AN URGENT SIGNAL FOR THE COMING ICE AGE

INTRODUCTION

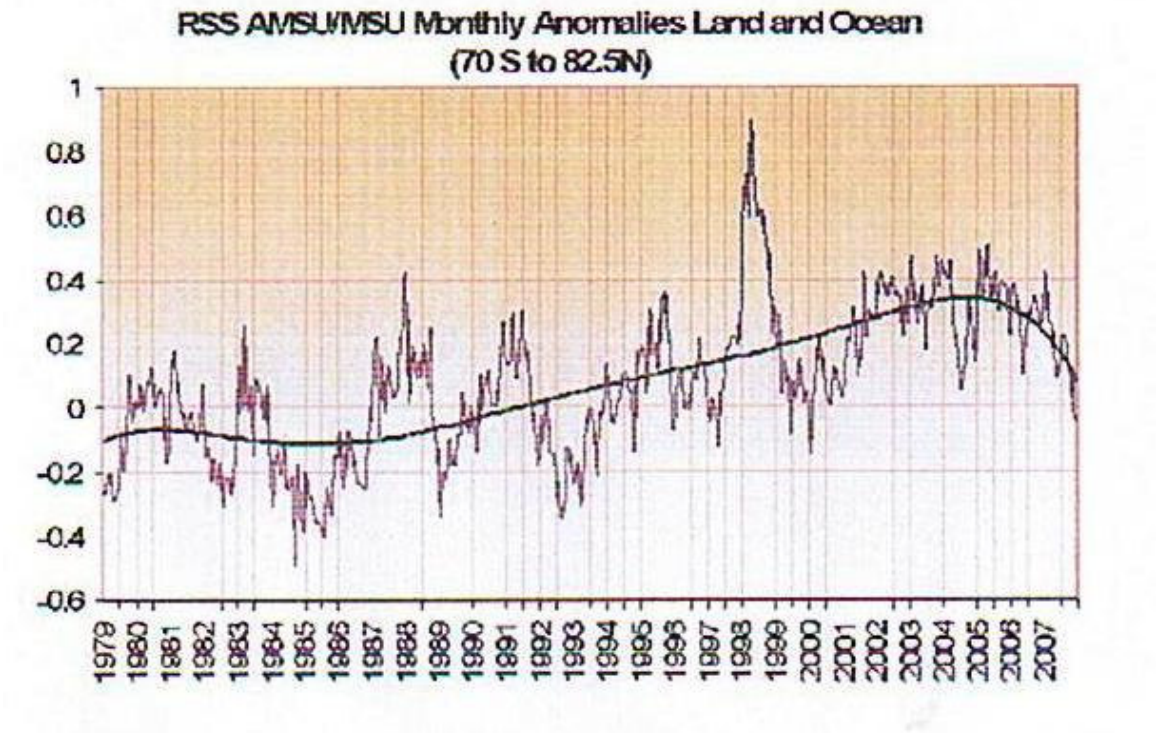
When paleoclimatologists met in 1972 to discuss how and when the present warm climate would end , termination of this warm climate we call the Holocene seemed imminent and it was expected that rapid cooling would lead to the coming ice age. These ideas were based on the 1M year analogue for climate transitions first proposed by M Milankovitch over 60 years ago which has been demonstrated to show the correlation of glacial and interglacial climate with solar insolation as it is modulated by our changing distance from the sun.
These data may be used to serve as a signal for the coming ice age.
Orbital geometry was approaching similar conditions to those of the previous transitions to ice.
But soon it was observed that global temperature was increasing and at about this time Global Climate Modeling GCM received more attention and the Milankovitch analogue was forgotten. There has been no further discussion about the coming ice age.

THE AGW DIVERSION

Perhaps underwriting the idea that our consumption of carbon and production of CO2 was contributing to climate warming was the work of Loutre and Berger and the paper by Loutre in 2000 http://www.dvgu.ru/meteo/library/243887.pdf **claimed that the Holocene would extend for at least another 30 000 (KY) years because of the effect of CO2 concentration as a greenhouse gas.**
It was acknowledged in this paper that the orbital geometry 400KY which featured muted amplitude, was the "best and closest analogue to our near future climate" , but inexplicably the Global Climate Model LLN2-D NH was "tuned" to replicate the past 200KY climate transitions when insolation amplitude was at it's highest level over the 400KY cycle and quite unlike present conditions. Using different values for CO2 it was found that "best agreement with SPECMAP is obtained near 210ppmv. CO2 ".
Then using a modeled Holocene they projected climate using a range of CO2 forcing, and they reported that there was no transition to ice for at least 30KY into the future.
The algorithm for this process is not disclosed but the authors rightly list the limitations of the model in which CO2 is considered as an external forcing ie *the carbon cycle is not simulated by the model.* Clouds and the hydrological cycle are simplified and so is the heat transport to middle and deep ocean. In addition regional changes such as the North Atlantic and over Europe are not simulated "and might depart from the global trend"

It is unfortunate that these limitations appear to have been ignored and the AGW hypothesis was born and has occupied science and the media ever since.
The Milankovich analogue has been forgotten.

But the reality is that CO2 is *not* driving temperature up , in fact the data below suggests that global T may be cooling since 1998 and CO2 continues to climb.



Remote Sensing Systems Advanced Microwave Sounding Units Satellite Temperature data ; analysis here:
:http://wattsupwiththat.wordpress.com/2008/03/10/feb-2008-rss-global-temperature-anomaly-near-zero-and-in-good-agreement-with-uah/

There is further detailed material here in a paper by Dr Willie Soon which shows that there is no evidence to support global warming by CO2.
http://www.jpands.org/vol12no3/robinson600.pdf
The concentration of CO2 varies according to the temperature of the ocean and CO2 follows T. If the present decline in T continues we can expect to see a decline in the rate of CO2 as more is dissolved in a cooler sea. This paper by Prof. Lance Endersbee explains the processing of CO2 by the ocean.

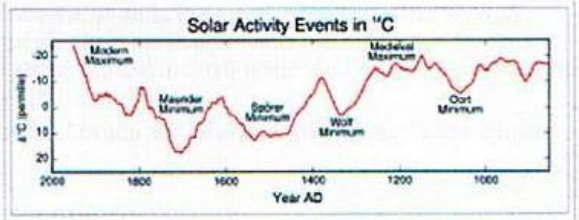
Oceans and CO2 EngrsAust apr08.pdf

The climate trends during the Holocene, and also the regular sudden climate transitions between the ice ages and the interglacial climate over the past 1M years are better explained by reference to the great external driver, the Sun.

There is abundant archeological evidence to show that global Temperature is closely correlated with solar activity.

Here is a chart which shows how solar activity has correlated with climate during the Holocene. The data is based on analysis of Carbon 14 which varies in concentration according to the level of solar activity.

Event	Start	End
Oort minimum (see Medieval Warm Period)	1040	1080
Medieval maximum (see Medieval Warm Period)	1100	1250
Wolf minimum	1280	1350
Spörer Minimum	1450	1550
Maunder Minimum	1645	1715
Dalton Minimum	1790	1820
Modern Maximum	1950	ongoing



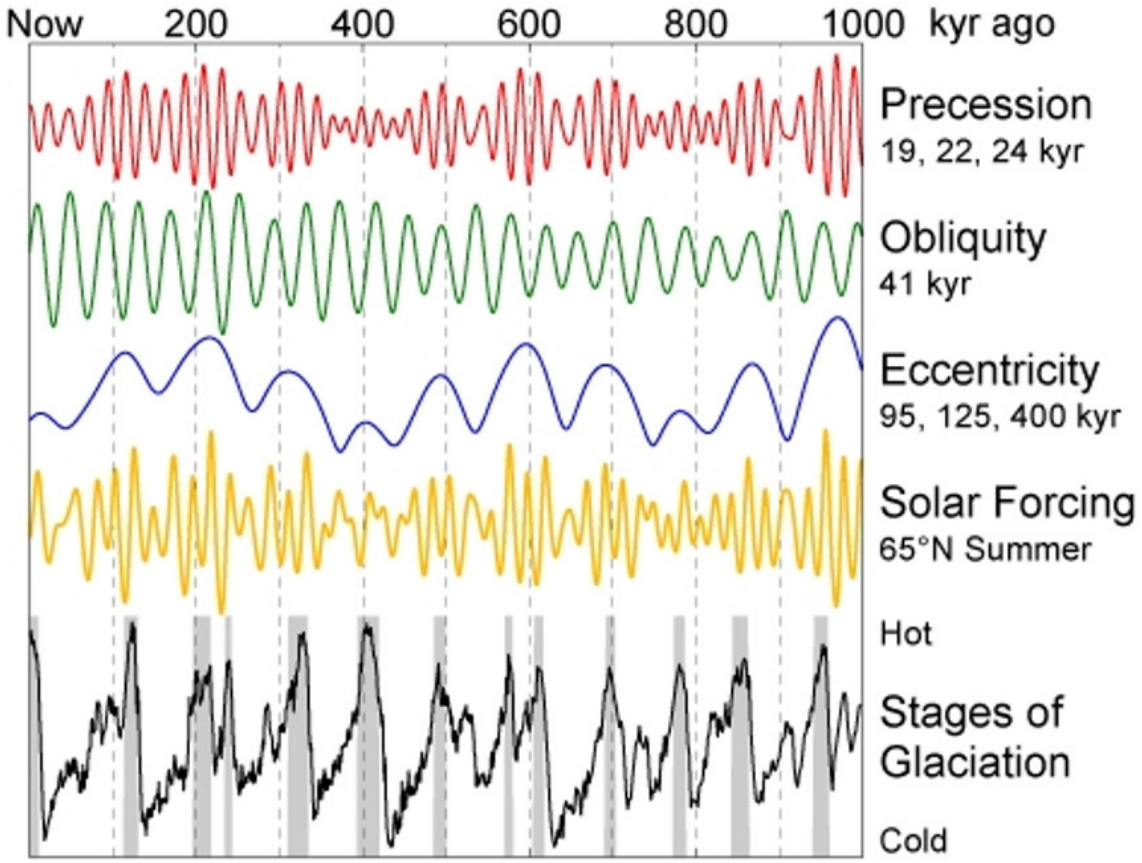
Solar activity events recorded in radiocarbon.

Solar activity over the past 70 years has been greatest for 8000 years and is the most likely cause of the recent temperature trend through 1998 that has been wrongly attributed to CO2 warming.

THE SIGNAL FOR THE NEXT ICE AGE

The evidence for the solar insolation signal for the ice ages is contained in the Milankovitch analogue which has been overlooked for over 30 years.
The data below was compiled by the mathematicians Quinn, Levine et al in 1991 and Insolation values due to Precession, Obliquity and Eccentricity as well as total insolation or Solar Forcing are charted on the same time scale as Stages of Glaciation representing climate. This climate data was provided by Lisieckie and Raymo and is based on sediment proxies. The climate data shows close agreement with Ice core data based on a different proxy.
Produced in 1991 this chart confirms the correlation of climate transitions with insolation which is modulated by Earth position in orbit and was first proposed by Milutin Milankovitch over 60 years ago.

The work was published by the mathematicians Quinn et al as " A 3 Million year Integration of Earths Orbit"; The Astronomical journal 101 pp 2287-2305, June 1991.



MILANKOVICH ANALOGUE DATA QUINN ET AL 1991 Copyright

In studying the analogue there is no use of a GCM which is subject to limitations and interpretation. Use of the analogue is based on simple observation of clear empirical data and the archeological record of temperature. The data and the correlation are sound.
The interglacial stages are shaded grey by the authors, and the glacial stages are clear.
The signal for each transition to ice can be found by careful inspection of the data and projections.
By reference to this chart we can make the following observations:

* **The glacial stages are only slightly affected by up to 3 cycles of Solar Forcing as glaciation continues up to the next sudden transition which occurs near peak Eccentricity. The process for these sudden recoveries is not fully understood.**

* **Every interglacial (shaded grey) survives for a single half cycle maximum in Solar Forcing or total insolation, (yellow) and expires when insolation is in rapid decline and we are near that position now.**

The interglacials at 200 and 600KY are split because Precession (red) and Obliquity (green) combine in opposite phase to defeat Eccentricity and the interglacial temporarily returns to ice.
Conversely total insolation at 400KY is forced into a second half cycle and the interglacial is extended to 28,000 years. Because muted Eccentricity at 400KY is considered a precedent for present conditions, the 28KY interglacial has been widely misreported as evidence for an extended Holocene. From the data we can see we have no such additional insolation half cycle. Insolation now is in rapid decline from a single peak.

* **Each of the "Ice Ages" over the past 1M years corresponds with the minimum half cycle of Eccentricity (blue) which is the predominant orbital factor. We are close to the Eccentricity half cycle minimum now.**

* **Counter intuitively every transition occurs from peak global T ;We may have a decline in T since a peak in 1998 .**

* **It follows that every transition occurs when polar ice melt has peaked.**
We have ice rebuilding in some regions now.

* **Last transition to ice occurred about 120KY ago when T was 5 degC hotter than now and polar ice melt was greater than now. The average cycle is 100KY and the coming transition is overdue.**

* **By inspection we can see that all of the transitions have occurred when Solar Forcing ie total Insolation was very close to the present level.**

* **In addititon to the above which relates to the Milankovitch cycles we have a coincident decline in solar activity.**
Solar activity is dormant now and cycle 24 is delayed.

A MECHANISM FOR THE SUDDEN CHANGE TO ICE

The variations in Insolation seen in the data are not sufficient alone to explain the sudden climate transitions from interglacial to ice and reverse. The data provides a template for timing the changes based on the extended correlation but there must be an internal mechanism to explain the rapid process.

At the tipping point for each transition, global T has peaked. This follows from the fact that Earth has been receiving peak insolation throughout the interglacial for about 10,000 years. Polar ice melt has peaked and the polar seas are freshened which may affect circulation of the MOC and interrupt heat exchange with the equator leading to sudden NH cooling.
In addition it has been proposed by William Kininmonth, meteorologist and former head of Australia's National Climate centre, that atmospheric heat and humidity

transport to the NH would offer a larger contribution to variations in heat budget if it could be shown to respond to the 100KY cycle.
I think that this factor which is driven by equatorial SST will indeed have a 100KY signature because the 100KY transitions correspond to T max. and SST will also peak near T max in accordance with the 100KY cycle.
This proposal offers the further advantage that it would provide a faster response which helps to explain the rapid climate change observed in the transitions.
It is significant to note that at this tipping point, energy transport to the NH is at a peak and there is abundant humidity transported to the NH at a critical time when insolation is in rapid decline.

These are the conditions which favour maximum precipitation in the NH winter.

These are the conditions NOW.

I think that the rapid decline to ice conditions will occur by the following process:
As T declines under rapidly declining insolation the precipitation will increasingly be snow and as albedo increases more heat will be reflected. Initially cloud cover will insulate the snow from summer insolation. Insolation continues to decline.
As T further declines water vapour in the NH will be reduced and at T zero deg C it will practically disappear leading to a sudden elimination of water vapour GHG.
Then positive feedback due to this process will lead to a rapidly widening region of sub zero T and glaciation will begin to expand.
There will be a decrease in cloud cover allowing more heat to escape in winter.
In this way the sudden transition to ice has commenced.

The geological record shows that the transitions are sudden, long term and extreme.

All of the Milankovitch parameters for a transition are satisfied by the present orbital position. We have already seen extreme NH winter conditions and T appears to be declining in the short term. The decline will continue under rapidly declining insolation and the coincident effect of reduced solar activity which has also been correlated with temperature in the past.

It is possible that we may have already entered the sudden stage of the transition.

I would challenge: is there a good reason why the analogue will not apply now?

It is overdue time for engineers and scientists to reconsider the Milankovitch analogue and to plan for the contingency of an imminent transition to ice.
I think that the AGW hypothesis has proven to be a costly diversion of resources .

Peter Harris
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