Transitions to Sustainability - Are we confident about the IPCC climate change predictions for the future?

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ABSTRACT:

In a quest for a 'Transition to Sustainability' this paper, in the tradition of engineering enquiry, revisits the fundamental assumptions under-pinning the IPCC's pronouncements which concern the relationship between increasing anthropogenic greenhouse gases emitted to the atmosphere and corresponding projected average global temperature rises. The complexity of this issue, together with the stated uncertainty of outcomes, is re-examined in the light of natural phenomena (Pacific Decadal Oscillation, La Nina, Barycentre and reducing Sunspot activity) which now combined have commenced global cooling. This paper concludes that atmospheric carbon reduction measures are restrained until the trend in global warming or cooling is beyond doubt.

1. INTRODUCTION

The authors are concerned about the apparent divergence of recently observed average global temperatures from those that were predicted by the Intergovernmental Panel on Climate Change (IPCC) and the subsequent carbon dioxide reduction strategy which is underpinned by these predictions. This concern has become urgent since the recent ascendency of important natural climate drivers such as the Pacific Decadal Oscillation, La Nina, Barycentre and reduced Sunspot activity which now combined have commenced global cooling. The authors are unsure whether the major cyclical natural climate temperature variations, caused by the onset of the above dominant climate drivers are masking the predicted 'enhanced greenhouse effect' or if the 'enhanced greenhouse effect' hypothesis is overstating the heating relationship between carbon dioxide and the temperature of the Earth's atmosphere. The authors suspect that there is a notable reduction of the 'enhanced greenhouse effect' and a correspondingly greater influence by the natural climate drivers.

This paper revisits the genesis of 'Global Warming' in the light of late 20th and early 21st Century scientific findings which ascribes the majority of the measured global warming over the period of the Industrial Revolution to the 'enhanced greenhouse effect' and not to natural climate variability.

The authors of this paper have chosen to refer to the writings of Houghton and Bolin - two pivotal proponents of Anthropogenic Global Warming (AGW) whose careers span the last three decades of the 20th Century and who have guided the formation and execution of the IPCC's founding science, findings, pronouncements and mitigation strategies. The authors' concerns surround the apparent failure of the initial scientific hypothesis and its unforeseen implications to the carbon dioxide reduction strategies.

The first proponent is,

> "Sir John Houghton CBE, FRS co-chairman of the Science Assessment Working Group of the Intergovernmental Panel on Climate Change; chairman of the Royal Commission on Environmental Pollution; and a member of the British Government's Panel on Sustainable

Development. He was Chief Executive of the Meteorological Office from 1983 to his retirement in 1991. He is the author of *The Physics of Atmospheres and Does God Play Dice?* , and he has published numerous papers and contributed to many influential research documents.” (Houghton, 1994).

His book referenced in this paper is entitled, “***GLOBAL WARMING – The Complete Briefing. An investigation of the evidence, the implications and the way forward***.”

The second proponent is Bert Bolin, Professor Emeritus in the Department of Meteorology at the University of Stockholm, Sweden. He is a former director of the International Institute for Meteorology in Stockholm, and former Scientific Advisor to the Swedish Prime Minister. He was Chairman of the IPCC from 1988 to 1997. His book is entitled, “***A History of the Science and Politics of Climate Change – The Role of the Intergovernmental Panel on Climate Change***.”. (Bolin, 2007)

Both Sir John Houghton and Emeritus Professor Bert Bolin have articulated the phenomena of Global Warming to the world. Sir John said in his book,

> “As chairman or co-chairman of the of the Scientific Working Group I have been privileged to work closely with hundreds of scientific colleagues in many countries who readily gave of their time and expertise to contribute to the IPCC work. For this book I have drawn heavily on the 1990 and 1992 reports of all three working groups of the IPCC.” (Houghton, 1994:8)

2. UNDERPINNING SCIENCE AND ASSUMPTIONS FOR THE IPCC REPORTS

Sir John Houghton sets out very clearly in chapters 1 and 2 of his book ‘The problem of Global Warming’, the ‘Uncertainty and response’, ‘ How the Earth keeps warm’, The greenhouse effect’ and ‘The enhanced greenhouse effect’. The logic of 20th Century physics as applied to enhanced greenhouse gases is clearly explained, however, no calculations are offered for the predicted 2.5^{o}C rise in Global temperature by 2100 as a result of a doubling of the atmospheric carbon dioxide concentration levels and allowing for feedback effects. A summary of his explanation of the ‘enhanced greenhouse effect’ is shown in figure 1. (His FIG. 2.8)

FIG. 2.8 Illustrating the enhanced greenhouse effect. Under natural conditions (a) the net solar radiation coming in (S = 240 watts per square metre) is balanced by thermal radiation (L) leaving the top of the atmosphere; average surface temperature T_s is 15°C. If the carbon dioxide concentration is suddenly doubled (b), L is decreased by 4 watts per square metre. Balance is restored if nothing else changes (c) apart from the temperature of the surface and lower atmosphere which rises by 1.2°C. If feedbacks are also taken into account (d) the average temperature of the surface rises by about 2.5°C.

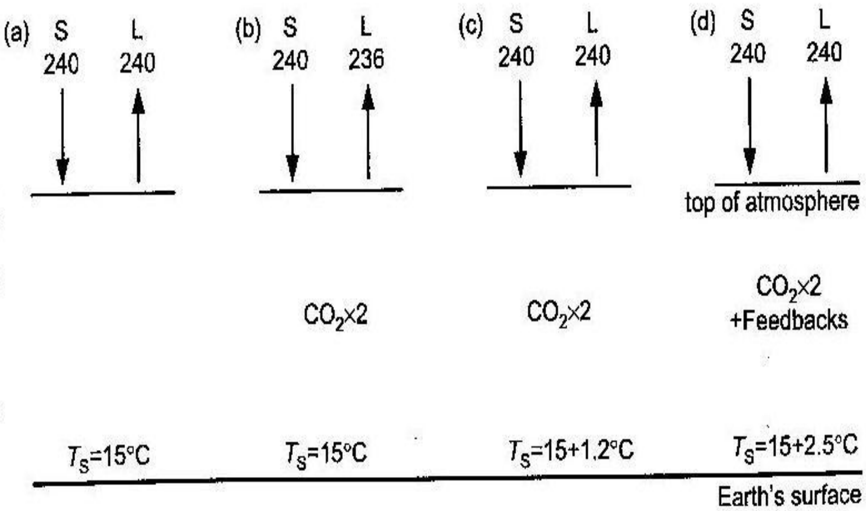


FIGURE 1. Showing the solar energy balance for enhanced greenhouse warming and a rise in the Earth’s surface temperature for a doubling of the carbon dioxide concentration in the atmosphere with an accommodation of the feedback processes. (Houghton, 1994:26)

The above relationships and outcomes derived from these calculations underpin 'in principle' all the IPCC's subsequent predicted average global temperatures.

In figure 1 above (Houghton's FIG. 2.8c) the carbon dioxide concentration has been doubled thereby reducing the thermal radiation from the Earth's surface and atmosphere by 4 watts/m^2. The energy balance would be restored if the temperature of the Earth's surface and the lower atmosphere increase by 1.2^{o}C: when the anticipated '*positive* and *negative* feedbacks' (increased water vapour, changes in clouds etc) are taken into account the average surface temperature becomes 2.5 ^{o} C as shown in (d) and the solar energy balance returns to equilibrium.

In discussing positive and negative feed-backs Houghton states,

> "The situation is much more complicated than this simple calculation… Suffice it to say here that the best estimate at the present time of increased average temperature of the Earth's surface if carbon dioxide levels were to be doubled is about twice that of the simple calculation: 2.5^{o}C." (Houghton, 1994)

Table 1 (Houghton's Table 5.1) is reproduced below. From Table 1 it is clear that a small increase in low level clouds beyond + 3% can have a considerable cooling effect on the average global surface temperature compared to the assumed warming effect of doubling the carbon dioxide concentration. Further, in the discussion on ocean-circulation feedbacks he states,

> "The oceans act on the climate in three important ways. Firstly, as we have already noted, they are the main source of water vapour which, through its latent heat of condensation in clouds, provides the largest single heat source for the atmosphere. Secondly, they possess a large heat storage capacity compared with the atmosphere, in other words a large quantity of heat is needed to raise the temperatures of the oceans only slightly…". (Houghton, 1994:68)

Table 1. Showing Houghton's assumptions about greenhouse gases and clouds and how they are expected to influence average Global temperature outcomes.

TABLE 5.1 Estimates of global average temperature changes under different assumptions and for changes in greenhouse gases and clouds.

Global average temperature changes under different assumptions about greenhouse gases and clouds

Greenhouse gases	Clouds	Change in °C from current average global surface temperature of 15°C
As now	As now	0
None	As now	-32
None	None	-21
As now	None	4
As now	As now but + 3% high cloud	0.3
As now	As now but + 3% low cloud	-1.0
Doubled CO_2 concentration; otherwise as now	As now (no additional cloud feedback)	1.2
Doubled CO_2 concentration + best estimate of feedbacks	Cloud feedback included	2.5

Sir John Houghton was well aware of the importance of the comparison of model results with observations when considering the temperature rise over the last 140 years when he said,

> "…the most obvious point to note about the record is the significant variability which occurs over a period of a few years to decades, which probably arises from natural changes within

the climate system… Because of the variability, it is difficult to draw any strong conclusions from the trend in the observed record to date.”

Sir John continued by quoting from the executive summary of the 1990 IPCC report.

“The unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more.” and he continues “in other words, we need to wait a number of more years before the global warming signal due to the increase of greenhouse gases stands out clearly above the natural climate variability.”

It is now almost two decades since Sir John Houghton wrote the above statement and this is the raison d’être for this paper.

3. A COMPARISON WITH OBSERVED DATA - A DECADE OR MORE LATER

Following is a comparison of some of Houghton’s main predictions with recent average global temperature observations to 2009.

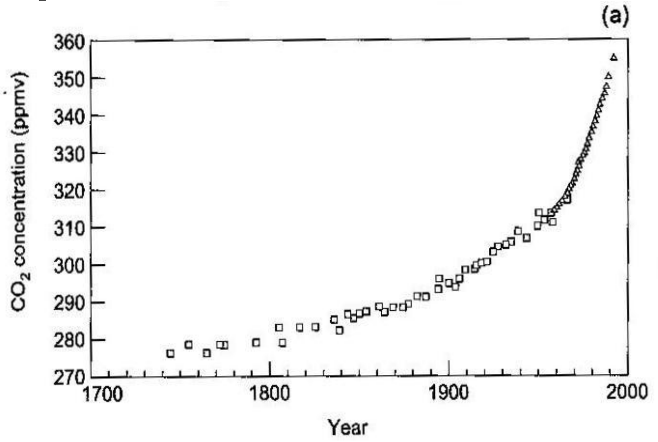


FIG. 3.3 (a) The increase of atmospheric carbon dioxide since 1700[2], showing measurements from ice cores in Antarctica (squares) and since 1957, direct measurements from the Mauna Loa observatory in Hawaii (triangles).

FIGURE 2. Showing the observed rapidly increasing carbon dioxide concentrations in the Earth’s atmosphere. (Houghton, 1994)

Figure 2 (Houghton’s FIG. 3.3) (a) shows the rapid increase in carbon dioxide concentrations in the last fifty years. The carbon dioxide concentrations in the last ‘decade or more’ to 2010 have continued on the same upward projection as to that with which is shown in the figure and does not require further confirmation here.

Figure 3 (Houghton’s FIG. 6.1) shows the observed temperatures from 1860 to about 1989 together with the IPCC’s predicted change in global average temperature under a ‘business as usual’ scenario, (IPCC IS 92a) (First Assessment Report 1990). The middle curve is the IPCC’s best estimate of the change (Medium) with the upper (High) and lower (Low) curves indicating the estimated range of uncertainty. The three curves correspond to the ‘climate sensitivities’ of 4.5, 2.5 and 1.5^{o} C respectively. The business-as-usual’ emission scenario from IPCC IS 92a is very similar to the ‘A2’ scenario used in current Fourth Assessment Report (AR4). (IPCC, 2007)

To minimise any confusion with quoted temperatures it is to be noted that the IPCC has adopted the average global temperature methodology jointly prepared by the UK Met Office Hadley Centre and the University of East Anglia Climate Research Unit (HadCRUT) and not that of the NASA Goddard Institute for Space Studies (GISS) nor the NOAA National Climate Data Center NCDC). HadCRUT3 average global temperatures are based on 1961 to 1990 base period whereas GISS temperatures relate to a 1951 to 1980 base period. All three use much the same input observations, however, James Hansen, a leading scientist at GISS, states in a recent paper on the issues of differences that, “We discuss sources of uncertainty in the temperature records and provide some insights about the magnitude of the problems via alternative choices for input data and adjustments to the data.” (Hansen et al, 2010) GISS average global temperatures are nearly always noticeably higher for recent temperatures.

Superimposed on this figure is a triangular envelope, shown blue, representing the three past IPCC temperature projections: the First Assessment Report (FAR) 1990, Second Assessment Report (SAR) 1995, and the Third Assessment Report (TAR) 2001). The current Fourth Assessment Report (AR4) 2007 is shown as a red zigzag line representing the Special Report on Submission Scenarios (SRES) (IPCC, 2000).

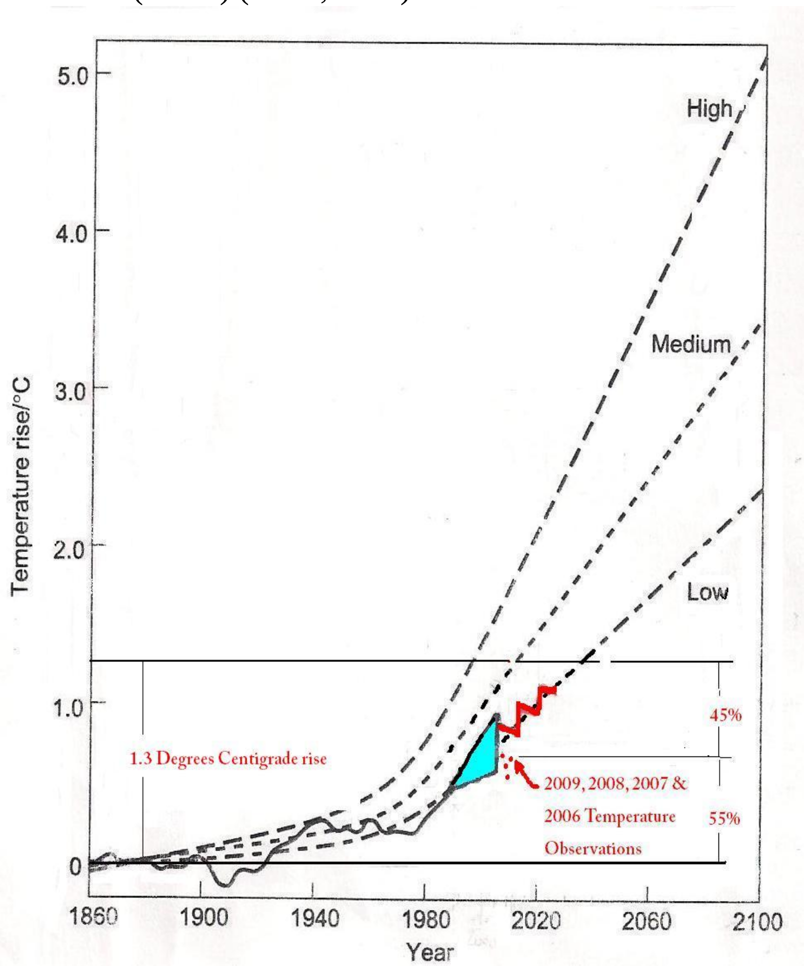


FIG. 6.1 The predicted change in global average temperature under a ‘business-as-usual’ scenario (IPCC IS 92a) from 1860 until 2100 (the change is shown from the beginning of pre-industrial times in 1765). The middle curve is the IPCC’s best estimate of the change; the upper and lower curves indicate the estimated range of uncertainty. The three curves correspond to ‘climate sensitivities’ of 4.5, 2.5 and 1.5°C respectively[2]. Also shown is the best estimate of the observed global average temperature from 1860 until the present (see Fig. 3.1).

FIGURE 3. Showing the observed and predicted rises in temperature from 1860 to 1993 where the solid black line represents the best estimate of the observed global average temperature. The subsequent discrete temperature observations (HadCRUT3), 2006, 2007, 2008 and 2009 have been added as little red dots to this figure, these small dots appear like fly specks at the end of the blue triangular envelope. Superimposed on this figure for further comparison is the ‘Model Projections Compared with Observations’ reproduced from the IPCCs Fourth Assessment Report (Figure TS.26) which is shown as a zigzag red line.

This superposition makes clear the comparison between the IPCC, IS 92a scenario (Medium curve) and the most recent average global temperature observation (2009) which shows the temperature rise is about **only 55%** or **0.7C** of what was predicted and is in fact below the lower projection curve (Low) and so outside the IPCC’s lower estimated range of certainty. The predicted rise corresponding to 2009 is approximately 1.3°C. Hence, what are the implications of this divergence particularly if these temperatures are now responding to natural climatic variation forces as discussed later in section 6? One implication is that the IPCC current carbon dioxide reduction strategies (Bolin, 2007) projecting into the future are a gross over-estimation with lesser predicted warming and lesser sea level rises.

Also the superposition makes clear the impact of the IPCC's declared starting point adjustments as, "These projections were adjusted to start at the observed decadal average value in 1990." (IPCC, 2007:Figure TS.26). This adjustment lowered the starting point in 1990 by 0.25°C and moves the starting point of the original IPCC (FAR) 'business-as-usual' (IPCC IS 92a) from the middle (Medium) curve which was the IPCC's "best estimate of change" to the lower (Low) curve which was the lower estimated range of uncertainty. (Houghton, 1994, 80)

In addition, in figure 3, it can be seen that the current IPCC (AR4) 2007 projections represented by the red zigzag line lies on the Low estimate range of uncertainty of the original prediction which means the current IPCC 2007 future temperature predictions for the year 2100 have been reduced by about 1.0°C.

Figure 4 shows the IPCC's 'Model Projections Compared with Observations' and is included to assist with the comparison and to provide more detail; this figure shows in much more detail the triangular envelope of past IPCC temperature projections. The multi-coloured triangular shape

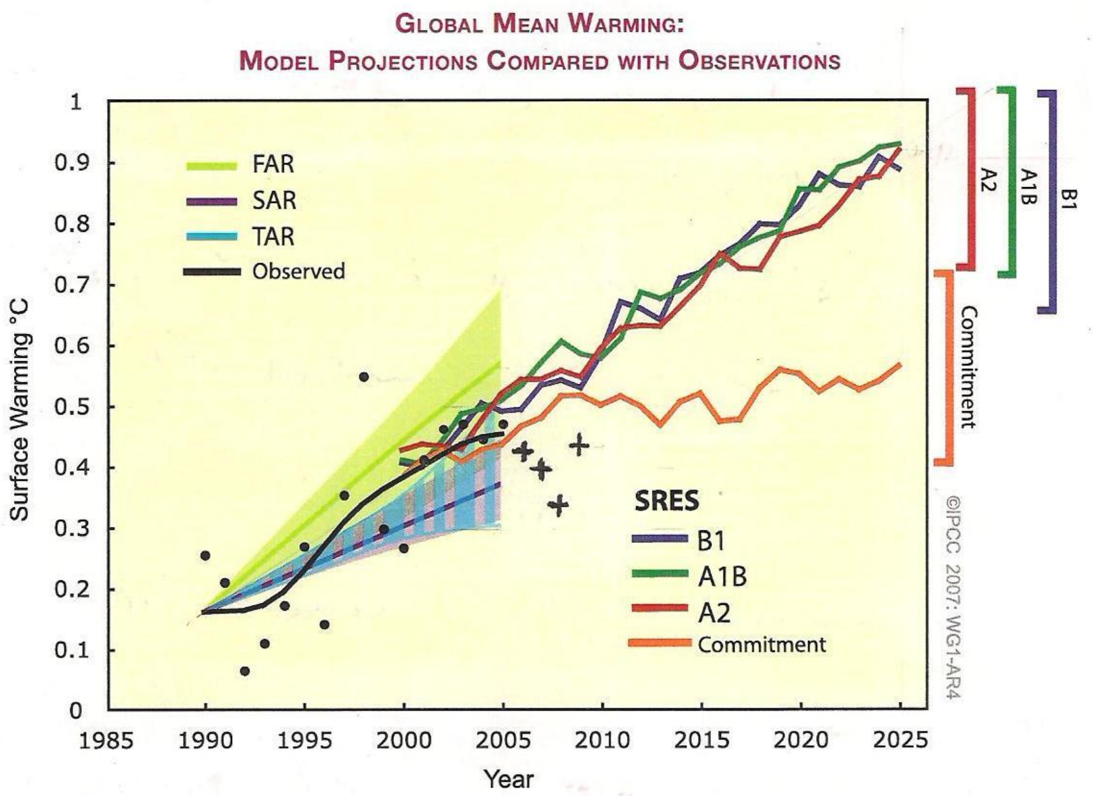


Figure TS.26. *Model projections of global mean warming compared to observed warming. Observed temperature anomalies, as in Figure TS.6, are shown as annual (black dots) and decadal average values (black line). Projected trends and their ranges from the IPCC First (FAR) and Second (SAR) Assessment Reports are shown as green and magenta solid lines and shaded areas, and the projected range from the TAR is shown by vertical blue bars. These projections were adjusted to start at the observed decadal average value in 1990. Multi-model mean projections from this report for the SRES B1, A1B and A2 scenarios, as in Figure TS.32, are shown for the period 2000 to 2025 as blue, green and red curves with uncertainty ranges indicated against the right-hand axis. The orange curve shows model projections of warming if greenhouse gas and aerosol concentrations were held constant from the year 2000 – that is, the committed warming. {Figures 1.1 and 10.4}*

FIGURE 4. Shows the Model Projections Compared with Observations including the recent average annual global temperature (HadCRUT3) for 2006, 2007, 2008 and 2009 inserted by the authors and shown as crosses. Note these four recent temperature observations fall below the Orange Line (Committed Warming) – GHG emissions held constant at 2000 levels.

represents the temperature projections in the first, second and third IPCC assessment reports. The multi-modelled mean projections of the fourth assessment report is shown as four emission scenarios that extend from 2000 to 2025. Their respective uncertainty ranges are shown on the right hand side axes of the figure. The average global temperatures (HadCRUT3) are maintained on the Commonwealth of Australia's Bureau of Meteorology website (BOM, 2007) and the four most recent temperatures, 2006, 2007, 2008 and 2009, have been added by the authors to the figure and are shown as crosses.

From the above it is clear these four recent temperatures are much lower than the predictions and in fact all lie below the 'Commitment' projection and below the lower projection curve (Low) and are outside the IPCC's estimated range of uncertainty.

The divergence of the observed average global warming temperature from the IPCC's prediction raises question as to the validity of the 'enhanced greenhouse effect' hypothesis and consequently to the prudence of continuing with the IPCC's atmospheric carbon dioxide reduction strategy as it is currently proposed. (Bolin, 2007)

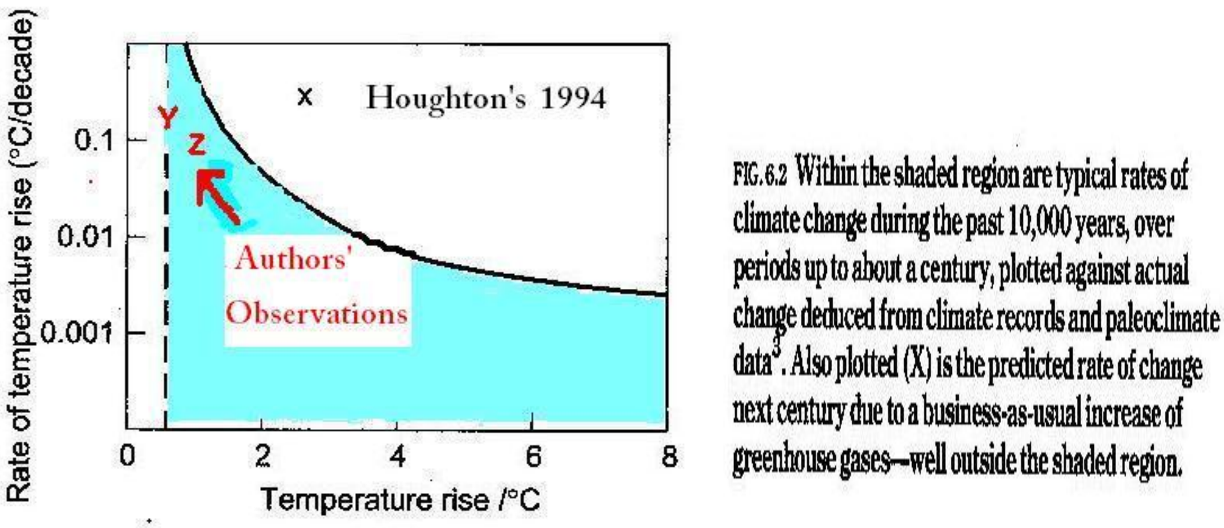


FIGURE 5. Showing (Y) and (Z) the rate of decadal temperature change for the last 20 and 100 years respectively (added by the authors) to be consistent with the rates over the last 10,000 years and are consistent with the recent IPCC's AR4 findings.

Houghton referred to the rate of change of average global temperature, as a measure, to illustrate that in the 21st Century the 'enhanced greenhouse effect' (rate of temperature rise) could be shown to be exceptional when compared to the last 10,000 years. In figure 5 (Houghton's FIG. 6.2) Houghton plotted 'business-as-usual' emission scenario (IPCC IS 92a) can be seen above the curve and shown as an (X). The shaded aqua area below the line represents the typical decadal rates of temperature change over the past 10,000 years. In contrast to the 'business-as-usual' plot the authors have plotted the rates of change of the average global temperature for the last 20 and 100 years (Y) and (Z) respectively on figure 5. As a comparison, the authors found that the rate of change of the average global temperature over the last 20 and 100 years to be within the shaded area and so consistent with the rates of the last 10,000 years. The IPCC's 2007 recent rate-of-change findings are consistent with the authors' findings. (IPCC, 2007:FIG. TS.6)

4. FINDINGS FROM A COMPARISON WITH OBSERVED DATA

A comparison of the four most recent average global temperature observations with the IPCC predictions (FAR) 1990 indicate a 'notable' departure from the global warming scenario that was predicted. This departure raises serious questions concerning the scientific hypotheses and assumptions underpinning the predictions of future temperatures and the prudence of continuing with the carbon dioxide reduction strategy (for temperature mitigation alone) as is currently proposed for global temperature control. Findings are;

1) The increase in carbon dioxide in the atmosphere over the past two decades is as predicted.

2) (i) The IPCC in adjusting its predictions in 2007 (IPCC, 2007:203) to the observed average global temperature in 1990 have lowered the starting point for further temperature projections by about 0.25^0C.
   (ii) The IPCC (AR4) 2007 predictions now follow the lower (Low) curve of uncertainty which is a significant shift from the IPCC's "best estimate of change" (IPCC IS 92a) which was the middle (Medium) curve.
   (iii) The recent average global temperatures for 2006, 2007, 2008 and 2009 are much lower than the IPCC 2007 (AR4) predictions.
   (iii) The recent average global temperatures for 2006, 2007, 2008 and 2009 are all below the IPCC's 2000 prediction for warming in the hypothetical case where greenhouse gases and aerosols have been held at 2000 levels (i.e. below the orange 'curve' in figure 4).
3) The rise in average global temperature, as predicted two decades ago, has not eventuated and the IPCC's best estimate of change for the 'business-a usual' scenario (IPCC IS 92a) and more recent SRES estimates are a gross over-estimate of average global temperature rise. In fact, the observed temperature rise (HadCRUT3) is below the 'lower curve' of the IPCC's 'estimated range of uncertainty'. Furthermore the last decade, on average, has progressively cooled not heated.

4) The rate of temperature rise, when applied to the two decades since the FAR, is consistent with the typical rates estimated for the past 10,000 years and does not support the predicted rate of change for the next Century under the 'business-as-usual' 'enhanced greenhouse effect' scenario.

5) All of the above findings indicate the original scientific hypotheses and assumptions as expounded by Sir John Houghton and associated with the modelling of the Earth's atmosphere are either masked by natural climate variation phenomena or an overestimate. This implies such models should not be used as tools to predict future 'warming' until temperature observations confirm model predictions.

5. ADDRESSING 'GLOBAL WARMING' UNCERTAINTIES

From the above findings it is clear that IPCC's computer models of the Earth's atmosphere are, at present, incapable of modelling future global temperatures with confidence. Earlier, in Table 1 it was shown how Houghton drew attention to the sensitivity of any model to the percentage of low-level clouds. Since that time later versions of the computer models now incorporate many additional forcing agents (clouds, prescribed ice, ocean, volcanic activity, sulphates, aerosols, overturning circulation, interactive vegetation, carbon cycle, freshwater and chemistry) in an attempt to better model the Earth's atmosphere. These added complexities and difficulties were anticipated by an IPCC working group who stated in 2006;

> ***"The reasonable accuracy of AOGCM (atmospheric-ocean general circulation models) forcing at TOM (top of model - troposphere) and the significant bias at the surface together imply the effects of increased WMGHGs (well-mixed greenhouse gases) on the radiative convergence of the atmosphere are <u>not</u> <u>accurately simulated</u>."*** (Collins et al, 2006) (Emphasis added) Clearly from the analysis in this paper the models have not been successful.

The question that needs to be asked is, "what is the reason for the divergence between the prediction and observation?" Is it the limitations of 20th Century physics to model the phenomena of the 'greenhouse effect' in the Earth's atmosphere or is it the level of understanding of feedbacks and complexities which at present are beyond being fully understood? Or is it natural climate variability phenomena masking a much smaller 'enhanced greenhouse effect'? One thing of paramount importance is the radiative balance.

5.1 Radiative Balance – key importance – IPCC energy balance approach

The IPCC outlines its approach to 'radiative forcing' as follows:

> "Radiative forcing is a measure of how the energy balance of the Earth-atmosphere system is influenced when factors that affect climate are altered. The word Radiative arises because these factors change the balance between incoming solar radiation and outgoing infrared radiation within the Earth's atmosphere. This radiative balance controls the Earth's surface temperature. The term forcing is used to indicate that Earth's radiative balance is pushed away from its normal balance." (IPCC, 2007:136)

5.2 Radiative Forcing – Models, feedbacks and limitations

Houghton's Table 1 shows how assumptions about levels of radiative forcing provide changes in the average global surface temperature. For different combinations of greenhouse gases and clouds a range of temperature changes can be predicted. It is of interest to note the sensitivity of clouds, be it high or low level clouds, that cause variations in the predicted average global temperature. Note that in figure 1c doubling of the carbon dioxide concentration with no additional feedback raised the temperature 1.2^{o}C, whereas with the 'best estimate of feedbacks' the temperature rises an additional 1.3^{o}C.

Fifteen years later the radiative forcing components have become more complex and uncertain as depicted in the IPCC's Figure 2.20 (AR4, 2007:203) reproduced as figure 6. This figure shows both the anthropogenic and natural direct solar radiative forcing components (Watts/m^2), spatial scale, and the level of scientific understanding (LOSU).

From this figure it is clear that a major effort has been made to quantify the positive and negative feedback mechanisms and identify the levels of uncertainty associated with the various agents. It is important to note the total aerosol radiative forcing, which includes an estimate for clouds, is a 'low' level of 'scientific understanding' depicted in the Probability Distribution Function (PDF) by the skewness and large standard deviation. This PDF does not include the solar radiative forcing of approximately +0.12 Watts/m^2 which is a relatively small contribution to the net radiative forcing shown as +1.6 Watts/m^2. It is important to note Houghton determined the radiative forcing of the 'enhanced greenhouse effect' to be about +4 Watts/m^2 (Houghton, 1994:26) which would appear now to be a gross over estimation and the reason for the subsequently high predictions for the future global temperatures, particularly since recent temperature observations have not supported the model predictions and there has been a continual rise in carbon dioxide levels.

5.3 Radiative Forcing – Water Vapour and Clouds – Emerging Science

The level of scientific understanding concerning the radiative forcing of water vapour and cloud is low and contributes to the uncertainty of the net amount of radiative forcing.

Emerging new science relates the level of cosmic rays entering the Earth's atmosphere to the formation of cloud forming nuclei: (Duplissy et al., 2010) more solar activity results in less cosmic rays entering the Earth's atmosphere and vice versa. Less cosmic rays produce less nuclei in the low level clouds which result in lessened cloud coverage. The overall effect is to increase solar radiation reaching the land and sea surface producing an overall warming effect. In the upper atmosphere the increased solar radiation produces a decrease in the reflectivity of the troposphere which results in warming. These two effects combine and amplify the small observed increase in solar radiation by approximately six fold. (Friis-Christensen and Svensmark, 1997)

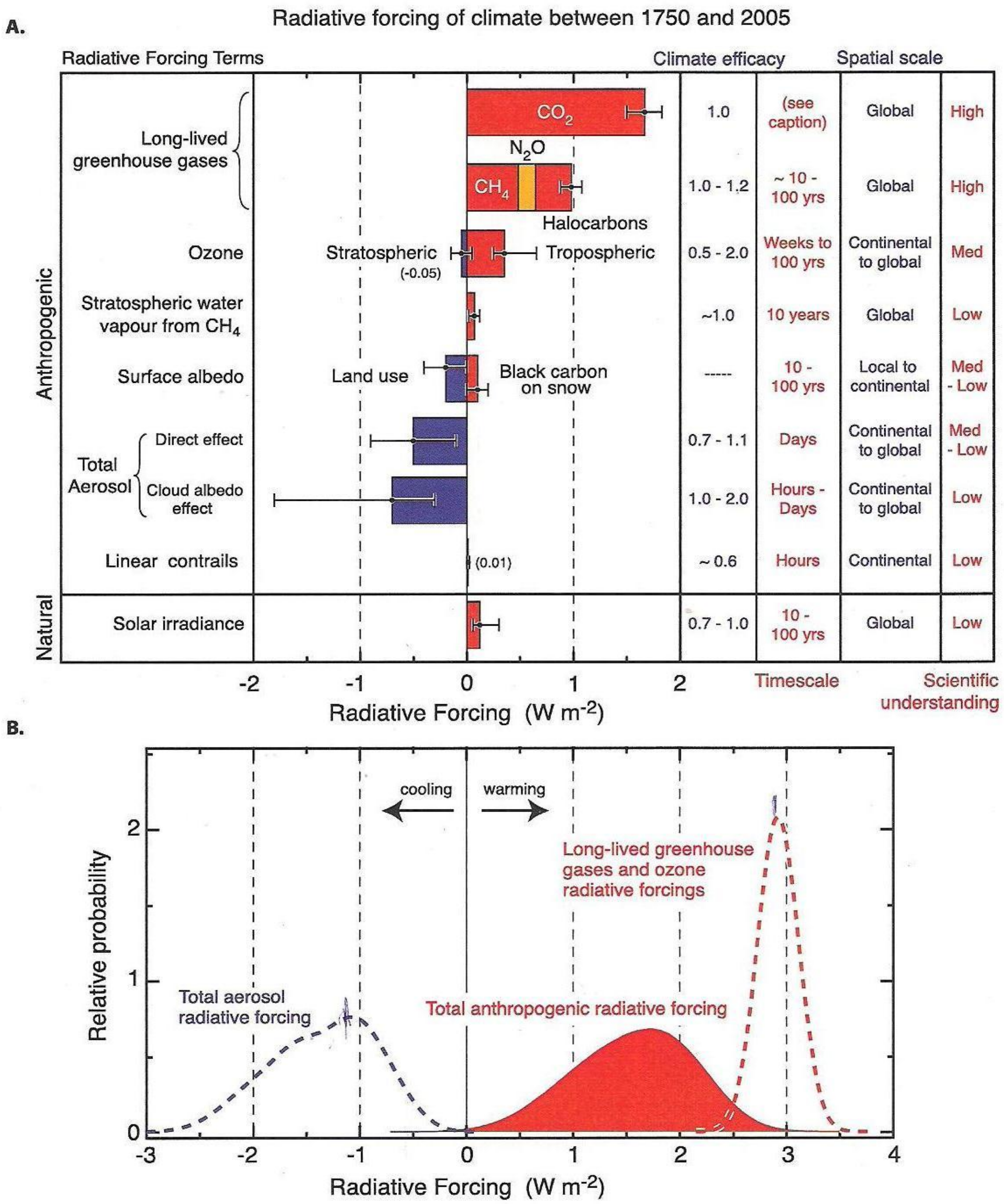


FIGURE 6. (IPCC's Figure 2.20) Shows the Radiative Forcing Components. (IPCC, 2007; 203). Note the small solar irradiance and the high level uncertainty associated with both being critical to the overall net effect and shifting of the distribution curve of probabilities.

5.4 Solar Irradiance – The Sun and Emerging Science.

The Sun and its Sunspot number and cycles have been studied for many centuries, however, it is only in the last twenty years there has been renewed research interest in the Sun, its solar activity, variations and particularly its effect on the Earth's climate. This interest has emerged because of the apparent correlation between the amplitude and occurrence of Sunspots to known periods of global warming and cooling which is shown in figure 7. (Lean, 2010) This figure relates the Maunder and Dalton Minima and the Modern Maximum to both Sunspot number and various reconstructions of Total Solar Irradiation. A Sunspot number of 80 is a notional threshold considered by some below which the Earth cools and above which it is warmed due to increased solar irradiation. Another reason for the interest is to aid space exploration. The use of space era observations over the past three decades has greatly enhanced the understanding of the Sun and its interaction with the Earth and the Cosmos.

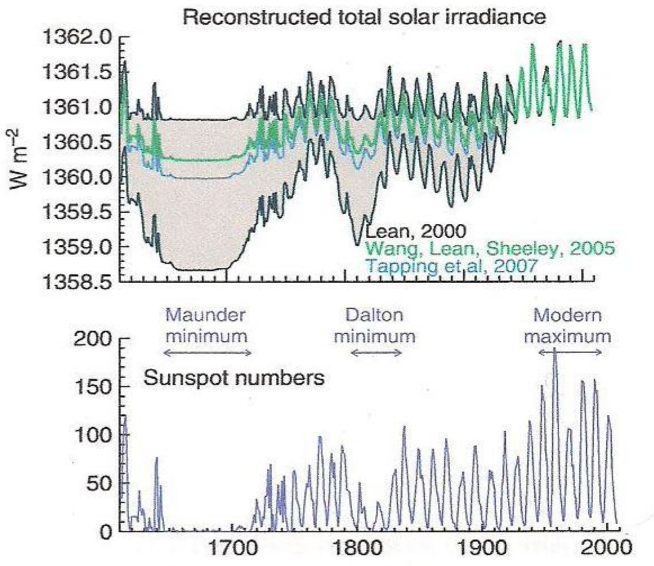


FIGURE 7. Shows the relationship between the Maunder and Dalton Minima and the Modern Maximum to both Sunspot number and various reconstructions of Total Solar Irradiation (TSI). (Reproduced from Lean, 2010) Note the variations in the estimates of TSI.

6. NATURAL CLIMATE VARIABILITY – COOLING TENDENCIES

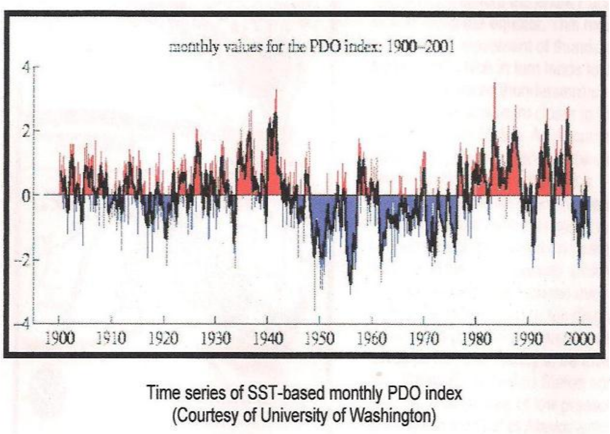
The IPCC has relied on the 'enhanced greenhouse effect' hypothesis and increasingly complex climate computer models to predict future average global temperatures: unfortunately this process has discounted natural climate variability with having a major influence on global temperature. The Earth's climate is defined by its relationship with the Sun and other cosmic bodies, particularly the influences of the larger solar system planets. About 70% of the solar insolation received by the Earth is influenced by the three Milankovitch Mechanisms; Earth's eccentricity, precession and axis tilt. (Russell, 2008) The IPCC acknowledges the above and the multiple time scales of natural phenomena operating simultaneous in the troposphere (IPCC, 2007, 68): this is the modelling dilemma.

6.1 Natural Climate Variations – 'Barycentre' of the Solar System and the Sun's Centre of Mass

The planet's moving centre of angular momentum, the Barycentre, as it rotates around the nucleus of the Sun (and the disturbances it causes) is used to infer solar activity and to calculate periods of warming and cooling of the Earth. Landscheidt predicted a "...considerable weaker activity..." for Sunspot 23 two decades ago and "...a long period of cool climate with its coldest phase around 2030...". (Landscheidt, 2003)

6.2 Natural Climate Variations – Pacific Decadal Oscillation

The Pacific Decadal Oscillations (PDO) are decadal to inter-decadal atmospheric temperature variations (occurring in 30 to 40 year cycles) which are most likely due to oceanic processes, particularly the extra-tropical ocean influences where heat anomalies are subducted and re-emerge in response to changes that occur in the ocean gyre. (IPCC, 2007) Figure 8a shows the PDO and the annual time series for the Annual PDO Index. (ibid, 2007) Figure 8b shows the most recent (2009) PDO Index tending downwards. (Spencer, 2010) A comparison of these figures with the bold black line, depicting average global temperature, in figure 1 bears an uncanny similarity to warming and cooling periods in the 20th Century. Given the recent PDO Index value, a negative Index, is probable for the next three or four decades.



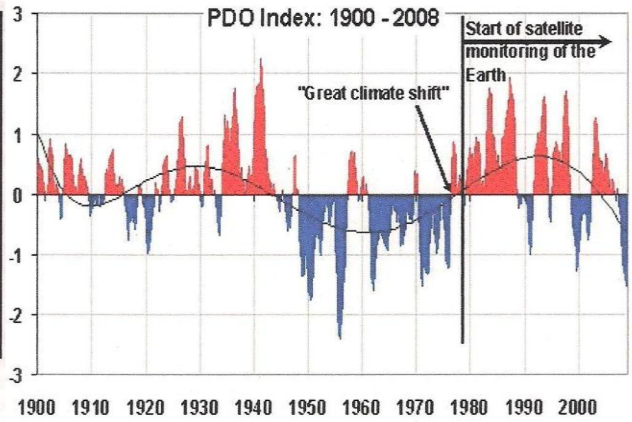


FIGURE 8a. Shows the Pacific Decadal Oscillation. Note the correspondence of the PDO with the warming (1900 to 1940 and 1979 to 1998) and cooling periods (1940 to 1979) during the 20th Century.

FIGURE 8b. Shows the inclusion of the most recent PDO Index and a downward trend line in 2009. Further observations are needed to confirm any trend. (Reproduced from Spencer, 2010)

6.3 Natural Climate Variations – ENSO – La Nina Cycle

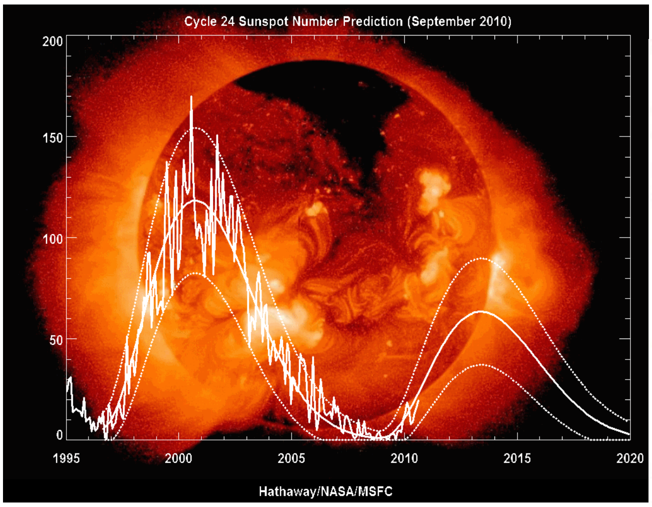
This year the El Nino Southern Oscillation in the Pacific Ocean has changed from a weak El Nino to a strong La Nina event. A deepening La Nina will reduce the projected magnitude of the average global temperature for 2010 (Hansen, 2010:21) and so contribute to global cooling.

6.4 Natural Climate Variations – Sunspots – Cycles- Decadal

As discussed in section 5.4 sunspots are related to inter-centennial warming and cooling events and as such are used to predict future Sunspot cycle amplitude and length of cycle. These predictions assist in the planning of space exploration as sunspot activity is associated with electromagnetic storms which can interfere with communications, damage space craft and herald in changes to the Earth's climate.

Figure 9 is a reproduction of the actual Sunspot numbers for Cycles 23 and 24 as of September 2010. It is of interest to note that National Aeronautical Space Administration (NASA) has progressively down-graded its Sunspot number for Cycle 24 from 140 to 65 about 115% since May 2006. David Hathaway a solar physicist at the National Space Science and Technology Centre (NSSTC) has predicted the Sunspot numbers to be 140 and 65 for cycles 24 and 25 respectively. These predictions are shown in figure 10 where the actual Sunspot number is shown in dark green (drawn in by the authors) and the prediction revised to the green dotted line. The recent prediction by NASA of a Sunspot number of 65 for Cycles 24 would indicate the onset of cooling. The minimum Sunspot number during the Dalton Minimum was about 25, refer to figure 7.

It is of importance to note that Theodor Landscheidt predicted in the 1970's (using Barycentre analyses methodology) lower Sunspot numbers commencing in the 1990's (Landscheidt, 2003) and Abdussamatov predicted, in 2007, Sunspot numbers 80, 45 and 25 for Cycles 24, 25 and 26 respectively which would emulate a repeat of a Dalton Minimum. (Abdussamatov, 2008)



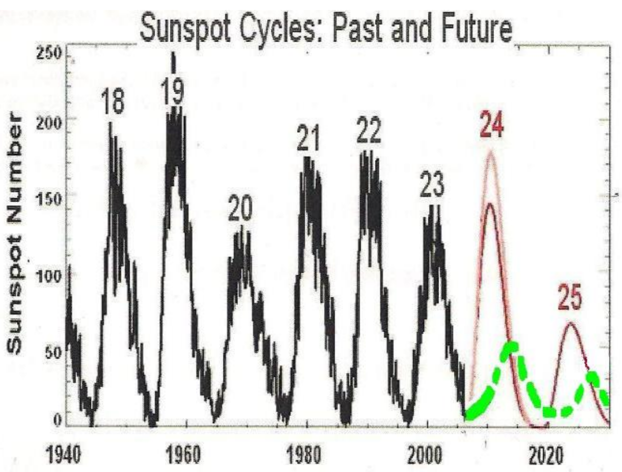


FIGURE 9. Showing the completed Sunspot Cycle number 23 and the predicted size of Sunspot Cycle number 24 that has been reduced in amplitude from 140 in May 2006 to 60 since September 2010.

FIGURE 10. Showing the observed Sunspot number in black, the predicted number by Hathaway (Red) and Dikpati (orange) in May 2006. The bold and dotted green lines (added by the authors) depicts the recent observations and the most likely predictions for cycles 24 and 25.

6.5 Climate Natural Variations – Cycles and trends in solar irradiation

Judith Lean, a senior author cited twelve times in the IPCC AR4, has recently completed a 'Focus Article' for John Wiley and Son entitled, "Cycles and trends in solar irradiance and climate". She is funded by NASA and concludes her paper with the following statement:

> ***"As the only external climate forcing directly specified independently of climate models, solar irradiance variations promise a touchstone for advancing understanding of climate change. When climate models can reproduce the multiple, complex responses embodied in the empirical evidence, confidence will increase in their ability to simulate climate changes in response to other radiative forcings, including greenhouse gases."***

These findings are similar to those of the authors of this paper who have independently found the shortcomings of the 'parameterization' techniques of computer modelling being unable to cope with the complexities of natural climate variability's, at this time, and the need to consider the emerging solar irradiative science as a more direct and promising tool for the predictions of Earthy warming and cooling.

7. GLOBAL COOLING POSSIBILITY AND ITS IMPLICATION

The observed average global temperature data for this decade is not confirming the IPCC's predicted relationship between increasing carbon dioxide levels in the Earth's atmosphere and their prognosis of global warming. A combination of natural phenomena that result in cooling will most likely be the dominant climate drivers to control the Earth's atmospheric temperature this decade. The implications of this possibility for the World's communities are significant since the IPCC is totally committed to a global atmosphere carbon reduction strategy to mitigate against global warming. Emeritus Professor Bert Bolin's book, "A History of the Science and Politics of Climate Change – The Role of the Intergovernmental Panel on Climate Change." will provide the reader with a full measure of the commitments. (Bolin, 2007)

8. SUMMARY

1) Recent observations of average global temperatures during the last decade are ***not*** conforming to the predictions of global warming as outlined by Sir John Houghton.
2) The scientific hypothesis, on which the 'enhanced greenhouse effect' is based, is ***not*** supported by recent average global temperature observations.
3) Global warming has ceased early in the last decade.
4) The complexities of Earth's climate are beyond the current capabilities of modellers to model the 'enhanced greenhouse effect' and produce reliable predictions of current or future average global temperatures.
5) The warming trend predicted by the IPCC of the Earth's temperature in the first decade of the 21th Century now appears to be in reverse and the Earth has entered global cooling as a result of the onset of cooling natural climate variables: at present this scenario seems more likely than global warming,
6) Future observations over the next decade will conclusively confirm one way or another whether there is global warming or global cooling.
7) Premeditative actions to mitigate predicted short-term global warming would be ill advised given the high level of scientific uncertainty.
8) Western science, its processes and subsequent politicization is on public trial together with the hypothesis of carbon dioxide dominated global warming.
9) Atmospheric carbon reduction measures should be restrained for at least a decade until the trend of average global temperature is known and has moved outside the natural climate variations experienced on Earth over the last 1200 years.

9. CONCLUSION

It is concluded that atmospheric carbon reduction measures are restrained until the trend in global warming or cooling is beyond doubt.

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