Winter 2009 / 2010 – The Explanation

by

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Introduction:

The current cold spell affecting most of the northern hemisphere is causing quite a stir with widespread scientific and media attention and confusion.

The proponents of human caused climate change seem to be in a panic and most sceptics carry a smirk.

However it all fits in very nicely with the forecast that I issued last August concerning the coming winter. The full prediction (Winter2009/2010 for UK) can be found in my section of the climaterealists.com forum but here are a couple of quotes:

"The jets are still well south of us and if that persists into autumn and winter then of course there will be greater influence from cold high pressure over Europe and Greenland.

UK coming winter cooler than recently and likely to further reduce the warming trend of the 1975 to 2000 period. Not necessarily back down to the longer term average but well on the way with an outside chance of a memorable winter.

More snow than we have been used to but generally drier than average in the north and wetter than average in the south."

All of that is proving to be perfectly correct yet it is derived from simple observations available to the Meteorological Office.

Why did they not come up with a similar conclusion?

The basic explanation:

My previous article concerning the missing climate link enables me to take another step forward in describing the climate system.

The important point in that article was the recognition that in fact it is the turbulence of the solar wind that controls the rate of energy loss from the upper atmosphere to space and that the effect of such turbulence is greater than the effect of variations in solar power from one cycle to another.

It is that effect that tends to result in a cooling stratosphere when the sun is more active and a warming stratosphere when the sun is less active.
As I pointed out in that previous article the act of changing the sign for the effect of a more active sun from positive (warming) to negative (cooling) enables one to juggle the separate solar and oceanic cycles to explain a number of previously unexplained phenomena such as the relative stability of climate during inter glacial periods as compared to glacial epochs and the size of the swings in climate that do occur during inter glacial periods despite the very small variations in solar power output that have been observed.

In this article I can now extend those ideas to explain the behaviour of the Arctic Oscillation (AO) and suggest how the Arctic Oscillation may well be interacting with the oceanic Pacific Decadal Oscillation (PDO) to produce the climate changes that we observe.

This article is directly relevant to the current 2009/2010 winter which is proving to be unexpectedly cold in the continental regions of the northern hemisphere.

What we seem to be seeing is a large redistribution of tropospheric heat energy with poleward regions cooling but equatorial regions remaining warm.

In the process of that redistribution the air circulation patterns have shifted substantially equatorward but that in itself is merely an extension of the changes that should have been apparent to all observers of weather and climate since 2000.

Applying my general climate description I would say that the following is the likely explanation:

i) Generally a latitudinal shift in the air circulation patterns is ocean driven and since about 2000 the PDO has been trending to the negative phase so that gives a basic background cooling effect with the air circulation systems and especially the mid latitude jet streams moving more equatorward.

ii) In contrast the Arctic Oscillation that controls the size and position of the polar high pressure systems is driven by a combination of the speed of the hydrological cycle as dictated by the rate of ocean energy release and the speed at which the stratosphere can radiate energy to space which is driven by variations in the turbulence of the flow of energy from the sun. The SABER satellite results appear to show that the rate of loss of energy to space is greater when the sun is active and less when the sun is less active.

iii) At present the quiet sun is reducing the rate of energy loss to space and the stratosphere is warming. At the same time the 2009 El Nino has been pumping energy faster to the stratosphere. The combined effects have both been supplementing one another to increase the flows of energy up into and downward out of the stratosphere to enhance the size of the polar high pressure cells and push them equatorward against the counter pressure from the El Nino.

iv) The result is cooling mid latitudes but warming equatorial and polar latitudes.

The two main climate oscillations:

Although there are many oscillatory effects in both oceans and air I find that those two (AO and PDO) are by far the more dominant and would only be affected at the margins by interaction with other oscillatory features of ocean and air.

Here is some information about the Arctic Oscillation:

http://www.arctic.noaa.gov/detect/climate-ao.shtml

and here for the Pacific Decadal Oscillation.

http://jisao.washington.edu/pdo/

and here some significant findings from 1999 which seem to have been ignored in favour of the proposed CO2 warming effect:

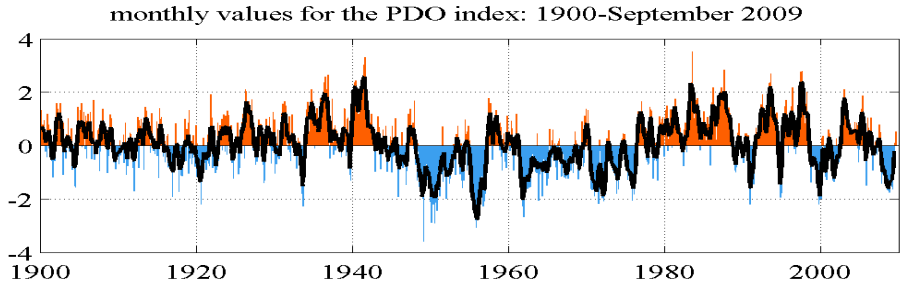
http://www.washington.edu/newsroom/news/1999archive/12-99archive/k121699.html

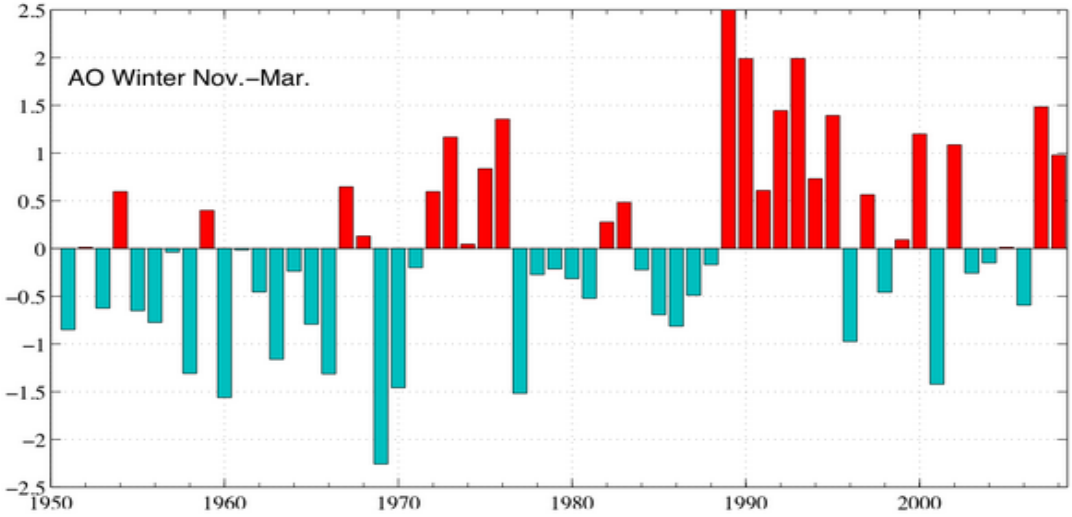
Importantly they say this:

"The stratosphere's effect on the Arctic Oscillation's behaviour appears particularly intriguing because it is opposite of what happens in other major climate systems," Baldwin said. When the oscillation changes phases, the strengthening or weakening of the circulation around the pole tends to begin in the stratosphere and work its way down through lower levels of the atmosphere. In phenomena such as El Niño in the equatorial Pacific Ocean, the changes begin in the ocean and work their way up through the atmosphere."

That is entirely consistent with my previous description of the climate system being balanced between the convective regime of energy transfer from oceans to tropopause and the radiative energy transfer regime from stratosphere to space.

Here we can see the two charts next to one another:





<u>The way it all fits together:</u>

1) Note that from about 1950 to about 1975 the PDO was in cooling mode and from 1975 to about 2005 it was in warming mode.

The Arctic Oscillation was in cooling mode a little longer, to about 1988 though there was a short weak warming spell in the early 1970s. It was then in a strong warming mode from about 1988 to date but is clearly now reverting to a cooling mode.

The relatively strong warming of the late 20th Century occurred whilst both PDO and AO were in positive mode simultaneously and I will now go on to explain why that is significant.

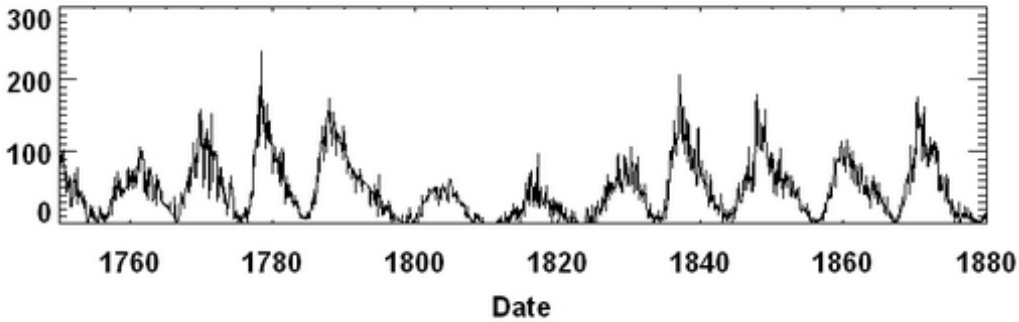
2) I have previously proposed that the rate of energy loss from upper air to space is controlled by the turbulence of the solar wind and that the rate of energy transfer from ocean to air is controlled by internal ocean variability. The temperature and depth of the troposphere is a consequence of the ever changing balance between the two processes and the greater any differential that develops between sea surface and surface air temperatures then the faster the hydrological cycle works in order to maintain a temperature equilibrium between sea surface and surface air.

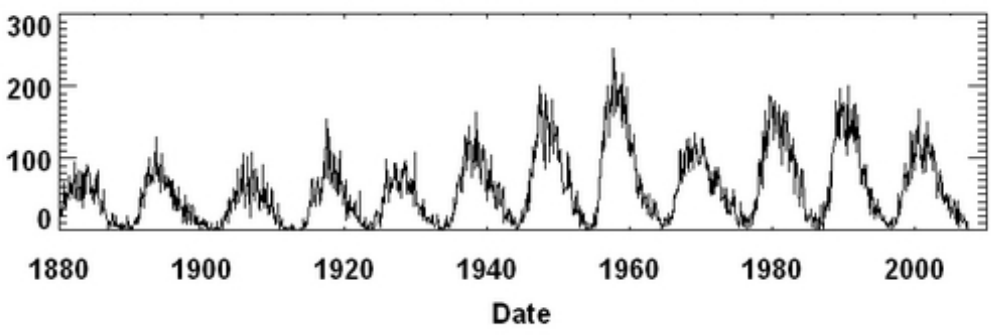
3) I have also proposed that the cause of relative climate stability during an interglacial is that for so long as the oceanic cycles and solar cycles are approximately in phase with each other they offset one another and prevent wild climate extremes alternating as they do during ice ages.

4) We see that from 1950 to 2000 sun and oceans were broadly (though not perfectly) in phase and thereby offsetting one another in their climate effects as they appear to have been throughout recorded history. Thus a faster release of energy from the oceans is by and large coincident with a faster flow of energy from upper atmosphere to space during a period of active sun. The troposphere warms and cools as the oceanic and solar cycles interact but for the time being the phasing prevents climate swings larger than we have seen from the peak of the Mediaeval Warm Period to the trough of the Little Ice Age.

At this point I should bring the solar activity chart into play but for current purposes we need only consider the more recent cycles 19 to 23 that cover the period 1960 to about 2005.

If what I say is correct then the Arctic Oscillation should ebb and flow approximately in time with the level of solar turbulence.





Solar cycle chart.

A more active sun allows faster energy loss from upper atmosphere to space which cools the stratosphere and increases the flow of energy from troposphere to stratosphere and from stratosphere to space thus giving a positive AO with lower pressure over the poles and a faster energy flow from equator to poles. That involves a poleward shift of the air circulation systems and less north/south variation in surface air flows

A less active sun allows slower energy loss from upper atmosphere to space that warms the stratosphere and decreases the flow of energy from stratosphere to space thus giving us a negative AO with higher pressure over the poles and a slower energy flow from equator to pole. That involves an equatorward shift in the air circulation systems and more north/south variation in surface air flows (winter 2009 / 2010)

Note however that over time during a negative AO the larger high pressure systems will themselves migrate equatorward to some degree and allow a low pressure system to develop at the poles themselves.

In contrast over time during a positive AO the smaller high pressure systems at the poles will contract to the extent that they increase the size of the dry regions between the mid latitude depression tracks and the equatorial air masses (much of the period 1975 to 2000).

It can readily be seen that the match is not perfect. Indeed the highest solar cycle, number 19 around 1960 is not represented by a positive AO.

However, I did say that the climate outcome is a balance between solar wind turbulence and oceanic energy release so I would contend that the failure of powerful solar cycle 19 to translate into a positive AO was most likely a consequence of the long period of negative PDO phase from 1950 to 1975. The weakness of the negative oceans provided no poleward pressure on the air circulation systems from a faster hydrological cycle and the active sun failed to pull the air circulation systems poleward on it's own leaving the AO in mildly negative mode instead of strongly positive as would have been expected from such a high level of solar turbulence.

That was quite unlike winter 2009 / 2010 when a moderate El Nino has pushed the air circulation systems poleward at the same time as a quiet sun has reduced the rate of energy loss to space thereby causing stratospheric warming and a strongly negative AO with climate consequences that I discuss below.

As I have pointed out previously the temperature of the equatorial surface waters has a rapid effect on the latitudinal positions of all the air circulation systems and logic dictates that because of the density and thermal capacity of water it will have a more powerful effect than changes in the air. The speed of effect of solar changes on the AO is therefore rather slower.

If the situation of negative oceans had continued for longer than up to 1975 then the faster cooling of the stratosphere by the active sun would have been supplemented by a cooling of the troposphere by still negative oceans and a period of profound cooling

of the troposphere would have ensued. Whilst the sun and oceans remain roughly in phase and thereby offsetting each other's effects that does not tend to happen so the cooling from 1950 to 1975 was relatively small. It is fortunate that the positive PDO phase shift occurred in the late 1970s.

Thus from 1950 to 1975 the cool ocean surfaces offset the effect on the Arctic Oscillation of the high solar cycle 19 and the slightly weaker solar cycle 20 made little difference. Then the ocean waters warmed at around the time of the commencement of solar cycle 21 and noticeable global warming of the troposphere started with a notable shift poleward in all the air circulation systems and a positive AO in response to both the ocean surface warming speeding up the hydrological cycle and the high level of solar turbulence allowing a faster energy loss to space.
In essence, high solar turbulence pulls energy out of the Earth system and with current solar and oceanic cycle phase times the oceans are usually pushing energy into the air at around the same time to mitigate the overall effect on air temperatures.

Tropospheric air temperatures therefore rose from 1975 to 2000 but not nearly as much as they would have done if the sun had been quiet at the same time.

The importance of timing:

The system works on several overlapping timescales and it is the interaction that gives us all the climate shifts so far observed.

a) Interannual:

   The El Nino Southern Oscillation (ENSO) switches from El Nino warming to La Nina cooling effects over periods of one to two years. The effect on the climate system of those variations is roughly comparable to the timescales of increased or decreased solar turbulence at different times within a single solar cycle. Thus an El Nino accompanied by a brief outbreak of solar activity will have a different climate effect to an El Nino accompanied by a period of less active sun and similarly for La Nina events.

b) Multidecadal:

   The PDO switches from warming to cooling effects over periods of 25 to 30 years. The effect on the climate system is roughly comparable to the changes in solar cycle activity that we see over two to three successive solar cycles. Again, the climate effect of each PDO phase will vary depending on the overall level of solar turbulence during that PDO phase.

c) Millennial:

I propose an oceanic cycle of about 500 years from peak to trough because it has been suggested that the Inter Tropical Convergence Zone (ITCZ) was on the equator during the Little Ice Age but is now somewhat north of the equator. I regard latitudinal shifts in the air circulation systems as a 'fingerprint' of oceanic forcing. That ocean cycle is roughly comparable to the change in solar turbulence observed between the Maunder Minimum and the recent Modern Maximum. As before the

climate effect of oceanic changes will vary depending on the overall level of solar turbulence.

Note that the effect of any particular combination at any specific time will dictate the speed of energy flow through the various components of the Earth system (ocean, troposphere, stratosphere, upper atmosphere) and result in warming or cooling of ocean, troposphere and stratosphere and upper atmosphere, each changing independently as the variation in the rate of energy flow moves from one to another.

Oceans cool/warm as energy transfers faster/slower to troposphere, troposphere cools/ warms as energy transfers faster/slower to stratosphere (unless more than offset by a faster/slower flow from the oceans) and the stratosphere cools/warms as energy is transferred faster/slower to space during periods of a more/less turbulent solar wind.

In comparison to all those changes it seems that the variability in solar energy input to the system is a much less influential variable except over many millennia.

Long term implications:

There is apparently no need for the solar and oceanic cycles to be approximately in phase as they are now. Over time I suspect that they gradually shift out of phase thereby starting to supplement each other's climate effects rather than offsetting them as they mostly do now.

We will see a less active sun allowing the stratosphere to warm up (reducing energy loss to space) at the same time as the oceans warm the troposphere so that the troposphere tries to warm up even more due to the slowing down of upward energy loss to space caused by the warmer stratosphere. And vice versa for enhanced cooling, of course.

When that happens the huge and sudden climate shifts typical of a glacial epoch will most likely return and the enormous winter snows on the continents will no longer have time to melt in the summers.

True global warming is, therefore, not coincident with a warmer troposphere. The warmth can be held in oceans and stratosphere with the troposphere being merely a precipitation dumping ground (often involving heavy snows) as the speed of the hydrological cycle changes to push energy more rapidly between the oceans and the stratosphere.

At such times total global energy might increase but the temperature differentials between poles, continental mid latitudes and equatorial regions increase enormously from the example we have observed during the 2009 / 2010 winter with heavy snows and coolness on the northern landmasses and eventually the development of glaciations.

So during warming periods when sun and oceans combine to create 'real' global warming then the tropospheric temperature differentials increase and the volume of northern continental mid latitude snows is greatly enhanced yet during 'cooling' periods when sun and oceans combine to create global cooling the tropospheric

temperature differentials decrease and volume of snows might be far less but the coldness of the northern continents becomes much deeper.

The huge (only in terms of our observational experience) extent of the current 2009 / 2010 northern hemisphere continental mid latitude coolness is but a minor and brief snapshot of what happens when long lasting warm ocean surface events coincide with lengthy periods when the sun is inactive and reducing energy loss to space.

Fortunately, as far as I can tell, the sun and oceans remain in phase and thus offsetting one another's extremes so this little episode during the 2009 / 2010 winter will not last long but can serve as an illustration of what can happen all too frequently when sun and oceans become in phase thus supplementing each other over longer periods of time.

Conclusion:

Given the sheer scale of these natural variations I do not see CO2 levels in the air as being of any significance whatever.

It appears that the Meteorological Office, for some 20 years or more, has stopped considering the energy flow characteristics of the climate system as a coherent and ever changing whole in favour of the unproven assumption that natural variation is insignificant enough to leave the quantity of CO2 in the air as a dominant climate influence.

Events have proved that their research policy has been wholly inadequate throughout to the extent that they are now a public laughing stock.

In view of the potential of my new climate description to explain current ongoing climate events I urge that the issues I have raised and the ideas set out over the past two years be given serious consideration by the climate professionals.