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Those who have knowledge, don't predict. Those who predict, don't have knowledge" – Lao Tzu, 6th Century BC Chinese Poet

Why No Dangerous Rise in Temperatures Threatens

Address to University of Third Age, Orrong Rd, 28 March 2011

By Des Moore

I start with a confession that I have no belief in the thesis promulgated by the Intergovernmental Panel on Climate Change that unless early government action is taken to reduce emissions of greenhouse gases there will be a continuing increase in temperatures that will reach dangerous levels for humans. This is not to deny that temperatures have increased and may increase further: the key questions to examine are the cause and the possible human contribution, and whether any further likely increases are capable of being handled safely, as they have to date. I propose to examine the main arguments adduced to support the dangerous warming thesis and to show that there is no substantive basis to them. I say this despite the acceptance of the thesis by just about all major political parties in the Western world and despite persistent claims that there is a scientific consensus on the issue.

When I first began to present my views on global warming in public three or four years ago I was widely regarded as being extreme and ignorant about what some regard as the greatest threat faced by mankind. Those terms have re-emerged strongly in recent days in Canberra and elsewhere. I present myself here as someone who is attempting to present the facts and who knows many with like minds.

It is important to recognise that supposedly irrefutable arguments by experts have been discarded or substantially altered many times in the past. Back in 1972 when I attended the Royal College of Defence Studies in London many respected scientists (and others) were then promulgating the view that unless governments acted to stop or radically slow the growth of population the world would soon run out of resources to feed and care for the needs of the higher populations. The thesis I wrote as part of my attendance at the College in London argued that the scientists concerned had not only failed to understand the way economic systems function to overcome actual or potential shortages but had overlooked the almost certain development of scientific innovations that would ensure growing living standards.. This 1972 Malthusian thesis is still hovering around but has faded somewhat as living standards have increased even as populations have grown and as the identified supply of resources has also continued to grow.

Today, the global warming scare is starting to fade too, although less in Australia than some other countries. A large survey (7000) in March in the US by the popular science journal, Scientific American, showed that 78% believe climate change is a natural process and 26% believe it comes from greenhouse gases. A PEW survey last October showed 34% believed warming came from human activity, which is about the same as the proportion who believe houses are haunted! In Australia, a Gallup poll last August showed 44% believe warming is due to human activity, down from 52% in 2006, although 69% believe it is a serious or very

serious problem, only slightly down from the previous poll of 75%. A US Gallup Poll in 2009 showed that out of eight environmental problems global warming ranked last

My argument that the global warming scare is fading is not simply based on such polling. It partly reflects the fiasco in Copenhagen last year. That showed that, when political leaders have to make decisions that would hurt their taxpayers' pockets, they are much less likely to agree than when they are asked to answer questions requiring no action. Just as important as the Copenhagen and Cancun flops has been the exposure of exchanges of emails between scientists that revealed the experts who are part of the supposed scientific consensus are in reality themselves uncertain about the science. This exposure, popularly described as ClimateGate, also revealed that even scientists are not above manipulating data and using dodgy analyses to produce results that fit the theory. One outcome is that there is now doubt even about the accuracy of actual surface temperature measurements and the extent of increases.

Other influences over the last 2-3 years have been the increasing analyses by scientists questioning claims by the IPCC. These have revealed important errors in the IPCC 2007 report including the claim that Himalayan glaciers are in danger of melting by 2035, which if correct would have serious adverse implications for water supplies in major countries. It turns out that, contrary to IPCC claims that everything has been peer-reviewed, this one was not. The Indian head of IPCC, Rajendra Pachauri, who initially said the denial of melting was voodoo science, eventually had to admit an error. But this was not the only case where IPCC alarmism or failure to peer review had been used to scare people into believing the thesis. Others include incorrect claims that 40% of the Amazon rain forest is at risk of destruction; that African agricultural production is likely to be cut in half; that coral reef degradation will be extensive; that glacier melt will occur in the Andes and Alps; that extreme weather related events are causing rising costs; and that the Netherlands is 55% below sea levels when in fact it is only 26% and has shown itself well able to handle relevant problems.

These errors and the exposures of uncertainty led to the announcement of "independent reviews" into the IPCC, a section of the US university attended by prominent believer Michael Mann and the Climate Research Unit at East Anglia University. That CRU unit has been the major supplier of data and analyses to the IPCC, which itself undertakes no scientific research. The head of the CRU, Phillip Jones, let the cat out of the bag in an interview last year with the BBC environment reporter when he admitted that surface temperature data probably cannot be verified or replicated, that the medieval warming period may have been as warm as today; that no statistically measured global warming has occurred for the last 15 years; and that the science is not settled.

Despite such revelations and the Copenhagen fiasco, the four reviews held into ClimateGate did not produce any sackings or formal retractions. Independent analyses of these reviews have concluded that they were heavily influenced by those appointed to undertake them, most of whom were believers in the dangerous warming thesis. The unfortunate reality is that so many scientists (and others) have locked themselves into the supposed scientific consensus that it is likely to take some considerable time before government policies designed to reduce greenhouse gas emissions are either abandoned or allowed to wither on the vine.

More generally however, although the believers in the dangerous warming thesis have not reversed their view that the basic *science* is right, there has been increasing acknowledgement that there are uncertainties. This should not be surprising given that in the 987 page report of

Working Group 1 of the IPCC's 2007 report the words "uncertain" or "uncertainty" appear more than 1,300 times and includes no less than 54 "key uncertainties" that acknowledge limits to capacity to predict climate change. However the uncertainties referred to in this key Working Group document attract very little public or political attention. The focus is on the much shorter "Summary for Policy Makers" also published by the IPCC and designed to "sell" the dangerous warming thesis to governments and the public. It claims the thesis has 90% certainty.

Perhaps the most important public recognition by mainstream scientists of the uncertainties has been last September's report by the Royal Society, which is a widely regarded as an authority on climate science. This report was produced in response to concerns by some members that it was wrong for the Society's public statements to claim there is a consensus. While the report itself had a bit both ways, it did acknowledge that climate change "continues to be the subject of intensive research and public debate", that "some uncertainties are unlikely ever to be significantly reduced", and that" it is not possible to determine how much the Earth will warm or exactly how the climate will change in the future". A not dissimilar development occurred in the American Physical Society (the top body of US physicists), where a large dissenting group circulated a letter last year saying ClimateGate had revealed "an international fraud, the worst any of us have seen". More recently, when 18 scientist believers sent a letter to Congress in February asking that its attention be concentrated on the view that human activity is changing the climate, 36 scientists responded with a letter referring to 678 peer-reviewed scientific studies that "offer a point-by-point rebuttal of all the claims" by the 18. Also in the US over 30,000 scientists, including 9,000 Phds, have signed a petition specifically rejecting the dangerous warming thesis. In Australia a written document was sent last year to the government by four respected sceptical scientists and this led to a hearing in Canberra before the then Climate Minister Wong - but rejection of the proposal for an independent inquiry into the science.

These and other reactions by mainstream scientists confirm that those rejecting the dangerous warming thesis are far from being ignorant extremists.

Outside the scientific world many books and articles have been written either rejecting or questioning the thesis and pointing out the many analytical mistakes made in the past by scientists. I mention here only the book *Scared to Death* by Christopher Booker which gives numerous worrying examples of the disastrous consequence associated such mistakes.

Published analysis by Australia's professionally respected Productivity Commission is also important. It has noted that "uncertainty continues to pervade the science and geopolitics and, notwithstanding the Stern Report, the economics" (that 2006 report by economist Nicholas Stern argued that the benefits of strong, early action on climate change considerably outweigh the costs because it will be difficult or impossible to reverse the changes in temperatures from doing nothing and, hence, tackling climate change is the pro-growth strategy for the longer term). The Productivity Commission has also pointed out that "independent action by Australia to substantially reduce GHG emissions, in itself, would deliver barely discernible climate benefits, but could be nationally very costly". And it described the Stern report "as much an exercise in advocacy as it is an economic analysis of climate". The Commission is now examining where Australia currently lines up internationally on the net effect of various policies designed to reduce emissions and PC chief Banks has already pointed out publicly that the cost of achieving a similar level of reductions to others will be greater for Australia because we are a bigger user of fossil fuels.

Notwithstanding this, and the publicly available acknowledgements of uncertainties and possible flaws in the science, the Gillard Government aims to start in 2012 a policy of reducing emissions by 5% by 2020 (compared with 2000) through, initially, a tax and then through the establishment of a system that would impose limits on carbon emissions by 2000 leading businesses and provide opportunities to trade in available carbon. It proposes to proceed regardless of what other countries do. The Opposition also supports the need to reduce emissions although by direct action such as planting of trees and carbon sequestration. Last March the CSIRO and Bureau of Meteorology produced a joint *State of Climate* report that accepted the dangerous warming thesis. This report, which claims to be "sourced from peer-reviewed data", says that Australia will be hotter and drier in coming decades. It also claims that it is "very likely that human activities have caused most of the global warming since 1950". The Fairfax press remains firmly locked in to this view and even The Australian, which publishes sceptical views, has stuck to an editorial position that there is a warming problem. The Australian has, however, opposed the adoption by Australia of an emissions reduction policy regardless of what others do.

Another major supporter of the need for early government action is prominent economist Ross Garnaut, who has been employed by the Federal (and some state) Government as chief adviser on climate matters. His major report in 2008, which he is updating this year, has been accompanied by many statements justifying early action to reduce emissions, but he has dodged any attempt to assess the science. Initially he acknowledged there are **large** uncertainties in the science but asserted that "the outsider to climate science has no rational choice but to accept that, on the balance of probabilities, the mainstream science is right in pointing to high risks from unmitigated climate change" (Final Report on Climate Change Review, September 2008). In this year's Update, however, Garnaut seems to have "lost" his uncertainty and he now claims that developments since 2008 "have strengthened the position of mainstream science then held with a high degree of certainty". It is clear that Garnaut has now become little more than an adviser employed to help the government realise its stated objective and to pay minimal regard to the uncertainties. It is remarkable that he even supports the policy of Australia acting to reduce emissions without any binding global agreement – or any realistic prospect of such an agreement.

Let me just make it clear here that, like Garnaut, I am not a scientist. But my nearly 50 years experience as an economic analyst both in Treasury and outside provides a basis for assessing the credibility of data used to justify the dangerous warming thesis and for examining alternative explanations by sceptical scientists. Contrary to Garnaut's assertion, qualified "outsiders" **must** pass judgement on science-based proposals –if they did not there would be a much bigger hole in government budgets!

The uncertainties about mainstream science and the extent of dissent are so large that any attempt to apply the so-called precautionary principle would defy common sense. Moreover, even if it were accepted that temperatures will increase, the enormous uncertainties about the extent and timing of any such increases, and about whether comprehensive mitigating action is required, suggests no case has been established for governments to **start** an emissions reduction program. Some say it's no different to insuring your home. But even leaving aside that not all of the population does that, insurance of houses is totally different to insuring the whole economic system against damage whose possible extent and timing are highly uncertain. There is also a wide range of opinion here, even amongst believers, on when the benefits from emission reductions are likely to occur.

For example, in an interview last week government-appointed Climate Commissioner Flannery made the extraordinary assertion that "if the world as a whole cut all emissions tomorrow the average temperature of the planet is not going to drop in several hundred years, perhaps as much as 1000 years, because the system is overburdened with C02 that has to be absorbed". Flannery's timing perspective does serve, however, to draw attention to analysis by other experts of the timing and extent of economic changes from a major reduction in emissions.

Analysis of Economic Effects

For present purposes I draw attention only to Garnaut's analysis in his Final Report of September 2008 but I note that he presents a view there that is similar to Stern's. Both take the view that starting action now to mitigate the effects of higher temperatures will not produce net benefits for many years ahead when most of us will be dead. The basic Garnaut scenario is that, although a meaningful emissions reduction program would involve "a major change in the structure of our economy", over time the net effect of mitigatory action will be beneficial. This conclusion is based on a view that, in addition to preventing damage from higher temperatures, Australian and other major economies have adaptive capacities that allow the transfer to low-emissions energy with relatively small initial adverse economic effects. However, "the main benefits of mitigation accrue in the 22nd and 23rd centuries and beyond" (P249).

Garnaut's general message is that, if we start taking mitigatory action now, that will cut the growth rate over the next half century, but will lift it "somewhere in the last decades" and produce a GDP at the end of the century "higher with ... mitigation than without" (p 245). His graphical presentation shows GDP in 2100 *after* mitigatory action has been taken as about 5 per cent higher than it would otherwise have been (p 267). But note that Garnaut concludes that "Australian material living standards are likely to grow strongly through the 21st century, **with or without** mitigation" (p565, my emphasis).

While this is an unbelievable conclusion that is probably designed to attract support from sceptics and others who question the rationale, it also raises the question of why we should be concerned about the possibility that taking no mitigatory action now will have very little adverse effects on living standards between now and the end of the century "higher with 550 mitigation than without" (p 245). In fact Garnaut's modelling suggests that a do nothing policy would still mean a GDP 700 per cent larger in real terms than today.

In a separate document, released in 2008 by Treasurer Swan and Climate Change Minister Wong ("Australia's Low Pollution Future: The Economics of Climate Change Mitigation", 30 Oct 08) Treasury arrived at virtually the same conclusion. After examining various global scenarios it concluded that mitigatory action to achieve CO2 concentration levels of 550 ppm by 2050 would reduce real GDP per capita growth by only 0.1-0.2 % pa. Thus we have the view of experts that damage from global warming between now and 2100 would be miniscule.

It is simply unbelievable that Garnaut and Treasury have painted a picture of no significant adverse effects from operating with much less efficient capital and energy or from the major increase in government intervention in economic decision-making that would likely inhibit entrepreneurial activity outside the financial sector. In comparison, climate economist Richard Tol, who was an IPCC lead author, has estimated that the cost of mitigatory action

by 2100 will be about 40 times greater than the benefits (see "Climate folly before failure", Alan Wood, The Australian, 1 Oct 09). The reality is that even mitigatory action between now and 2020 to achieve 20% lower emissions could have significantly greater adverse initial economic effects than implied by the modelling. In their pamphlet "Back to the 19th Century" some colleagues have, with former Finance Minister Peter Walsh, outlined the extensive potential for adverse influences.

The Garnaut report raises three questions about the need for urgent government action.

First, given that the Garnaut report effectively assumes that Australian living *standards* would increase progressively to ever higher levels even if there is also a large increase in temperatures, doesn't this suggest that a private sector that is getting wealthier and wealthier should be directly responsible for alleviating or suffering the main costs? That should mean a policy based mainly on adaptation rather than mitigatory action enforced by government.

Second, given the wide range already available of technological alternatives to fossil fuels, and the considerable research assistance already provided by governments, is it not very likely that over the next 25 years one of those technologies will become economically viable? Even if this doesn't eventuate, is there any substantive reason why nuclear power could not start to be used in Australia, perhaps initially on a subsidised basis, and then extended progressively if temperature increases resume? It is surely contrary to the national interest to start now **forcing** reductions in CO2 emissions, let alone mandating resort to very expensive alternatives to supply 20 per cent of electricity by 2020.

It is relevant that one parameter in the Treasury modelling is that "carbon capture and storage technology combined with coal and gas electricity generation is assumed to be available on a **commercial** scale from 2020 in both Australia and the world" (emphasis added). If this is likely, there is no need to proceed with an emissions reduction policy as we can simply continue with using our greatest asset, coal.

My third question is why has no account taken of the likelihood that by 2050 some existing alternative energy technologies will become economically usable by then. Even leaving carbon capture and storage aside, history tells us that scientific research will very likely have produced a new, but now unknown viable solution. It is nonsensical to argue for government intervention now to "save the planet" simply because no economically viable solution is *currently* available.

My assessment of the published economic modelling, and the potential availability of alternative technology, is that it provides no substantive basis for the need to take urgent action to reduce greenhouse gas emissions. But, as Garnaut rightly says "Climate change policy must begin with the science", (Garnaut Climate Change Review Interim Report, February 2008, p8) and we also need to assess the data used to justify the scientific basis.

Assessing the Science

Although the IPCC's key public document ("Summary for Policy Makers") derives from submissions by scientists, the drafters have mainly been people sympathetic to the dangerous global warming view. Claims that peer reviews of IPCC assessments ensure accuracy are meaningless when reviewers are in the same "club" (and some important conclusions now appear not to have been peer reviewed). In any event, as already mentioned, today we now

have a situation in which there are many peer-reviewed analyses that reject or qualify analyses in IPCC reports.

Chapter 9 of the Fourth Assessment report of the IPCC sets out that body's basic science conclusion that "it is very likely that anthropogenic greenhouse gas increases caused most of the observed increase in global average temperatures since the mid-20th century" and its report portrays graphs of rising global and regional temperatures over the last 100 years. The IPCC's conclusion is that, as human activity and use of fossil fuels will continue to increase emissions of carbon dioxide, this will add to concentrations of CO2 in the atmosphere and hence temperatures. Moreover, as it is also concluded that once CO2 concentrations reach a certain level it will become impossible to stop temperatures from continuing to increase, early action to reduce emissions is the only way to "save the planet".

The IPCC is correct in saying that some of the emissions of CO2 and other greenhouse gases do stay in the atmosphere in a concentrated form and do reflect back to earth some of the heat radiated from the earth's surface. However the extent to which the greenhouse effect carries through to temperatures needs to be considered against relevant data and science.

The CSIRO/BOM report of 15 March last year also simply draws on the IPCC analysis. It claims "there is greater than 90% certainty that increases in greenhouse gas emissions have caused most of the global warming since the mid 20th century". However the only support provided for this statement is a one sentence reference to "evidence of human influence ... detected in ocean warming, sea-level rise, continental-average temperatures, temperature extremes and wind patterns".

Temperatures and Concentrations of CO2 and Methane

I turn now to the graphs I have circulated.

Let us look first at Figures 1 and 2 showing data of annual averages of temperatures from 1910 published by our Bureau of Meteorology, the Hadley centre of the UK's bureau of meteorology and used by the IPCC. These bodies usually present this data publicly in the form of ten year averages but this misses out on showing the considerable variation from year to year and also on showing important change points that suggest changes in the trend. An important change point is the increase in Australian temperatures of about 0.6 of a degree in the mid 1970s due to the Great Pacific Climate Shift in the mid 1970s. Why is this important? Because the increase reflected *natural* causes and had no connection with fossil fuel emissions. Thus of the increase over 100 years of about 0.7-0.8 of a degree about 75% reflected natural causes, not increased emissions of fossil fuels.

Note also the solid lines showing trends in global averages involving an upward movement from 1910 to 1940, then a decline, followed by the upward movement starting after the Great Pacific Climate shift, and finally the relatively flat period since 1998.

This leads us to the graphs shown in Figure 4 and the table at the bottom summarising the changes in different periods of both temperatures and CO2 concentration levels. What the table shows is that there were two periods, one from 1939 to 1977 and one from 1997 to the present, during which temperatures were relatively stable but CO2 concentration levels increased quite strongly, particularly in the most recent period. It also shows a period when both temperatures and CO2 concentration levels increased (1977 to 1997), but that was when

the increase in temperatures had nothing to do with emissions. It is only in the pre-World War II period from 1910 to 1939 that it might be said there was a close connection between changes in the two. However in that period usage of fossil fuels would have been relatively low. My assessment is that, on the basis of this analysis, there is only a limited statistical relationship between changes in temperatures and changes in CO2 concentration levels.

Figures 10 and 11, which show the behaviour of another greenhouse gas, methane, are also relevant and of importance for interpreting the possible effect on concentrations of Australia's agriculture. The graphs show a surge in methane concentrations between 1940 and 1980 and a subsequent sharp drop, while the table shows that the current rate is now about the same as in the early 19th century. What is the likely explanation of these changes? The CSIRO-BOM *State of the Climate* report simply says that methane has shown similar increases to carbon dioxide. But it makes no mention either of the fall from the end of the 1980s or of the likelihood that both the rise and fall reflect initial leakages from pipelines and the subsequent fixing of those leakages.

I have skipped past the graphs shown in Figure 2 and I want to say here only that they show that "raw" temperature data as collected are "adjusted" by official meteorological organisations and, while adjustments are needed from time to time, they may be questionable. That is certainly seems the case with the adjustments made to Darwin temperatures by the BOM which wrongly added to the upward trend. When challenged at a Senate Estimates Committee meeting, the head of BOM indicated that the Bureau did not use the adjusted series for Darwin in its "high quality" published series for Australia. There remains a question as to how much confidence can be given to the other BOM adjustments and it is of interest that Hadley still uses Australian raw data in its figures showing the global average.

However let us assume that the published temperature data is correct. One often-made claim is that temperatures are higher now than they were a century ago and that the last decade shows the highest temperatures "on record". The warmest temperature on record in the last decade was repeated in an article in Friday's Age by the Government's chief scientific adviser Professor Steffen, Climate Commissioner Flannery and a former chairman of the Business Council's sustainable growth task. The article also made various assertions about increased temperatures and record hot days over the past 30-50 years. However, no mention was made of either the evidence available indicating that higher temperatures occurred in periods before official measurements were started from about 1850 or of the 0.6 increase in 1976/77 due to natural causes.

Figures 5 to 7 show that the 0.6 increase occurred about the same time as breaks in the time series showing CO2 concentrations. This suggests that there is a strong interaction between the ocean and the atmosphere, that is, when there is a significant (natural) change in the behaviour of the oceans that may in turn cause a significant change in increases in CO2 concentrations.

As to likely temperatures *before* 1850 when fossil fuel usage and CO2 concentrations were small, the IPCC's 1990 report included a graph showing estimated temperatures for the Medieval Warming Period (800 -1,100) higher than for the 20th century. Although the IPCC did not repeat that graph in subsequent reports, and did not explain why, it is now widely accepted that there is strong evidence that temperatures were higher then and also in the Greco-Roman warm period (600 BC - 200 AD). A report commissioned by US Congress from an expert statistician concluded that there were fundamental flaws in an analysis

purporting to show, from tree rings, little or no increase in temperatures prior to the industrial revolution – the so-called hockey stick presentation. More generally, it is not surprising that some warming from natural causes has been experienced since the end of the Little Ice Age, which occurred around 1800 well before CO2 emissions became significant.

It seems difficult to avoid the conclusion that there is no policy significance in claims that we have temperatures that are the highest on record. Once account is taken of rises over the past century due to the Great Pacific Climate Shift, of possible manipulations of temperature data to help fit the warming theory, and of historical evidence of higher temperatures, there is no policy significance in the claims

I conclude that the statistical analysis presented by the IPCC and others, including advisers to the present government, is seriously defective in suggesting a close connection between temperature increases in the past century or so and increases in CO2 concentrations and does not form any sound basis for the projection of an increase in temperatures to 2100 ranging from 2-4 degrees.

But what about other evidence?

Droughts and Rainfall

I turn now to Figures 8 and 9.

Although the Government's Green paper of July 2008 acknowledged that since the 1950s the NE of Australia has become wetter (it actually appears more to be in the NW), much attention has been given to below average rainfalls in other areas, particularly in the Murray-Darling Basin since 2000. Drawing on advice from the CSIRO and the BOM, Garnaut's modelling assumes that the projected higher temperatures will be accompanied by lower rainfall and, in the case of the MDB, he makes the extraordinary claim that "by mid-century it would lose half of its annual irrigated agricultural output … and by the end of the century … would no longer be a home to agriculture" (Final Report, p258). However, even the joint CSIRO/BOM report of 15March acknowledges that over the past 50 years "total rainfall in the Australian continent has been relatively stable" and provides no evidence that would support the Garnaut conclusion.

There is in fact no sound basis for such modelled projections. The variations in MDB annual rainfall clearly show no connection with levels or variations in Australia's average temperature. Indeed, there is no statistically significant change in MDB rainfall since 1900 and the above average temperatures in the 1980-2000 period, reflecting the Great Pacific Climate Shift, were accompanied by above average rainfall.

Past Australian droughts occurred when global temperatures were lower than now and wetter years occurred when such temperatures were rising. There is no reason to expect that to change.

Antarctic and Arctic Ice Sheets -and the Reef

I turn now to Figures 12 to 14.

If large ice sheets and glaciers started to melt, sea levels rose and low-lying land became more susceptible to flooding that could be indirect evidence of warming.

The last IPCC report predicted an increase in average global sea levels to 2100 ranging between 18 and 59 cms (about 2 feet). As to the CSIRO/BOM report of March last year, it suggests that the rate of global sea level rise increased in the 20th century, and the accompanying published graph showed an increase of about 1.5 cms per decade. A continuation of that rate would suggest an increase to 2100 close to the lower end of the IPCC's predicted range.

Satellite measurements of sea levels from 1994 also show an average rate of increase close to the lower end of the IPCC's initial predicted range, but with a lower rate of increase in the last 8 years (See figure 12). In 2009 the Dutch Meteorological Institute stated that sea levels have risen 20 centimetres (about 8 inches) in the past century and there is "no evidence for accelerated sea-level rise". Yet both under Prime Ministers Rudd and Gillard there have been what can only be described as scare campaigns that climate change threatens sea levels that will likely inundate many thousands of houses near the sea. The briefing instructions to Labor MPs reported in the last Weekend Australian tells them that "sea levels could rise by up to a metre and possibly even more by the end of the century ... up to 250,000 existing homes are at risk of inundation". Owners of properties close to the ocean are being stopped from development by such alarmism and may be able to take legal action to prevent such measures.

As to the Arctic (Figure 14), while meltings did sharply reduce the extent of sea ice in 2007, that occurred when global temperatures were falling and during a period of cloudlessness in the area. Since 2007 the sea ice extent has returned to what it was in 2005. Although a downward trend remains, more extensive Arctic meltings have occurred in the past when CO2 emissions were very much lower and such meltings have no effect on sea levels because the ice is already in the sea. Canada's North West passage has in fact been navigated in periods when fossil fuel usage was small.

As to the Antarctic, the total ice area has been increasing and has recently reached record levels. Break offs of sections of the Antarctic ice sheet do occur but are normal and recent imaginative claims of a small increase in temperatures (from 50 degrees below) were based on data from the one or two weather stations that cover the vast area. Satellite data covering the past thirty years show a distinct cooling of the Antarctic region.

Turning to the Great Barrier Reef, which is high on the Government's list of reasons for an emissions reduction scheme and has a Foundation that is concerned about possible bleaching caused by global warming, any action by Australia to reduce emissions would not help unless there is an effective agreement by major emitters. It should also be noted that most of the reef has recovered from the bleachings of 1998 and 2002, which probably resulted from the temporary warming of sea water that occurs during the light winds that occur at the time of El Ninos and that limit the flow of cooler water across the reef. The Reef may have a stronger capacity to continue than is thought by some.

The Science of Emission Concentrations

I turn to figures 15 and 16.

The IPCC's 2001 report acknowledged that the climate is a "complex, non-linear, chaotic object" and that long-term prediction of climate states is "impossible". All such analytical qualifications have since disappeared and the politicisation of climate science has almost certainly played an important part in that.

Figure 15 is difficult for a non-scientist to explain. Most importantly, it shows that increases in C0 2 concentrations do *not* result in a commensurate increase in radiation back to the surface of the earth (the greenhouse effect). Let us look at what would happen if CO2 concentrations were to double, which is what the IPCC projects to happen by 2100 if there is no government action to reduce emissions. Thus Figure 15 shows that if concentrations increased from where they are now (nearly 400ppm) to 800ppm that would only increase radiation back to the earth's surface by about 10 per cent (from about 29 watts per square metre to about 32 watts). (This analysis comes from an online calculator of energy in the atmosphere (MODTRANS) and is an international and IPCC accepted standard for atmospheric calculation).

The question then arises as to what would happen to surface temperatures and what are the implications for the modelling of temperatures in the future.

There is in fact very considerable doubt about the basis of the modelling used by the IPCC to project temperature increases. Although these models incorporate the positive feedbacks from water vapour that increase the radiation effects back to earth and oceans from increased CO2 concentrations (and hence cause some initial rise in temperatures), they fail to reflect all the temperature **reducing** effects from the negative feedback coming from the strong increase in evaporation from the ocean (which constitutes 70% of the earth's surface) that also occurs as surface temperatures rise.

This means that the IPCC models significantly **understate** the temperature reducing effects that offset the initial increases from radiation back to earth. The modelled outcomes of larger CO2 concentrations by the IPCC thus produce a much larger increase in surface temperature than would be likely to occur.

Figure 16 provides a summary of the various warming or cooling influences identified by the IPCC as producing the radiative forcings back from CO2 concentrations in the atmosphere, with an **average** increase of 1.6 watts per square metre. But the range around the average is enormous - from 0.6 to 2.4 square metres - and that in turn reflects the large ranges in radiative forcings for the various individual influences. Some of the estimates are also based on opinions of experts, not measured data. If the estimates of radiative forcing are much too large, which is quite possible given the margin of errors, that would obviously reduce the warming effect on the earth's surface.

What all this means is that there is potential for wide margins of error in the estimates of the temperature effects arising from the greenhouse gases that remain in concentrated form in the atmosphere and, hence, in the future projections of temperatures. This reinforces the uncertainties already identified in assessing other features of the climate.

Conclusion

I summarise my assessment as follows. There are fundamental faults in the statistical and scientific analyses used to justify the need for early comprehensive mitigatory action by

governments; claims of a consensus on the IPCC science have no credibility and account is not taken of the long history of faulty analyses by scientists; that examination of the temperature and CO2 concentrations data indicate that the green house effect on temperatures to 2100 is likely to be much less than the IPCC (and other believers) predict; that there is no substantive evidence of threats from rising sea levels or meltings of sea ice in the Arctic or Antarctic; that there is no evidence of any significant change in average rainfall or that droughts and other severe weather events are likely to occur more frequently. In conclusion, my submission is that the best policy is to adapt to changes in climate and to leave that mainly to the private sector.

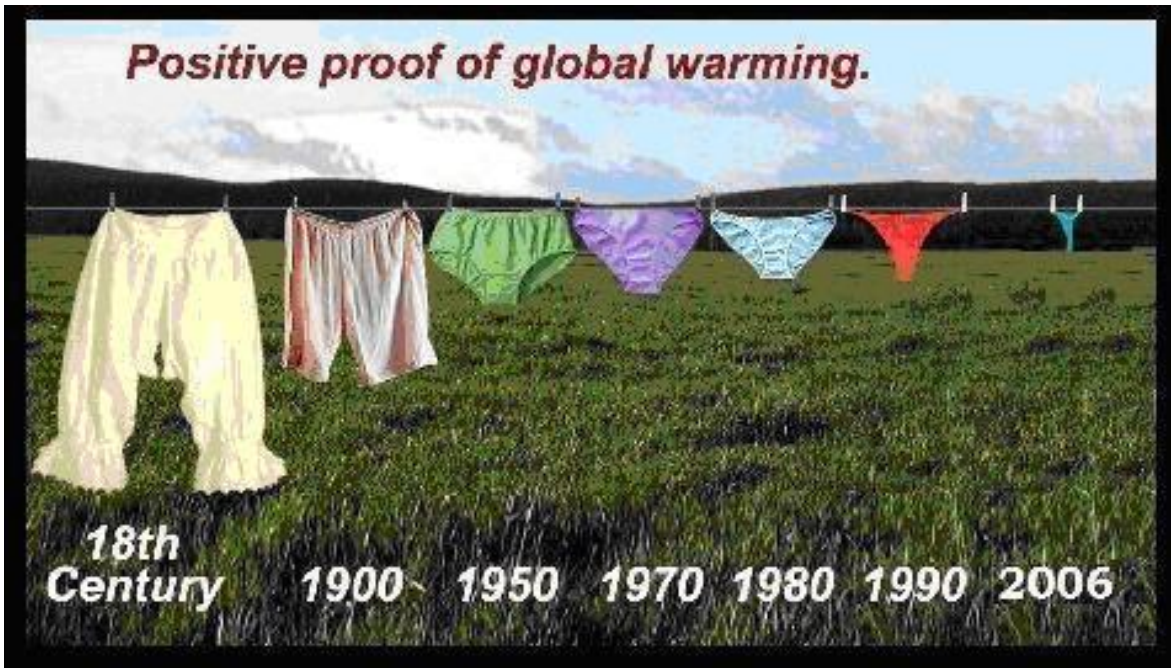
An Almanac of the Atmosphere

being

A random walk through observation, calculation and estimation of changes to the climate.

Compiled 22 March 2011

Positive Proof of Global Warming



HEALTHY POLAR BEARS TOO!

A splendid example of a member of an expanding population of polar bears. Polar bears in Norway's remote Svalbard archipelago photographed by Steve Kaslowski.

TEMPERATURES MEASUREMENTS

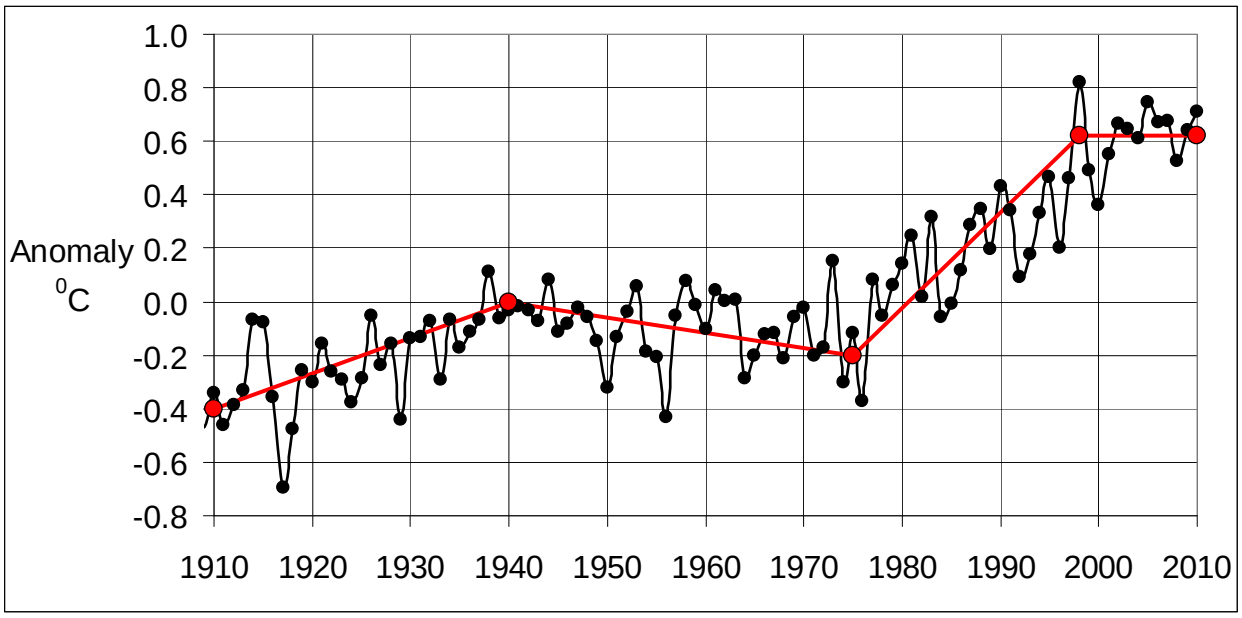


Figure 1: *Annual global temperatures. Ten year averages, on their own, as used by Hadley Centre, IPCC and Garnaut, miss out on important change points. Here solid lines show warming and cooling periods. The Great Pacific Climate Shift occurs in the late 1970s when cooling turns to warming. Source Hadley-CRU*

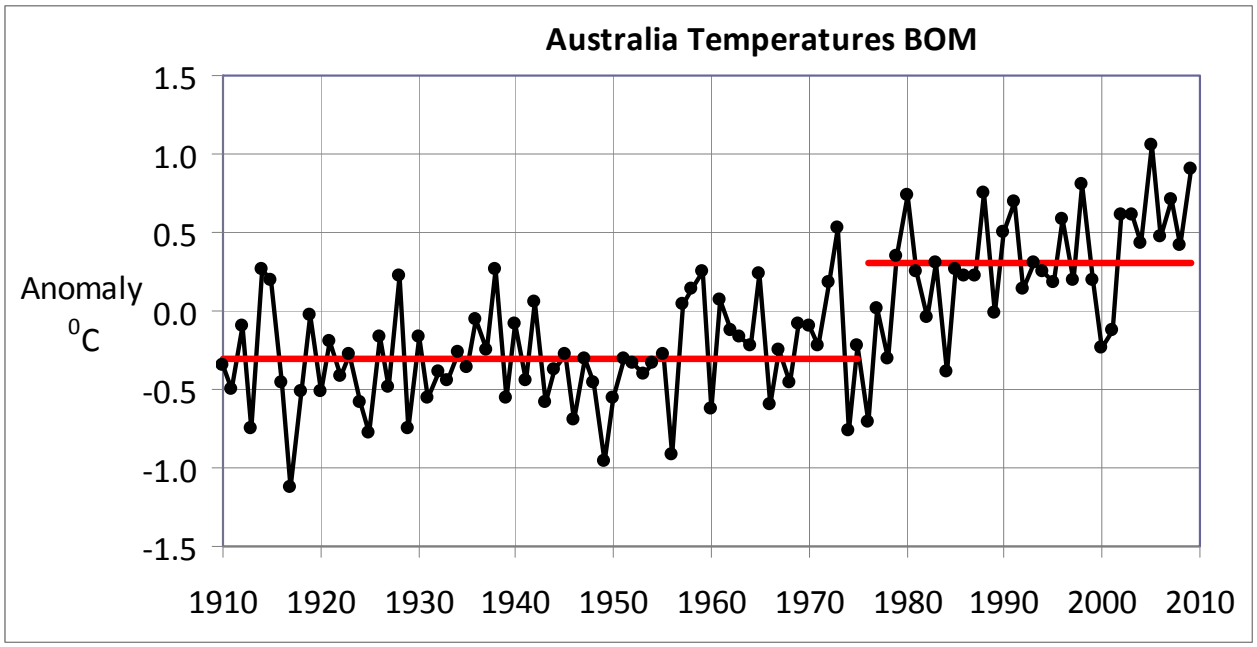


Figure 2: *Annual Australian temperatures from the Bureau of Meteorology (BOM) high quality data series. The jump in the solid lines of 0.6^{0}C is a consequence of the Great Pacific Climate Shift of 1976-78 that is also reflected in the global temperature. Although this is due to natural changes, climate modelling assumes it reflects the effect of emissions of CO_2. This naturally suggests a relationship but not a causative one.*

Back in 1977, the Pacific Ocean underwent a major transformation in sea surface temperature patterns that was called the Great Pacific Climate Shift. Suddenly warm water replaced cold water that had dominated for most of the prior three decades near the west coast of North America and along the equatorial eastern Pacific. In 1997, researchers reported that a multidecadal oscillation in Pacific sea surface temperature and pressure had been discovered. They called it the Pacific Decadal Oscillation.

TEMPERATURE MEASUREMENTS AND ADJUSTMENTS

This illustrates the effect of adjustments that can be made by official bodies such as BOM to actual recorded temperatures

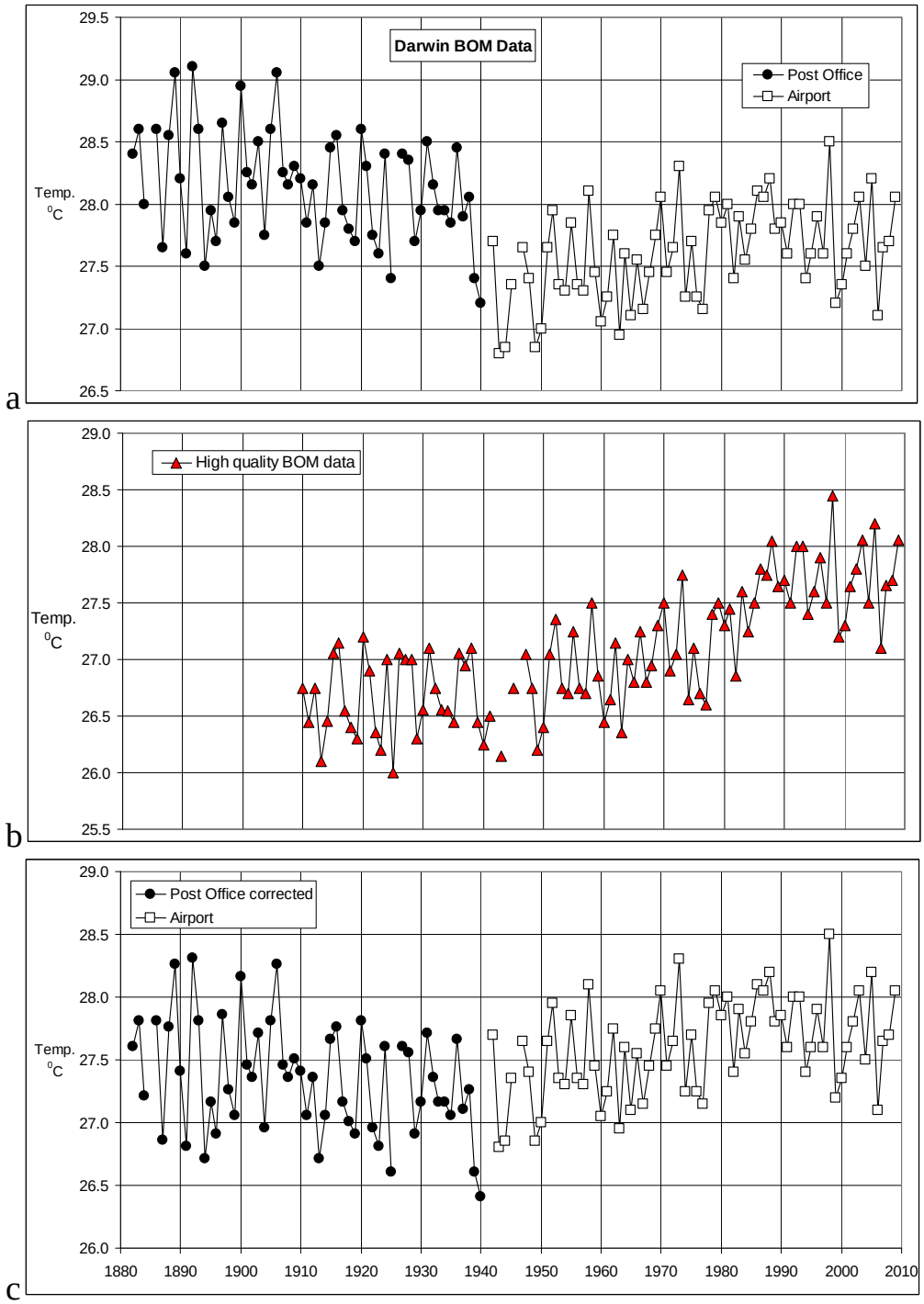


Figure 3: *BOM measurements at Darwin.* ***a)*** *Initially at the Post Office and from 1941 also at the airport. Measurements ceased at the Post Office when it was bombed in 1942.* ***b)*** *shows the result of the BOM "high quality" adjustments. The BOM reduced all measurements before 1940 by 1.4^{0}C and by 0.6^{0}C from 1940 to 1980 thus adding to the upward temperature trend.* ***c)*** *shows the simple reduction of Post Office temperatures by 0.8^{0}C for the change of location. This should be the preferred series unless faced with compelling evidence of the need for further adjustments. The international temperature databases (CRU, NCDC and GISS) use the raw uncorrected data shown in* ***a****.*

The Bureau of Meteorology does not use the Darwin measurements in their composite Australian high quality time series but adjustments have been made to many sites included in the composite series.

100 YEARS OF ATMOSPHERIC MEASUREMENTS – 1910 TO 2010

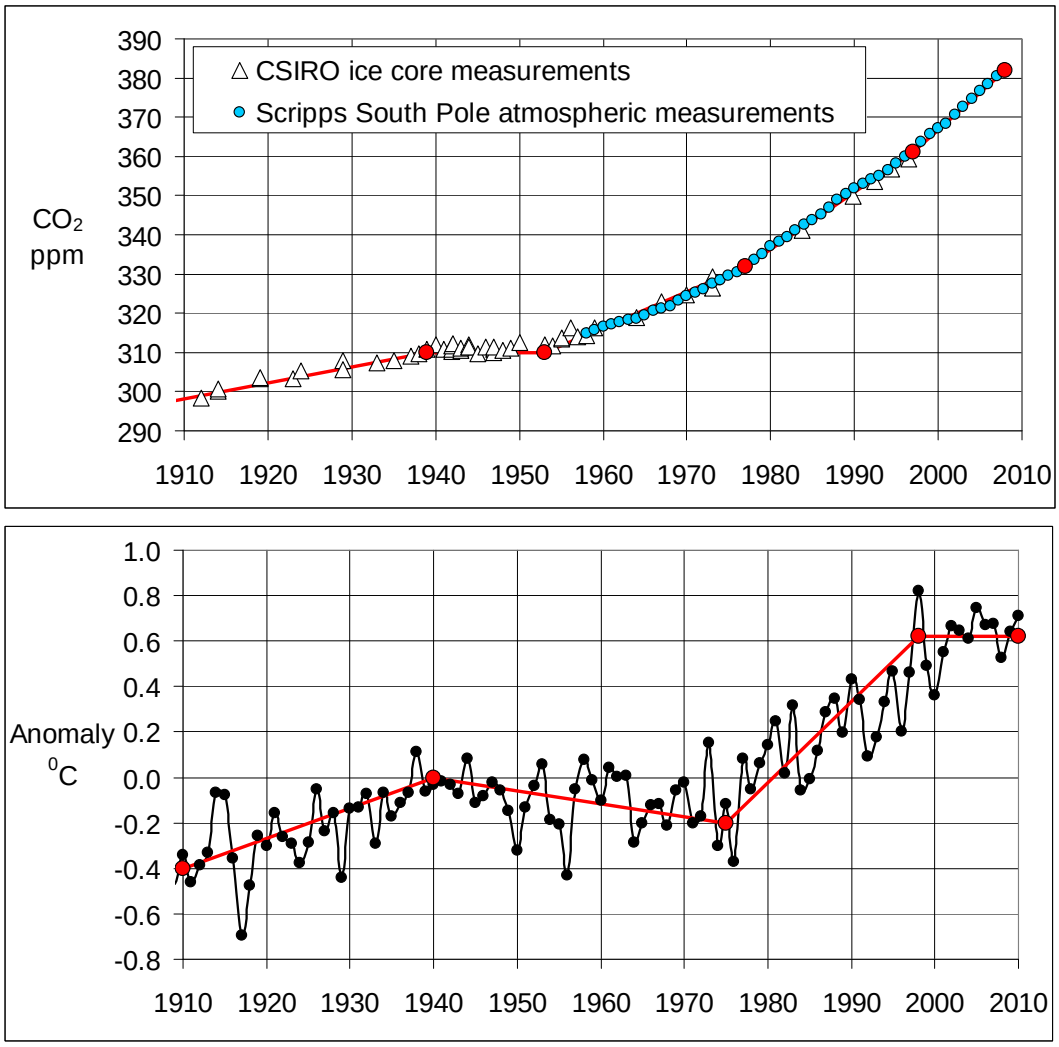


Figure 4: Top – *Ice core and atmospheric measurements of CO_2 concentration levels in Antarctica at the Law Dome for ice cores and at the South Pole for direct measurements. From 1940 to the early 1950s there was no increase in CO_2. Red dots indicate significant changes in annual increases.* ***Bottom –*** *Global temperatures estimated by the Hadley Centre of the UK Met Office. Solid lines indicate warming and cooling*

Period	CO_2 at the South Pole Annual increase in ppm	Period	Global Temperature ^{0}C Increase per 10 years
1910 - 1939	0.38 +/- 0.03	1910 - 1939	0.15 +/- 0.02
1939 - 1953	0.08 +/- 0.05	1939 - 1977	-0.02 +/- 0.03
1953 - 1977	0.77 +/- 0.03		
1977 - 1997	1.46 +/- 0.02	1977 - 1997	0.12 +/- 0.03
1997 - 2007	1.89 +/- 0.03	1997 - 2009	0.03 +/- 0.06

Temperature change does not appear to have a strong relationship with CO_2 change in the atmosphere

DIRECT ATMOSPHERIC MEASUREMENTS OF CO_2

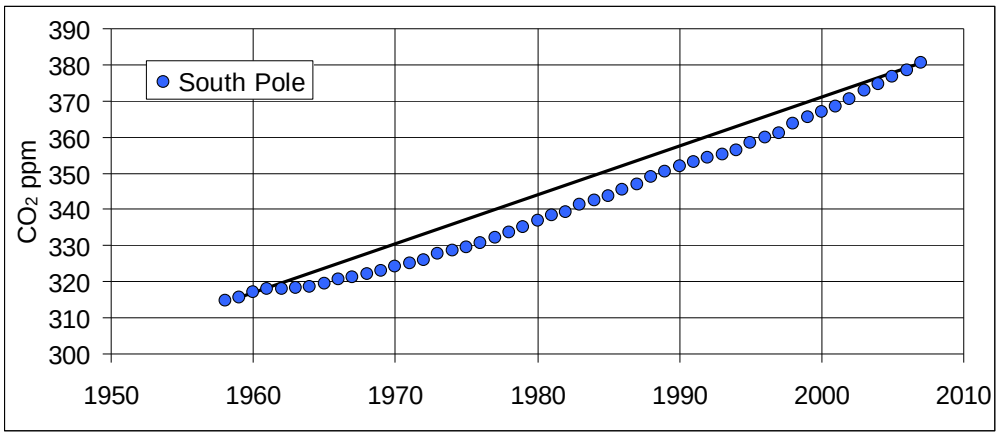


Figure 5: *Annual CO_2 measurements at the South Pole. The solid trend straight line is drawn from the first to last measurement of the time series. For each year the difference of the measurement from the trend line is shown in Figure 6. Source Scripps Institute.*

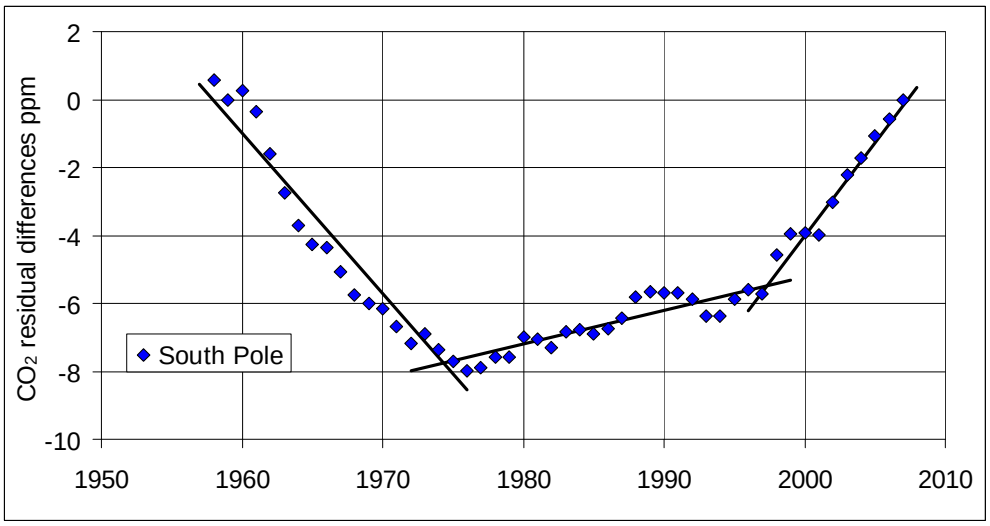


Figure 6: *Residual differences of CO_2 measurements from the trend line for each year. The three straight lines show periods of constant increase and their intersections in 1974 and 1998 mark years of significant change. The changes are coincident with the changes in temperature trends shown in Figure 7. The other 60 year CO_2 time series from Mauna Loa in Hawaii gives the same results.*

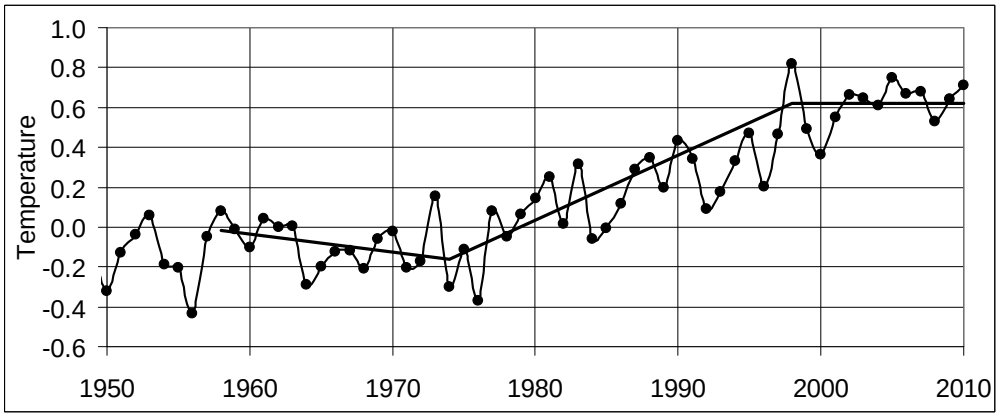


Figure 7: *Global temperatures estimated by Hadley CRU. Solid lines indicate warming and cooling*

The coincidence of the mid 1970s breaks in the temperature and CO_2 time series, at the time of Great Pacific Climate Shift, illustrates the strong interaction of the oceans with the atmosphere. Likewise the timing of the change in the global temperature in 1998 coincides with a change in the annual rate of CO_2 increase. The mid 1970s and late 1990s breaks may be indicators of the start and end of a phase of the Pacific Decadel Oscillation that has a powerful influence on CO_2 in the atmosphere.

MURRAY-DARLING BASIN YEARLY RAINFALL 1900 TO 2008

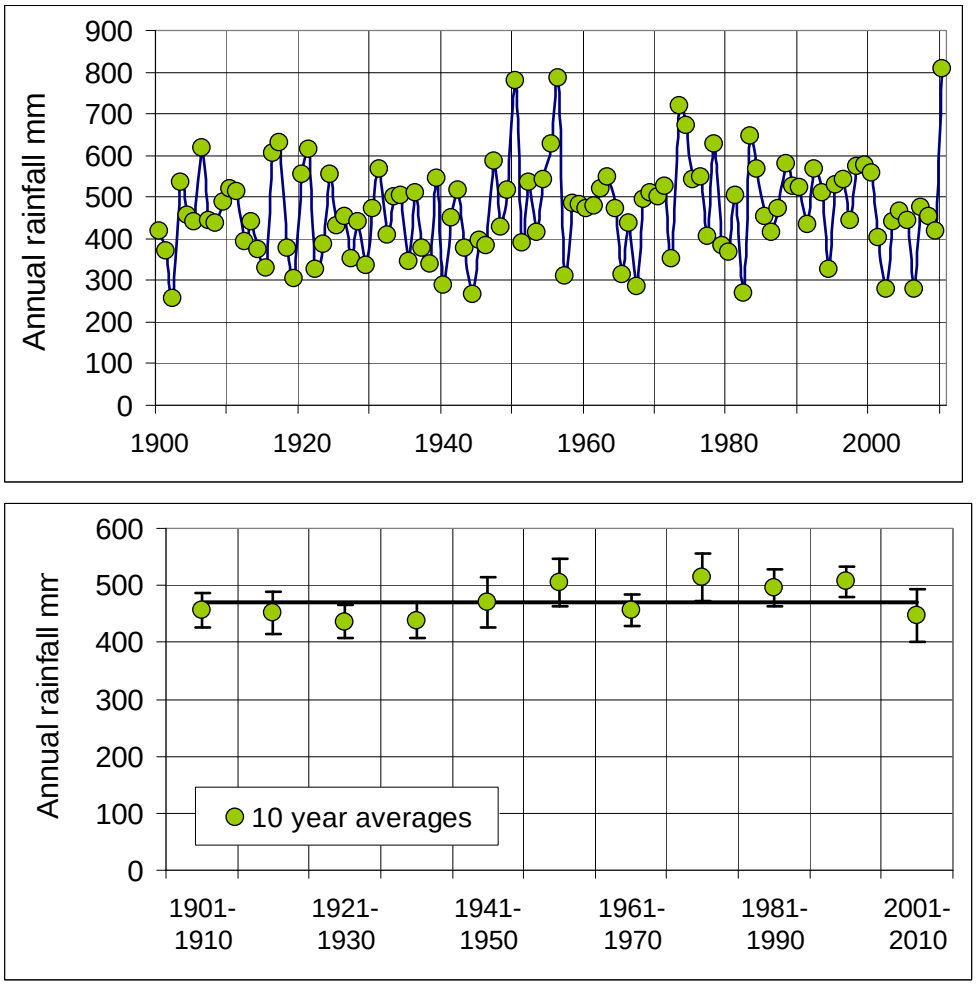


***Figure 8: Upper**: Yearly and **Lower** 10 year average rainfall in the Murray-Darling Basin. Mean value of 471 mm (solid line) and median 472 mm. There is no significant trend in rainfall through this period but with large variability- standard deviation of 112 mm with rainfall extremes of a minimum 257 mm and a maximum of 808 mm in 2010*

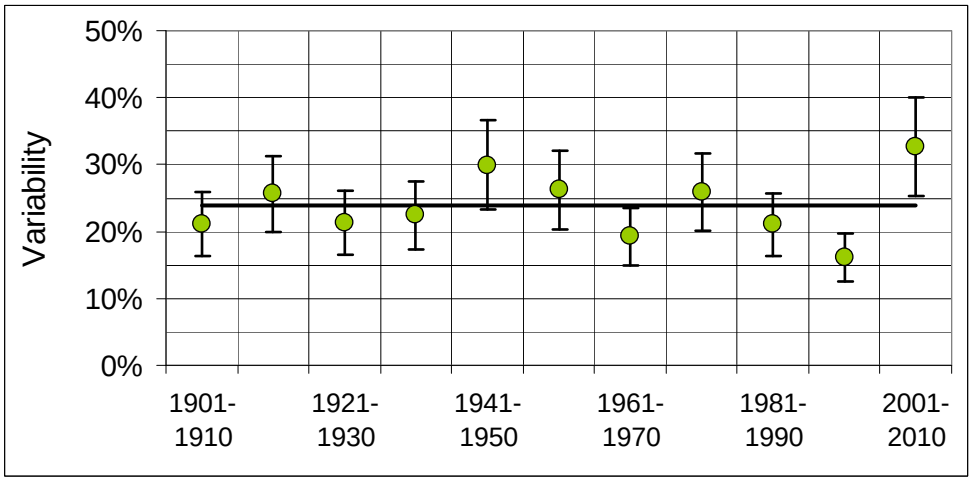


***Figure 9:** Murray Darling Basin variability. Variability is the rainfall standard deviation divided by mean rainfall for 10 year periods.*

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”.

LONG TERM BEHAVIOUR OF ATMOSPHERIC METHANE

The CSIRO-BOM report 'State of the Climate' published in 2010 has the following: "methane, which is another greenhouse gas, has shown similar increases [to carbon dioxide]."

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/trends/atm_methane.html . The only additional data handling has been to calculate the annual increase in methane concentrations.

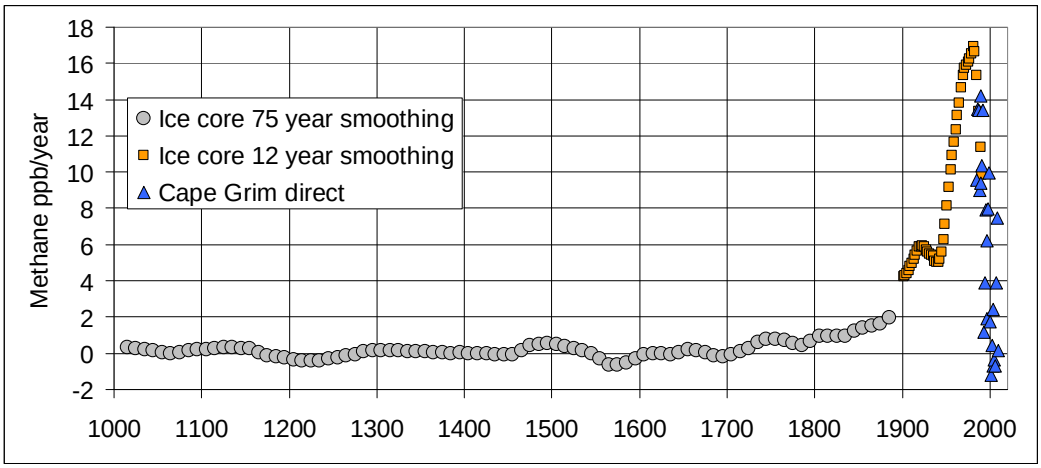


Figure 10: *Ice core and direct measurements of atmospheric methane. Data source CSIRO*

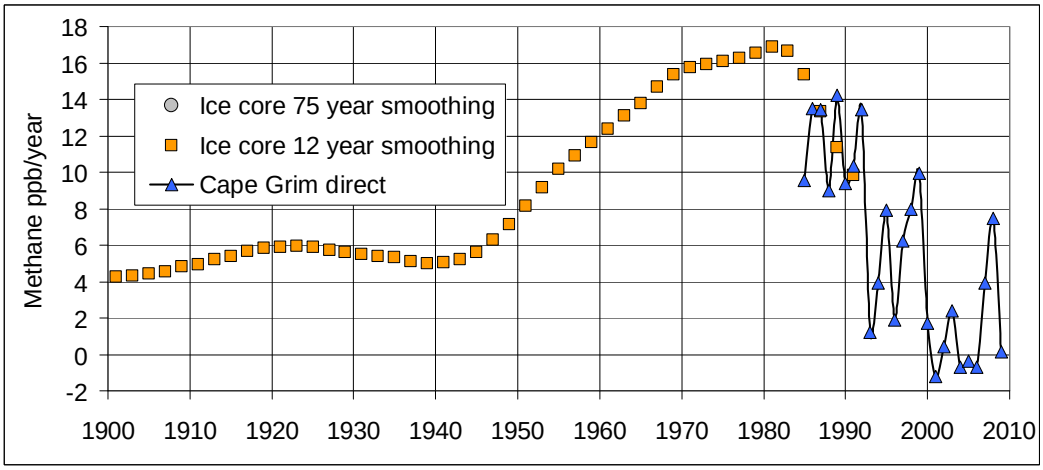


Figure 11: *Ice core and direct measurements of atmospheric methane from 1900. The peaks in the direct measurements correspond to El Ninos with the exception of 1992 which is an indirect result of the Mt Pinatubo eruption. Data source CSIRO.*

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	2009
Methane ppb/year	0.05	0.63	1.00	1.63	5.36	10.00	13.85	16.11	15.76	7.22	1.27

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.

GLOBAL SEA LEVEL CHANGES

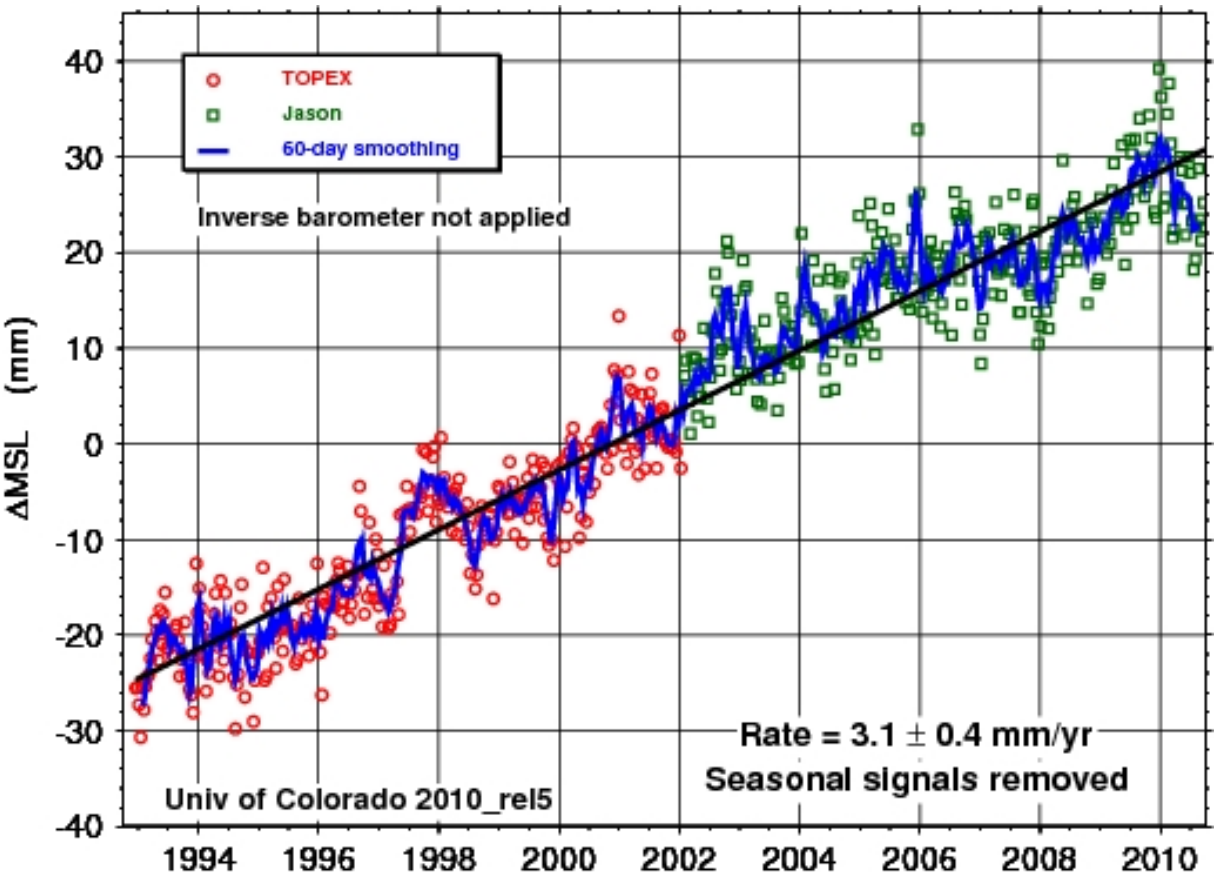


Figure 12: *The global mean sea level graph was made using satellite altimetry and processed by the University of Colorado at Boulder. Note that the rate of increase is 3.1 +/- 0.4 mm/year for1992 to 2010 but falls to 2.2+/- 0.3 mm/year for 2002-2010. If the rate of increase continues at about 3 mm a 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.

THE GLOBAL OCEANS – detail showing sea level movements are complex.

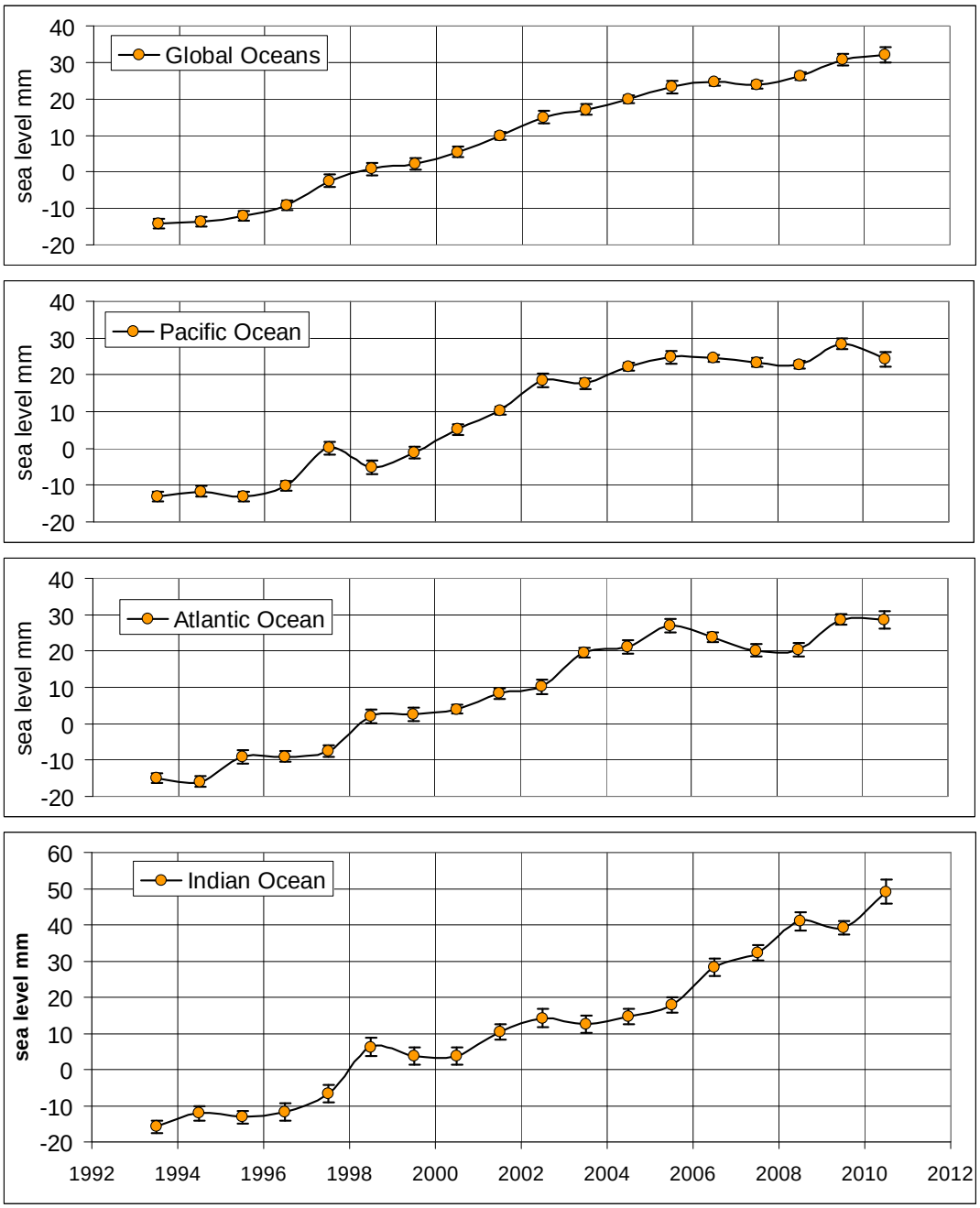


Figure 13: *Annual sea level anomalies derived from satellite measurements for the global oceans and separately the Pacific, Atlantic and Indian Oceans.*

Oceans	Annual sea level rise from 1993 to 2010 mm per year	Annual sea level rise from 2002 to 2010 mm per year
Globe - all	3.1 +/- 0.4	2,2 +/- 0.3
Pacific	2.8 +/- 0.2	0.9 +/- 0.3
Atlantic	2.8 +/- 0.2	1.6 +/- 0.6
Indian	3.7 +/- 0.2	4.8 +/- 0.5

The table shows the complexity of sea level rises. So in the Pacific Ocean a continuation of the present sea level rise for 100 years could be from 9 to 28 cm. This is at the low end of the IPCC global projections of 19 to 59 cm. (At the end of the last ice age, about 16,000 year ago, the sea level rose 120 m over a period of 7,500 years at a rate of 16 mm per year. The CSIRO projections for the Port Phillip Bay region are 10 mm per year).

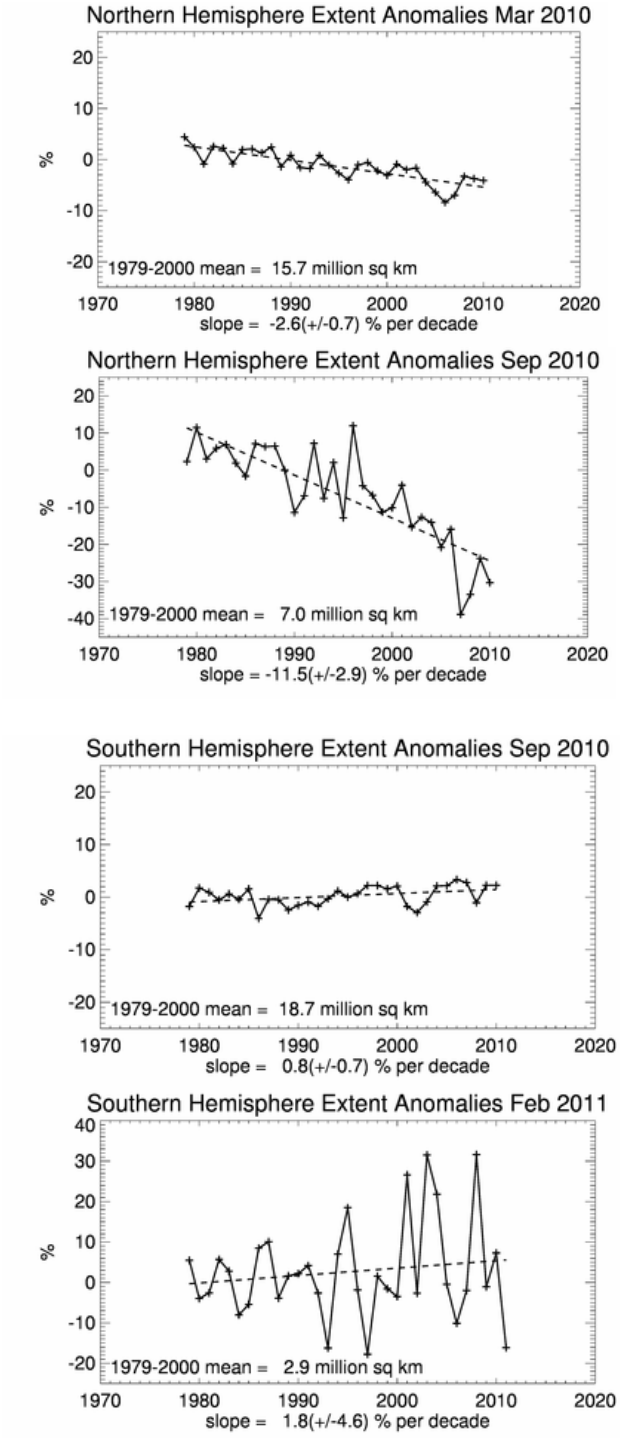


Figure 14 *Arctic and Antarctica ice extent. The maximum extent occurs in March in the Northern Hemisphere and in September in the Southern Hemisphere, summer minima occur in September and February. The Northern Hemisphere ice extent is decreasing with reducing maximum and minimum extent. Note that the 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/

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.”

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MODELLING AND PROJECTING CLIMATE CHANGES

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 primary driver of 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**
   The problems of understanding the variations in methane (Figures 10 and 11) illustrate the uncertainties in understanding sources and sinks of green house gases. The structured increases in CO_2 (Figures 5, 6 and 7) point to 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 (Figures 1, 2, 6 and 7) 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.**

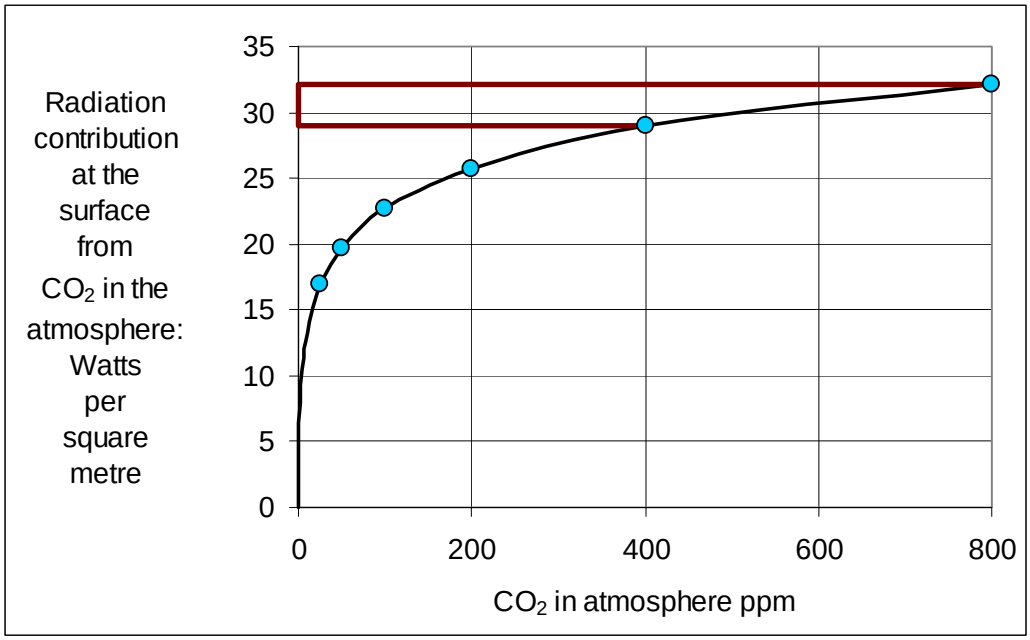


Figure 15 *As the concentration of CO_2 increases, there is increased radiation back to the surface of the earth (the greenhouse effect). This is measured in Watts per square metre (left axis). However the relationship is not linear. In fact doubling the concentration of CO_2 from 400 ppm to 800 ppm 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 MODTRANS, a University of Chicago on-line calculator of energy in the atmosphere. MODTRANS is an international and IPCC accepted standard for atmospheric calculations).*

GLOBAL MEAN RADIATIVE FORCING

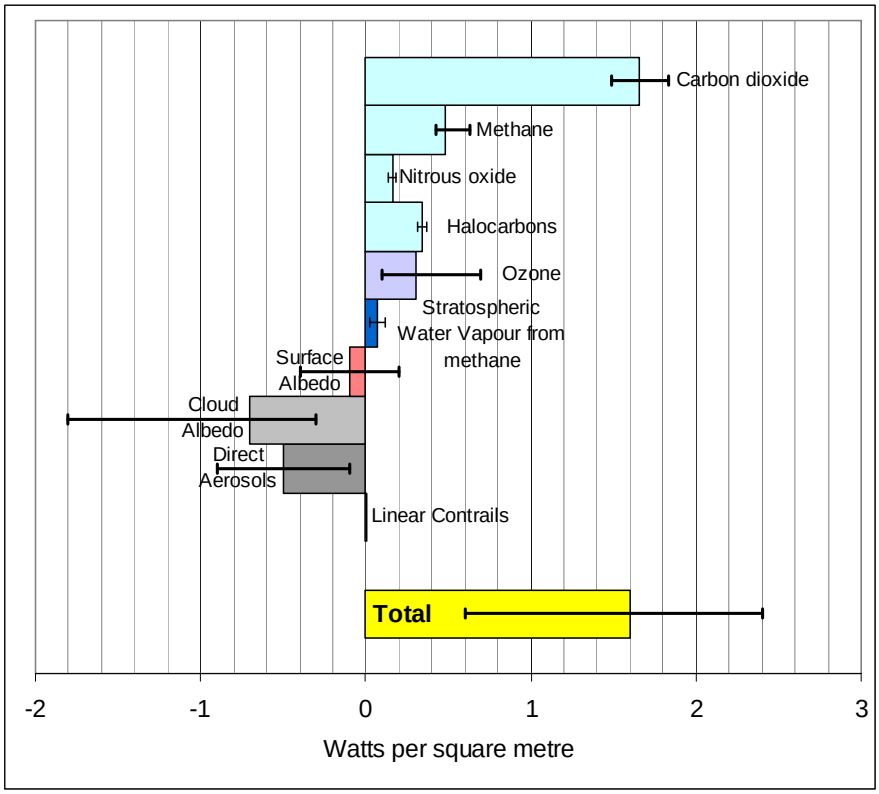


Figure 16: *Radiative forcing from various sources. The error bars show the uncertainty for each source. The total is described by the IPCC as "the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m^{-2} (see Figure SPM.2)". [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.

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**

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 negative rather than positive feedback with increasing temperature.

Garnaut Climate Change Review **-Update 2011**

THE SCIENCE OF CLIMATE CHANGE

Before the 2011 Update Garnaut stated on April 16 2009 “there is uncertainty in the science ... the uncertainty adds to the case for strong and early mitigation” and on January 25 2010 “the science is not settled on all the dimensions of a complex natural system ...science is never settled ... the detail will be adjusted continuously”.

Key points

• Observations and research outcomes since 2008 have confirmed and strengthened the position that the mainstream science then held with a high level of certainty, that the Earth is warming and that human emissions of greenhouse gases are the primary cause. - By mainstream science I mean the overwhelming weight of authoritative opinion in the relevant disciplines, as expressed in peer reviewed publications.

There are many distinguished mainstream scientists who disagree. As an example on 8 February 2011, 74 scientists sent a letter to the US Congress drawing attention to a report quoting 678 scientific studies to provide a point-by-point rebuttal of all the various claims by alarmist scientists, citing in every case peer-reviewed scientific research. Further the revelations through Climategate showed that considerable uncertainties were discussed even amongst those committed to the IPCC position.

• The statistically significant warming trend has been confirmed by observations over recent years:

- global temperatures continue to rise around the midpoints of the range of the projections of the Intergovernmental Panel on Climate Change (IPCC) and the presence of a warming trend has been confirmed;

Statistical analysis shows the temperature reached an apparent plateau but the change that occurred around 2000 is also to be found in other climate observables, in particular CO_2. This coincides with ocean surface temperature changes. There must be great uncertainty in temperature projections of present climate models if the interaction of the oceans with the atmosphere is not well understood.

- the rate of sea level rise has accelerated and is tracking above the range suggested by the IPCC;

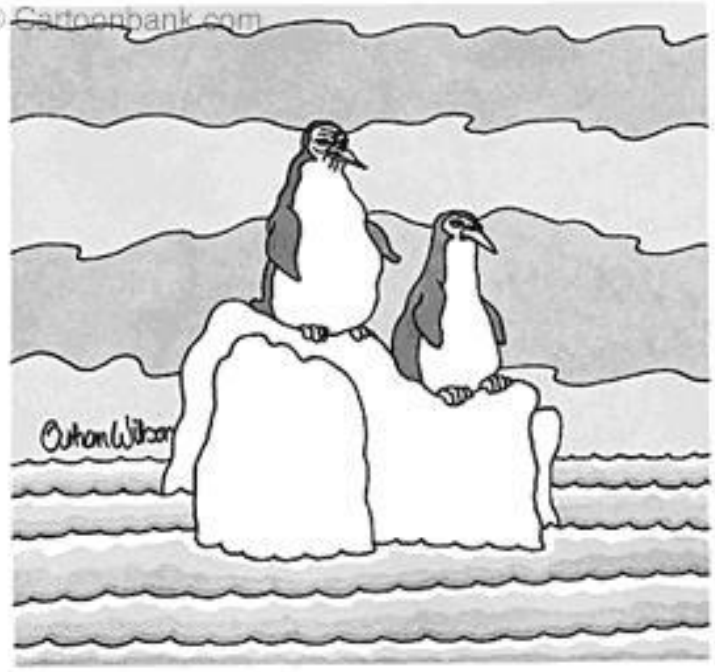
The measured sea level rise on a global scale remains at 3 mm per year for the period 1993 to 2010. This is at the low end of the IPCC projections of 19 to 59 cm by 2100. However in the Pacific Ocean the rise from 2002 to 2010 is even less at 1 mm per year while the global rise is 2 mm per year.

The Royal Society: Climate change: a summary of the science
September 2010
Paragraph 45: Because of the thermal expansion of the ocean, it is very likely that for many centuries the rate of global sea-level rise will be at least as large as the rate of 20 cm per century that has been observed over the past century. Paragraph 49; There is currently insufficient understanding of the enhanced melting and retreat of the ice sheets on Greenland and West Antarctica to predict exactly how much the rate of sea level rise will increase above that observed in the past century

- rates of change in most observable responses of the physical and biological environment to global warming lie at or above expectations from the mainstream science.

  As an example of observable responses consider methane There is no evidence for this statement and in fact what is happening is quite the contrary with the substantial reduction in annual increases of methane concentrations since 1980. Likewise statements about decreasing and more variable rainfall in the Murray-Darling Basin are not born out by measurement.

  There is widespread agreement that recent severe weather events do not provide a basis for suggesting that rising temperatures will mean more frequent such events



"Call this an iceberg? When I was a kid we wouldn't have called this an iceberg!"

From the New Yorker