MODEL FAILURES, GREENHOUSE GASES, UHI AND NATURAL FORCING

ISSUE SUMMARY

This comment questions justification for

TSD ES2. Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. Climate model simulations suggest natural forcing alone (e.g., changes in solar irradiance) cannot explain the observed warming.

TSD ES3. Future warming over the course of the 21st century, even under scenarios of low emissions growth, is very likely to be greater than observed warming over the past century.

COMMENTS

First of all the observed changes over the last century can be easily explained by urban and local contamination that exaggerated the warming and multidecadal cycles in the oceans and on the sun. CO2 correlates poorly with the temperatures except during brief intervals in the 1920s to 1940s and 1979 to 1998.

The models, regardless of scenarios used are failing. They can not thus be used to say it "is very likely the warming is very likely to be greater than observed warming over the past century."

Other natural factors, discounted by the IPCC and CCSP and thus the EPA can be shown to explain observed changes and thus are better guides as to future climates than the failed models. These other factors, despite coverage in the IPPC, were discounted in the Summary for Policymakers and the entire CCSP report except to acknowledge short term variability due to ENSO. This is true despite considerable peer review support for their importance to climate and correlation with observed climate changes.

I. PRINCIPAL CONCLUSIONS

A striking feature of the UN IPCC and the US CCSP Reports is a unilateral presentation of information, with an almost exclusive concentration on greenhouse gases, and particularly on the man-made emissions of carbon dioxide, as the dominant cause of climate change and the recent modern warm period. **The reports totally ignore studies that disagree with the man-made warming hypothesis and should be rejected by the EPA as useful in making an informed judgment about "endangerment".**

These reports predicate effects based on global climate models, whose skill in predicting (or reproducing) observations has never been demonstrated and in fact have even been challenged by IPCC lead author modelers. See the comments below:

Coordinating Lead Author of IPCC Fourth Assessment Report (AR4)Working Group 1(WG1), Chapter 3: (Observations: Surface and Atmospheric Climate Change) Kevin Trenberth in a Nature June 2007 weblog noted *"None of the models used by IPCC are initialized to the observed state and <u>none of the climate states in the models correspond even remotely to the current observed climate</u>. In particular, the state of the oceans, sea ice, and soil moisture has no relationship to the observed state at any recent time in any of the IPCC models."*

IPCC Lead Author James Renwick of New Zealand National Institute of Water and Atmospheric Research **a contributing author to the same WG1, Chapter 3,** admitted *"Climate prediction is hard, <u>half of the variability in the climate system is not predictable</u>, so we don't expect to do terrifically well."* (see quote <u>here</u>)

As Chris Folland of the United Kingdom Meteorological Office (UKMO), another contributing author of WG1, Chapter 3 admitted *"The data doesn't matter. We're not basing our recommendations for reductions in carbon dioxide emissions upon the data. We're basing them upon the climate models"* (see quote <u>here</u>)

A recent post by Ann Henderson-Sellers (2008) [until 2007 she was the Director of the World Climate Research Programme based in Geneva at the headquarters of the World Meteorological Organisation] entitled "The IPCC report: What the lead authors really think" highlighted additional questions about the IPCC report. Her post is based on a workshop conducted *"In the final months of the Intergovernmental Panel on Climate Change's Fourth Assessment reporting in 2007"* when *"the world's three leading climate science agencies asked people directly and intimately involved with the report for their views on how the process had gone and some of the key issues it raised.*

" The three agencies in question: the Global Climate Observing System Programme (GCOS), the World Climate Research Programme (WCRP), and the International Geosphere-Biosphere Programme (IGBP) are the world co-ordinators of observations and research on climate change. They also held a workshop in Sydney in October 2007 on Learning from the IPCC Fourth Assessment Report, for which I drafted an outline of a workshop paper, based entirely on responses to the survey.

" What follows is the text I drafted one year ago which itself came entirely from quotes from IPCC lead authors responding to a questionnaire sent out by GCOS-WCRP-IGBP. The full details of the questionnaire and the replies submitted, some of which came in after this draft was written, ***have since been restricted*** *but an early summary can still be found.*

In this article I report what these eminent folks said – every bullet point comprises a reply submitted by an IPCC respondent in mid-2007 and the only editing has been to improve the English, clarify or spell out acronyms.

Serious inadequacies in climate change predictions that are of real concern

• The rush to emphasize regional climate does not have a scientifically sound basis.

• Prioritize the models so that weaker ones do not confuse/dilute the signals.

• Until and unless major oscillations in the Earth System (El Nino-Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), North Atlantic Oscillation (NAO) and Atlantic Multidecadal Oscillation (AMO) etc.) can be predicted to the extent that they are predictable, regional climate is not a well defined problem. It may never be. If that is the case then we should say so. It is not just the forecast but the confidence and uncertainty that are just as much a key.

• Climate models need to be exercised for weather prediction; there are necessary but not sufficient things that can best be tested in this framework, which is just beginning to be exploited.

• Energy budget is really worrisome; we should have had 20 years of ERBE [Earth Radiation Budget Experiment] type data by now- this would have told us about cloud feedback and climate sensitivity. I'm worried that we'll never have a reliable long-term measurement. This combined with accurate ocean heat uptake data would really help constrain the big-picture climate change outcome, and then we can work on the details.

• [Analyse] the response of models to a single transient 20th century forcing construction. The factors leading to the spread in the responses of models over the 20th century can then be better ascertained, with forcing separated out thus from the mix of the uncertainty factors. The Fourth Assessment Report missed doing this owing essentially to the timelines that were arranged.

• Adding complexity to models, when some basic elements are not working right (e.g. the hydrological cycle) is not sound science. A hierarchy of models can help in this regard.

Climate change research topics identified for immediate action

• Thorough understanding of the physics and dynamics of the Greenland and Antarctic ice sheets, with a view to predicting sea level rise within 20% for a specified change in climate over the ice sheets.

• Simulation of the main modes of variability in each of the main oceans (e.g. ENSO and PDO in the Pacific, thermohaline circulation (THC), meridional overturning circulation (MOC) and AMO in the Atlantic, and monsoons in the Indian Ocean) is essential. Replicating relative changes over the past 50 years is essential and is an initial value problem for the oceans."

Professor Gerard Roe, University of Washington, Seattle

Two U.S. climate scientists said in a paper published in the journal *Science (Oct2007)* -- that despite the scientific improvements of the past 30 years, predicting how much the climate will change still has its difficulties. They explain that certain feedback loops in climate systems boost the impact of greenhouse gases on the atmosphere in a way that models cannot accurately predict, thus making the likeliest conditions for warming the least reliably gauged by models. *"Small uncertainties in the physical processes are amplified into large uncertainties in the climate response, and there is nothing we can do about that,"* said Gerard Roe, an associate professor of earth and space sciences at the University of Washington-Seattle. "*We're pretty much there. Current modeling is about as good as it gets."*

Kesten C. Green and J. Scott Armstrong (2007)

The forecasts in the Report were not the outcome of scientific procedures. In effect, they present the opinions of scientists transformed by mathematics and obscured by complex writing. We found no references to the primary sources of information on forecasting despite the fact these are easily available in books, articles, and websites. We conducted an audit of Chapter 8 of the IPCC's WG1 Report. We found enough information to make judgments on 89 out of the total of 140 principles. The forecasting procedures that were used violated 72 principles. Many of the violations were, by themselves, critical. We have been unable to identify any scientific forecasts to support global warming. Claims that the Earth will get warmer have no more credence than saying that it will get colder.

Comments by Demetris Koutsoyiannis and Associates

Anagnostopoulos et al. (2009) concluded:

* The performance of the models at local scale at 55 stations worldwide (in addition to the 8 stations used in (Koutsoyiannis et al.,2008) is poor regarding all statistical indicators at the seasonal, annual and climatic time scales. In most cases the observed variability metrics (standard deviation and Hurst coefficient) are underestimated.

* The performance of the models (both the TAR and AR4 ones) at a large spatial scale, i.e. the contiguous USA, is even worse.

* *None of the examined models reproduces the over year fluctuations of the areal temperature of USA (gradual increase before 1940, falling trend until the early 1970s, slight upward trend thereafter); most overestimate the annual mean (by up to 4°C) and predict a rise more intense than reality during the later 20th century.*

* *On the climatic scale, the model whose results for temperature are closest to reality (PCM 20C3M) has an efficiency of 0.05, **virtually equivalent to an elementary prediction based on the historical mean**; its predictive capacity against other indicators (e.g. maximum and minimum monthly temperature) is worse.*

* The predictive capacity of GCMs against the areal precipitation is even poorer (overestimation by about 100 to 300 mm). All efficiency values at all time scales are strongly negative, while correlations vary from negative to slightly positive.

* Contrary to the common practice of climate modelers and IPCC, here comparisons are made in terms of actual values and not departures from means ("anomalies"). The enormous differences from reality (up to 6°C in minimum temperature and 300 mm in annual precipitation) would have been concealed if departures from mean had been taken.

Discussion on models by Dr. Madhav Khandekar, retired meteorologist/climatologist Environment Canada and IPCC reviewer

“I have discussed some of these issues in my report "Uncertainties in GHG induced climate change" prepared for the Government of Alberta & published June 2000. PDF

Many of the uncertainties I identified then in 2000 still remain today (ex. urban impact, cloud cover, aerosols, inclusion of sea ice using sea ice dynamics model with a viscous-plastic rheology). Many of the problems are probably addressed by the climate modeling community, however most peer reviewed papers do not specifically mention these, so it is hard to know what the modelers are doing unless someone belongs to the modeling community. The modelers seem to have a 'closed' networking so they do not share any info unfortunately.

My report identifies the problem of cloud cover and whether "the clouds heat OR cool the planet earth?" (see p. 30-32 of my report). While working on my report I attended the IUGG General Assembly in Birmingham UK July 1999 and had a brief discussion on cloud cover etc with Dr Ramanathan (a high-profile atmospheric scientist and cloud specialist at UCSD La Jolla USA) and asked him if "he could conduct a simple numerical experiment based on satellite-derived cloud climatology to show that most cloud cover of the world-which are most of the time low to mid-level cloud- would produce cooling OR warming" Ramanathan could not answer positively to my suggestion.

Now Lindzen and others are calling this cloud cover and their impact on mean temperature as a "negative feedback' (Does the earth have an Iris? AMS Bulletin 2001).

In another paper by Randall et al (1984 AMS Bulletin) the authors argue that just a 4% increase in marine stratocumulus cloud world-wide would offset all future warming due to a doubling of CO_2!

No one knows how the earth's cloud cover will evolve in future say 10 years from now. With Svensmark's new theory of increased cloud cover due to increased cosmic ray flux, this is the most challenging problem for climate models today. The modelers do not spell out what sort of cloud cover they use for future projection, but my guess is they use some of the cloud growth models (ex cumulus cloud growth thru parameterization etc) and the models generate these could cover internally as the models are integrated in time.

The Canadian Climate Centre's 1993 model (first version) significantly underestimated marine cloud cover over South American coastline (all along the south American coastline, there is a perennial low cloud cover due to cold Humbolt Current. In Lima Peru the local meteorologists call this as "roof of Lima"). I like to think that such problems of inadequate cloud cover over the South American coast and over the Arctic and Antarctic still exist.

The best way to describe climate models' future projections is "cloudy" literally and figuratively."

Dr. William Kininmonth, Head of Australia's National Climate Centre from 1986 to 1998

"How the models work. They start at time To with initial conditions just as a weather forecasting model would. The model is then integrated out, half hour by half hour (or some other short time step satisfying the computational stability criterion) for a hundred or a thousand years.

The actual weather events lose relevance after a few days. The claim by the modellers is that it is not the individual weather events that are important but the period mean (or climate) that is important; supposedly, so long as the scale of the weather systems is correctly represented then the integrated effect of the weather systems is captured in the period mean. This may or may not be true.

The 2001 IPCC TAR went to great lengths to establish that the 'climate' is unvarying unless forced, for example by increasing CO2. Long integrations of 1,000 years with little departure of global mean temperature; representing the past 1,000 years of temperature by the 'hockey stick' with unvarying temperature until forced by CO2 of industrialisation. TAR then went on (in the SPM) to claim that, based on computer models, the climate system had little internal variability. El Nino and decadal scale oscillation well known in meteorology were claimed to not affect the long term trend of CO2 forcing; just a little variability about the trend line. We were led to believe that only human caused CO2 was going to force the global mean temperature to exceed a 'tipping point' and bring on dangerous climate change.

The sudden fall in global temperature (0.6C) during 2007 must have come as a shock to the modelling community and the IPCC alarmists. Remember, in early January 2007 based on their computer model the UK Met Office had predicted that 2007 was going to be warmer than 1998! Not only was it not warmer but by January 2008 global mean temperature had reverted to the coldest in several decades. We then had the spectacle of new integrations from the modelling community that claimed to take account of decadal oscillations and suggesting that the Earth will continue to not warm for several years (because of whatever had caused the cooling during 2007 perhaps continuing to have an effect) but then AGW would come back with a vengeance. This was no more than covering bases – an excuse for why CO2 was not continuing to warm Earth. Of course the modellers failed to note their inconsistencies of logic! In 2001 there was no internal *variability of the climate system; now there is an admission to serious internal variability but the unverifiable claim that models now captured the internal variability. As Alice would say, 'curiouser and curiouser'!"*

A central question for EPA related to the ANPR should have been "How are the climate models doing?" The answer is, as Trenberth and Renwick alluded to, not very well at all. And, EPA should be concerned that contributors to the IPCC are acknowledging that model FICTION trumps data REALITY. In addition, EPA surely understands that the requirements under the Federal Information Quality Act cannot be ignored. The models on which the important conclusions and policy decisions are based are clearly fatally flawed. Simpler straightforward correlations of temperatures with real data show a very different causation and a drastically different view of the future.

II. REALITY VERSUS FICTION EXPOSED IN THE CCSP

The first examination should be of the CCSP SAP 1.1.

The key fingerprint characteristic of ALL global greenhouse climate models is a significant warming in the middle and high atmosphere. However this "fingerprint" is not shown in either actual radiosonde balloon (U.S. and U.K) or U.S. satellite MSU data. This alone calls into question the assumed, but unproven, hypothesis that carbon dioxide is the principal driver of "global warning". Both the CCSP and IPCC reports start with the assumption that this is not hypothesis but fact and proceeds from there ignoring data that negates that hypothesis.

This "fingerprint" problem was reported in the Nongovernmental International Panel on Climate Change (NIPCC) "Nature, Not Human Activity, Rules the Climate" report edited by Singer (2008) with the chart from the CCSP SAP 1.1 from 2006 (see Figure 1 below). The NIPCC notes:

"This mismatch of observed and calculated fingerprints clearly falsifies the hypothesis of anthropogenic global warming (AGW). We must conclude therefore that anthropogenic GH gases can contribute only in a minor way to the current warming, which is mainly of natural origin."

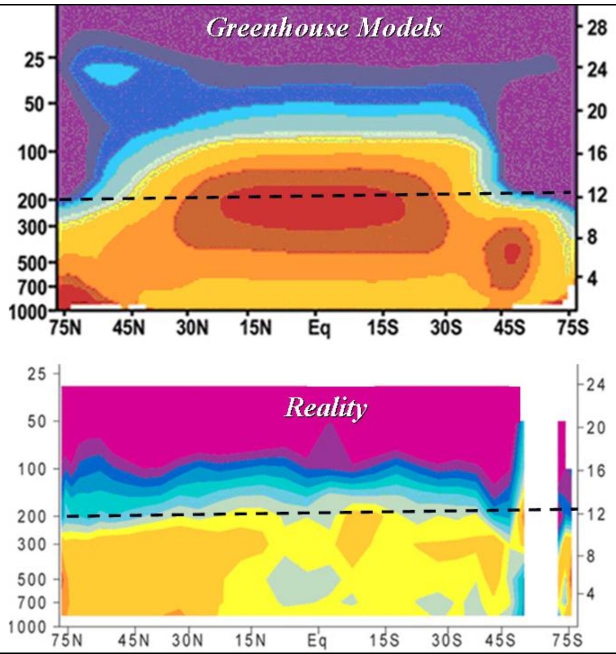


Figure 1: Greenhouse ***model forecast*** *temperatures (top) versus* ***data*** *reality (bottom) as determined by balloon radiosonde and satellite measurements. Top from CCSP SAP 1.1(2006), Figure 1.3, page 25, bottom from Figure 5.7 p. 116.*

Douglass et al (2007) have done a more detailed comparison of this disparity of tropical temperatures and climate models forecasts. Figure 2 below provides a detailed view of the disparity of temperature trends is given in the plot of trends (in degrees C/decade) versus altitude in the tropics. Note that the IPCC models show an increase in the warming trend with altitude, but balloon and satellite observations do not.

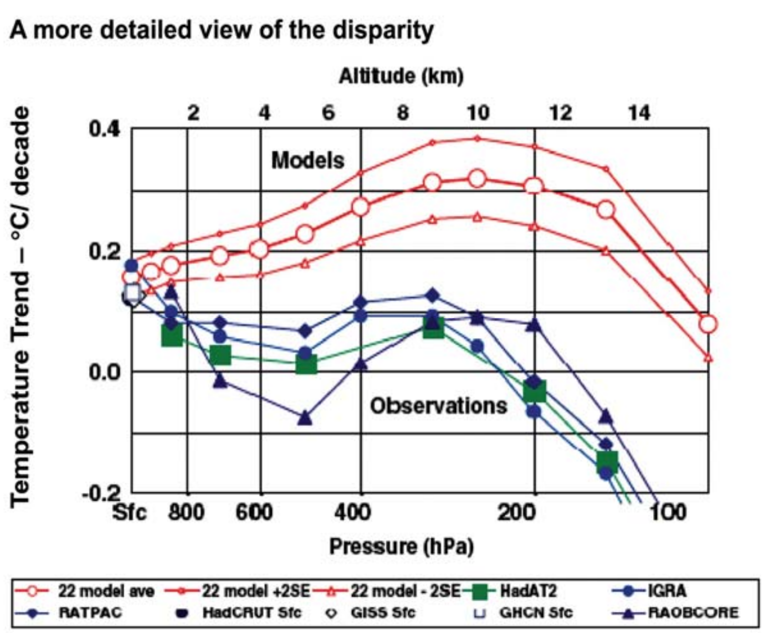


Figure 2: *A detailed view of the disparity of temperature trends is given in this plot of trends (in degrees C/decade) versus altitude in the tropics [Douglass et al. 2007]. Models show an increase in the warming trend with altitude, but balloon and satellite observations do not.*

The mystery of the missing hot spot is solved by the Miskolczi (2007) greenhouse effect theory and confirmed by the declining relative humidity, especially at the altitude of the predicted hot spot. The declining relative humidity reduces the temperature compared to the model projections so there is no hot spot. The GCM assumption of constant relative humidity is wrong and is yet another proof that the climate predictions of the IPCC are wrong.

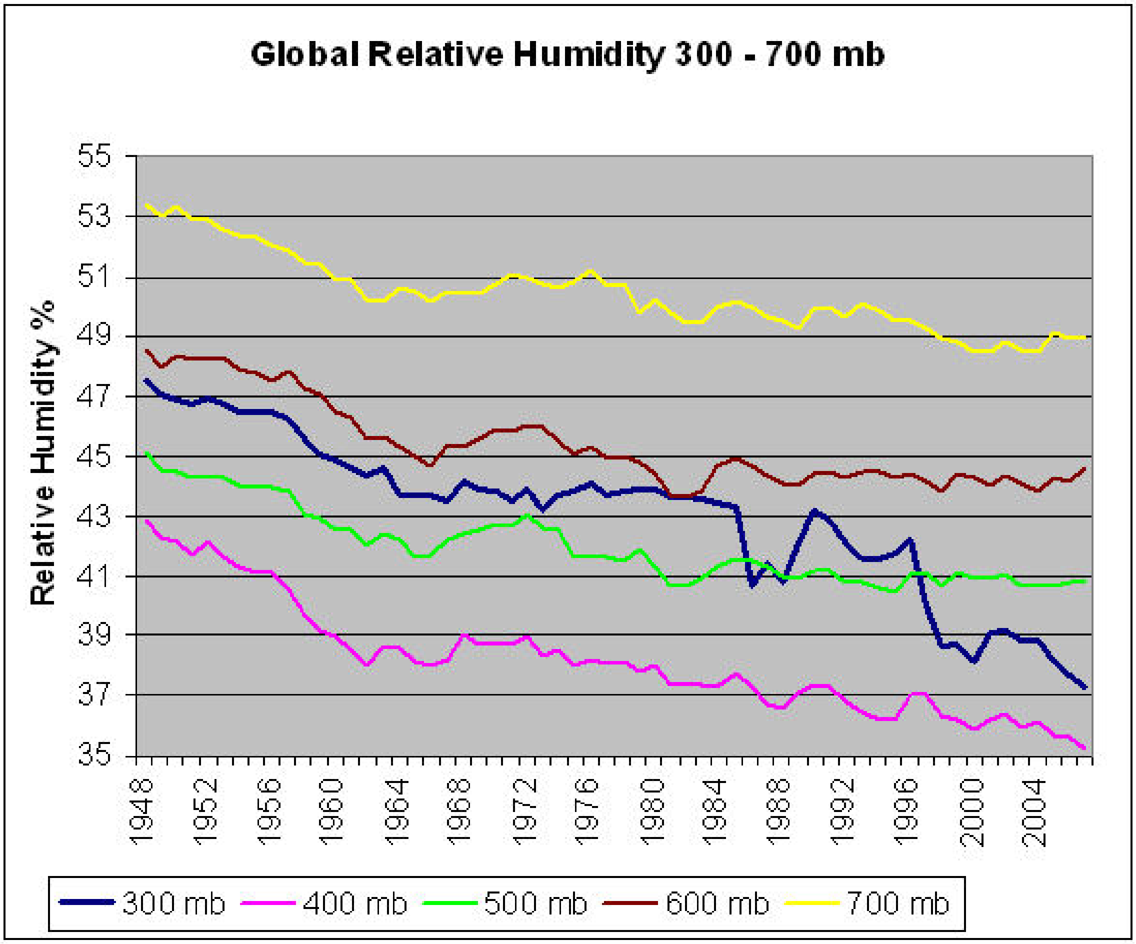


Figure 3: Miskolski (2007) graph global average annual relative humidity at various elevations in the atmosphere expressed in milli-bars (mb) from 300 mb to 700 mb for the period 1948 to 2007. The data is from the NOAA Earth System Research Laboratory here.

Dr. John Christy has tracked actual satellite derived temperatures adjusted to the surface and Hadley CRUT[surface data] in the lower troposphere with the IPCC model forecasts from the most recent IPPC AR4. Just two years into the forecast period, the temperatures are significantly colder on a global basis than any scenario including the steady CO2 state (see figure 4 below). The global data bases all show a decreasing temperature trend since 2002 and no net warming since 1998.

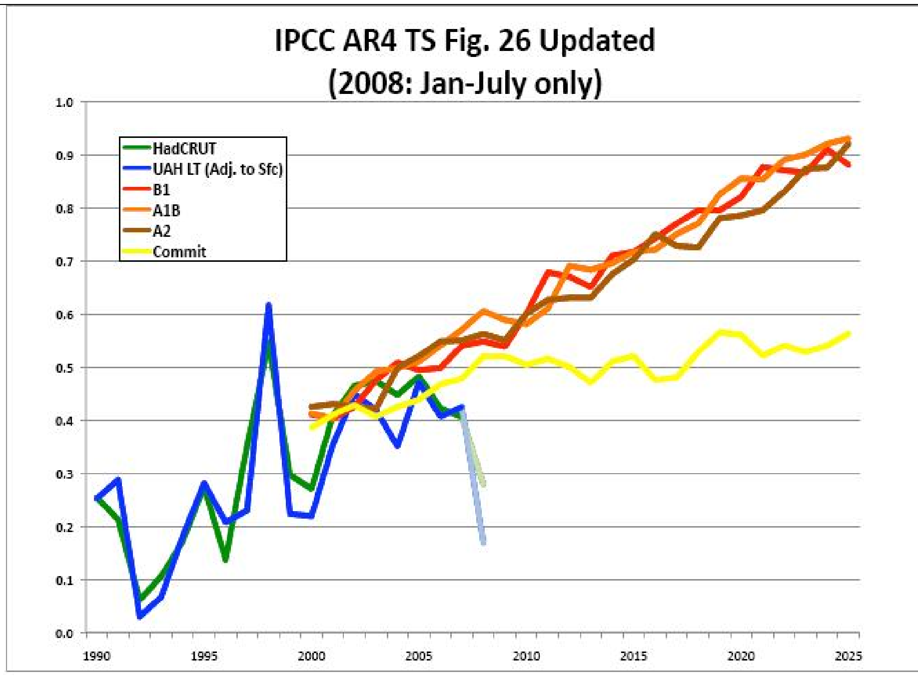


Figure 4: IPCC model scenarios versus actual satellite derived temperatures adjusted to the surface and Hadley CRUT in the lower troposphere (Source John Christy UAH)

A recent paper Douglass and Christy (2008) further documents the disparity between model fiction and reality shown above. "The global atmospheric temperature anomalies of *Earth* reached a maximum in 1998 which has not been exceeded during the subsequent 10 years. The global anomalies are calculated from the average of climate effects occurring in the tropical and the extratropical latitude bands. *El Niño/La Niña* effects in the tropical band are shown to explain the 1998 maximum while variations in the background of the global anomalies largely come from climate effects in the northern extratropics. These effects do not have the signature associated with CO2 climate forcing with positive feedback."

<u>*Additional Model Verification*</u>

Ian Plimer (2009) showed the same is true for the 2000 IPCC models.

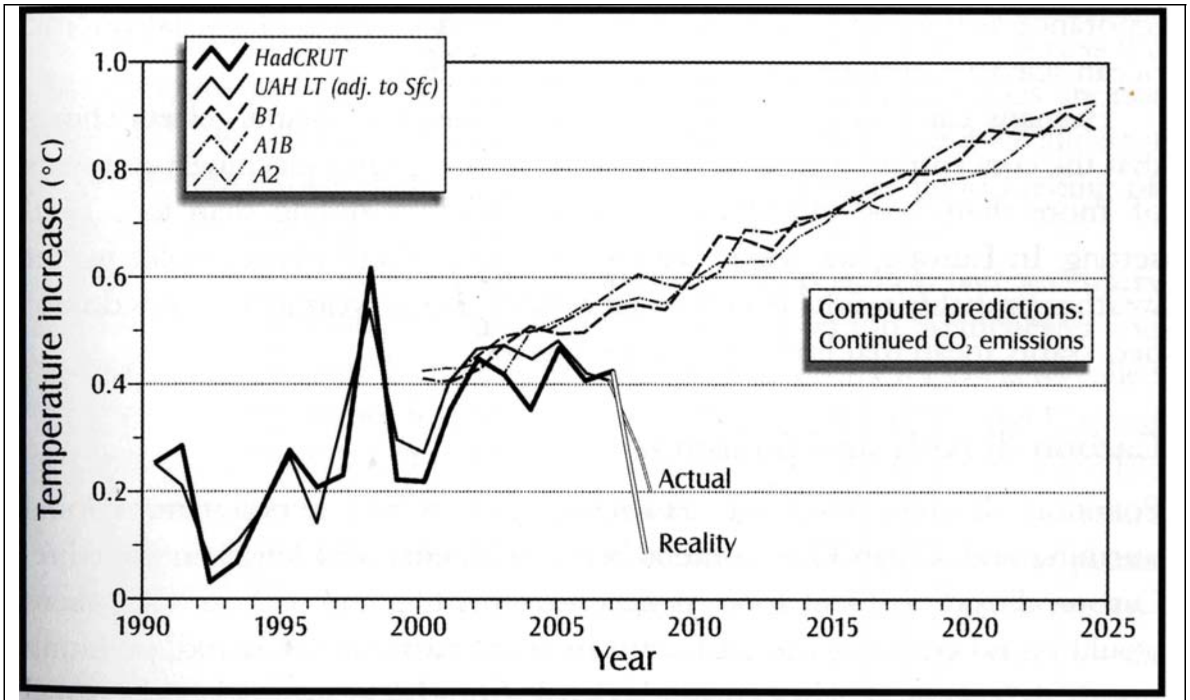
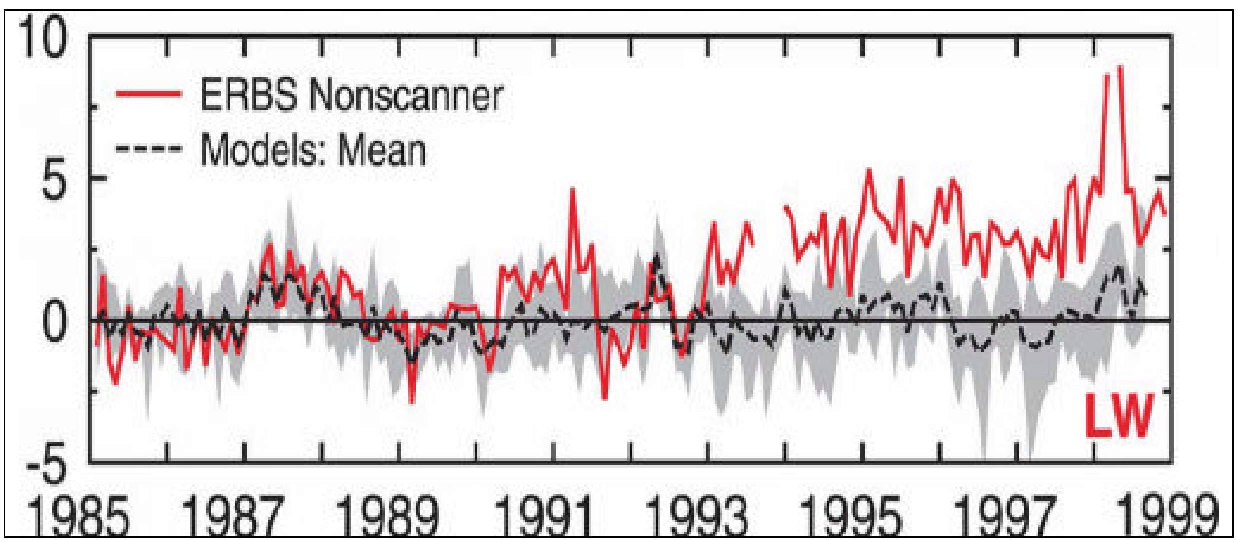


Figure 5: Ian Plimer (2009) comparison of IPPC projections made in 2000 with actual Hadley and UAH MSU LT adjusted to surface

3 IPCC projections made in 2000. The models were not able to predict even a decade in advance let alone 50 years or a century. (Ian Plimer Heaven and Earth Figure 1)

Wielicki (2002): Observed (red) long-wave flux anomalies for the tropics against the mean of five climate model simulations (black) using observed sea surface temperature, and the total range of model-predicted anomalies (gray band). They showed the satellite observed heat escaping the models showed were trapped



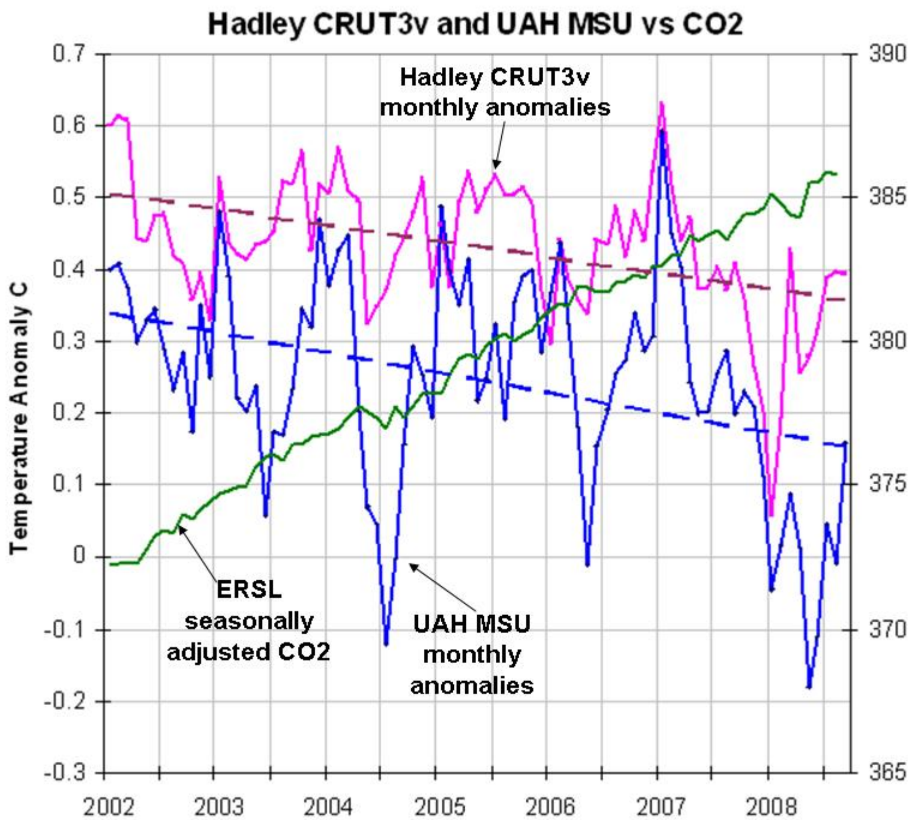


Figure 6:: UAH MSU monthly lower tropospheric global temperatures and Hadley Center CRUT3v surface temperatures versus seasonally adjusted ESRL(explain)

Figure 7 shows that longer term, using NCDC's prize (though it has been shown as flawed) USHCN data base, 5 of the last 7 decades since the onset of the industrial revolution in the Post WWII boom have seen cooling (indicated as Correlation -). Only during the 1980s and 1990s has a warming been seen to parallel the CO2 increase (indicated as Correlation +).

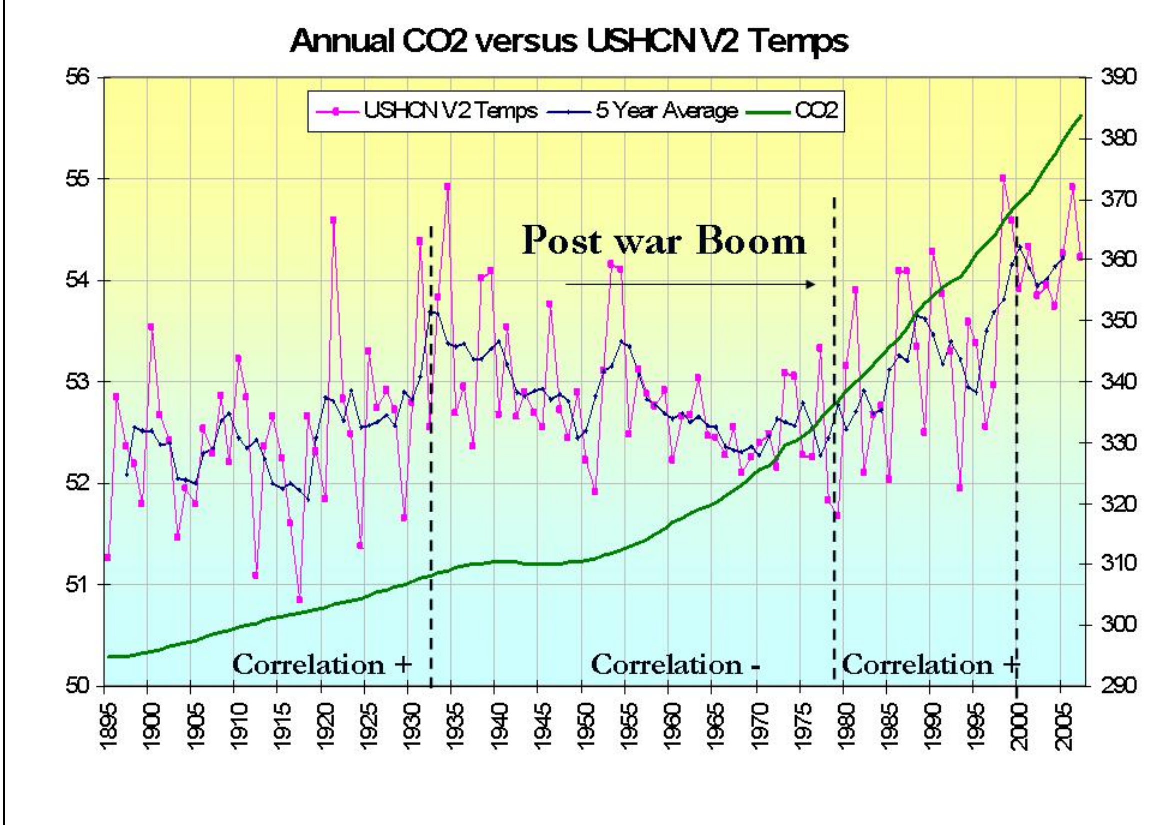


Figure 7: USHCN version 2 annual mean temperatures versus annual average CO2 sice 1895.

This on again, mainly off again relationship of temperatures to CO2 calls into serious question the proposed hypothesis.

The principal issue: If CO2 is not responsible for the changes in temperature, what is?

The sun and oceans were discussed by IPCC scientists but in the end dismissed as factors in the multidecadal trends and climate change. This is because to admit their role, is to weaken the case for greenhouse gases as the principal agent of climate warming and the expensive economic steps that are desired because of political agenda of the UN, environmental groups, and others hoping to profit from the actions.

The data discussed below show that these natural factors are the real drivers for the changes. Man's role in climate change is primarily through land use changes and urbanization that together with station dropout, missing data and poor station siting are responsible for the exaggerated longer term warming of the global data bases from NOAA NCDC, NASA GISS and Hadley. See the end note.

III. THE OCEANS AND SUN AS THE REAL CLIMATE DRIVERS

Multidecadal cycles in the ocean are shown to correlate with the frequency and strength of the shorter term El Niño Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO) phases and through them the United States temperatures. Total solar irradiance (TSI) is shown to vary with these multidecadal ocean cycles suggesting the sun, not CO2 concentration, as the principal driver.

Though the sun may be the ultimate driver of climate cycles and change, it appears the oceans act as the flywheel of the climate system, providing the mechanisms to bring about the changes. For example, when too much heat builds in the tropical oceans as solar activity increases, the oceans appear to flip into their warm mode, which in the Pacific is the positive Pacific Decadal Oscillation (PDO) favoring more El Ninos which transport excess heat poleward. A while later, the Atlantic warms and transports warm water and air to the higher latitudes and the arctic. This sequence happened in the 1930s and 1940s and again the 1980s into the early 2000s.Global temperatures respond upwards. **Conversely when the solar activity diminishes, the tropical oceans cool and the Pacific flips into its negative cold mode. The global temperatures begin to cool and then accelerate as the Atlantic begins a cooling.**

The state of the factors suggest cooling is more likely than warming in the decades ahead. With a cooling Pacific (PDO and La Nina) and an extended solar minimum, one would expect cooling global temperatures. The plot of the last 7 years in Figure 5 above shows that is already taking place. **It is verifying while the greenhouse climate models and CO2 fail.**

A. What the IPCC and the CCSP Ignored (or Missed)

The sun and ocean undergo changes on regular and predictable time frames. Temperatures likewise have exhibited changes that are cyclical. These comments compare the cycles in temperatures with the cycles on the sun and in the oceans.

The ocean and solar influences on climate were discussed at some length in the scientific back-up to the IPCC 2007 Fourth Assessment Report (AR4). EPA apparently doesn't understand that the Summary for Policy Makers (SPM) is not a reliable basis for drawing any policy conclusions. Their opinions of Contributing Authors were largely discarded in the SPM.

IPCC AR4 Working Group 1, Chapter 3 (Observations: Surface and Atmospheric Climate Change) defined the circulation indices including the short term and decadal scale oscillations in the Pacific, and Atlantic and attributed their origin as natural. It noted that the decadal variability in the Pacific (the Pacific Decadal Oscillation or PDO) is likely due to oceanic processes

"Extratropical ocean influences are likely to play a role as changes in the ocean gyre evolve and heat anomalies are subducted and reemerge". (3.6.3)

The Atlantic Multidecadal Oscillation (AMO) is thought to be due to changes in the strength of the thermohaline circulation. But in the end the IPCC does not make any connection of these cyclical oceanic changes to the observed global cyclical temperature changes. But, the IPCC does make a possible connection to regional variances:

"Understanding the nature of teleconnections and changes in their behavior is central to understanding regional climate variability and change." (3.6.1)

IPCC Working Group 1, Chapter 2, discussed at length the varied research on the direct solar irradiance variance and the uncertainties related to indirect solar influences through variance through the solar cycles of ultraviolet and solar wind/geomagnetic activity. They admit that ultraviolet radiation by warming through ozone chemistry and geomagnetic activity through the reduction of cosmic rays and through that low clouds could have an effect on climate but in the end chose to ignore the indirect effect. They stated:

"'Since (the Third Assessment Report), new studies have confirmed and advanced the plausibility of indirect effects involving the modification of the stratosphere by solar UV irradiance variations (and possibly by solar-induced variations in the overlying mesosphere and lower thermosphere), with subsequent dynamical and radiative coupling to the troposphere. Whether solar wind fluctuations (Boberg and Lundstedt, 2002) or solar-induced heliospheric modulation of galactic cosmic rays (Marsh and Svensmark, 2000b) also contribute indirect forcings remains ambiguous". (2.7.1.3)

These comments look at the oceanic based teleconnections and solar variances and temperatures in this paper and look at how the various cycles that are evident interrelate with each other and correlate with temperatures.

In 2007, A team of mathematicians led by Dr. Anastasios Tsonis produced a model that supports this theory (Tsonis 2007). The model indicates the known cycles of the Earth's oceans-the Pacific Decadal Oscillation, the North Atlantic Oscillation (NAO), El Nino (Southern Oscillation Index or SOI)) and the North Pacific Oscillation (NPO) - all tend to try to synchronize with each other. The theory is based on a branch of mathematics known as Sychronized Chaos. The math predicts the degree of coupling to increase over time, causing the solution to "bifurcate," or split. Then, the synchronization vanishes. The result is a climate shift. Eventually the cycles begin to sync up again, causing a repeating pattern of warming and cooling, along with sudden changes in the frequency and strength of El Nino events**. They show how this synchronization of the cycles has explained the major shifts that have occurred including 1913, 1942 and 1978.** These may be in the process of synchronizing once again with a likely impact on climate very different from the so called "consensus" suggested by the UN IPCC and the US CCSP.

B. The First Recognition of Large Scale Atmospheric Oscillations

Sir Gilbert Walker, was generally recognized as the first to find large scale oscillations in atmospheric variables. As early as 1908, while on a mission to try and explain why the Indian monsoon sometimes failed, he assembled global surface data and did a thorough correlation analysis.

On purely statistical grounds through careful interpretation, Walker was able to identify three pressure oscillations, a flip flop on a big scale between the Pacific Ocean and the Indian Ocean which he called the Southern Oscillation on a much smaller scale, between the Azores and Iceland, which he named the North Atlantic Oscillation, and between the areas of high and low pressure in the North Pacific he called the North Pacific Oscillation. Walker further asserted that the Southern Oscillation is the predominant oscillation had a tendency to persist for at least one to two seasons. He went so far in 1924 as to suggest the Southern Oscillation Index (SOI) had global weather impacts and might be useful in predicting the world's weather. He was ridiculed by the scientific community at the time for these statements. Ironically it was not for 4 decades that the Southern Oscillation was recognized as a coupled atmosphere pressure and ocean temperature phenomena (Bjerknes 1969) and over 2 more decades before it was shown to have statistically significant global impacts and could be used to predict global weather/climate at times many seasons in advance.

1. The Southern Oscillation Index (SOI)

The Southern Oscillation Index (SOI) is the oldest measure of the large-scale fluctuations in air pressure occurring between the western and eastern tropical Pacific (i.e., the state of the Southern Oscillation) during El Niño and La Niña episodes. Traditionally, this index has been calculated based on the differences in air pressure anomaly between Tahiti and Darwin, Australia. In general, smoothed time series of the SOI correspond very well with changes in ocean temperatures across the eastern tropical Pacific. The negative phase of the SOI represents below-normal air pressure at Tahiti and above-normal air pressure at Darwin. Prolonged periods of negative SOI values coincide with abnormally warm ocean waters across the eastern tropical Pacific typical of El Niño episodes. Prolonged periods of positive SOI values coincide with abnormally cold ocean waters across the eastern tropical Pacific typical of La Niña episodes.

Being an atmospheric observation based measure, it is subject not only to underlying ocean temperature anomalies in the Pacific but also the intraseasonal oscillations. such as the wave called Madden Julian Oscillation The SOI often shows month-to-month swings even if the ocean temperatures remain steady due to these atmospheric waves. This is especially true in weaker El Nino or La Ninas and La Nadas (neutral ENSO). Indeed even the changes week-to-week can be significant. For that reason, other measures are often preferred.

2. NINO 3.4 Region Anomalies

On February 23, 2005, NOAA announced that the NOAA National Weather Service, the Meteorological Service of Canada and the National Meteorological Service of Mexico reached a consensus on an index and definitions for El Niño and La Niña events (also referred to as the El Niño Southern Oscillation or ENSO). Canada, Mexico and the United States all experience impacts from El Niño and La Niña.

The index is defined as a three-month average of sea surface temperature departures from normal for a critical region of the equatorial Pacific (Niño 3.4 region: 120W-170W, 5N-5S). This region of the tropical Pacific contains what scientists call the "equatorial cold tongue," a band of cool water that extends along the equator from the coast of South America to the central Pacific Ocean. North America's operational definitions for El Niño and La Niña, based on the index, are:

El Niño: A phenomenon in the equatorial Pacific Ocean characterized by a positive sea surface temperature departure from normal (for the 1971-2000 base period) in the Niño 3.4 region greater than or equal in magnitude to 0.5 degrees C (0.9 degrees Fahrenheit), averaged over three consecutive months.

La Niña: A phenomenon in the equatorial Pacific Ocean characterized by a negative sea surface temperature departure from normal (for the 1971-2000 base period) in the Niño 3.4 region greater than or equal in magnitude to 0.5 degrees C (0.9 degrees Fahrenheit), averaged over three consecutive months.

3. Multivariate ENSO Index (MEI)

Wolter (1987) combined oceanic and atmospheric variables to track and compare ENSO events. He developed the Multivariate ENSO Index (MEI) using the six main observed variables over the tropical Pacific. These six variables are: sea-level pressure (P), zonal (U) and meridional (V) components of the surface wind, sea surface temperature (S), surface air temperature (A), and total cloudiness fraction of the sky (C).
The MEI is calculated as the first unrotated Principal Component (PC) of all six observed fields combined. This is accomplished by normalizing the total variance of each field first, and then performing the extraction of the first PC on the co-variance matrix of the combined fields (Wolter and Timlin, 1993).

In order to keep the MEI comparable, all seasonal values are standardized with respect to each season and to the 1950-93 reference period. Negative values of the MEI represent the cold ENSO phase, a.k.a. La Niña, while positive MEI values represent the warm ENSO phase (El Niño).

Figure 7 below is a plot of the three indices the last eight years.

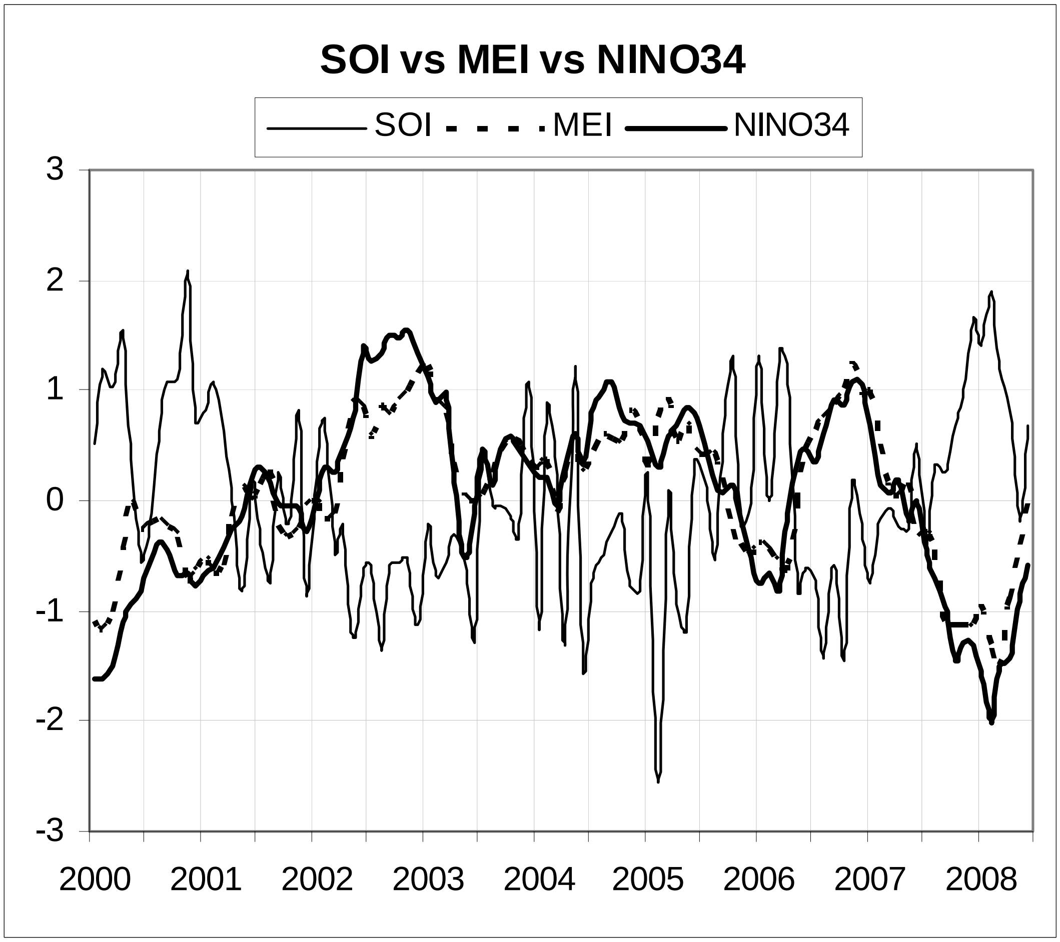


Figure 8: A comparison or SOI, MEI and NINO34 since 2000. Note the close relationship of MEI to NINO34. SOI is inversely proportional and shows more intra-annual variability

Figure 8 shows how well correlated the NINO 34 is to the MEI. You can also see the SOI is much more variable month-to-month than the MEI and NINO34. The MEI and NINO are more reliable determinants of the true state of ENSO especially in weaker ENSO events.

4. The Pacific Decadal Oscillation (PDO)

The first hint of a basin wide cycle was the recognition of a major regime change in the Pacific in 1977 among climatologists that became known as the Great Pacific Climate Shift. Later on, this shift was shown to be part of a cyclical regime change given the name Pacific Decadal Oscillation (PDO) by fisheries scientist Steven Hare in 1996 while researching connections between Alaska salmon production cycles and Pacific climate. This followed research first showing decadal like ENSO variability by Zhang in 1993. In a paper in 1997, Mantua et al found the "Pacific Decadal Oscillation" (PDO) is a long-lived El Niño-like pattern of Pacific climate variability. While the two climate oscillations have similar spatial climate fingerprints, they have very different behavior in time. Two main characteristics distinguish PDO from El Niño/Southern Oscillation (ENSO): first, 20th century PDO "events" persisted for 20-to-30 years, while typical ENSO events persisted for 6 to 18 months; second, the climatic fingerprints of the PDO are most visible in the North Pacific/North American sector, while secondary signatures exist in the tropics - the opposite is true for ENSO.

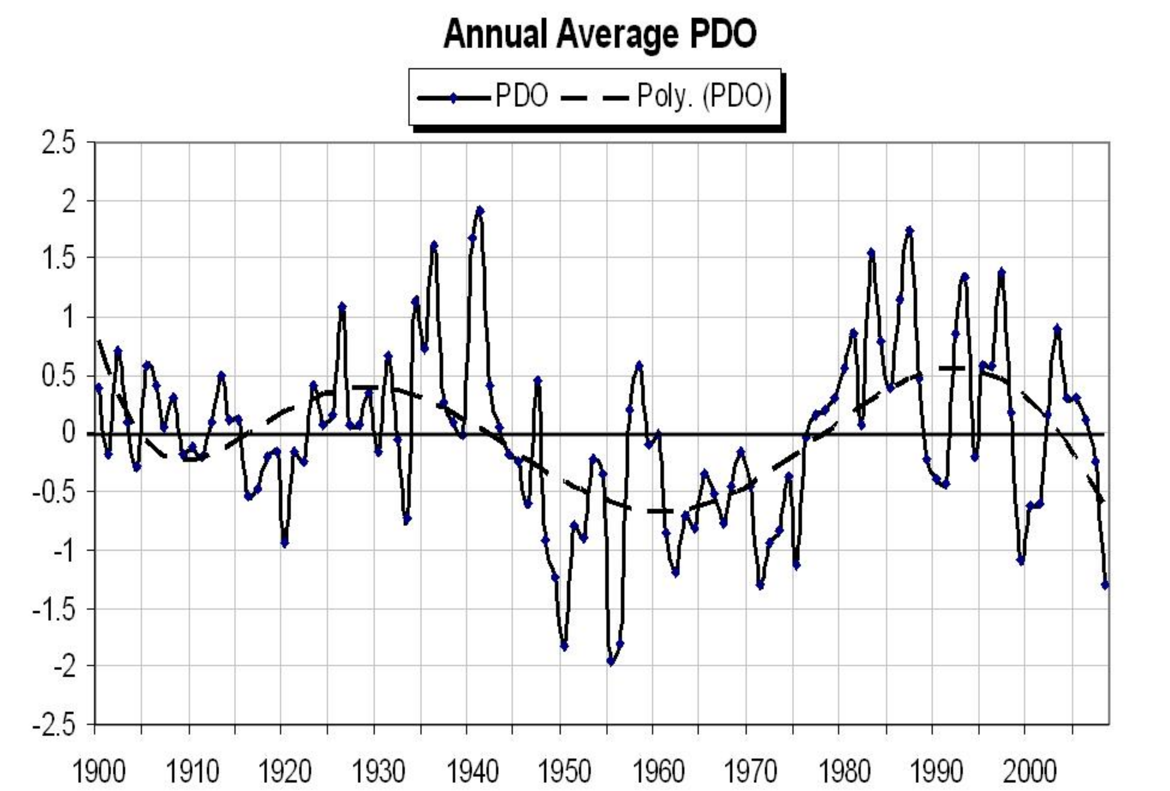


Figure 9: Annual average PDO 1900-2007. Note the multidecadal nature of the cycle with a period of approximately 60 years.

Verdon and Franks (2006) reconstruct the positive and negative phases of PDO back to A.D. 1662 based on tree ring chronologies from Alaska, the Pacific Northwest, and subtropical North America as well as coral fossil from Rarotonga located in the South Pacific. They found evidence for this cyclical behavior over the whole period. This is shown in Figure 10 below.

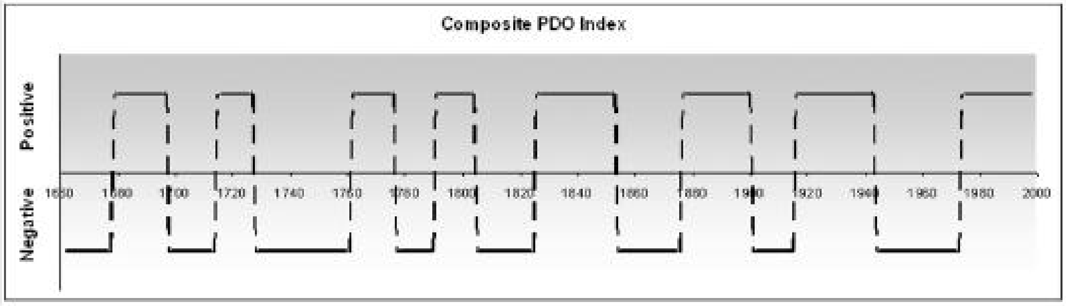


Figure 10: Verdon and Franks (2006) reconstructed PDO back to 1662 showing cyclical behavior over the period from 1662-2006.

A study by Gershunov and Barnett (1998) shows that the PDO has a modulating effect on the climate patterns resulting from ENSO. The climate signal of El Niño is likely to be stronger when the PDO is highly positive; conversely the climate signal of La Niña will be stronger when the PDO is highly negative. This does not mean that the PDO physically controls ENSO, but rather that the resulting climate patterns interact with each other.

Figure 11 below shows the annual PDO and ENSO (Multivariate ENSO Index) tracking well since 1950.

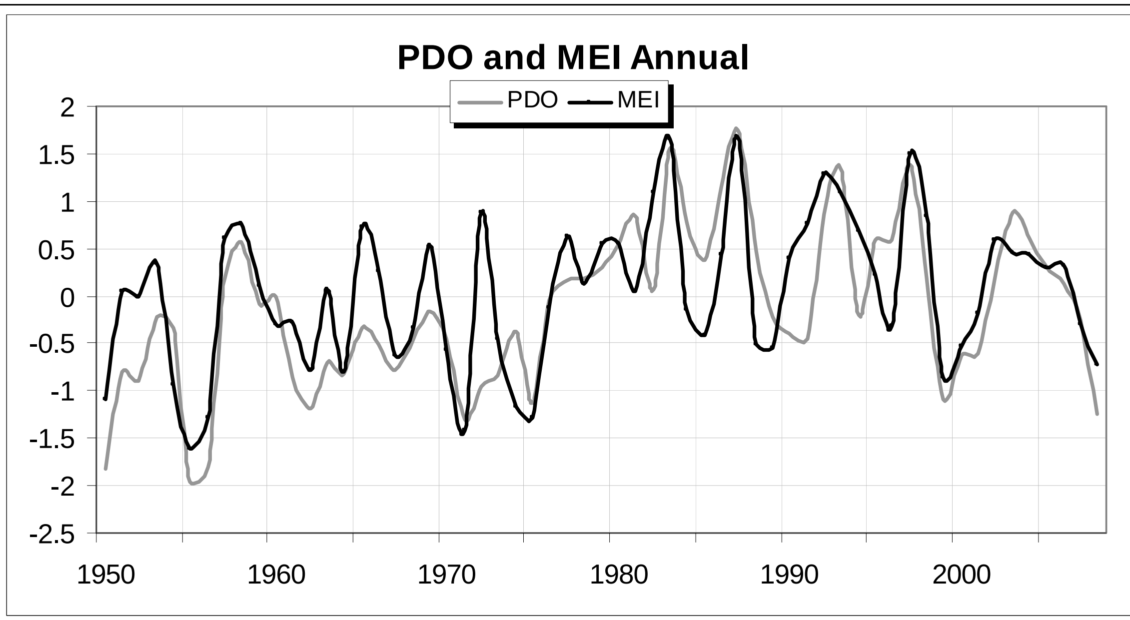


Figure 11: Annual average PDO and MEI from 1950 to 2007

5. ENSO Versus Temperatures

Douglass and Christy (2008) have used the NINO3.4 region anomalies and compared to the tropical UAH lower troposphere satellite measurements (UAH LT) showing a good agreement with some departures during periods of strong volcanism. This is shown in Figure 11 below.

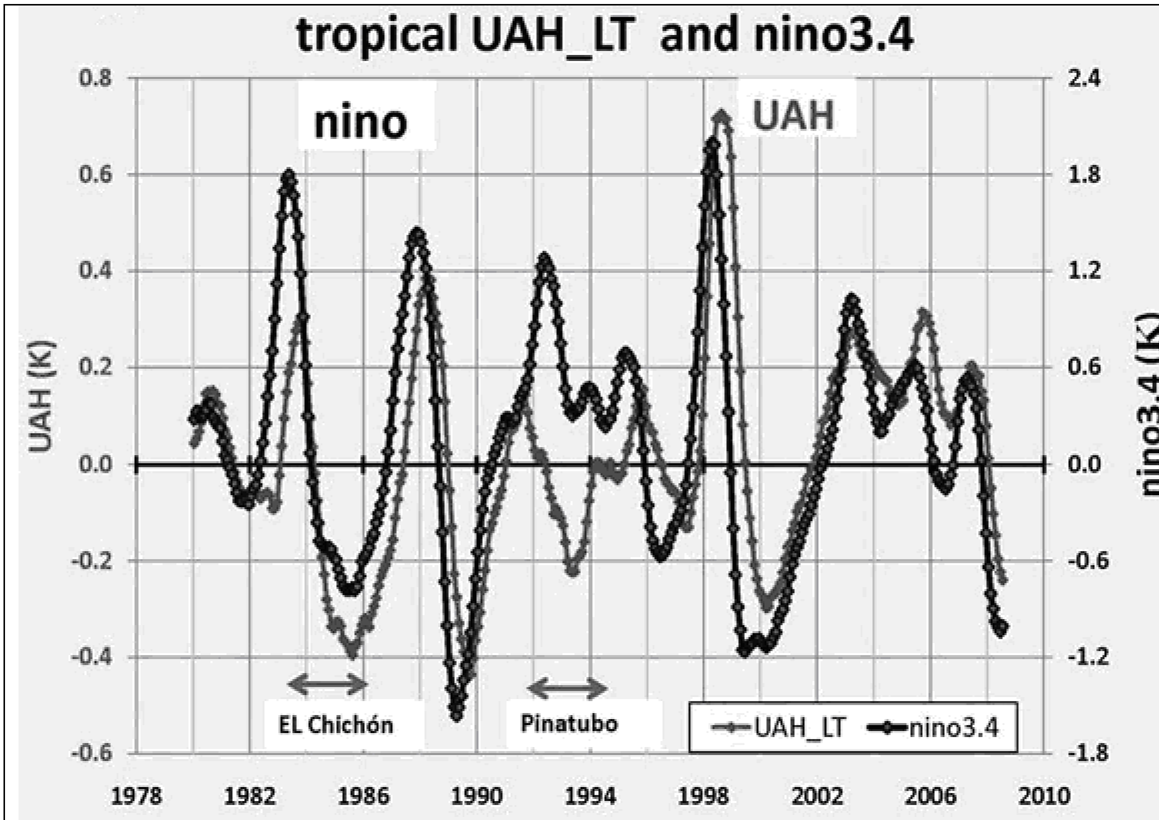


Figure 12: Douglass and Christy UAH MSU tropical lower tropospheric data versus NINO3.4 shows

Figure 13 shows a similar analysis of UAH global lower tropospheric data with the MEI Index. It shows also good agreement with some departure during periods of major volcanism in the early 1980s and 1990s.

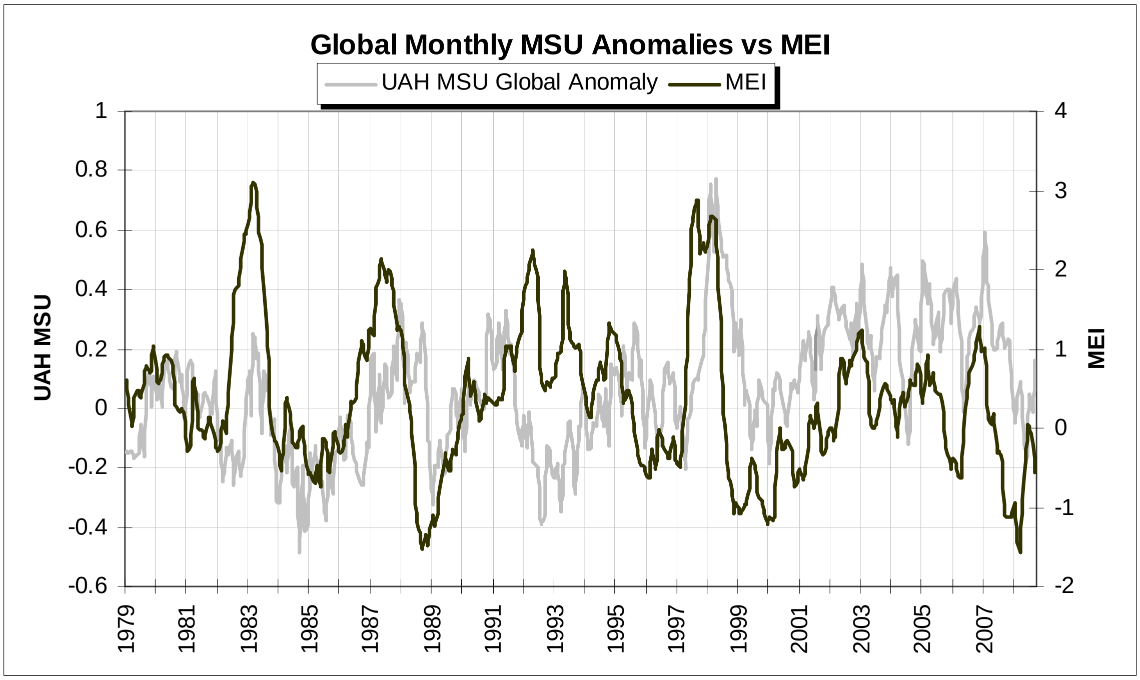


Figure 13: Global monthly UAH MSU temperature anomaly versus MEI. There is good correlation except during high volcanism period in the early 1980s and 1990s which held down the warming associated with El Ninos.

6. The Atlantic Multi-Decadal Oscillation (AMO)

Like the Pacific, the Atlantic exhibits multidecadal tendencies with like the Pacific a characteristic tri-pole structure. For a period that averages around 30 years, the Atlantic tends to be in what is called the warm phase with warm in the tropical North Atlantic and far North Atlantic and relatively cool in the central. Then the ocean flips into the opposite (cold) phase with cold tropics and far North Atlantic and a warm central ocean. The AMO (Atlantic sea surface temperatures standardized) is the average anomaly standardized from 0 to 70N. The AMO has a period of 60 years maximum to maximum and minimum to minimum.

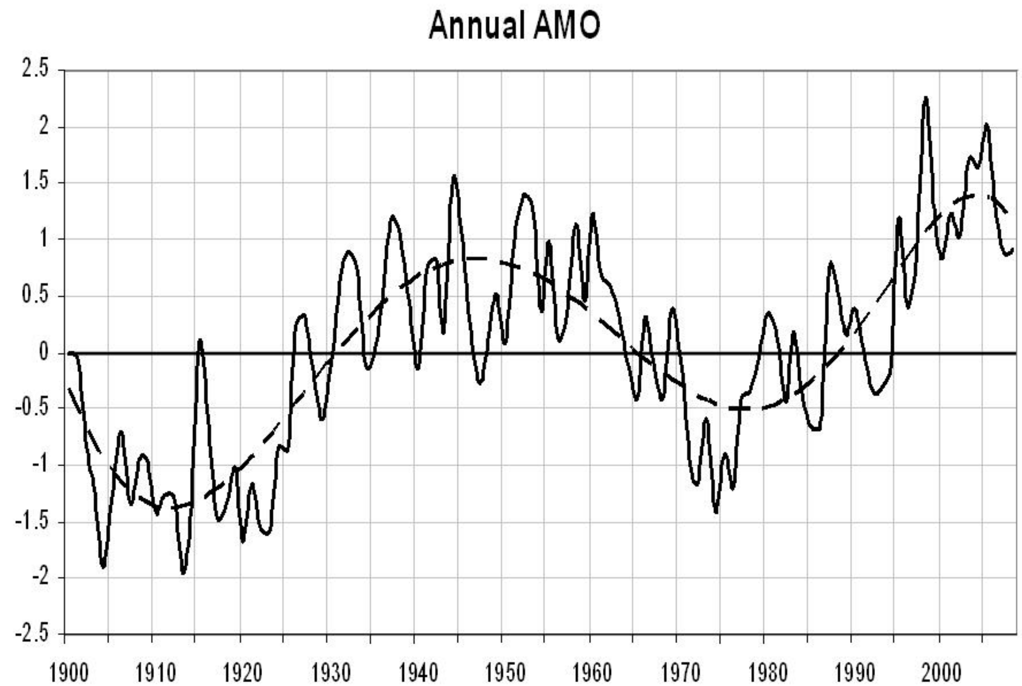


Figure 14: Annual average AMO from 1900 to 2007. Note the multidecadal nature of the Oscillation with a period again about 60 to 65 years.

7. North Atlantic Oscillation and Arctic Oscillation and the AMO

North Atlantic Oscillation (NAO) Index first found by Walker in the 1920s, is the north south flip flop of pressures in the eastern and central North Atlantic. The difference of normalized mean sea level pressure anomalies between Lisbon, Portugal and Stykkisholmur, Iceland has become the widest used NAO index and extends back in time to 1864 (Hurrell, 1995), and to 1821 if Reykjavik is used instead of Stykkisholmur and Gibraltar instead of Lisbon (Jones et al., 1997).

Arctic Oscillation (also known as the Northern Annular Mode (NAM) Index) is the amplitude of the pattern defined by the leading empirical orthogonal function of winter monthly mean NH MSLP anomalies poleward of 20ºN (Thompson and Wallace, 1998, 2000). The NAM /Arctic Oscillation (AO) is closely related to the NAO.

Like the PDO, the NAO and AO tend to be more frequently in one mode or in the other for decades at a time, though since like the SOI it is a measure of atmospheric pressure and subject to transient features, it tends to vary much more week to week and month to month. All we can state is that there is a relationship between the AMO and NAO/AO decadal tendencies. When the Atlantic is cold (AMO negative), the AO and NAO tend more often to the positive state, when the Atlantic is warm on the other hand, the NAO/AO tend to be more often negative. The AMO tri-pole of warmth in the 1960s below was associated with a predominantly negative NAO and AO while the cold phase was associated with a distinctly positive NAO and AO in the 1980s and early 1990s as can be seen below. There is a lag of a few years after the flip of the AMO and the tendencies appear to be greatest at the end of the cycle. This may relate to timing of the maximum warming or cooling in the North Atlantic part of the AMO or even the PDO/ENSO interactions. The PDO leads the AMO by about 15 years.

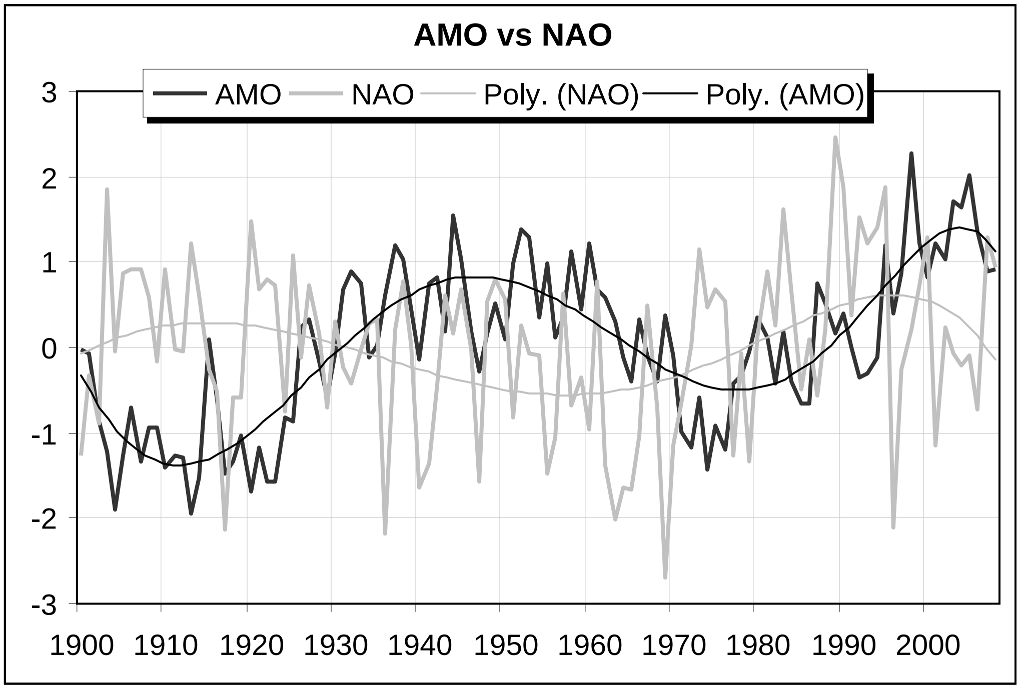


Figure 15: Annual Average AMO and NAO compared. Note the inverse relationship with a slight lag of the NAO to the AMO.

As noted in the AR4 (3.6.6.1), the relationship is a little more robust for the cold (negative AMO) phase than with the warm (positive) AMO. There tends to be considerable intraseasonal variability of these indices that relate to other factors (stratospheric warming and cooling events that are correlated with the Quasi-Biennial Oscillation or QBO for example).

8. The PDO and AMO Taken Together Versus Temperatures

The summation of the PDO and AMO offers an interesting Northern Hemisphere Ocean Warming Index with peaks near 1940 and 2000, a period of about 60 years.

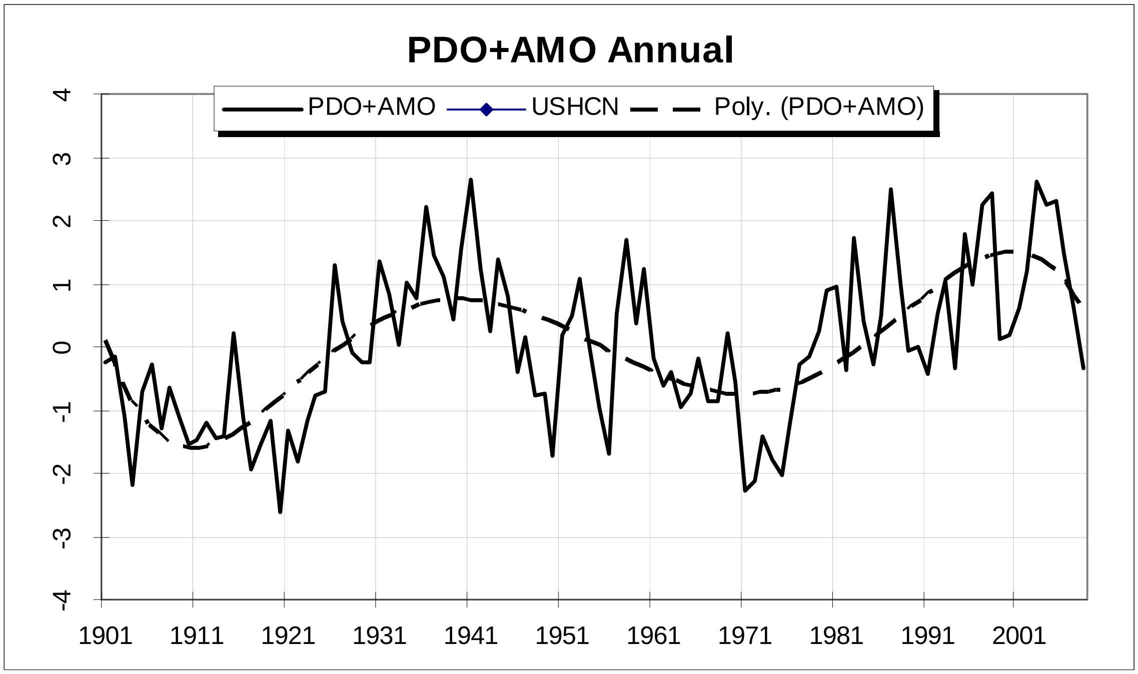


Figure 16: The Sum of the AMO and PDO Indices (each normalized). Note the net result as a period of about 60-65 years with peaks near 1940 and 2000.

This matches the USHCN Annual Mean Temperature cycles extremely well as can be seen in the NASA version (Figure 17 below). The USHCN version 2 data set has removed the urbanization adjustment in the first USHCN. This removal has had the effect of raising recent temperatures relative to those in the 1930s to 1950s. Still the net warming of the 1221 stations in the USHCN network in the cyclical peaks from 1940 to 2000 has been negligible (0.18ºC) and within the margin of error for measurement.

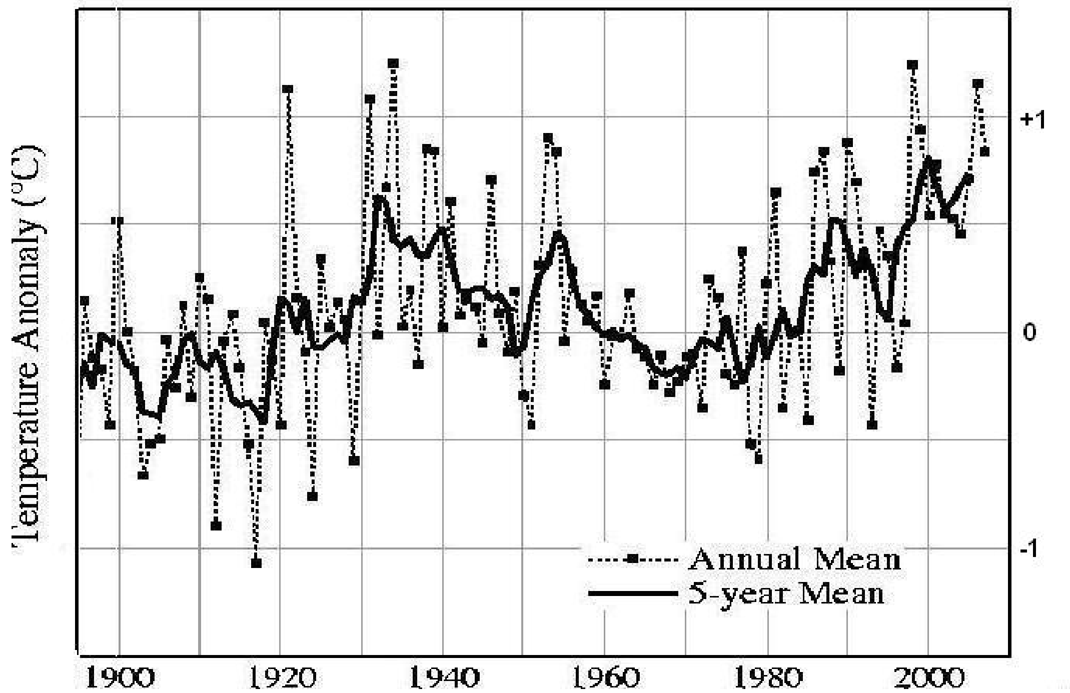


Figure 17: NASA GISS version of NCDC USHCN Version2 from 1895 to 2007

Figure 18 displays the annual average PDO+AMO compared to USHCN annual mean temperatures. There is a close correlation over the longer terms trends.

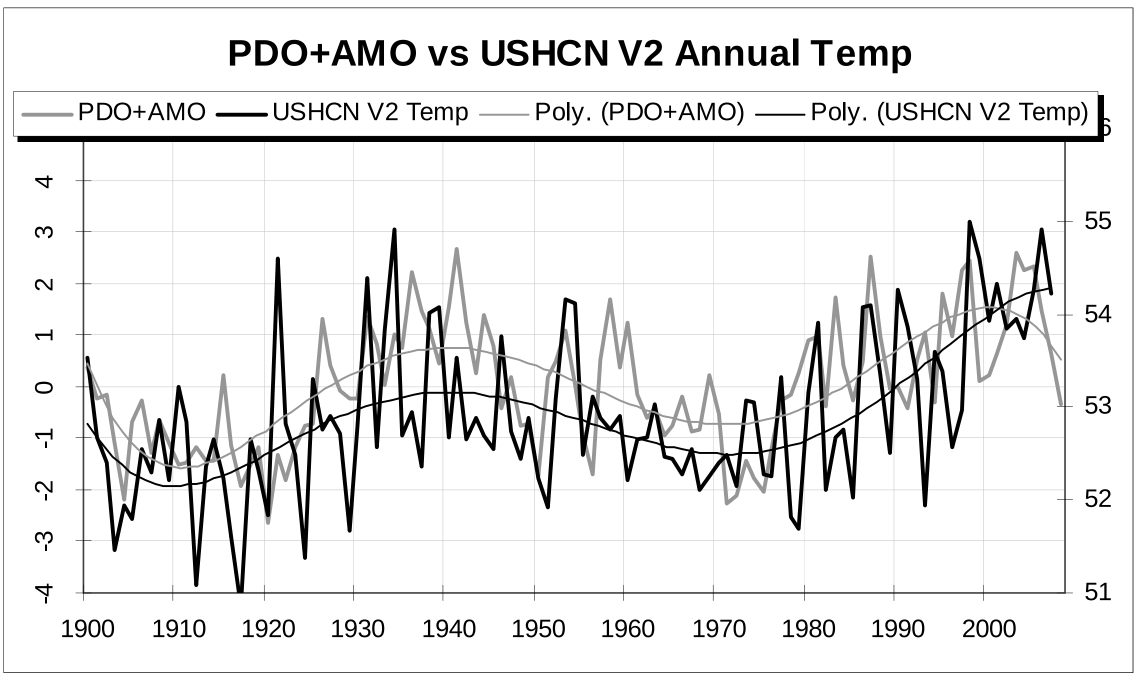


Figure 18: NASA GISS version of NCDC USHCN Version2 versus PDO + AMO (STD)

Indeed with a decadal scale smoothing, the ocean multidecadal indices and US temperatures are shown to correlate with a r-squared of 0.85.

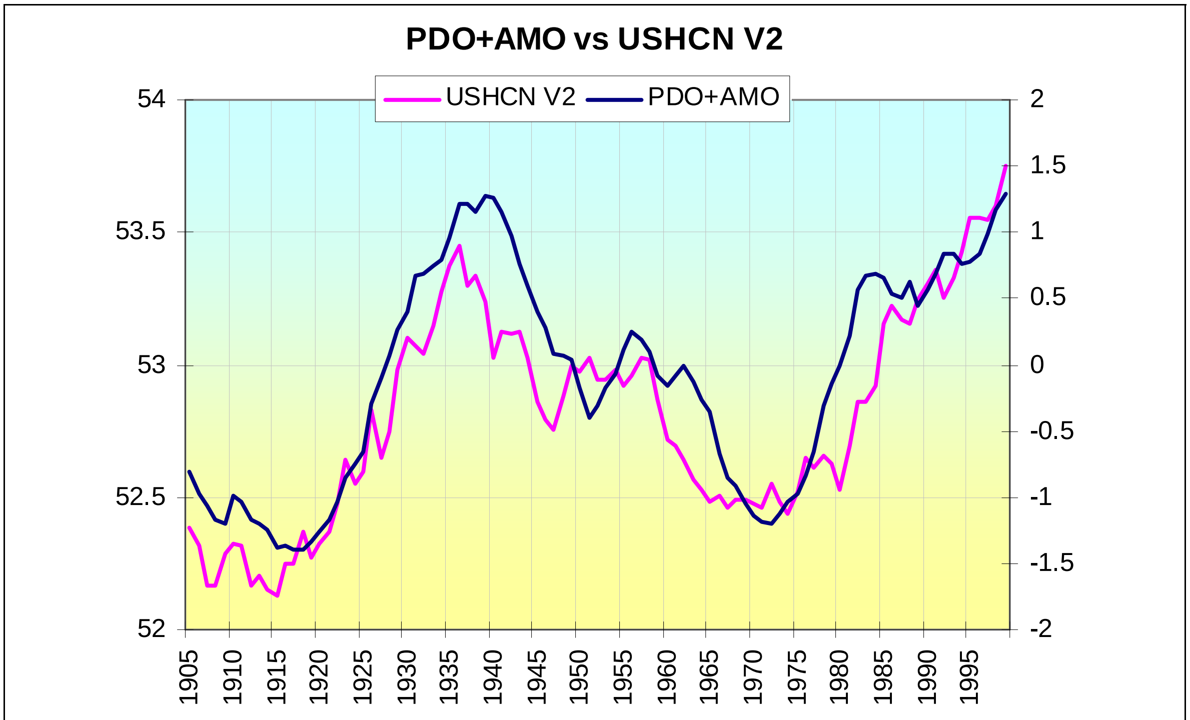


Figure 19: PDO+AMO versus USHCN version 2 11 year running means. The two have an r- squared of 0.85

In the following Figure 20, the temperatures were binned by signs of the PDO and AMO. **The warmest years were the positive and neutral PDO and positive AMO years and the coldest the AMO and PDO negative years. This further confirms the relationship of ocean multidecadal changes and land based cyclical changes.**

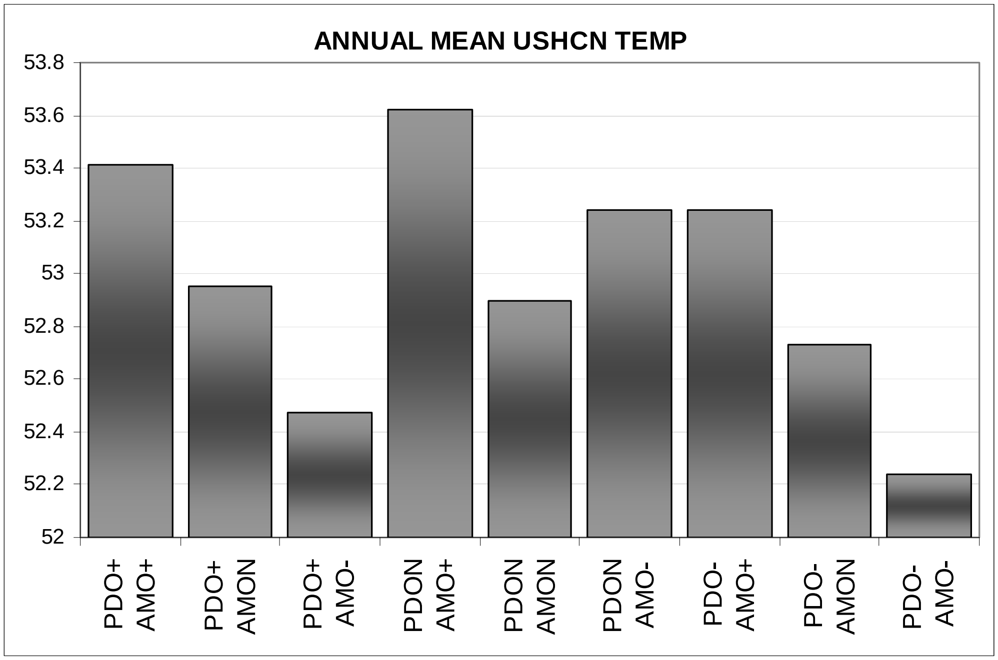


Figure 20: Annual Mean USHCN Version 2 (degrees F) binned by phases of the Annual Mean AMO and PDO.

<u>C. Solar Influence</u>

The sun changes on cycles of 11, 22, 53, 88, 106, 213 and 426 years and more. When the sun is more active there are more sunspots and solar flares and the sun is warmer. When the sun is warmer, the earth is warmer. Though the changes in brightness or irradiance the 11 year cycle are small (0.1%), differences over centuries since the Little Ice Age are thought to be as much as 0.3 to 0.5%).

Importantly, when the sun is more active there is more ultraviolet radiation (6-8% for UV up to a factor of two for extremely short wavelength UV and X-rays, Baldwin and Dunkerton (2004)) and there tends to be a stronger solar wind and more geomagnetic storms. Increased UV has been shown to produce warming in the high and middle atmosphere (that leads to surface warming) especially in low and mid latitudes, This is has been shown through observational measurements by Labitzke (2001) over the past 50 years and replicated in NASA models by Shindell et al. (1999).

Increased solar wind and geomagnetic activity has been shown by Svensmark (1997) and others to lead to a reduction in cosmic rays reaching the ground. Cosmic rays have a cloud enhancing property and the reduction during active solar periods leads to a reduction of up to a few percent in low clouds. Low clouds reflect solar radiation leading to cooling. Less low cloudiness means more sunshine and warmer surface temperatures. Shaviv (2005) found the cosmic ray and irradiance factors could account for up to 77% of the warming since 1900 and found the strong correlation extended back 500 million years.

According to Duke's Scafetta and West (2007) the total solar irradiance, is a proxy for the total (direct and indirect) solar effect, and account for 69% of the changes since 1900.

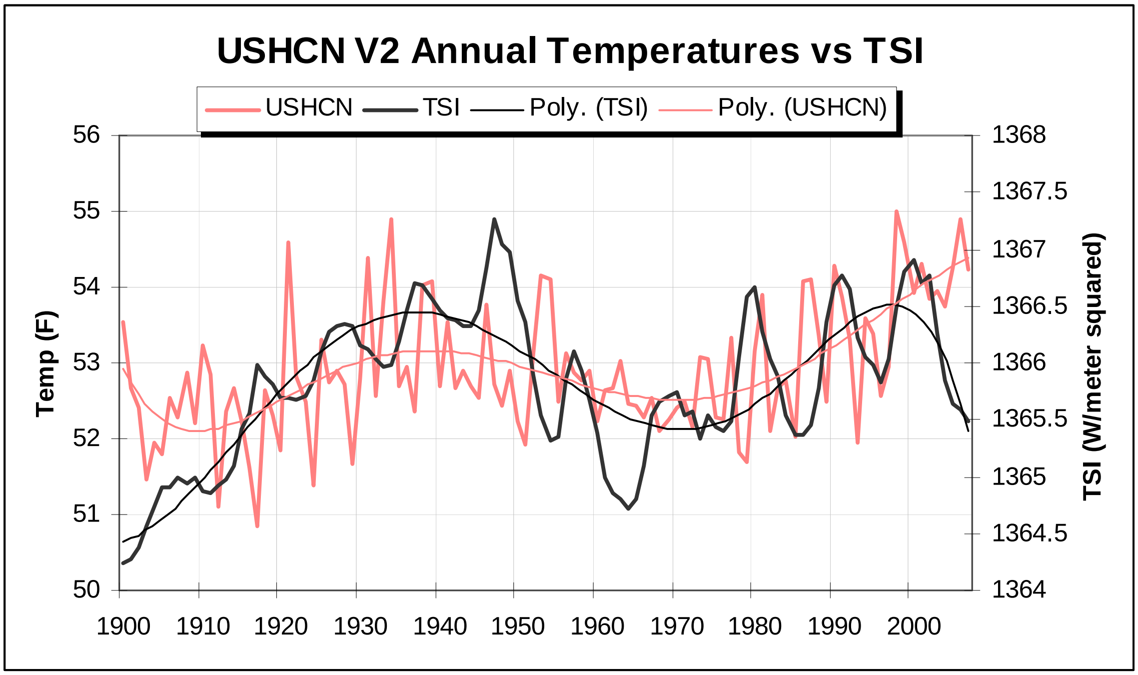


Figure 21: Annual USHCN v2 temperatures versus TSI (personal correspondence Hoyt/Willson)

In Figure 22, we see how well the USHCN version 2 temperatures changes with the TSI.

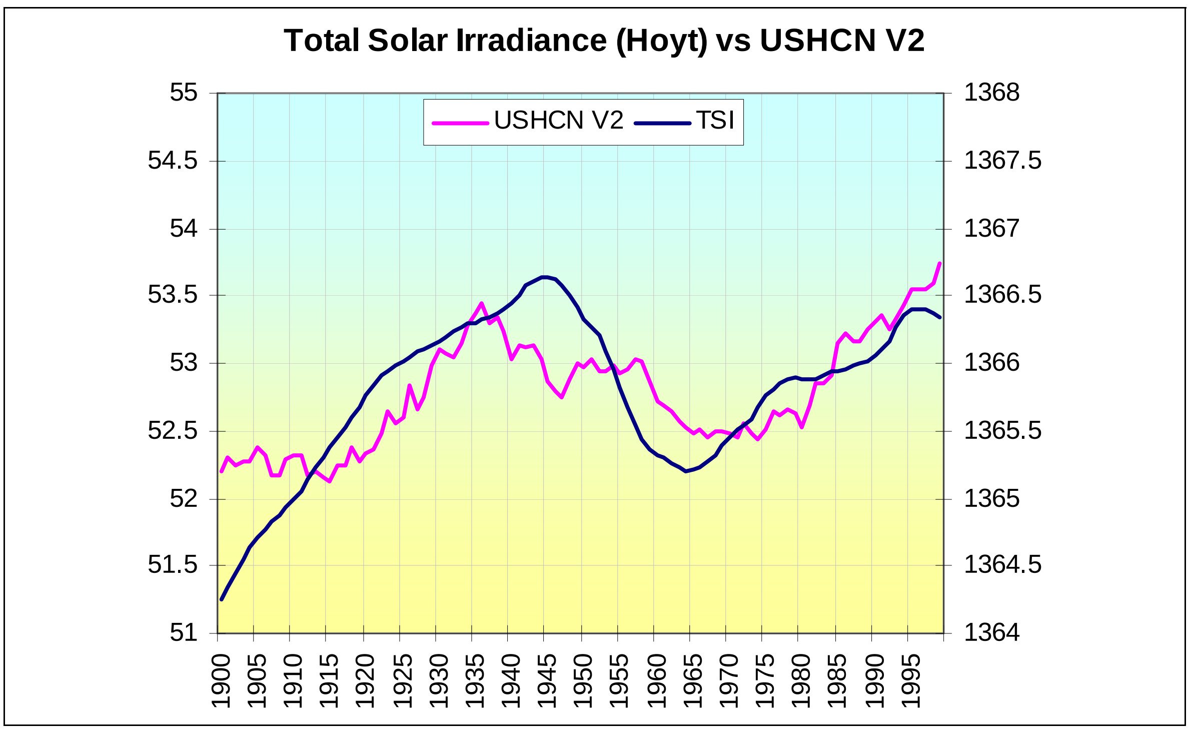


Figure 22: Total Solar Irradiance (TSI) from Hoyt/Schatten (private correspondence) versus USHCN version 2 (11 year running means). R-squared with temperature lag of 3 years was 0.64, close to Scafetta and West finding.

In the following Figure 23, we take the Total Solar Irradiance of Hoyt and Schatten and compare it to the ocean cycles**. Here we see the tendency for the sun to drive the ocean warming and cooling cycles. Since these cycles related to frequency of El Nino and La Nina and global warming and cooling, the sun is shown to be the real driver for climate.**

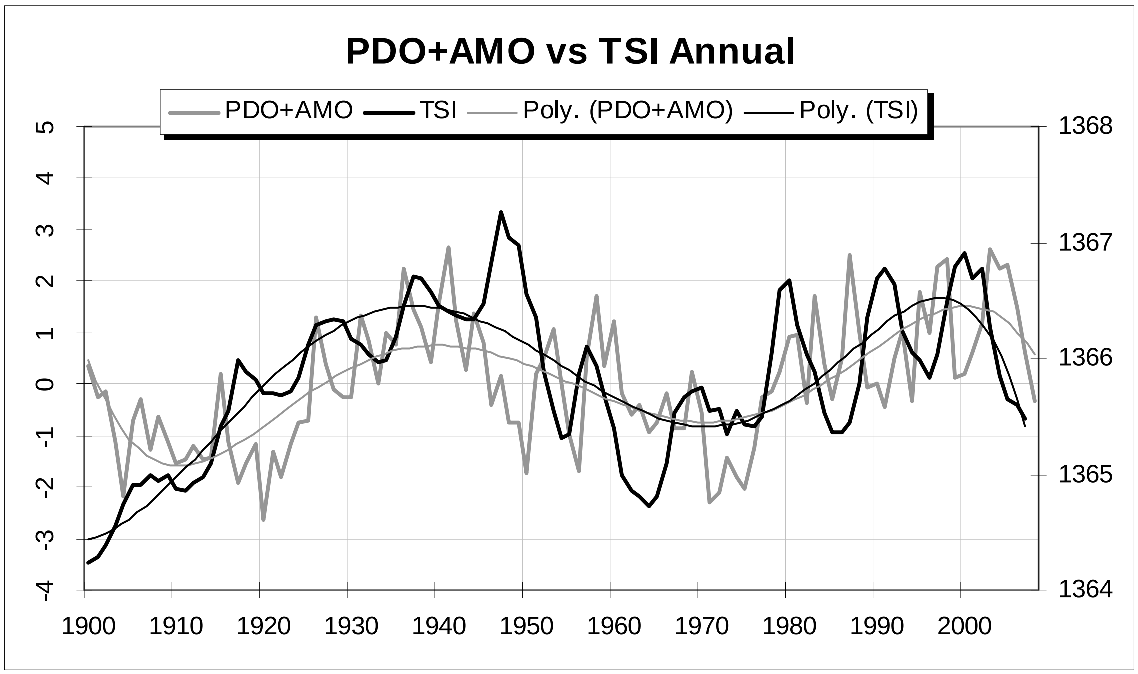


Figure 23: Total Solar Irradiance (TSI) compared to the Multidecadal Ocean Cycles (PDO+AMO)

The TSI data set ran through 2005. Since then it has continued to decline and we are experiencing the longest solar cycle in at least 100 years. Longer cycles are usually indicative of a cooling sun. NASA has noted the solar wind is at the weakest levels of the satellite age and probably in at least 100 years.

The Sun's Great Conveyor Belt has slowed to a record-low crawl, according to research by NASA solar physicist David Hathaway (2006). *"It's off the bottom of the charts,"* he says. *"This has important repercussions for future solar activity."* The Great Conveyor Belt is a massive circulating current of fire (hot plasma) within the Sun. Researchers believe the turning of the belt controls the sunspot cycle, and that's why the slowdown is important. *"The slowdown we see now means that Solar Cycle 25, peaking around the year 2022, could be one of the weakest in centuries,"* says Hathaway.

Livingston and Penn of the National Solar Observatory (2006) also have found the magnetic field has been weakening over the last few cycles at a rate that would if it continued, lead to no sunspots by around 2015.

In addition, the sequence of the last 3 cycles bears a good resemblance to cycles 2 to 4 in the late 1700s and early 1800s which has some solar scientists predicting a similar solar minimum period. That fits with the 213 year cycle identified by Clilverd (2007). That prior period was called the Dalton minimum. It was characterized by broad global cooling (the time of Charles Dickens and his snowy London winters and with the help of Mt Tambora, 1816, the "Year without a Summer").

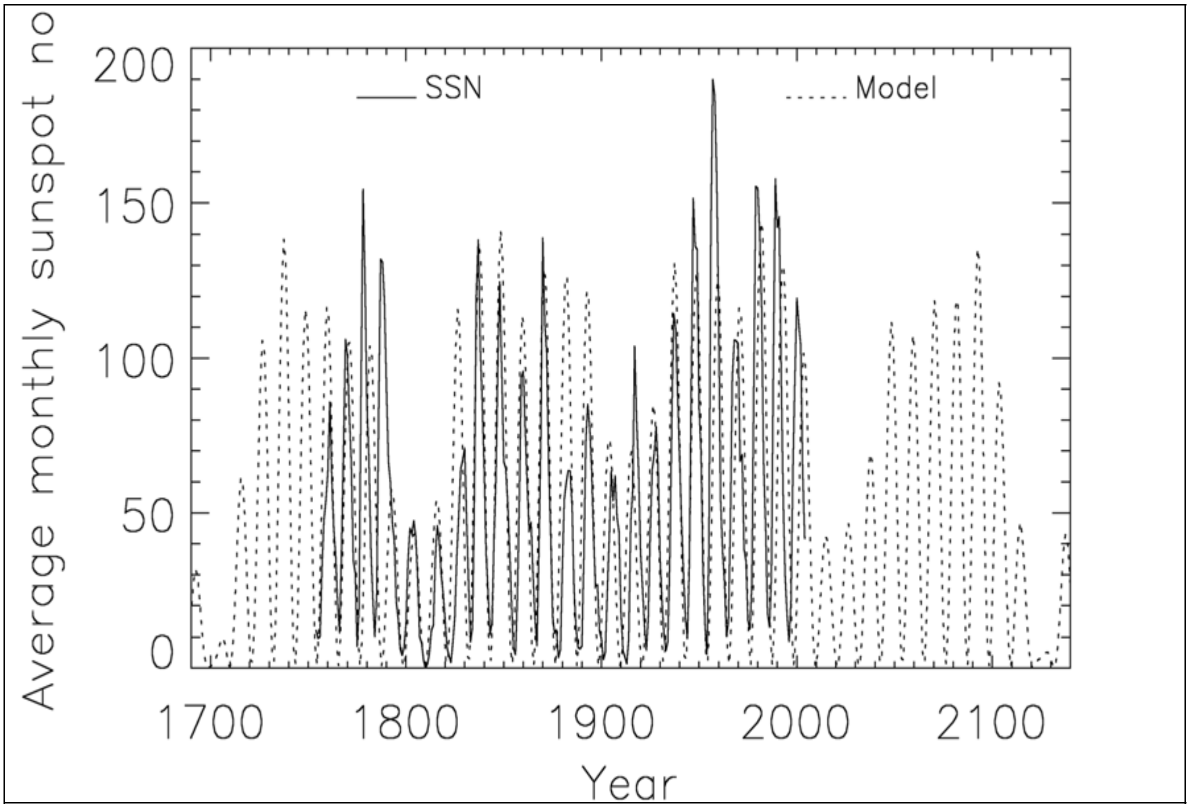


Figure 24: Clilverd et al 2007 statistical model predictions for cycles 24 and 25, similar to the Dalton Minimum

II. RECENT OBSERVED COOLING

The annual USHCN V2 shows the same cyclical pattern discussed above in the oceans and sun. The Industrial Age went into high gear after WWII. Temperatures for the period from the 1940s to the late 1970s fell even as CO_2 increased. The Temperatures after the Great Pacific Climate shift of the PDO in the late 1970s began to rise and paralleled the CO_2 rise for two decades to the super El Nino of 1998. After that, the Pacific flipped back to the cold mode and temperatures stopped rising. After 2002, the temperatures began falling.

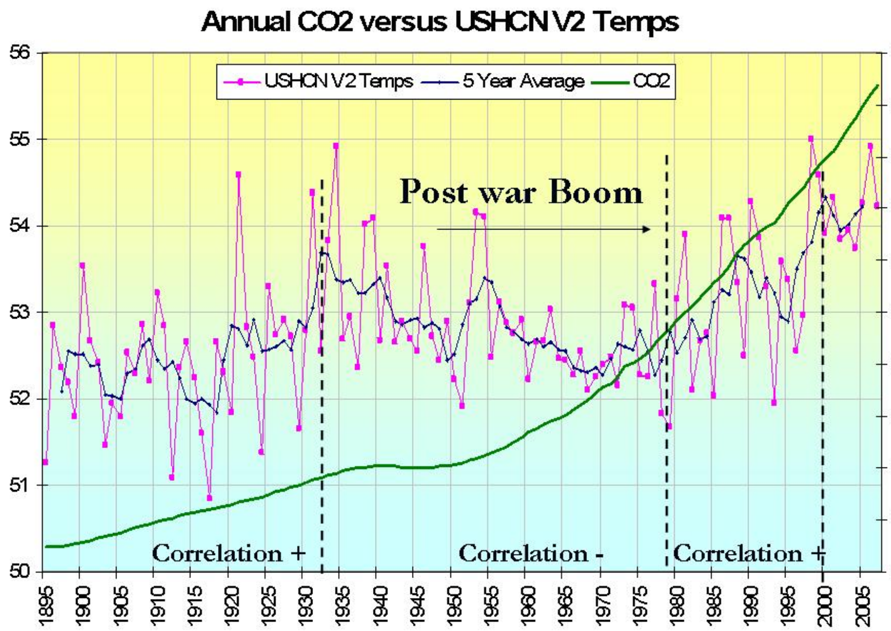


Figure 25: Annual CO2 (ESRL) versus USHCN version 2 annual temperatures from 1895 to 2007.

With a cooling Pacific (PDO and La Nina) and an extended solar minimum, one would expect cooling global temperatures. The MSU satellite data for the lower troposphere from the University of Alabama at Huntsville (Spence and Christy) shows that has been the case since 2002 despite a continuing rise in atmospheric CO2 by 3.5%.

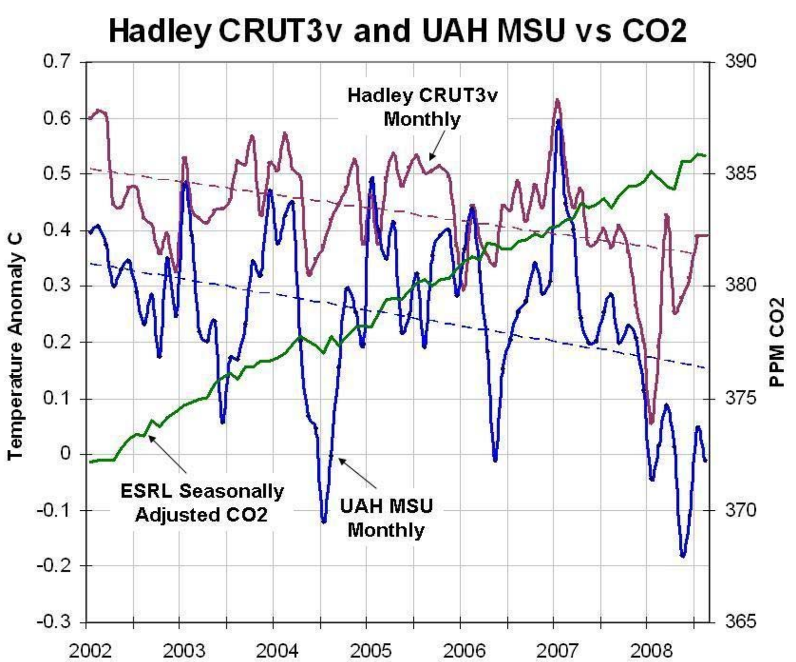


Figure 26: Monthly UAH MSU satellite and UK Hadley Centre temperature anomalies

(degrees Celsius) from 2002 to September 2008

Thus for 5 of the last 7 decades, the temperatures have declined as CO2 increased. This on again, mostly off again relationship suggests that CO2 is not the primary climate driver. The much better matches with both ocean and solar cycles suggest climate changes are primarily due to natural variability of the sun and oceans.

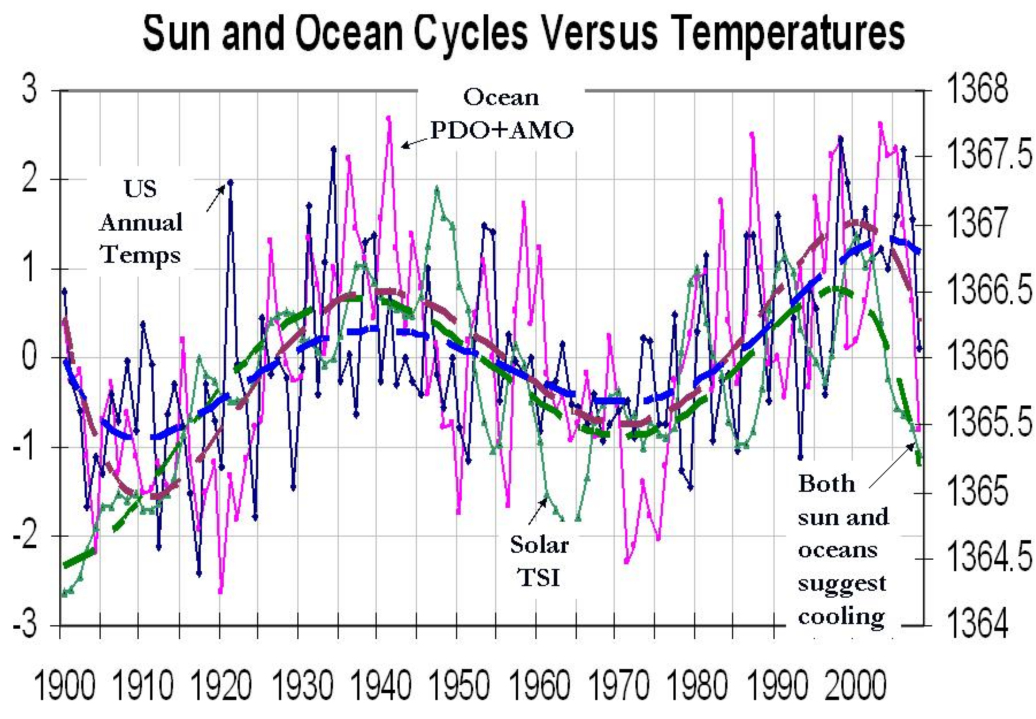


Figure 27: Monthly Annual PDO+AMO, TSI versus USHCN v2

D. SUMMARY

Large scale oscillations exhibit decadal scale variability and are shown to relate to one another and to temperatures in the past century here in the United States, where the data is most stable, albeit imperfect. **The recent rapid cooling of the Pacific PDO and La Nina and the synchronous sudden decline of solar activity may be signaling the arrival of a substantial cooling that may extend over multiple decades.**

Clearly the single minded focus on carbon dioxide as the principal driver of climate warming is misguided and the lack of attention to natural factors will lead to incorrect policy decisions. EPA’s proposal to address a “warming” that is not happening with costly economic proposals aimed at carbon dioxide control is at best misguided nonsense. Instead, EPA must acknowledge that we are threatened with a significant cooling that would have major impact on energy needs, which should be the major focus of our planning.

Figures

*Figure 1: Greenhouse **model forecast** temperatures (top) versus **data** reality (bottom) as determined by balloon radiosonde and satellite measurements. Top from CCSP SAP 1.1(2006), Figure 1.3, page 25, bottom from Figure 5.7 p. 116.*

Figure 2: *A detailed view of the disparity of temperature trends is given in this plot of trends (in degrees C/decade) versus altitude in the tropics [Douglass et al. 2007]. Models show an increase in the warming trend with altitude, but balloon and satellite observations do not.*

Figure 3: Miskolski (2007) graph global average annual relative humidity at various elevations in the atmosphere expressed in milli-bars (mb) from 300 mb to 700 mb for the period 1948 to 2007. The data is from the NOAA Earth System Research Laboratory here

Figure 4: IPCC model scenarios versus actual satellite derived temperatures adjusted to the surface and Hadley CRUT in the lower troposphere (Source John Christy UAH)

Figure 5: Ian Plimer (2009) comparison of IPPC projections made in 2000 with actual Hadley and UAH MSU LT adjusted to surface

Figure 6: UAH MSU monthly lower tropospheric global temperatures and Hadley Center CRUT3v surface temperatures versus seasonally adjusted ESRL(explain)

Figure 7: USHCN version 2 annual mean temperatures versus annual average CO2 sice 1895.

Figure 8: A comparison or SOI, MEI and NINO34 since 2000. Note the close relationship of MEI to NINO34. SOI is inversely proportional and shows more intra-annual variability

Figure 9: Annual average PDO 1900-2007. Note the multidecadal nature of the cycle with a period of approximately 60 years.

Figure 10: Verdon and Franks (2006) reconstructed PDO back to 1662 showing cyclical behavior over the period from 1662-2006.

Figure 11`: Annual average PDO and MEI from 1950 to 2007

Figure 12: Douglass and Christy UAH MSU tropical lower tropospheric data versus NINO3.4 shows

Figure 13: Global monthly UAH MSU temperature anomaly versus MEI. There is good correlation except during high volcanism period in the early 1980s and 1990s which held down the warming associated with El Ninos.

Figure 14: Annual average AMO from 1900 to 2007. Note the multidecadal nature of the Oscillation with a period again about 60 to 65 years.

Figure 15: Annual Average AMO and NAO compared. Note the inverse relationship with a slight lag of the NAO to the AMO.

Figure 16: The Sum of the AMO and PDO Indices (each normalized). Note the net result as a period of about 60-65 years with peaks near 1940 and 2000.

Figure 17: NASA GISS version of NCDC USHCN Version2 from 1895 to 2007

Figure 18: NASA GISS version of NCDC USHCN Version2 versus PDO + AMO (STD)

Figure 19: PDO+AMO versus USHCN version 2 11 year running means. The two have an r- squared of 0.85

Figure 20: Annual Mean USHCN Version 2 (degrees F) binned by phases of the Annual Mean AMO and PDO.

Figure 21: Annual USHCN v2 temperatures versus TSI (personal correspondence Hoyt/Willson)

Figure 22: Total Solar Irradiance (TSI) from Hoyt/Schatten (private correspondence) versus USHCN version 2 (11 year running means). R-squared with temperature lag of 3 years was 0.64, close to Scafetta and West finding.

Figure 23: Total Solar Irradiance (TSI) compared to the Multidecadal Ocean Cycles (PDO+AMO)

Figure 24: Clilverd et al 2007 statistical model predictions for cycles 24 and 25, similar to the Dalton Minimum

Figure 25: Annual CO2 (ESRL) versus USHCN version 2 annual temperatures from 1895 to 2007.

Figure 26: Monthly UAH MSU satellite and UK Hadley Centre temperature anomalies (degrees Celsius) from 2002 to September 2008

REFERENCES:

Anagnostopoulos, G. G., D. Koutsoyiannis, A. Efstratiadis, A. Christofides, and N. Mamassis, "Credibility of climate predictions revisited", European Geosciences Union General Assembly 2009, Geophysical Research Abstracts, Vol. 11, Vienna, 611, European Geosciences Union, 2009

Baldwin, M.P., Dunkerton, T.J.. (2004). The solar cycle and stratospheric-tropospheric dynamical coupling JAS 2004

Bjerknes, J. (1969): Atmospheric Teleconnections from the equatorial Pacific, Monthly Weather Review, 97, 153-172

Bunkers, M., Miller, D., DeGaetana, D.: 1996: An Examination of the El Nino/La Nina Relative Precipitation and Temperature Anomalies across the Northern Plains, Journal of Climate, January 1996, 147-160

Changnon, S., Winstanley, D.:2004: Insights to Key Questions about Climate Change, Illinois State Water Survey, http://www.sws.uiuc.edu/pubdoc/IEM/ISWSIEM2004-01.pdf

Christy, J.R., R.W. Spencer and W.D. Braswell, 2000: MSU tropospheric temperatures:Dataset construction and radiosonde comparisons. J. Atmos. Oceanic Tech., 17, 1153-1170.

Clilverd, M. A., E. Clarke, T. Ulich, H. Rishbeth, and M. J. Jarvis (2006), Predicting Solar Cycle 24 and beyond, SpaceWeather, 4, S09005, doi:10.1029/2005SW000207.

Delworth, T.L. ,and M.E. Mann, 2000: Observed and simulated multidecadal variability in the Northern Hemisphere. Climate Dyn., 16, 661–676.

Douglass, D.H., Christy, J.R., Limits on CO2 Climate Forcing from Recent Temperature Data of Earth, Energy and Environment, Accepted August 2008.

Douglass, D.H., J.R. Christy, B.D. Pearson, and S.F. Singer;2007. A comparison of tropical temperature trends with model predictions. Intl J Climatology (Royal Meteorol Soc). DOI:10.1002/joc.1651.

Drinkwater, K.F. 2006. The regime shift of the 1920s and 1930s in the North Atlantic. Progress in Oceanography ***68****: 134-151.*

Gershunov, A. and T.P. Barnett. Interdecadal modulation of ENSO teleconnections. *Bulletin of the American Meteorological Society*, 79(12): 2715-2725.

Gray, S.T., et al., 2004: A tree-ring based reconstruction of the Atlantic Multidecadal Oscillation since 1567 A.D. Geophys. Res. Lett., 31, L12205, doi:10.1029/2004GL019932.

Green, K.C., Armstrong, J.C., Global Warming: Forecasts By Scientists Versus Scientific Forecasts, (2007): Energy and Environment, vol. 18, No. 7+8, 996-1021

Hanna, E. and Cappelen, J. (2003). Recent cooling in coastal southern Greenland and relation with the North Atlantic Oscillation. Geophysical Research Letters 30(3): doi: 10.1029/2002GL015797. issn: 0094-8276.

Hanna, E., Jonsson, T., Olafsson, J. and Valdimarsson, H. 2006. Icelandic coastal sea surface temperature records constructed: Putting the pulse on air-sea-climate interactions in the Northern North Atlantic. Part I: Comparison with HadISST1 open-ocean surface temperatures and preliminary analysis of long-term patterns and anomalies of SSTs around Iceland. Journal of Climate ***19****: 5652-5666.*

Hansen, J., R. Ruedy, J. Glascoe, and Mki. Sato, 1999: GISS analysis of surface temperature change. J. Geophys. Res.*,* ***104****, 30997-31022, doi:10.1029/1999JD900835.*

Henderson-Sellers, A, 2008. ***The IPCC report: what the lead authors really think.***

September 17, 2008. http://environmentalresearchweb.org/cws/article/opinion/35820

Joseph, R. and S. Nigam, 2006. ENSO evolution and teleconnections in IPCC's twentieth-century climate simulations: Realistic representation? Journal of Climate, 19, 4360-4377.

Kerr, R. A., A North Atlantic climate pacemaker for the centuries, Science, 288 (5473), 984-1986, 2000.

Khandekar, M.L., 2000. Uncertainties in greenhouse gas induced climate change. Report prepared for Science and Technology Branch, Alberta Environment, ISBN 0-7785-1051-4, Edmonton, Alberta.

Kininmonth, W.A.., *Climate Change: A Natural Hazard (2004)*, Multi-Science Publishing Co, UK

Koutsoyiannis, D., A. Efstratiadis, N. Mamassis, and A. Christofides, On the credibility of climate predictions, Hydrological Sciences Journal, 53 (4), 671-684, 2008. doc_id=864

Kunkel, K.E., Liang, X.-Z., Zhu, J. and Lin, Y. 2006. Can CGCMs simulate the twentieth-century "warming hole" in the central United States? Journal of Climate ***19****: 4137-4153.*

Labitzke, K., 2001: The global signal of the 11-year sunspot cycle in the stratosphere. Differences between solar maxima and minima, Meteorol. Zeitschift, 10, 83–90.

Latif, M. and T.P. Barnett, 1994: Causes of decadal climate variability over the North Pacific and North America. Science 266, 634-637.

Lindzen, R.S., Ming-Dah Chou and A. Y. Hou,. 2001: Does the Earth Have an Adaptive. Infrared Iris?, BAMS, 82, 417-432

Livingston,W., Penn, M., 2006: Sunspots May Vanish by 2015 http://www.astroengine.com/wp-content/uploads/2008/08/livingston-penn_sunspots2.pdf

Lockwood, M., and R. Stamper, 1999: Long-term drift of the coronal source magnetic flux and the total solar irradiance. Geophys. Res. Lett., 26, 2461-2464.

Mantua, N.J., Hare, S.R., Zhang, Y., Wallace, J.M., Francis, R.C., 1997, A Pacific interdecadal climate oscillation with impacts on salmon production, BAMS, 78, 1069-1079

Miller, A.J., D.R. Cayan, T.P. Barnett, N.E. Graham and J.M. Oberhuber, 1994: The 1976-77 climate shift of the Pacific Ocean. Oceanography 7, 21-26.

Minobe, S. 1997: A 50-70 year climatic oscillation over the North Pacific and North America. Geophysical Research Letters, Vol 24, pp 683-686.

Minobe, S. Resonance in bidecadal and pentadecadal climate oscillations over the North Pacific: Role in climatic regime shifts. Geophys. Res. Lett.26: 855-858.

Miskolczi, F.M. "Greenhouse Effect in Semi-Transparent Planetary Atmospheres", Quarterly Journal of the Hungarian Meteorological Journal, Vol. 111, No. 1, January - March 2007.

Plimer, Ian, Heaven And Earth: Global Warming - The Missing Science (2009), Conner Court Publishing, Paperback, ISBN 978-1-921421-14-3

Randall, D.A., J.A. Coakley, C.W. Fairall, R.A. Kropfli and D.H. Lenschow, 1984: Outlook for research on subtropical marine stratiform clouds. *Bull. Amer. Meteor. Soc.*, 65, 1290-1301

Roe, G.H., Baker, M.B., Why Is Climate Sensitivity So Unpredictable? (26 October 2007), *Science* 318 (5850), 629. [DOI: 10.1126/science.1144735]

*Scafetta, N., West, B.J., J. Geophys. Res. **112**,D24S03 (2007)*

Shindell, D.T., D. Rind, N. Balachandran, J. Lean, and P. Lonergan, (1999). Solar cycle variability, ozone, and climate, Science, 284, 305–308

Shaviv, N. J., (2005). "On Climate Response to Changes in the Cosmic Ray Flux and Radiative Budget", *JGR-Space, vol. 110, A08105.'*

Singer, F., ed., Nature, Not Human Activity, Rules the Climate: Summary for Policymakers of theReport of the Nongovernmental International Panel on Climate Change, Chicago, IL: The Heartland Institute, 2008.

Soon, W., (2006). "Variable Solar Irradiance as a Plausible Agent for Multidecadal Variations in the Arctic-Wide Surface Air Temperature Record of the Past 130 years " GRL, vol 32

Solanki, S.K., M. Schüssler, and M. Fligge, 2002: Secular variation of the sun's magnetic flux. Astronomy and Astrophysics, 383, 706-712.

Solanki, S.K., I.G. Usoskin, B. Kromer, M. Schüssler, and J. Beer, 2004: Unusual activity of the Sun during recent decades compared to the previous 11,000 years. Nature, 431, 1084-1087.

Soon, W. W.-H. 2005. Variable solar irradiance as a plausible agent for multidecadal variations in the Arctic-wide surface air temperature record of the past 130 years. Geophysical Research Letters ***32*** *L16712, doi:10.1029/2005GL023429.*

Svenmark, H, Friis-Christensen, E.. (1997). Variation of cosmic ray flux and global cloud cover- a missing link in solar -climate relationships, Journal of Atmospheric and Solar-Terrestrial Physics, 59, pp 1125-32

Trenberth, K.E., and J.W. Hurrell, 1994: Decadal atmosphere-ocean variations in the Pacific. Clim. Dyn., 9, 303-319.

Trenberth, K.E. (2007). Predictions of climate. Climate Feedback: The Climate Change Blog, Nature.com, June 4. Available at http://blogs.nature.com/climatefeedback/2007/06/predictions_of_climate.html

Tsonis, A.A., Hunt, G., and Elsner, G.B. On the relation between ENSO and global climate change, Meteorol Atmos Phys 000, 1–14 (2003),DOI 10.1007/s00703-002-0597-z

Tsonis, A.A, Swanson, K.L., and Wang, G,: 2008 *On the role of atmospheric teleconnections in climate, J. Climate, In Press*

Tsonis, A.A., Swanson,K.L., and Kravtsov,S., 2007: A new dynamical mechanism for major climate shifts. Geophys. Res. Lett., 34, L13705, doi:10.1029/ 2007GL030288

Usoskin, I. G.,Mursula, K., Solanki, S. K., Schu¨ssler,M. & Alanko, K. Reconstruction of solar activity for the last millenium using 10Be data. Astron. Astrophys. 413, 745–751 (2004).

Van Loon, H.: Association Between the 11 Year Solar Cycle, the QBO and the Atmosphere, Part II, Surface and 700 mb in the Northern Hemisphere Winter, Journal of Climate, September 1988, 905-920

Venne, D., Dartt, D.,:An Examination of Possible Solar Cycle/QBO Effects on the Northern Hemisphere Troposphere; Journal of Climate, February 1990, 272-281

Verdon, D. C., and S. W. Franks, 2006. Long-term behaviour of ENSO: Interactions with the PDO over the past 400 years inferred from paleoclimate records. Geophysical Research Letters, 33, L06712, doi:10.1029/2005GL025052

Wielicki, B.A., T Wong et al. 2002. Evidence for large decadal variability in the tropical mean radiative energy budget. Science 295: 841-844.

Wolter, K., and M.S. Timlin, 1993: Monitoring ENSO in COADS with a seasonally adjusted principal component index. Proc. of the 17th Climate Diagnostics Workshop, Norman, OK, NOAA/N MC/CAC, NSSL, Oklahoma Clim. Survey, CIMMS and the School of Meteor., Univ. of Oklahoma, 52-57