

State of the Climate - 2009

Ric Werme

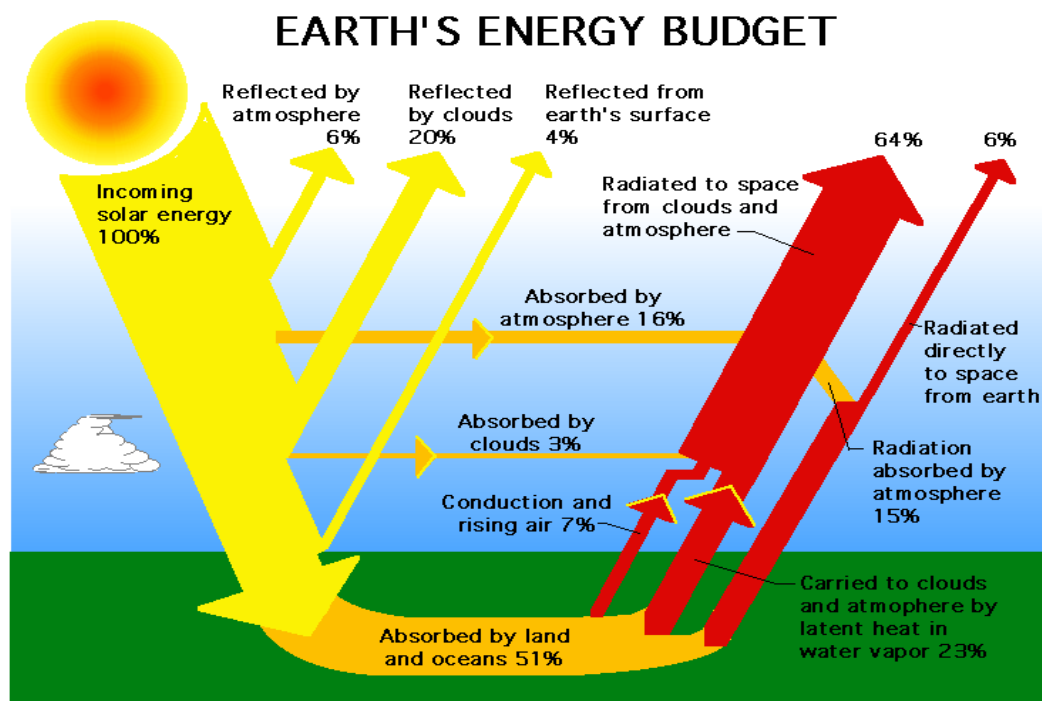
http://wermenh.com/climate/state_2009.pdf

1. Introduction

The impetus for this document is that New Hampshire Mensa has an annual Regional Gathering and has what has become an annual talk on climate issues. Past speakers have been tapped from outside Mensa, this year I volunteered to give the talk. While I once was a Chemistry major, my career has been software engineering and as such, I have little to advance climate science, but can compile data from people who have.

An old Chinese curse says “May you live in interesting times.” In the last year or two, some times have surpassed that and are now fully fascinating.

Our climate is a complicated beast. The figure below shows how it all comes down to energy transfer, starting with energy from the Sun and ending with a nearly equal amount leaving Earth. In between, energy can be concentrated in hot deserts and the cold Antarctic, stored in water vapor (and released as precipitation), and most of all, stored in the oceans. How it gets there is dependent on ocean currents, air currents, clouds, and light from the infrared to ultraviolet. Current science understands a lot of the system, but doesn't understand all of it. No one person understands everything we do know, and anyone can learn more about part of the system than any scientist does.



Source: NASA

2. Temperature

The most reported part of the climate system is the global surface temperature, or rather, the difference between the global temperature for each date and its long-term average temperature. There are four main groups that track this “anomaly.” Two (UAH and RSS) look at satellite measurements of air temperatures low in the troposphere, and two (GISS and HADCRUT) look at ground level temperatures. The satellite data goes back only about 30 years, ground data goes back to the 1860s.

The figure below from UAH shows that global temperatures reached a plateau around 2002 and have been declining since 2006. Many people are quick to point out that 2002 was only seven years ago, and that's way too short a time for measuring climate change. By that logic, then the only data we should display is the average over the last 30 years, which would make for a drastically different graph. 30 years is the standard interval used to establish a climate baseline, but it's easy to argue that is too short for some studies. Using the 30 year average would also make meaningless the news media reports that 1998 was the warmest year in the satellite record or this year's claim that the last decade is the warmest on record. We will see in a bit that there may be a good reason for finding meaning in periods only a few years long.

Why does the temperature anomaly go up and down? A lot of people say “It's the CO₂, stupid!”

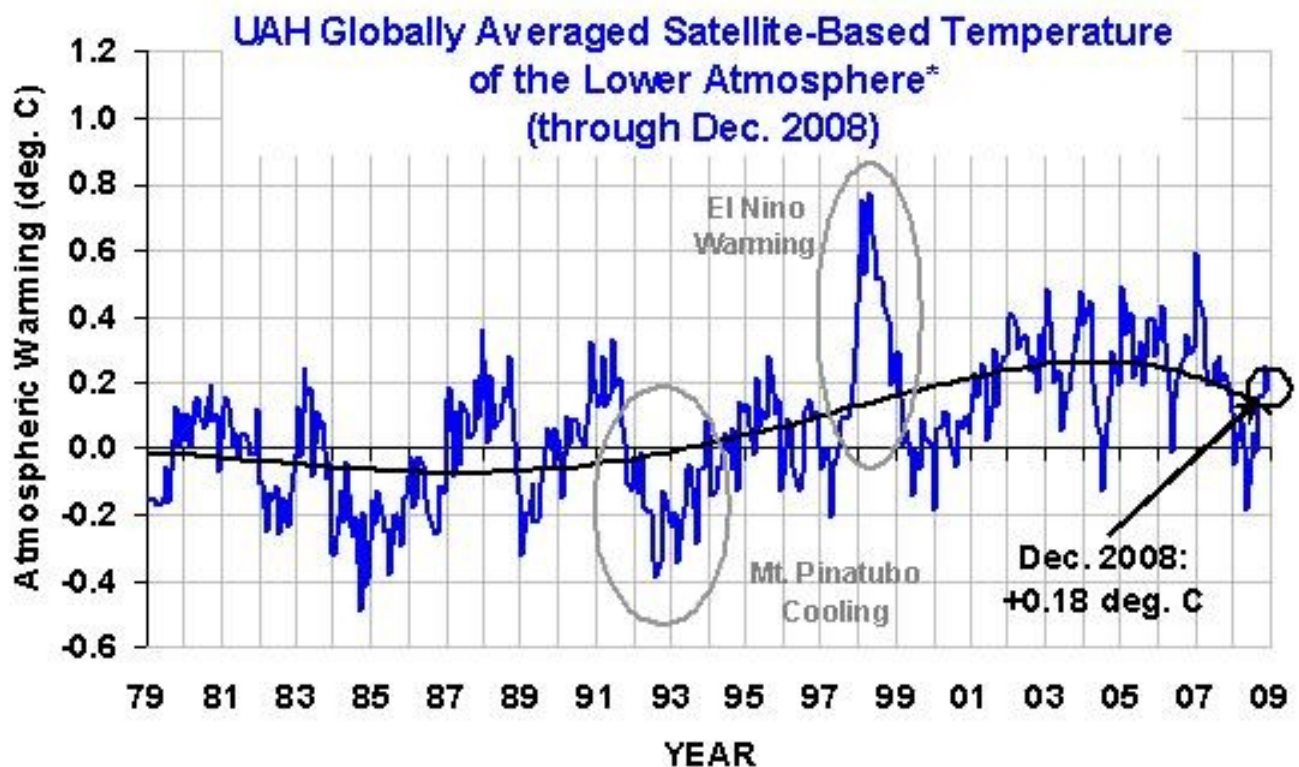


Figure 2: Credit: <http://www.drroyspencer.com/latest-global-temperatures/>

3. CO₂ and other greenhouse gases

In 1842 John Tyndall discovered that the CO₂ in the Earth's atmosphere could block the infrared radiation the Earth releases. Subsequent work by others led to the idea in 1896 that humans were releasing enough CO₂ to affect global temperatures. In the late 1950s, David Keeling of Scripps Institution of Oceanography started tracking CO₂ concentrations in the air at Mauna Loa, and soon saw CO₂ levels increase from year to year. At the time this was regarded as very strong evidence linking warming to CO₂, and it still is. While the Earth's temperature has not followed CO₂ closely, the trend has been upward. The temperature peak in 1998 (which was very close to 1934's temperature) is associated with an El Niño, and then a La Niña brought temperatures back down. This decade has brought a rise, plateau and descent, which does not match with the growth in CO₂

Dr. James Hansen, Director of NASA Goddard Institute for Space Studies, brought the global warming issue to the US Congress in June 1988. Twenty years later he returned to call for putting “energy executives on trial for crimes against humanity and nature.” One reason for his concern is that computer based climate models show runaway warming if CO₂ levels get too high, and he has started a public campaign to reduce CO₂ levels back to 350 ppm, a level that should be safe. This has transformed into an international campaign centered at <http://www.350.org/>.

Ironically, the GISS temperature data doesn't support either action. Their database reports that the average temperature in June 1988 was 0.39°C above the average, and was actually down slightly to 0.34°C in June 2008. UAH, a satellite-based database, reported a larger fall of 0.204°C!

4. Solar activity

The idea that solar variance is a climate driver dates back to 1801 when Sir William Hershel reported that when there were few sunspots, wheat prices increased, presumably due to poor farming conditions. In years with many sunspots, the climate was warmer and crops did better.

Last year, the Sun was at the end of solar cycle 23 and was very quiet, and that “falsified” several predictions about the starting point for the next solar cycle, SC24. This year the Sun is actually quieter and while there have been some SC24 sunspots, we are still in an overlapping period with SC23. Most of the remaining predictions have fallen by the wayside. Historically, a long cycle means that the next cycle will be weak, so that suggests more global cooling. No potential mechanisms have been identified that stand up to scrutiny, but there are various avenues of research that may yet identify one. Even if there is no link, the Sun is entering a period of unusual activity at a time when several instruments on the ground and in orbit are ready for events never before recorded. This is a very exciting time for solar science.

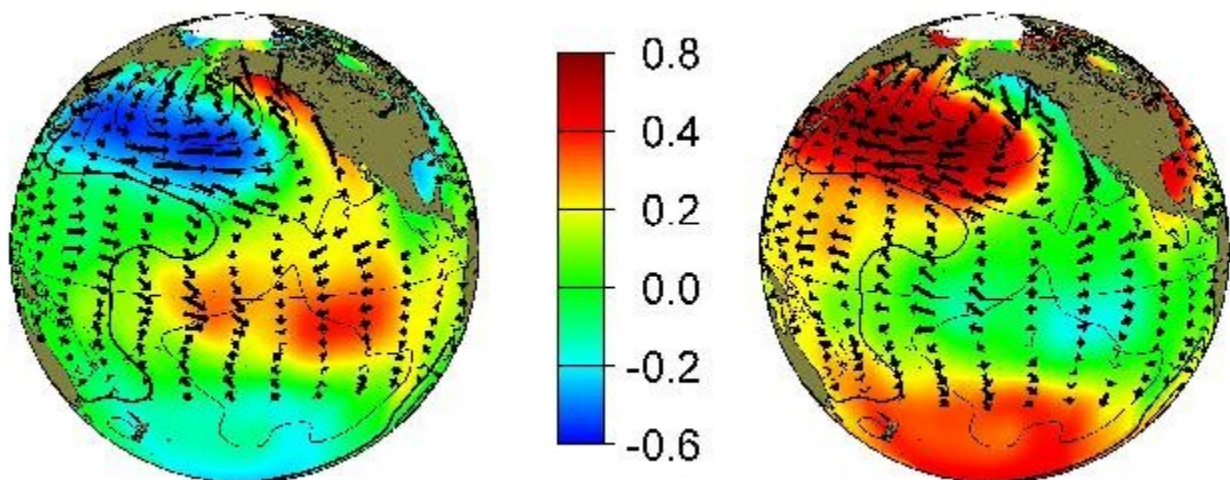
The first figure below shows NASA's 2007 predictions from groups that expected SC24 to be active and those that expect it to be quiet. The second figure shows that NASA is expecting a weaker cycle and expect it to get going immediately.

5. Ocean and atmospheric currents.

Some of the biggest influences on global climate come from ocean currents. As Ocean water moves, it warms or cools the air that comes in contact with it and then the air moves more quickly and flows over land. There are several, each with influences on climate and interactions with each other. The Atlantic Multidecadal Oscillation is associated with periods of increased Atlantic Hurricane activity (the latest started in 1995 and will run for a while longer). Some have a shorter period, the Madden-Julien Oscillation is only a few weeks long. The largest, and our focus, is the Pacific Decadal Oscillation (PDO) and its recent flips were in 1976 (positive) and late 2007 (negative).

The timing of the flips is interesting. Our best estimate of global temperatures come from satellite data, but that only reaches back to 1979. Nearly that entire record is associated with a positive PDO. During positive PDOs, the Pacific tends to have more El Niño events, the positive phase of the ENSO. Both these tend to warm the Earth, an effect that complicates measuring the effect of Greenhouse gases. Conversely, a negative PDO is associated with La Niña, and are linked to cooling. As CO₂ levels continue to rise, science will be able to tell strength of each effect on global temperatures.

First, let's look at one effect of the negative PDO:



From <http://jisao.washington.edu/pdo/>

Ocean currents during a positive PDO are on the left, and negative on the right. The colors reflect sea surface temperatures, the arrows show prevailing winds.

Look at the Alaskan coast in the right image, they have north winds and chilly waters. In 2008 the PDO and La Niña brought Anchorage the “worst [summer] weather in 20 years” and set records for the fewest days where the temperature reached 60, 65, and 70 degrees. Only four years earlier records for the most 65, 70, and 75 degree days were set. The Juneau Icefield gained mass for the first time since at least 1946.

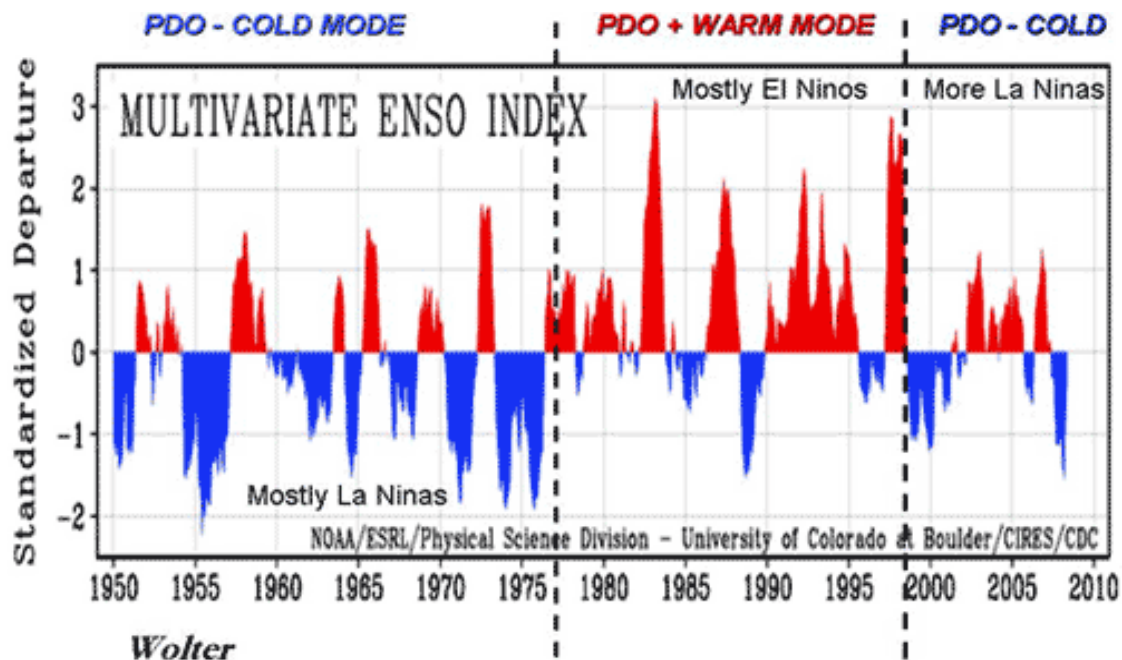
Mid America had a very cold January, and the cold stretched to New England. Caribou ME set five low temperature records that month. Snow fell in mountains outside of the United Arab Emirates for the

second time in recorded history.

In the winter of 2007/2008, earlier in the La Niña period, remarkable reports came from places like China and Vietnam (freezes devastated rice crops and killed thousands of farm animals), Afghanistan (many people lost limbs due to the cold), and Tajikistan (frozen mountain rivers forced the shutdown of a hydroelectric plant that powered the capital). Snow fell in Melbourne Australia, Johannesburg South Africa, Baghdad Iraq, and most recently in Brazil.

Could the PDO flip be behind all this? Yes, and the effects of a flip show up very quickly. When the PDO flipped positive around 1976 there was a dramatic warming along the Pacific coast, it appears that we're seeing as dramatic cooling with the return of the negative PDO.

The figure below shows the ENSO index, significantly positive values are El Niños, significantly negative values are La Niñas. The negative PDO flip is placed in 1999, some people place the recent flip in 2007.

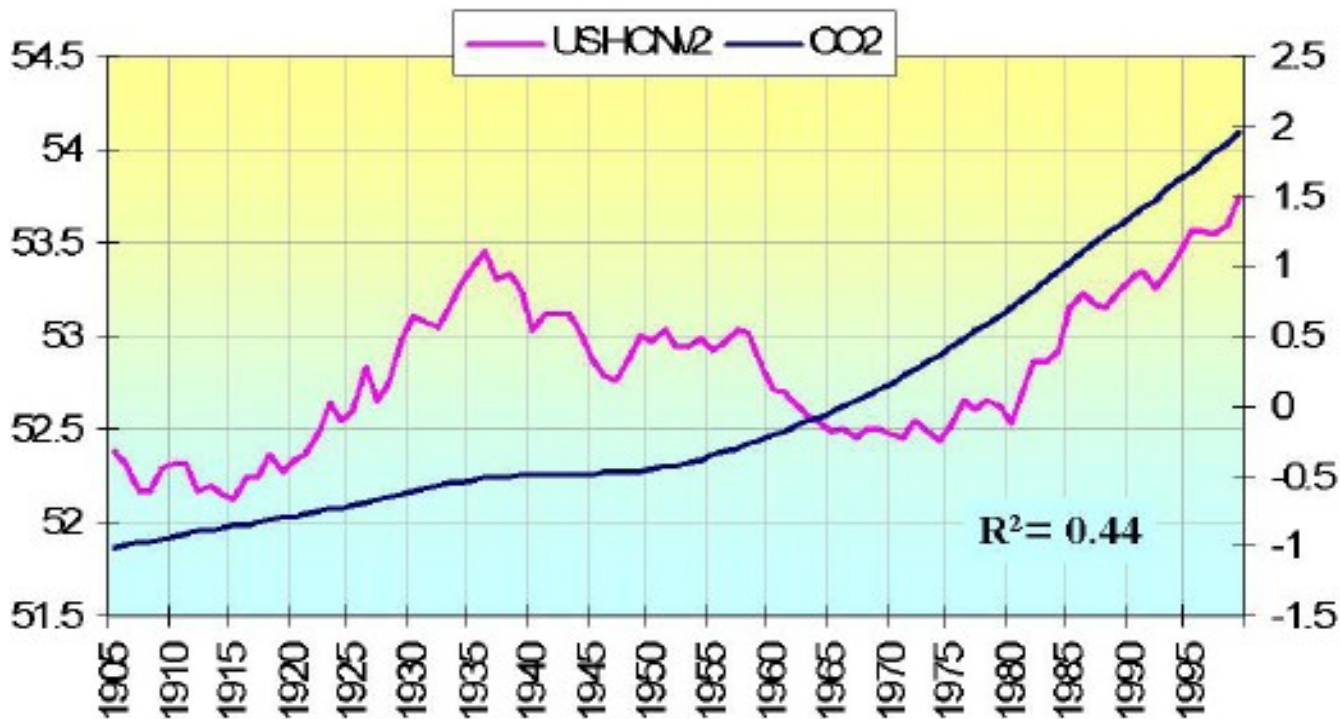


Wolter
<http://www.intellicast.com/Community/Content.aspx?ref=rss&a=129>

Joe D'Aleo has looked at the correlation between various phenomena and temperature. The correlation with CO₂ is not very good, but there is a much better fit with the PDO+AMO. (The Atlantic Multidecadal Oscillation is similar to the PDO.) So the answer is yes. Not only does this fit the data well, history suggests that we may be in for 30 years of cooling.

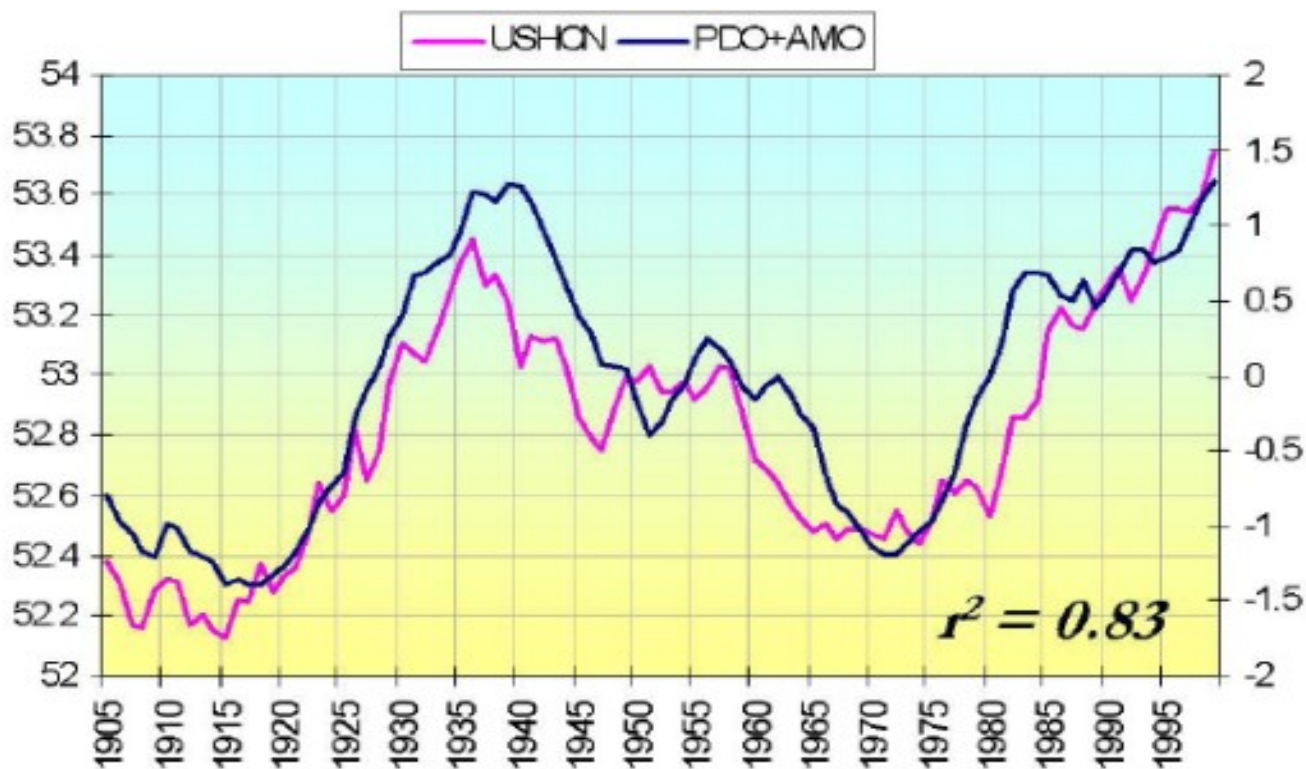
The graphs below show the two comparisons. USHCN is the United States Historical Climate Network and provides the data for the ground based temperature record. In both graphs the magenta line is temperature and the black lines are what's being compare. The R-squared number is a numeric gauge of correlation, with 1.00 being perfect.

CO2 vs USHCN Annual Mean Temps



<http://wattsupwiththat.com/2008/01/25/warming-trend-pdo-and-solar-correlate-better-than-co2/>

PDO+AMO vs USHCN2



Note this data set started in 1905 because the PDO and AMO was only available from 1900.

6. Arctic icecap and polar bears

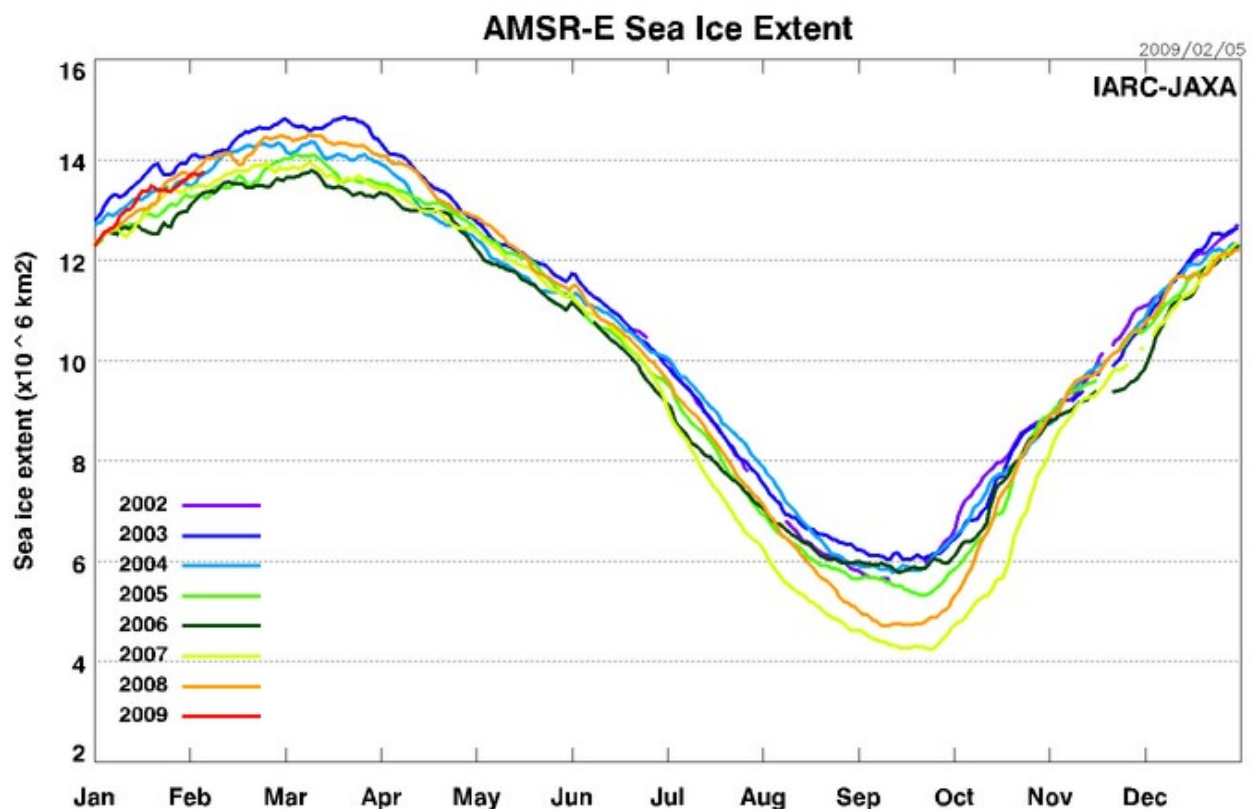
The ever-shrinking Arctic ice cap has led to predictions of drowning polar bears, an ice-free North Pole, off-shore oil drilling in the Arctic Ocean, etc. However, ice increased from 2007 to 2008.

Polar bears were added to the endangered species list this year despite that most polar bear populations are growing. Polar bears have drowned in open water during a storm, one was shot and killed after it reached Iceland, but for the most part populations that are not hunted are increasing.

A prediction that the North Pole might become ice-free in 2008 was enough to convince British explorer Lewis Pugh to kayak from near Spitsbergen at latitude 79.4° North. He made it to 80.5° North, about 1/10th the distance to the pole before hitting the pack ice. They did see a polar bear, though.

Arctic Ice appears to be recovering from the record low extent during the 2007 melt season. 2008 finished with 9% more ice than 2007 despite claims that thin first year ice would melt quickly.

Antarctic ice extent has fallen from above average extent to average extent over the last year.



http://www.ijis.iarc.uaf.edu/seaice/extent/AMSRE_Sea_Ice_Extent.png

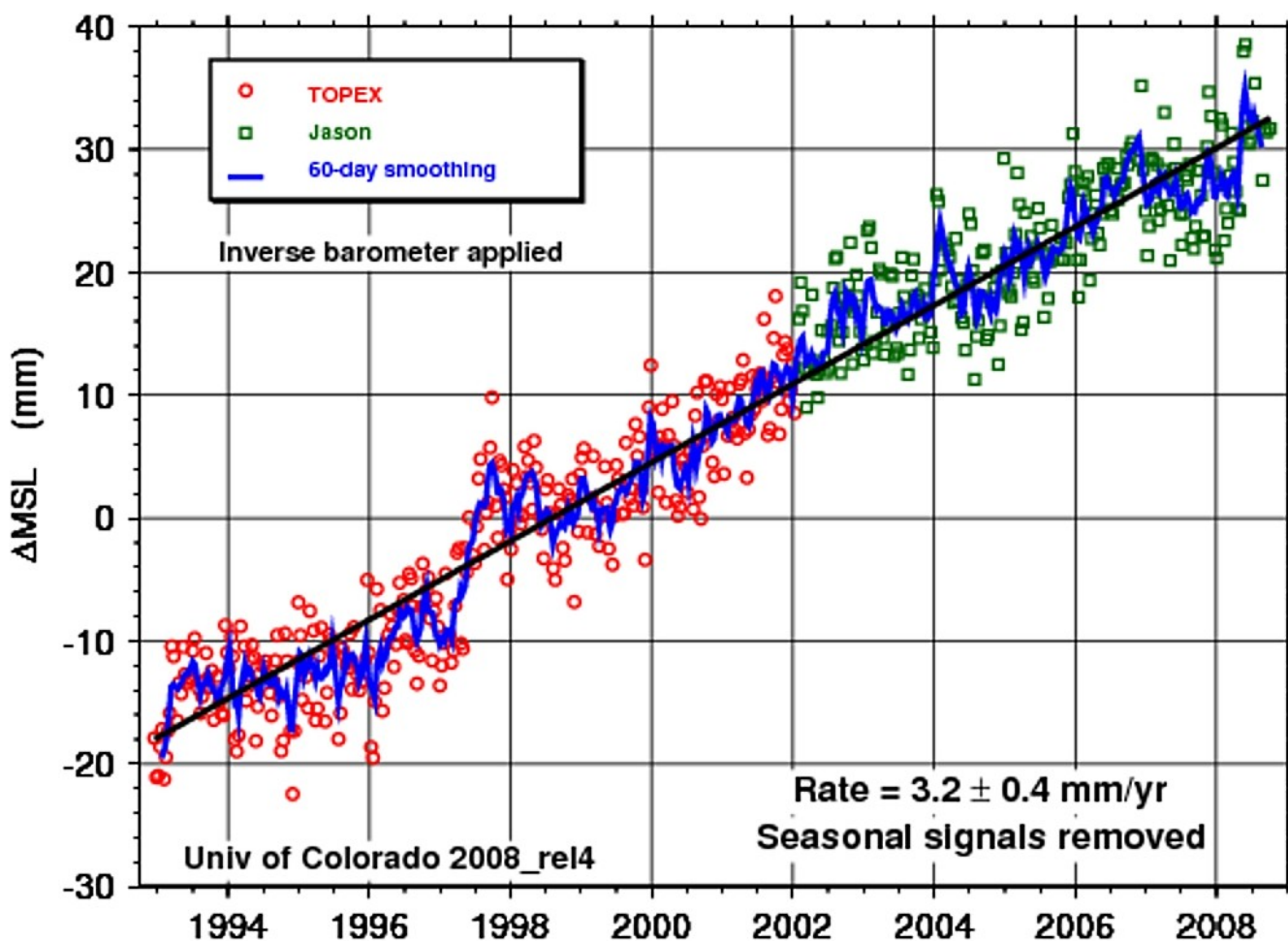
7. Sea level change

Finally, the last science item to check is driven by all of the above and more. How accurate are the predictions that rising sea levels are going to drown low-lying islands, Florida, Bangladesh, and sea coast cities? The predictions vary quite a bit, but ultimately global sea levels depend on ocean temperature (warm water expands) and land-based glacial melting (floating ice doesn't contribute to sea level as it melts, though there are some “second order effects” due to mixing fresh and salt water).

We have the Topex/Jason satellites (<http://topex-www.jpl.nasa.gov/mission/topex.html>) that measure sea surface topography to a few centimeters and the Argo Project (<http://www.argo.net/>) of autonomous ocean floats that log the ocean temperature in the top kilometer or two of water.

The satellites have found a rise of about 3 mm/yr over the last 15. This is about one foot per century, well below some of the more extreme predictions. Since the PDO flip, the rate of rise may have come down, it will be interesting to watch it in the next decade.

The Argo mission has found little change in ocean heat content, and perhaps a slight fall over the last five years.



http://sealevel.colorado.edu/current/sl_ib_ns_global.jpg

8. Mass media and journalism

The MSM (MainStream Media) has not picked up on the start of global cooling. A possible reason may be that the Society of Environmental Journalists is very strongly in favor of the warming views. While they list several skeptic sites, they usually include information to try to link them to tainted funding sources, e.g.:

Some of the most vocal skeptics have done relatively little recent peer-reviewed scientific research on the topic, and some have had their voices amplified via financial support from industries opposed to any government regulation or taxation of greenhouse gas emissions.

On the other hand, they don't criticize some of the warmist camps, e.g.

RealClimate posts authoritative, research-based articles in language accessible to lay readers while the controversy or deception is still fresh in headlines. The site is a collaborative effort of at least 11 scientists actively working on climate research — with Michael Mann of Penn State (author of the famous "hockey stick" graph of global temperature adopted by the IPCC) playing a principal role.

www.realclimate.org was set up by Environmental Media Services in Washington DC, and while it is run by scientists, it is roundly criticized for deleting blog comments from people (and scientists) who disagree with their view. The hockey stick was discredited years ago and in England is one of several things that must be disclaimed before showings of Al Gore's An Inconvenient Truth.

Things are beginning to change. The lack of warming over the last decade, the economic meltdown, and the anomalously cold weather (as I write this England is enduring the worst snow storm in 18 years) around the world are beginning to have an impact on journalists. The public's concern has waned, Global Warming ranked 20th in a recent poll at <http://people-press.org/report/485/economy-top-policy-priority>. As I make some final edits, the UK's Guardian published:

"Experts at Britain's top climate research centre have launched a blistering [attack on scientific colleagues and journalists who exaggerate the effects of global warming](#).

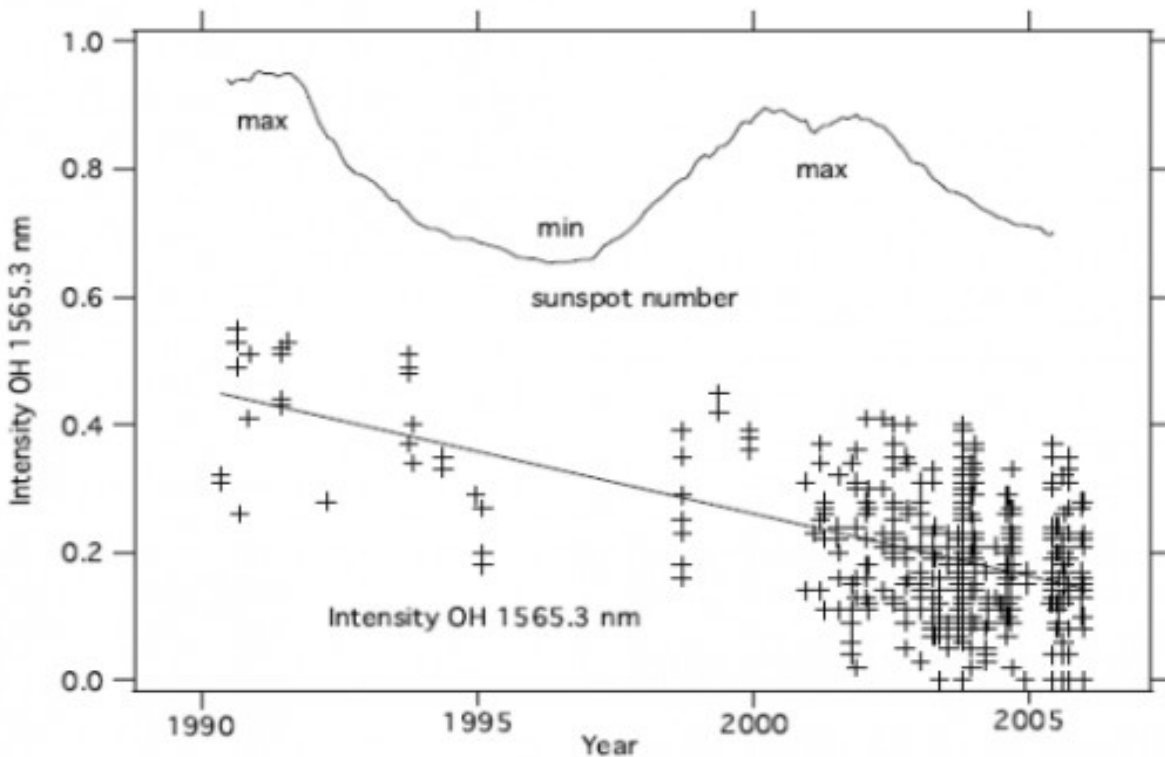
The Met Office Hadley Centre, one of the most prestigious research facilities in the world, says recent "apocalyptic predictions" about Arctic ice melt and soaring temperatures are as bad as claims that global warming does not exist.

9. What's ahead? Dalton-like minimum? Maunder-like minimum? Cheshire sunspots?

While premature, some writers have suggested we are entering a period like the chilly weather of the Dalton sunspot minimum or worse, the Maunder Minimum. While the link between solar activity and climate may be strong enough to warrant such linkage, there is one more facet of solar activity that is fascinating even if it has no connection to climate. A few years ago William Livingston and Matt Penn submitted a paper titled [Sunspots may Vanish by 2015](#) to the journal Science documenting evidence that the magnetic fields that ultimately make sunspots appear dark had been weakening for 15 years. If that rate continued, then the fields would be so weak that sunspots would fade from view around 2015. The journal rejected the paper because peer reviewers criticized it for being a purely statistical look without proposing potential mechanisms behind the changes. The paper was never resubmitted there or

to an astronomical journal, so very few people are familiar with what's happening. During the years since then, weakening has continued at the predicted pace and there are reports the few sunspots that have appeared during this minimum have a low contrast and are difficult to draw.

The figure below shows sunspot warming (through the weakening of the OH spectral line) over the last 20 years.



http://wattsupwiththat.files.wordpress.com/2008/06/livingston-penn_sunspots2.pdf

This phenomenon has never been reported before. It almost certainly has occurred before simply because our observational record of field strength and sunspot temperatures is so brief. It might have happened during the Maunder Minimum, but I know of no way to tell.

10. Skeptics and the flat earth society

One of the most annoying statements over the last year was from Al Gore on a [60 minutes broadcast](#) where he said “I think that those people are in such a tiny, tiny minority now with their point of view. They’re almost like the ones who still believe that the moon landing was staged in a movie lot in Arizona and those who believe the earth is flat. That demeans them a little bit, but it’s not that far off.”

This is especially rankling because I had just embarked on an effort to get more involved with understanding what was happening with the climate. Why would Gore make such an insulting comment? Many people in the skeptic community suggest that Gore and company are getting desperate and comments like this and James Hansen's call to put utility company executives on trial are attempts to keep people from questioning the science.

Well, the science isn't settled, and won't be for decades. Despite statements like Gore's some people do take a look and discover that it's okay to become one of the scorned. Many current skeptics started out believing that Anthropogenic Global Warming was underway but couldn't find the support for that view. Let's close with a post from a non-scientist on a blog owned by a meteorologist who used to campaign against Anthropogenic Global Warming before concluding man is not behind recent climate change:

From <http://wattsupwiththat.com/2009/01/30/co2-temperatures-and-ice-ages/#comment-79308>

Katlab (20:27:13) :

Thank you so much for having a website dedicated to the truth. These past six months I have been reading have shaken me to the core. I feel like I have dropped down a rabbit hole, and I cannot believe anything the MSM [mainstream media] tells me.

I once had a philosophy teacher state that the only valid reason to believe something is because it is true. As a child you may believe in Santa Claus. It makes you happy and you behave better. As an adult, you don't believe in it because it is not true, even though believing in it might make you happy and better behaved.

Al Gore and others want people to believe in AGW [Anthropogenic Global Warming] because of the effect it has on people. It is to manipulate them into doing things they wouldn't do otherwise. They view the net effect as good because it advances their agenda. It is the utter hatred and fear of the truth that has shocked me to the core. People do not want to know the truth, they hate you for it.

I love the truth, I would rather know the truth and find out I was wrong, then swallow a lie and believe I am right.

In the end, the truth wins, because they will huff and puff, but they cannot command the sun and the oceans to do their bidding. Thank you. Thank you for opening my eyes to the world no matter how shockingly painful it has been.