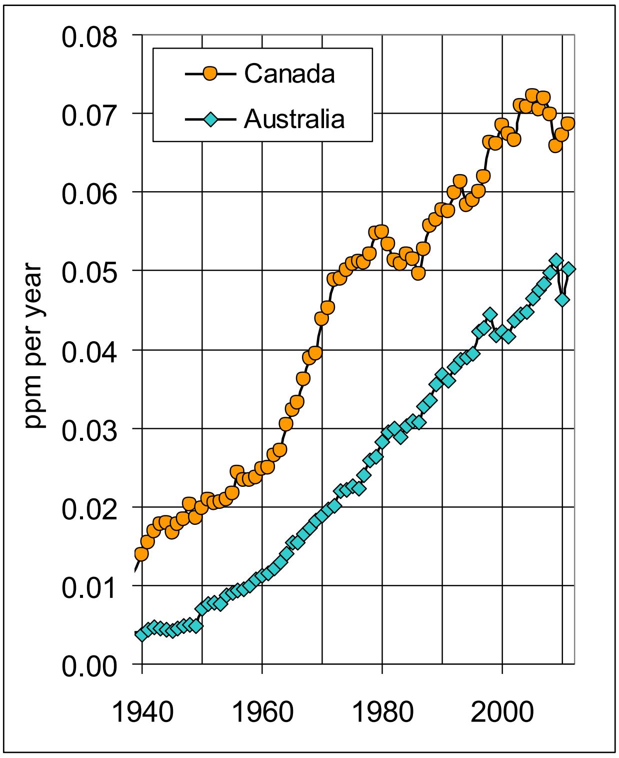


***Figure 1:** Annual changes for fossil fuel and cement production emissions (**brown line**), directly measured changes in atmospheric CO_2 concentrations at the South Pole (**light blue line**) and ice core measurements of CO_2 at the Law Dome in Antarctica (**dark blue line**). Sources – Scripps Institute of Oceanography and CSIRO*

Starting with the industrial revolution, the annual increases in atmospheric CO_2 concentrations remained above the estimated fossil fuel emissions until the 1920s. The difference was understood to be due to land use changes. Since the direct measurements commenced in 1958, it is estimated that 55% of fossil fuel emissions remain in the atmosphere (IPCC reports).

Note that through the 1940s there was no apparent rise in CO_2 concentrations.





China is now emitting as much in one year as Australia's total fossil fuel emissions.

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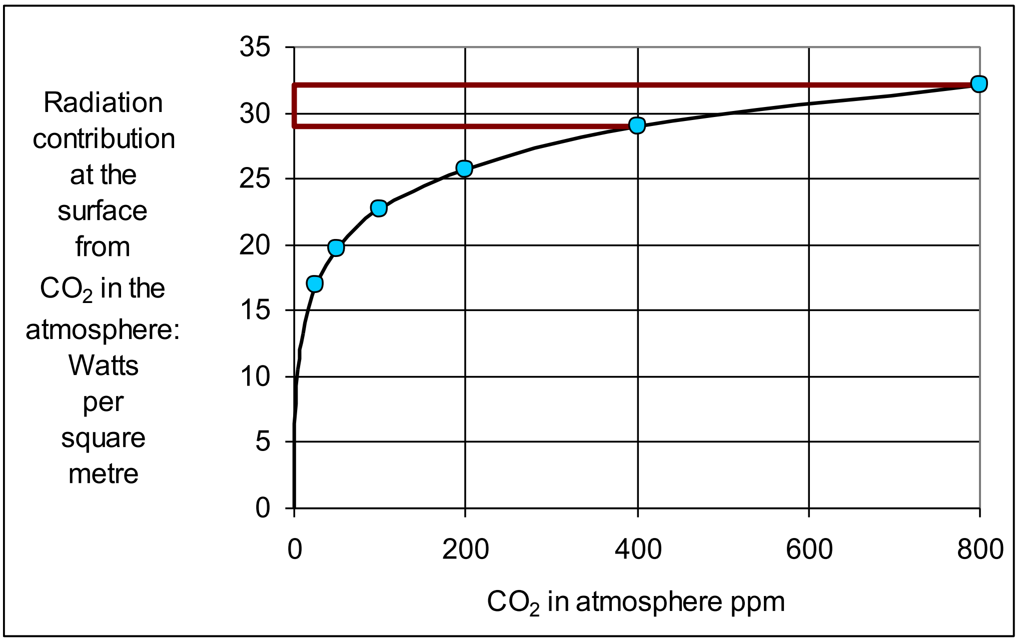

Figure 2: *As the concentration of CO_2 increases, there is increased radiation back to the surface of the earth (the greenhouse effect). This is measured in Watts per square metre (left axis). However the relationship is not linear. In fact doubling the concentration of CO_2 from 400 ppm to 800 ppm only increases the radiation from CO_2 at the surface by some 10% or 3.2 Watts per square metre. (Results derived for US standard atmosphere and cloudless sky from MODTRAN, a University of Chicago on-line calculator of energy in the atmosphere. MODTRAN is an international and IPCC accepted standard for atmospheric calculations).*

All the projections of future temperatures, sea levels, rainfall and disasters are the results of computer modelling. The critical inputs can grouped into four components:

1. **Present and past measurements of variables describing the behaviour of the atmosphere and oceans.**
   This is the starting point for understanding and important in verifying model calculations. In general the measurements are 'state-of-the-art'. Proxy data can be problematic. An example is tree ring analysis and the arguments over the Medieval Warm Period.
2. **Estimating the variations of sources and sinks for green house gases**
   There is considerable difficulty in identifying all sources and sinks for green house gases. The problems of understanding the variations in methane (Figures 12 and 13) illustrate the uncertainties in understanding sources and sinks of green house gases. The structured increases in CO_2 (Figures 6 and 7 and Table 1) indicate the important role of the oceans in setting CO_2 levels in the atmosphere.
3. **Coupling the oceans to the atmosphere**
   The oceans are 70% of the surface of the earth and have as much mass in their top 10 metres as the entire atmosphere. The changes in ocean surface temperature are a key determinant of global temperature. The recent climate models couple the oceans to the atmosphere. However the consequences of decadel oscillations of ocean surface temperature (Table 1) have largely been ignored since their occurrence and extent is not understood.
4. **Climate sensitivity**
   Climate sensitivity is how much warming is expected from a given change in CO_2. There is general agreement that more CO_2 in the atmosphere will increase the temperature at the surface of the earth. **A simple doubling of the CO_2 will give a temperature increase of less than 1^0C. The IPCC projections of greater increases from 2^0C to 4.5^0C are a consequence of positive feedback that follows the IPCC estimated radiative forcing**

ISOTOPES OF CARBON DIOXIDE

An isotope is any of two or more forms of a chemical element, having the same number of protons in the nucleus, or the same atomic number, but having different numbers of neutrons in the nucleus, or different atomic weights. There are two stable isotopes of carbon, carbon-12 (C12) and carbon-13 (C13). C12 has 6 protons and neutrons while C13 has 6 protons and 7 neutrons. Since the rate of chemical reactions and physical processes is greater for lighter isotopes, all other things being equal, enrichment and depletion of carbon isotopes occurs. For plants, photosynthesis has 2 pathways that lead to different depletion levels of C13 fixed in plants.

The various sources of atmospheric CO_2 have quite distinctive isotopic compositions (see *Footnote 1*).

The isotopic composition of atmospheric CO_2 has been measured since 1978 by Scripps. By combining the measurements of CO_2 concentrations and isotopic composition, it is possible to separate contributions from plants, whether on land or in the oceans, and contributions from the oceans.

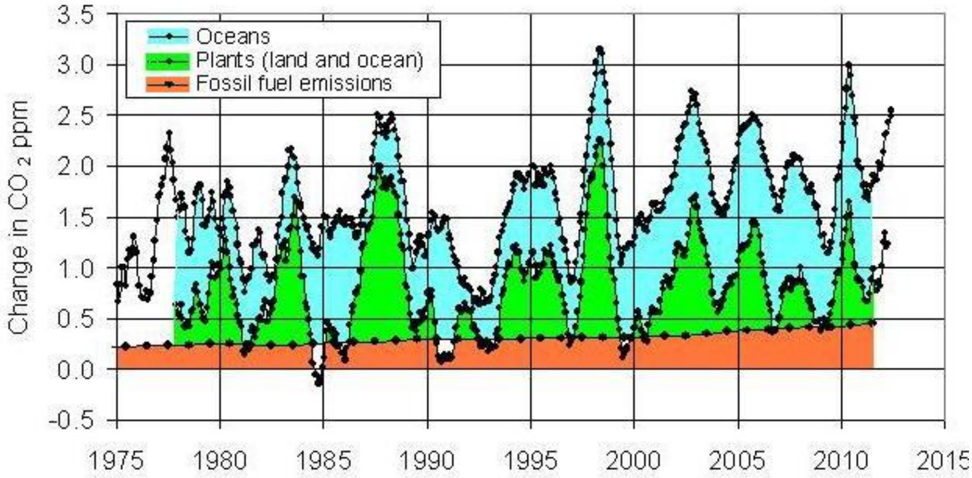

Figure 3: *5 month running averages for total annual CO_2 increases and the* ***l****and and ocean plant component of the annual CO_2 increases assuming $\delta^{13}C = -26$ for land. Also 10% of global fossil fuel and cement production emissions making up 19% of the average annual increase in CO_2 (Source CDIAC*

This preliminary analysis shows that after allowing for uncertainties less than 16% of fossil fuel emissions are found in the "well-mixed" atmosphere whereas the present accepted figure is 55% (Figure 1). The detail is shown in Figures 3B and C with separate land and ocean contributions

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Footnote 1:

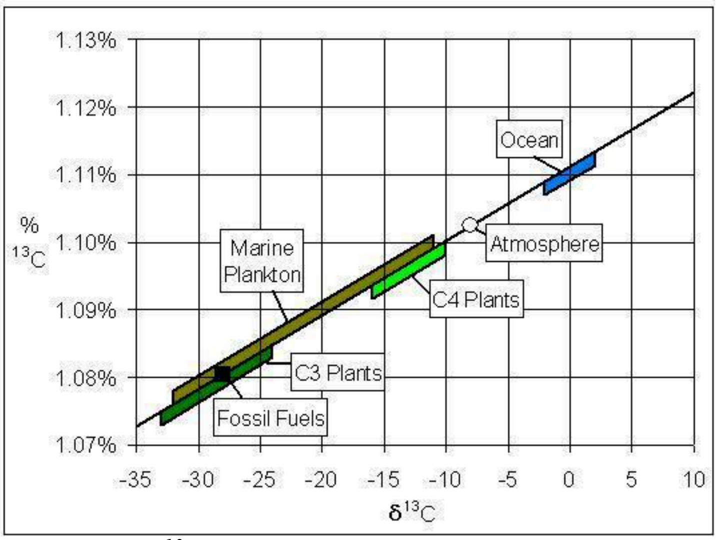


Figure R1: *$\delta^{13}C$ as a percentage of Carbon-13 in carbon*

TEMPERATURES MEASUREMENTS

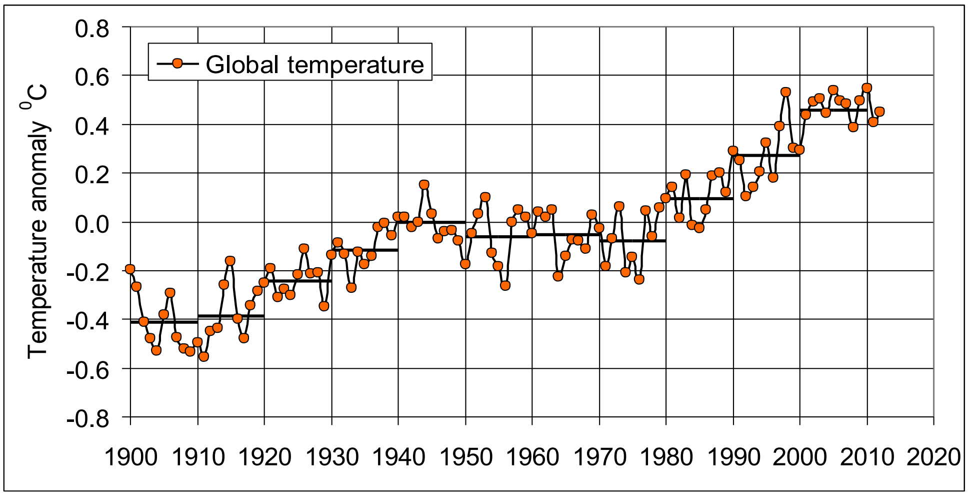


Figure 4: *Annual global temperatures from the Hadley Centre and the Climate Research Unit of the University of East Anglia (CRU). Here solid lines show ten year averages. Note the loss of detail in ten year averages such as the 1997-98 El Nino. (Source Hadley-CRU 2013)*

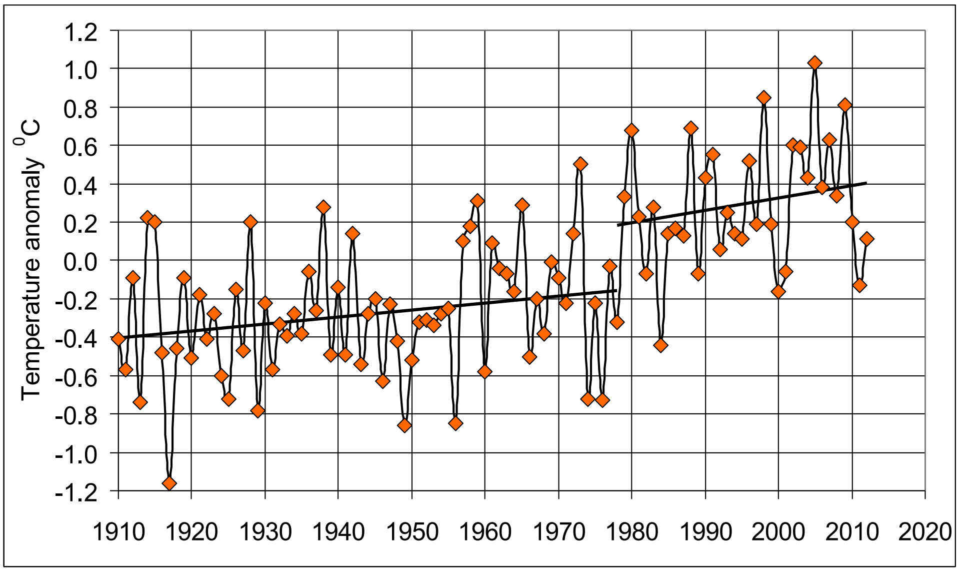


Figure 5: *Annual Australian temperatures from the Bureau of Meteorology (BOM) high quality data series. The break and jump in the solid lines of 0.4^{0}C is a consequence of the Pacific Decadal Oscillation moving from a cool to a warm phase, often called the Great Pacific Climate Shift of 1976-78 that is also reflected in the global temperature.*

Annual average Australian temperatures compiled by the BOM from high quality data that has been adjusted from the actual measured data to take account of changes in measurement technology and place of recording. The average is calculated solely from the minimum and maximum temperatures. Hadley CRU temperatures also use the average of the minimum and maximum temperatures

There is evidence suggesting that the adjustments by the BOM may have a significant upward bias. However, even using the BOM adjusted figures we find that the jump in the solid lines between the two periods covered show a 0.4 ^{0}C increase in average temperatures that must be largely if not entirely attributable to natural changes as there was no comparable jump in atmospheric CO_2 concentrations at that time.

In fact, in 1976-78 there was a major transformation in sea surface temperatures due to a sudden replacement of cold water with warm water along the west coast of North America and the equatorial eastern Pacific (in 1997 researchers identified a multi-decadal oscillation in Pacific sea surface temperature and pressure, which they called the Pacific Decadal Oscillation). The implication is that half of the increase of about 0.8 ^{0}C in temperatures in Australia during the last century reflected natural changes and that there is no validity in temperature prediction models that assume the increase reflected fossil fuel emissions.

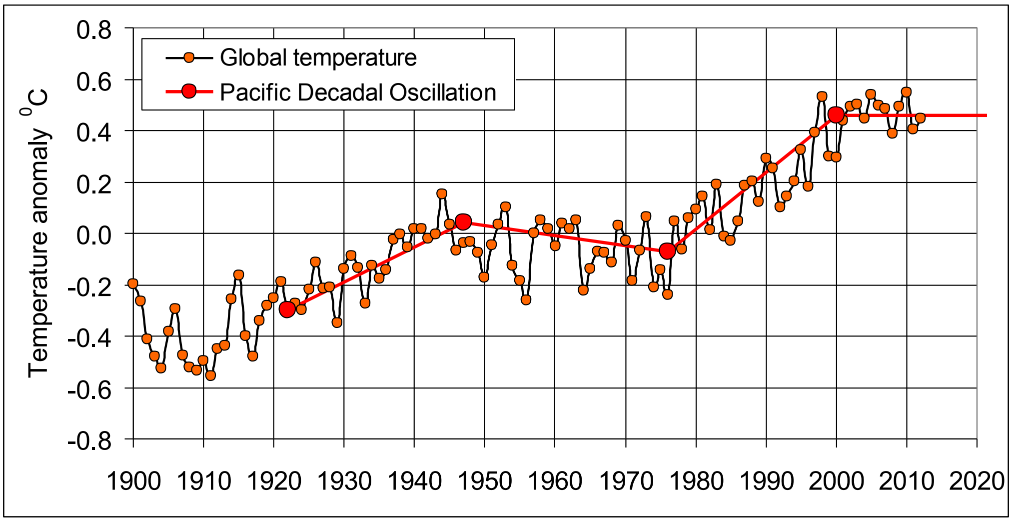


Figure 6: *Annual global temperatures from the Hadley Centre and the CRU. Here solid lines show ten year averages. The* ***red points*** *mark the phase changes of the Pacific Decadal Oscillations.*

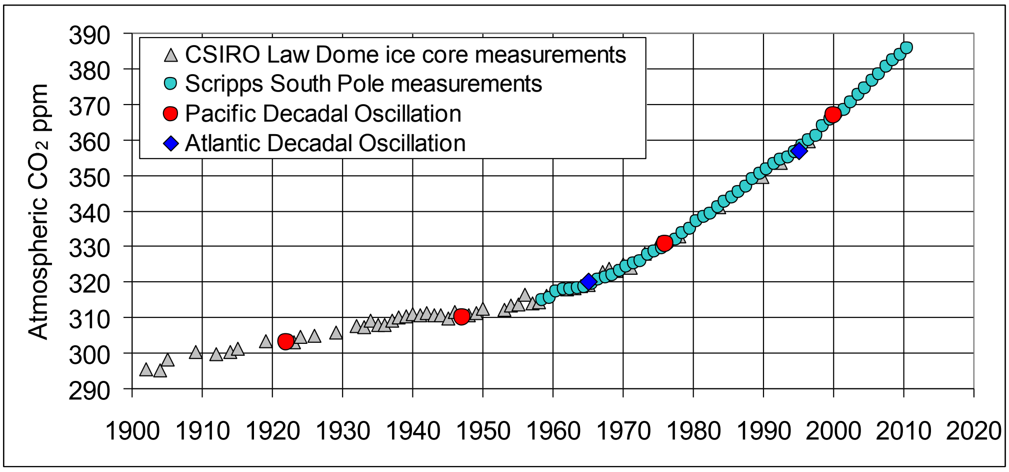


Figure 7: *Atmospheric CO_2 concentrations measured in ice cores at the Law Dome in Antarctica (CSIRO) and directly at the South Pole (Scripps Institute of Oceanography). The* ***red*** *and* ***dark blue points*** *mark the phase changes of the Pacific and Atlantic Decadal Oscillations including a probable change in 2000.*

The oceans cover 70% of the surface of the earth. The top 10 metres of the ocean have the same mass as the entire atmosphere. The oceans are a heat store for the planet and have a compelling influence on the atmosphere. The Pacific and Atlantic Decadal Oscillations are an expression of this influence.

The Pacific Decadal Oscillation appears to have the more powerful atmospheric influence as both temperature and CO_2 respond to the changing phases. There is no close relationship of temperature with CO_2 for either warm or cool phases of the Pacific Decadal Oscillation.

Table 1: Variations in temperature and atmospheric CO_2

PERIOD	Pacific Decadal Oscillation Phase	Global Temperature °C increase per 10 years	CO_2 at the South Pole Annual increase in ppm
1922 - 1947	Warm	0.13 +/- 0.02	0.40 +/- 0.03
1948 - 1976	Cool	-0.02 +/- 0.03	0.85 +/- 0.03
1977 - 2000	Warm	0.16 +/- 0.03	1.49 +/- 0.01
2000 - 2012	Cool?	-0.02 +/- 0.04	1.93 +/- 0.03

Clearly the connection of temperature and CO_2 concentrations is not simple

TEMPERATURE ADJUSTMENTS

There are two problems with the definition of **T**mean = ½(**T**minimum + **T**maximum) but the minimum and maximum temperatures constitute the historical record.

- First, does the average of minimum and maximum temperatures represent the mean temperature over a full day of 24 hours? The answer is that it does not. There is up to a 0.6 ^{0}C systematic error

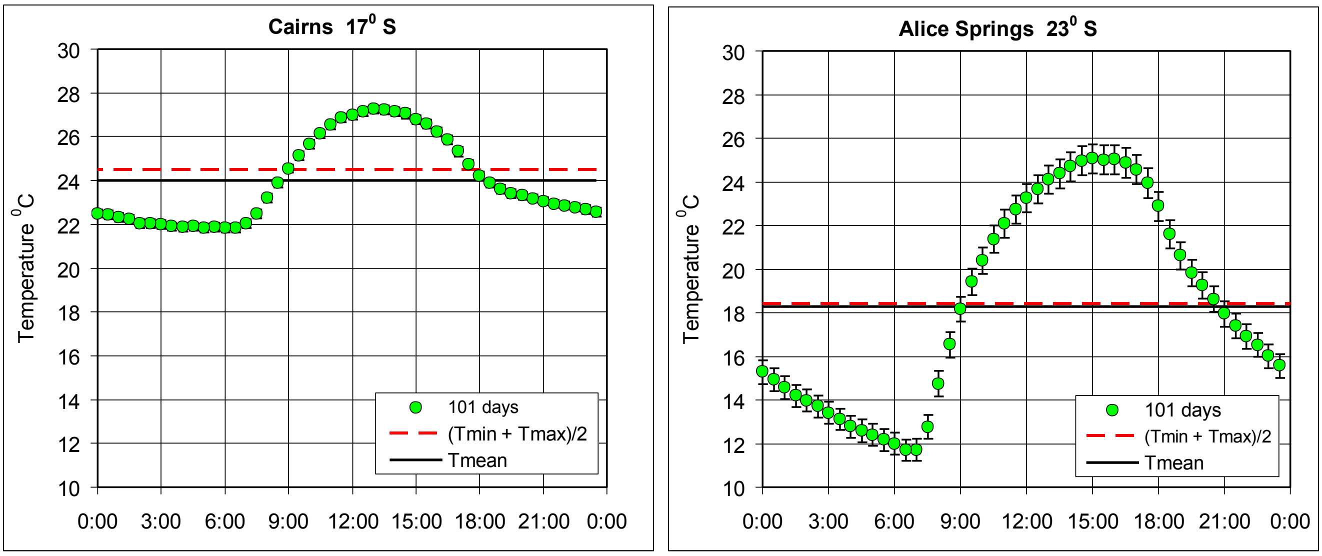


Figure 8: *Temperatures measured at 30 minute intervals through a 24 hour day.*

  The sample in Figure 8 is for 101 days from March to June 2013 and the error bars are the standard errors of the mean. The difference for (Tmin + Tmax)/2 - Tmean is **0.01 +/- 0.06** for Alice Springs and **0.55 +/- 0.04** for Cairns.

  The centre of the Australian continent has a desert climate and the Alice Springs location has a desert temperature behaviour that is representative of much of central Australia from Kalgoorlie to Broken Hill. On the other hand Cairns temperatures represent both coastal and inland areas where the humidity is greater than in central Australia.

- Second, minimum and maximum temperature thermometers record the extremes through a twenty four hour day. A comparison of the extremes with temperatures read every 30 minutes through the day shows the presence of a systematic error. The average error from the use of 24 hour thermometer readings is an increase in mean temperature of **0.13 +/- 0.01 ^{0}C**. This is an over-estimate of all mean temperatures calculated from the use of minimum and maximum values.

This systematic error is a consequence of the “one-way” temperature recording where, for example, a 10 minute 1^{0}C fluctuation increasing temperature would give a 0.5^{0}C increase in the average of minimum and maximum “mean” temperature rather than the properly weighted 0.01^{0}C change.

These are serious and un-addressed systematic errors which give a significant upward bias to continental and global land temperatures. Ocean temperature measurements are recorded in a quite different manner.

URBAN HEAT ISLAND EFFECT

There is a further problem that arises from adjustments made to get the “high quality” Australian temperatures. It is the “urban heat island effect”. A comparison of the BOM office site in central Melbourne and Laverton airport illustrates the problem. Laverton is some 18 km from the BOM office site in Melbourne.

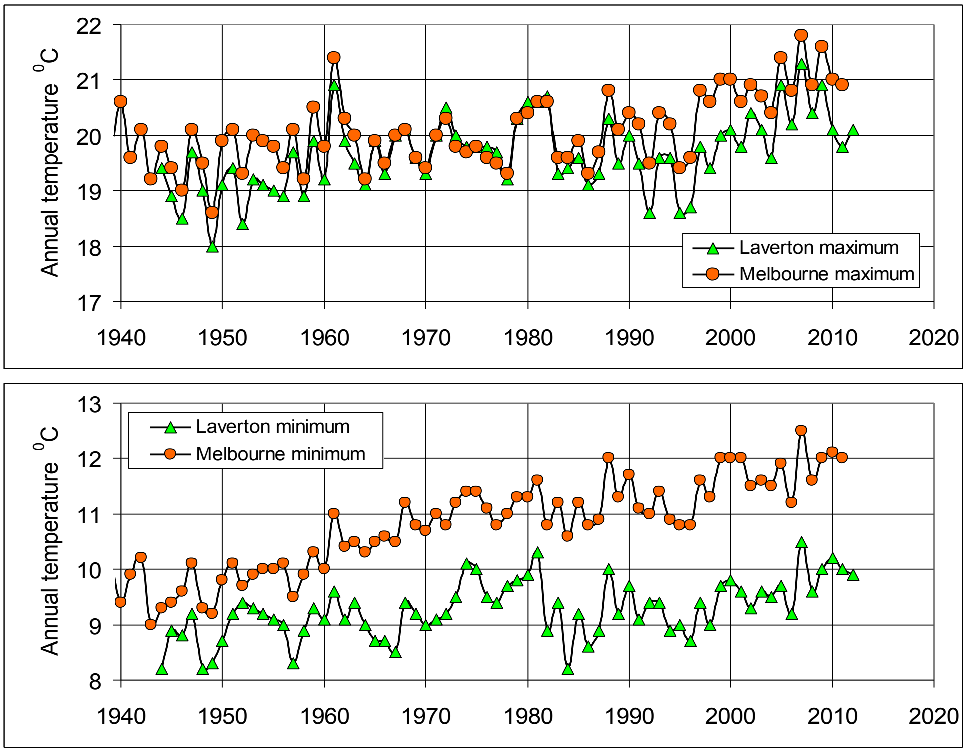


Figure 9: *BOM records of direct maximum and minimum temperatures at the BOM office in central Melbourne and at Laverton airport.*

For the minimum temperature at Laverton, there is a very significant difference to Melbourne in both temperature and trend over the same period. While there is a modest minimum temperature increase at Laverton of 0.13 +/- 0.03^{0}C per decade, the increase in Melbourne is 0.35 +/- 0.02^{0}C per decade

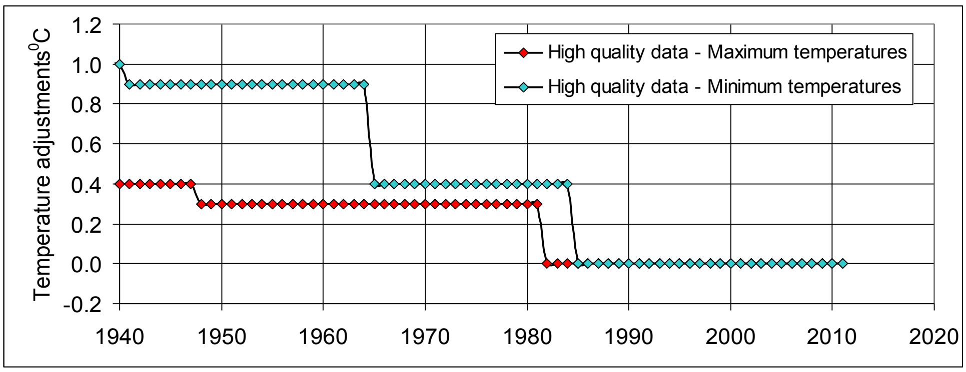


Figure 10: *Adjustments made to the direct BOM Melbourne office temperature records to give “high quality” BOM temperature records.*

The minimum temperatures occur just at or before sunrise, when the only sources of warmth are carried in the atmosphere or are radiated by buildings close to the recording thermometers. The BOM documents the changes in the surroundings of their site at the corner of Victoria and LaTrobe Streets but the adjustment figure above for the minimum temperature shows no hint of urban heating coming from the changes to the surroundings -- quite the reverse, in fact.

There are serious and un-addressed systematic errors in the over-estimation of continental and global temperatures. These errors are of the same size as the present adjustments.

VERIFICATION OF COMPUTER MODEL PREDICTIONS

The IPCC estimates of forcing are not supported by a number of experimental analyses. An example of this is the climate models' prediction that global precipitation will increase at a rate of 1-3% per degree rise in temperature. A recent analysis of satellite observations (Wentz 2007) does not support this prediction. Rather, the observations show that precipitation has increased at about 6% per degree rise in temperature over the last two decades. This result indicates reduced rather than increased temperature compared to the simple increase illustrated in Figure 2.

Roy Spencer's comparison of models and measurements:

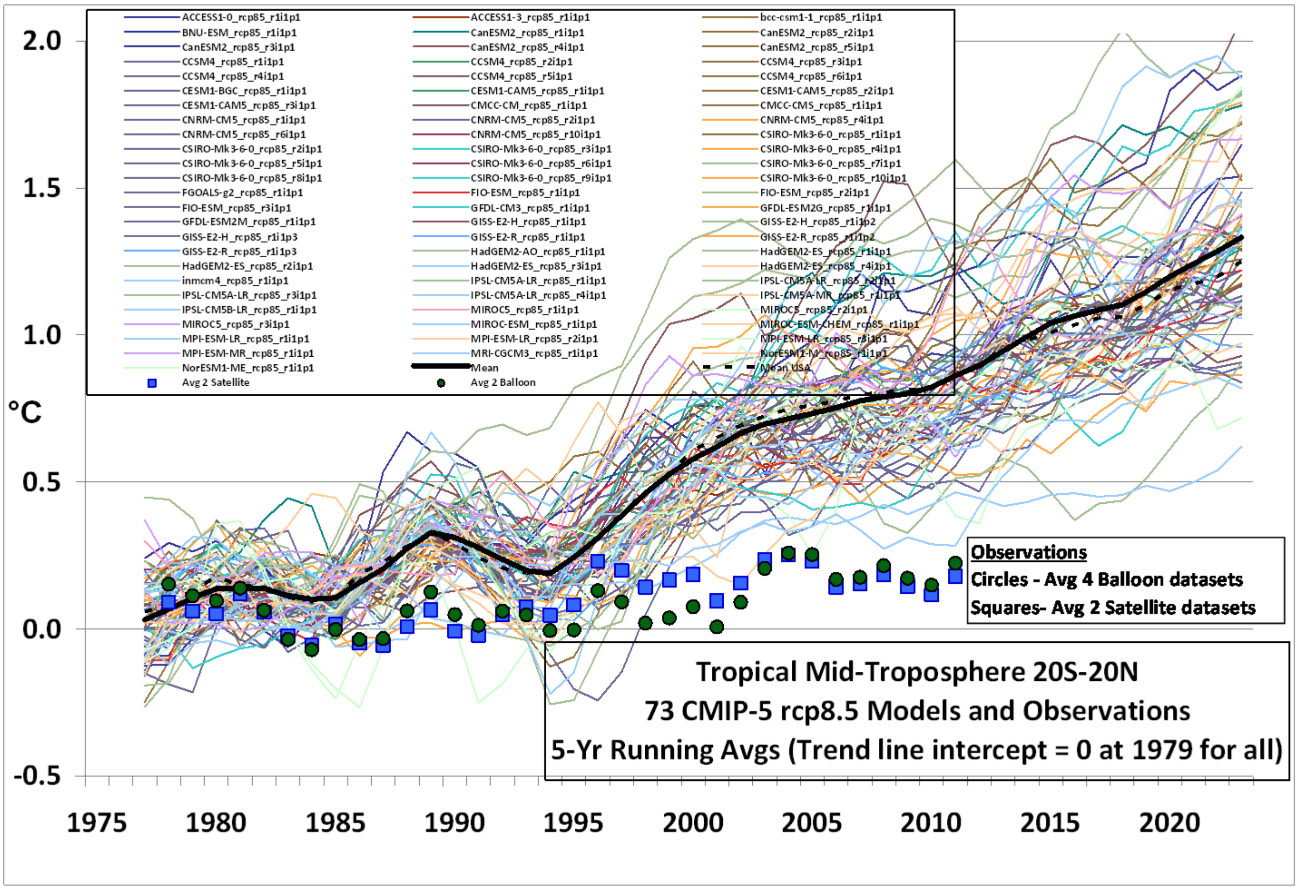


Figure 11: *A comparison of modelled and measured temperatures by Roy Spencer, University of Alabama at Huntsville. The continuous solid line is the average of 73 model projections. The green circles and blue squares are balloon and satellite measurements.*

None of the models projected measured temperatures.

LONG TERM BEHAVIOUR OF ATMOSPHERIC METHANE

CSIRO measurements and analysis of methane extracted from ice cores at the Law Dome in Antarctica. Direct measurements in the atmosphere come from CSIRO station at Cape Grim on the northwest corner of Tasmania. The data for these two figures comes from the CSIRO. This includes the smoothing of the data. All the methane data can be found on the Carbon Dioxide Information Analysis Center http://cdiac.ornl.gov/by_new/bysubjec.html#atmospheric . The only additional data handling has been to calculate the annual increase in methane concentrations.

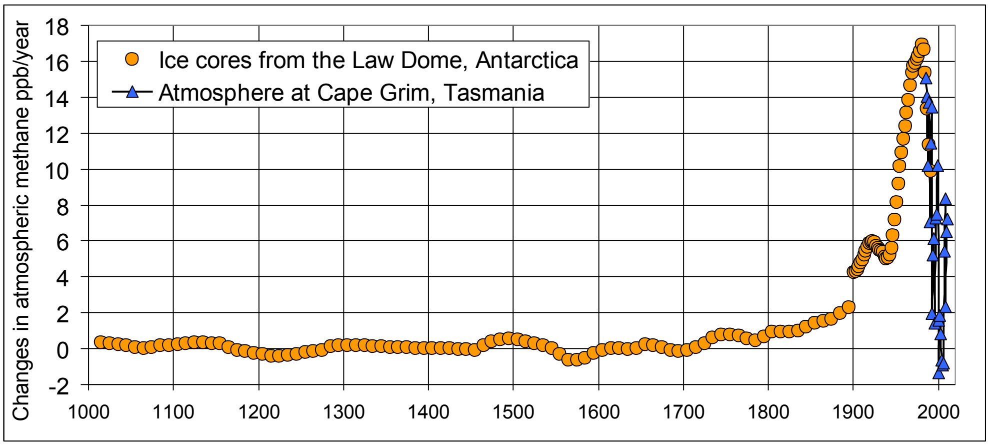


Figure 12: *Ice core and direct measurements of atmospheric methane. Data source CSIRO*

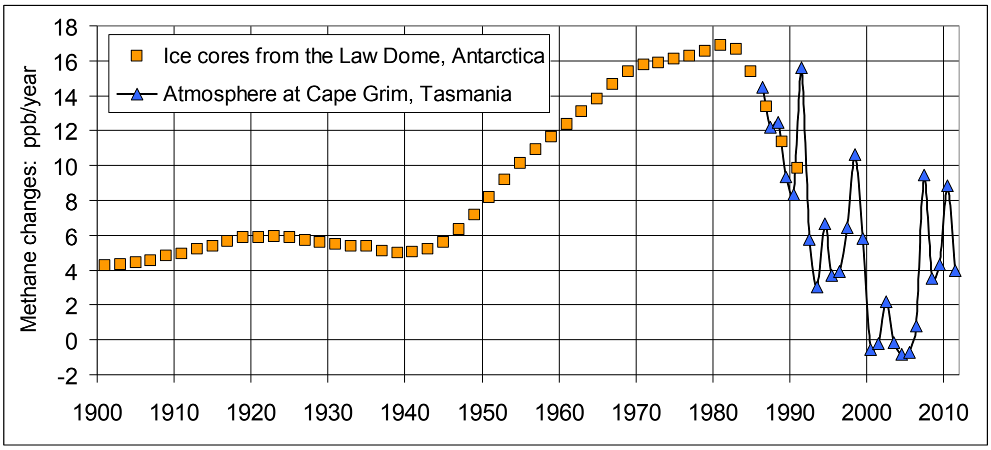


Figure 13: *Ice core and direct measurements of atmospheric methane from 1900. The peaks in the direct measurements correspond to El Ninos with the exception of 1992 which is an indirect result of the Mt Pinatubo eruption. Data source CSIRO.*

Table 2: Annual increase in atmospheric methane

From year	1000	1750	1800	1850	1900	1950	1960	1970	1980	1990	2000
To year	1750	1800	1850	1900	1950	1960	1970	1980	1990	2000	2011
Methane ppb/year	0.05	0.63	1.00	1.63	5.36	10.00	13.85	16.11	15.76	7.22	2.54

The annual increase in atmospheric methane is at about the rate of the early part of the nineteenth century. An explanation for the rise in methane from the 1940s to the 1980s is the expanding consumption of natural gas and its leakage from pipelines, particularly in the old Soviet Union. The steep fall at the end of the 1980s and early 1990s occurred as the leakage was greatly reduced and since that time variations follow a natural pattern showing El Ninos.

In the IPCC fourth report, Scenario A1FI gave the projected rise in methane as 8 ppb/year to year 2100, a factor of 4 times the last 10 years. The CSIRO uses scenario A1FI for many of their computer model forecasts.

MURRAY-DARLING BASIN YEARLY RAINFALL 1900 TO 2012

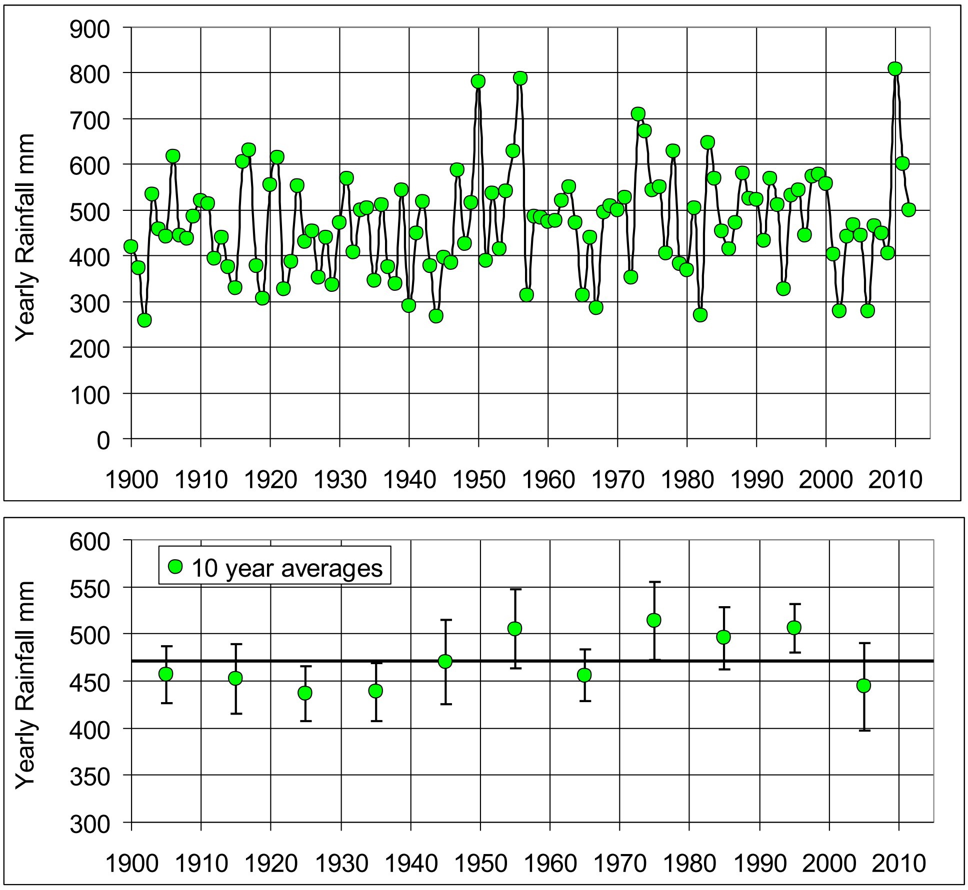


***Figure 14: Upper**: Yearly and **Lower** 10 year average rainfall in the Murray-Darling Basin. Mean value (solid line) and median are 471 mm. There is no significant trend in rainfall through this period but with large variability- standard deviation of 111 mm with rainfall extremes of a minimum 258 mm and a maximum of 809 mm in 2010*

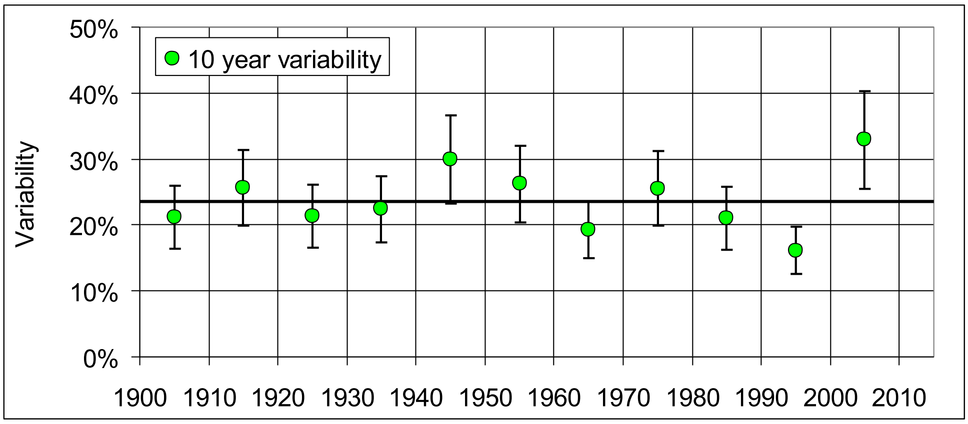


***Figure 15:** Murray Darling Basin variability. Variability is the rainfall standard deviation divided by mean rainfall for 10 year periods. Solid line is the overall variability of 24%.*

There results do not provide any support for the climate model projections of less rainfall and more variability.

The 1963 study by Sir Samuel Wadham of Australian climate over 75 years compared with overseas concluded that "nowhere in the world is there such a huge area of pastoral land of such erratic rainfall".

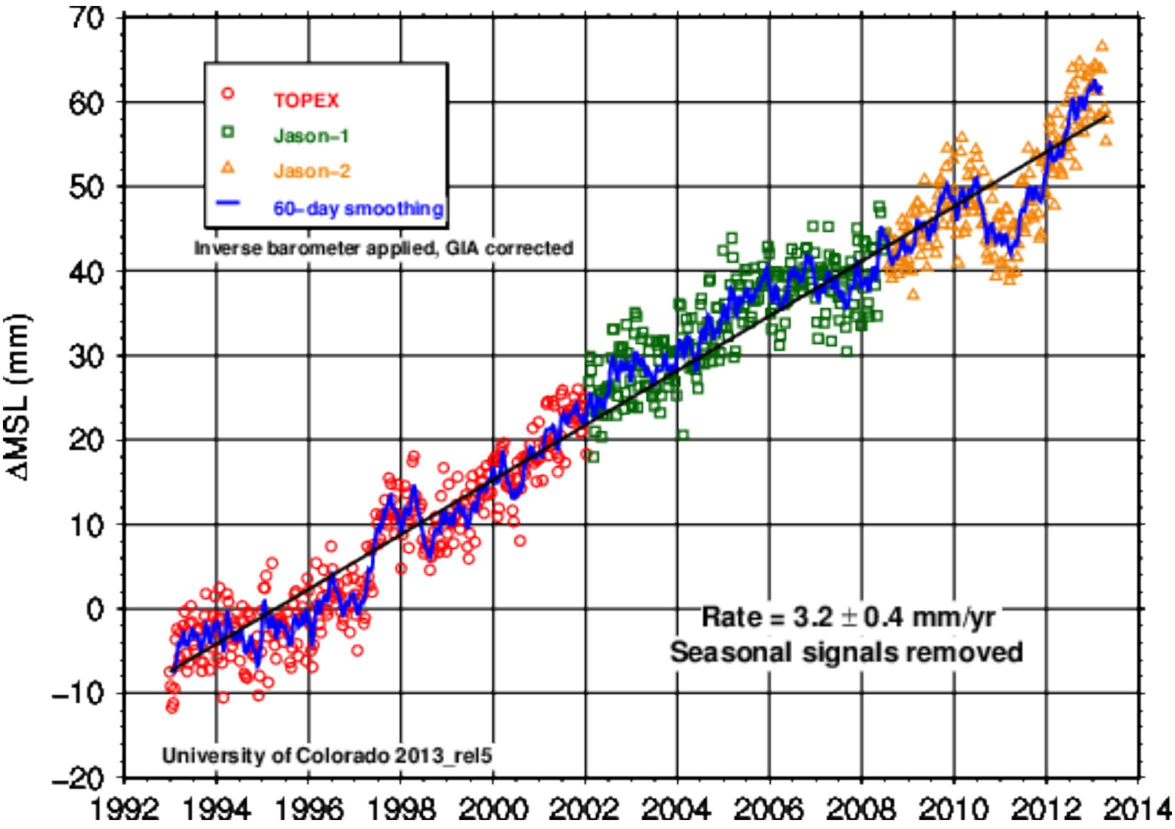


Figure 16: *The global mean sea level graph was made using satellite altimetry and processed by the University of Colorado at Boulder. Note that the rate of increase is 3.2 +/- 0.4 mm/year for1992 to 2012 but falls to 2.6+/- 0.3 mm/year for 2002-2012. If the rate of increase continues at about 3 mm a year, sea levels would reach about 30 cm in 2100. That is consistent with the IPCC's projection of 19-59 cm by 2100 and would not involve any significant inundations.*

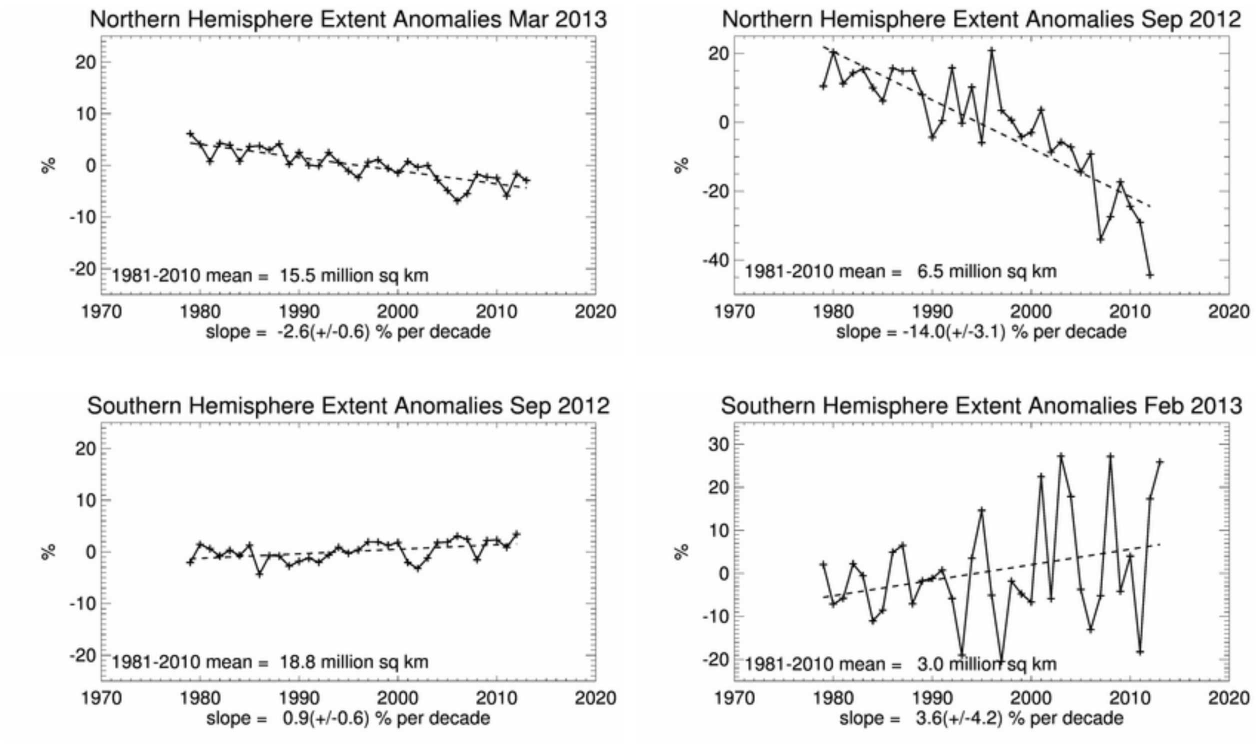
Over the last century, global sea level changes were obtained from tide gauge measurements by long-term averaging. The increase over the period to 1990 was estimated at 2 mm per year.

Since August 1992 the satellite altimeters have been measuring sea level on a global basis with unprecedented accuracy using precisely known spacecraft orbits. The TOPEX/POSEIDON (T/P) satellite mission provided observations of sea level change from 1992 until 2005. Jason-1, launched in late 2001 as the successor to T/P, continues this record by providing an estimate of global mean sea level every 10 days with an uncertainty of 3-4 mm. The latest mean sea level time series can be found on this site.

There is some criticism of the processing of the satellite data with an analysis (N Morner 2011) showing that land uplift and subsidence corrections to tide gauges have increased the sea level rise by 1 to 2 mm per year.

A “draft” of AR5 by the IPCC predicts an increase by 2100 of 29-82cm compared with the IPCC AR4 prediction of 19-59cm. An increase of 3mm a year would lead to an increase by 2100 at the bottom end of the IPCC AR5 projection range of 29-82cm.

CHANGES IN SOUTHERN AND NORTHERN ICECAPS



Maximum Minimum

Figure 17: *Arctic and Antarctica ice extent. The maximum extent occurs in March in the Northern Hemisphere and in September in the Southern Hemisphere, summer minima occur in September and February. The Northern Hemisphere ice extent is decreasing with reducing maximum and minimum extent. Note that the slopes for the fitted straight lines give the change per decade.*

Data from National Snow and Ice Data Center: http://nsidc.org/data/seaice_index/

The 30 year net global changes in maximum and minimum ice extent are -0.1 +/- 0.1 million sq km and -0.4+/- 0.2 million sq km.

This is not a statistically significant change.

Receding ice is not a new phenomenon.

In 1903, Amundsen led the first expedition to successfully traverse Canada's Northwest Passage between the Atlantic and Pacific Oceans.

In 1922 the US Weather Bureau reported "The Arctic Ocean is warming up, icebergs are growing scarcer and in some places the seals are finding the water too hot. Reports all point to a radical change in climate conditions and hitherto unheard-of temperatures in the arctic zone. Expeditions report that scarcely any ice has been met with as far north as 81 degrees 29 minutes. Great masses of ice have been replaced by moraines of earth and stones, while at many points well known glaciers have entirely disappeared."

GLOBAL MEAN RADIATIVE FORCING

Radiative forcing is used to assess and compare the anthropogenic and natural drivers of climate change. The many factors influencing temperature, both positively and negatively, are categorised under the title 'Radiative forcing' and the effects of each influence are naturally subject to margins of error. The IPCC publishes the following graphic (Fig 18) showing the various influences.

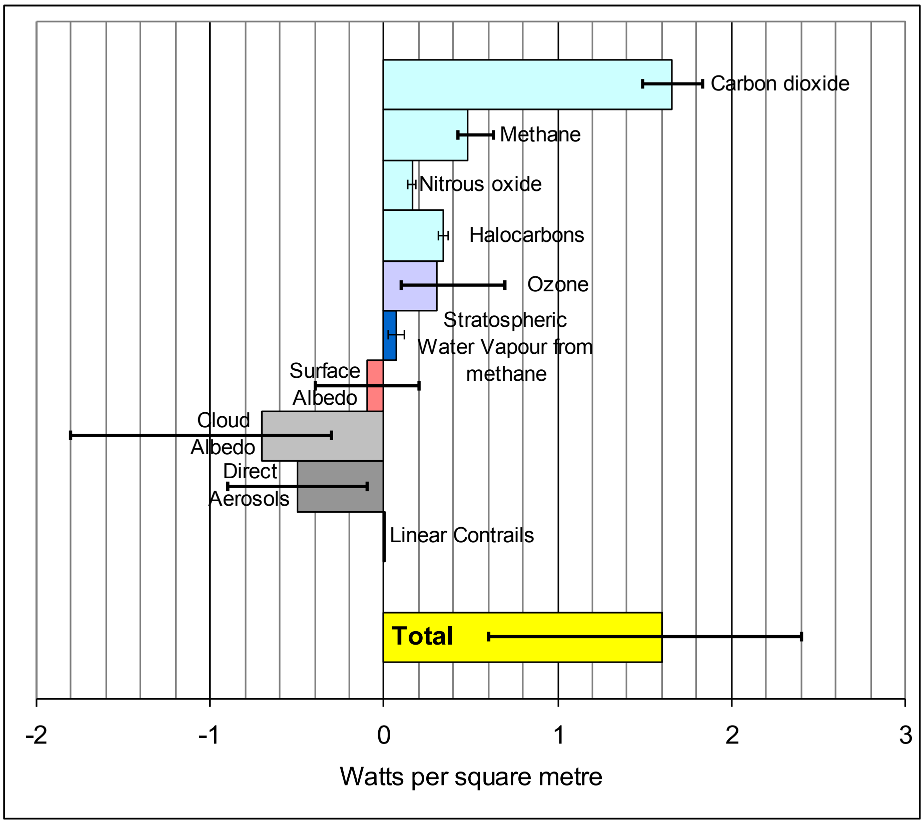


Figure 18: *Radiative forcing from various sources. The error bars show the uncertainty for each source. The total is described by the IPCC as "the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m^{-2} (see Figure SPM.2)". [IPCC-AR4 2007 WG1 Fig SPM.2]. Note the large uncertainties for aerosol and albedo forcing.*

The figure shows that the IPCC derived estimate of radiative forcing is 1.6 Watts per square metre from a range of sources which in many cases have considerable errors. Some are estimates based on "expert" opinion not measurement. These large errors give the summed total radiative forcing itself an equally large error. The radiative forcing value, in turn, leads the IPCC to claim in its last report that the resulting temperature increase of 0.8 (+0.4 to +1.1)^{0}C explains the temperature increase since 1750.

The temperature effects of the components of radiative forcing are often presented as feedback. It is generally agreed that there is a temperature increase due to increasing CO_2 and other greenhouse gases. Feedback is the result of other radiative forcing components that increase or decrease this temperature change. The feedback is represented by the formula:

$$\Delta T = \Delta T_0 / (1-f)$$

where ΔT_0 is the initial calculated temperature increase, f the feedback factor and ΔT is the final temperature increase.

Table 4: Feedback and temperature increase when atmospheric CO2 doubled

	f feedback	ΔT ^{0}C
Negative feedback (not found in any climate models but calculated by others)	-1.4 to -0.2	0.5 to 1.0
No feedback – ΔT_0 baseline from CO_2 and other greenhouse gases	0	1.2
Positive feedback (found in all climate models)	0.4 to 0.7	2.0 to 4.5
Measurement (this example is from precipitation)	**-0.5**	**0.8**