Arctic Temperatures and Ice – Why it is Natural Variability

By Joseph D'Aleo

On October 21st the Associated Press hit the wires with a story entitled Sea Ice Melting as Arctic Temperatures Rise.

The temperatures in the arctic have indeed risen in recent years and ice has declined, bottoming out in 2007 but it is not unprecedented nor unexpected. The arctic temperatures and arctic ice extent varies in a very predictable 60-70 year cycle that relates to ocean cycles which are likely driven by solar changes.

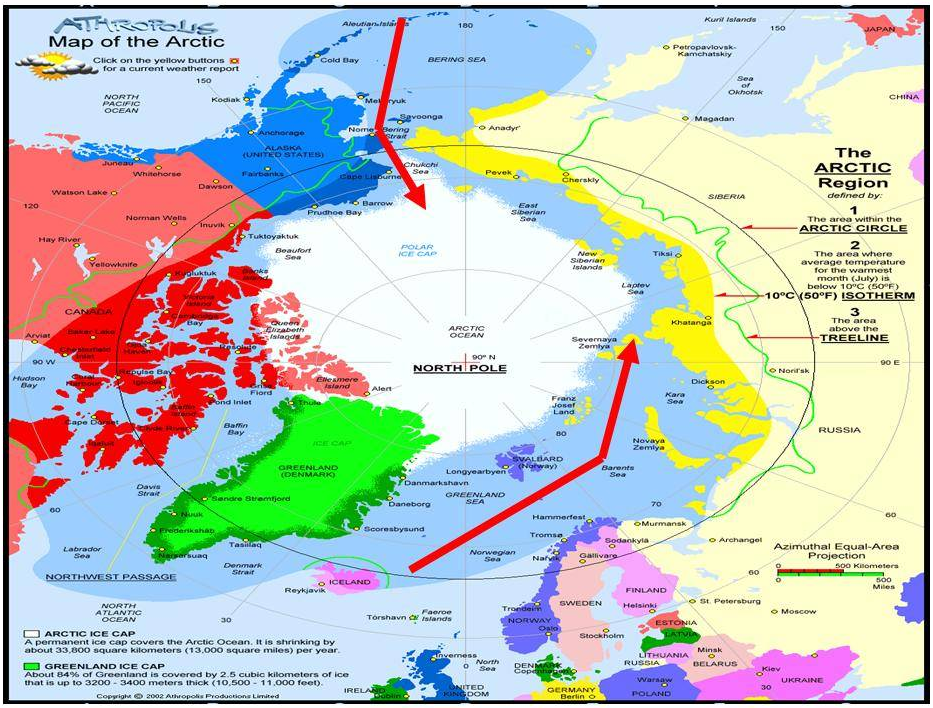
In 2007, NASA scientists stated that after years of research, their team had assembled data showing that normal, decade-long changes in Arctic Ocean currents driven by a circulation known as the Arctic Oscillation was largely responsible for the major Arctic climate shifts observed over the past several years. These periodic reversals in the ocean currents move warmer and cooler water around to new places, greatly affecting the climate. (The AO was at a record low level last winter explaining the record cold and snow in middle latitudes. A strongly negative AO pushes the coldest air well south while temperatures in the Polar Regions are warmer than normal under blocking high pressure).

We agree. And indeed both oceans play a role. In the record-setting (since satellite monitoring began in 1979) summer melt season of 2007, NSIDC noted the importance of both oceans in the arctic ice.

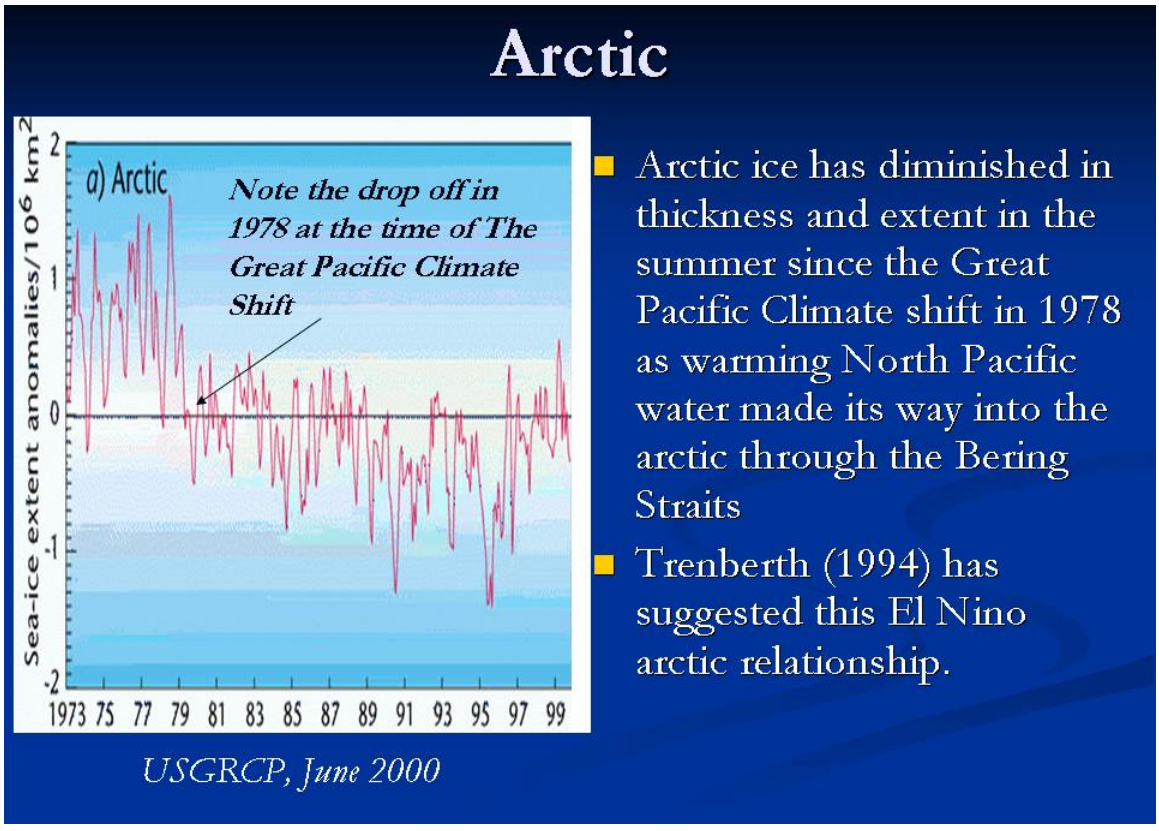
"*One prominent researcher, Igor Polyakov at the University of Fairbanks, Alaska, points out that pulses of unusually warm water have been entering the Arctic Ocean from the Atlantic, which several years later are seen in the ocean north of Siberia. These pulses of water are helping to heat the upper Arctic Ocean, contributing to summer ice melt and helping to reduce winter ice growth.*

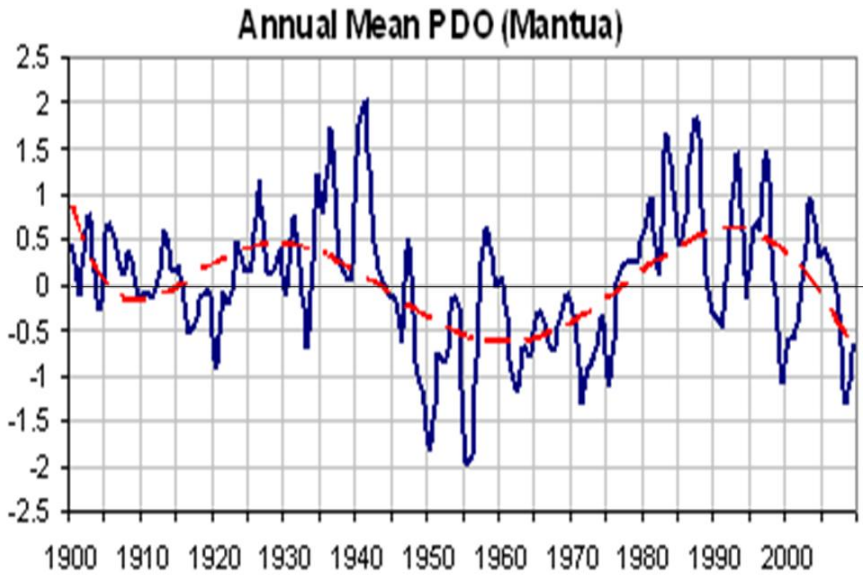
Another scientist, Koji Shimada of the Japan Agency for Marine–Earth Science and Technology, reports evidence of changes in ocean circulation in the Pacific side of the Arctic Ocean. Through a complex interaction with declining sea ice, warm water entering the Arctic Ocean through Bering Strait in summer is being shunted from the Alaskan coast into the Arctic Ocean, where it fosters further ice loss."

"Many questions still remain to be answered, but these changes in ocean circulation may be important keys for understanding the observed loss of Arctic sea ice."

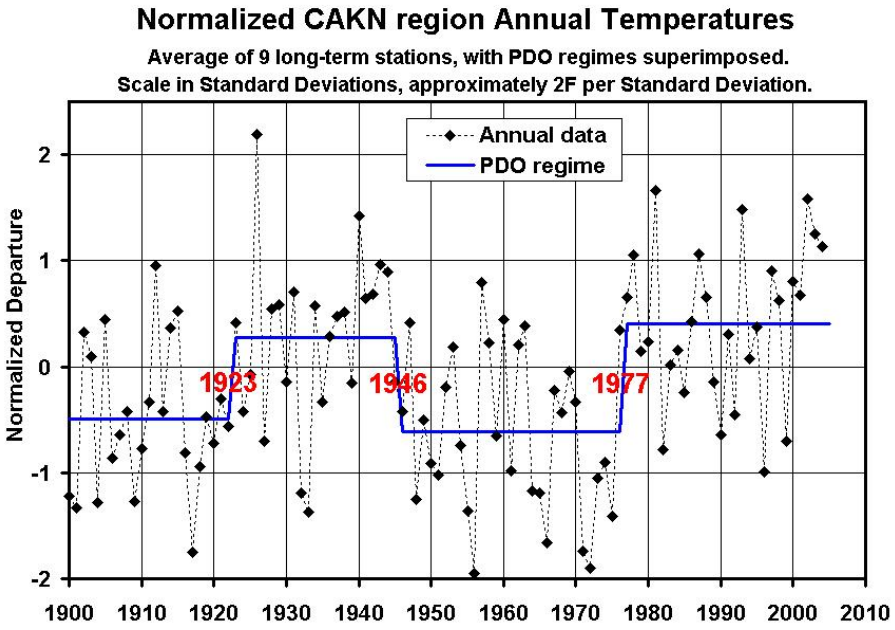


The Pacific warm mode favors more El Ninos and warmer water in the far northern Pacific including the Bering Straits. The PDO flipped into its warm mode in 1978 and the arctic temperatures began to warm and ice began to melt.

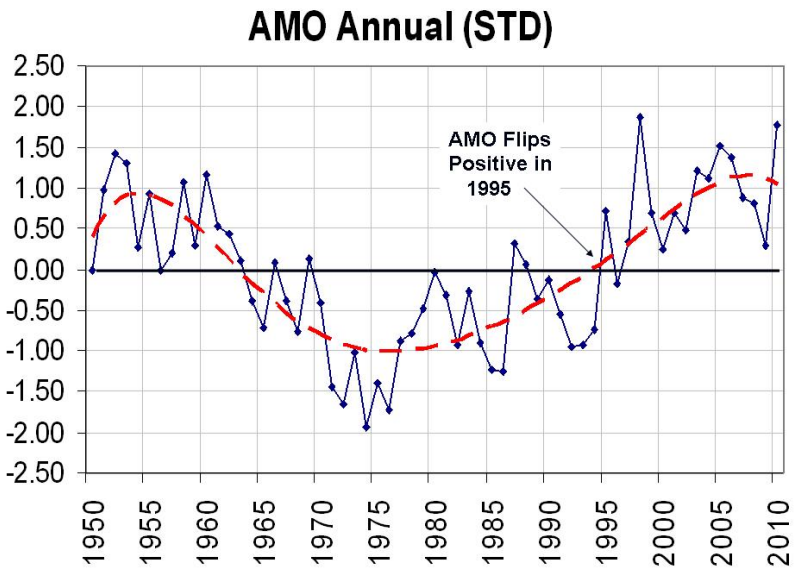




Notice how the temperatures in Alaska go through step changes tied to the PDO (Keen).

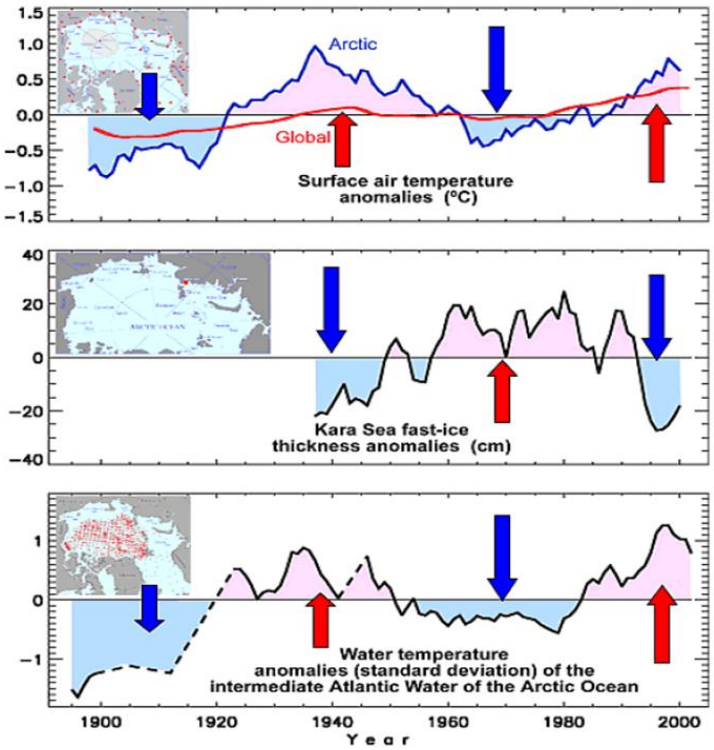


The Atlantic also cycles on a 60-70 year period. The Atlantic Multidecadal Oscillation or AMO returned to the positive warm mode in 1995.

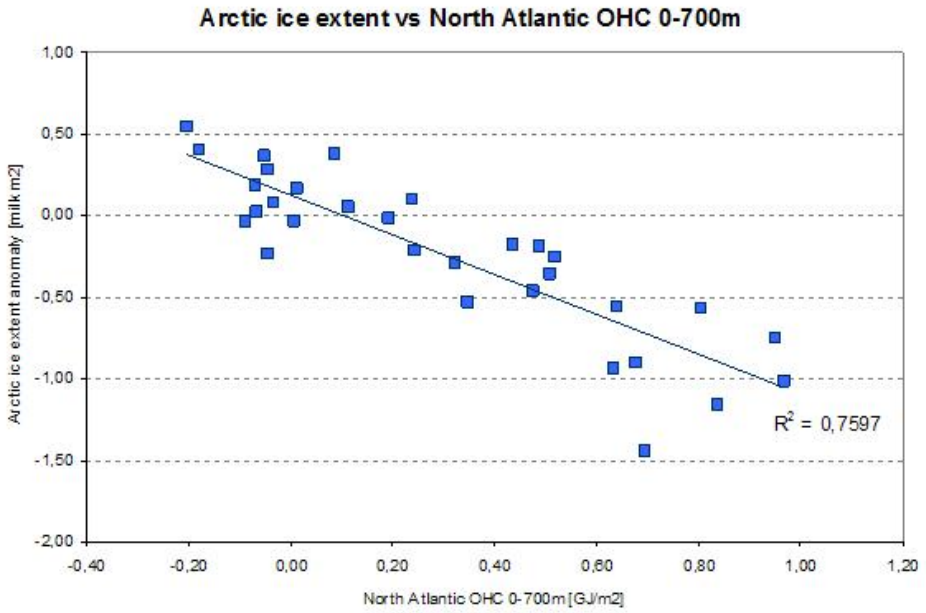


Frances et al. (GRL 2007) showed how the warming in the arctic and the melting ice was related to warm water (+3C) in the Barents Sea moving slowly into the Siberian arctic and melting the ice. She also noted the positive feedback of changed "albedo" due to open water then further enhances the warming.

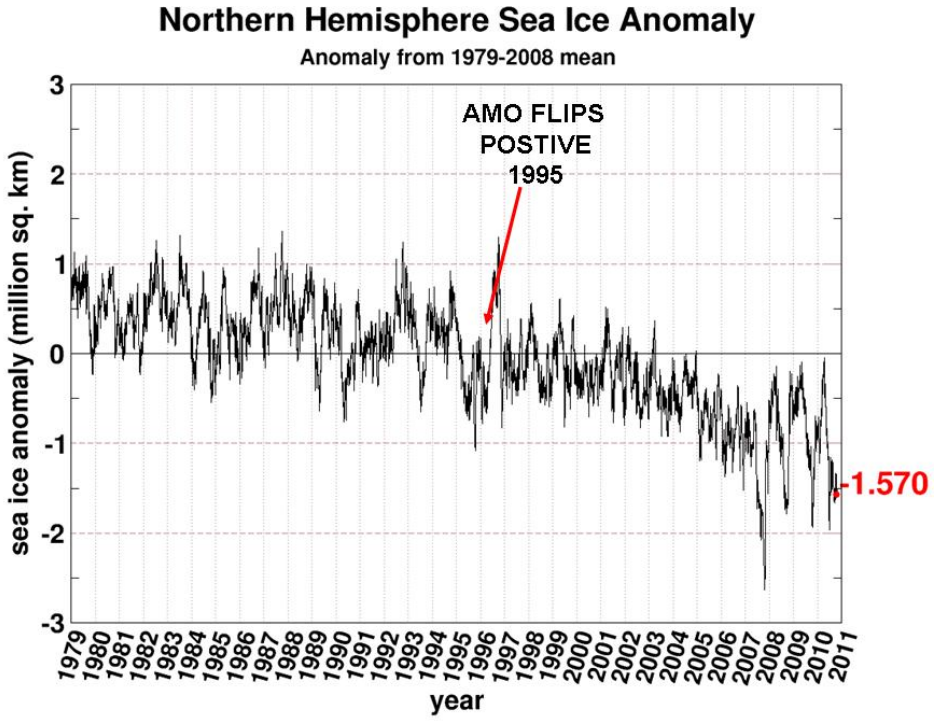
The International Arctic Research Center at the University of Alaska, Fairbanks showed how arctic temperatures have cycled with intrusions of Atlantic water –cold and warm.



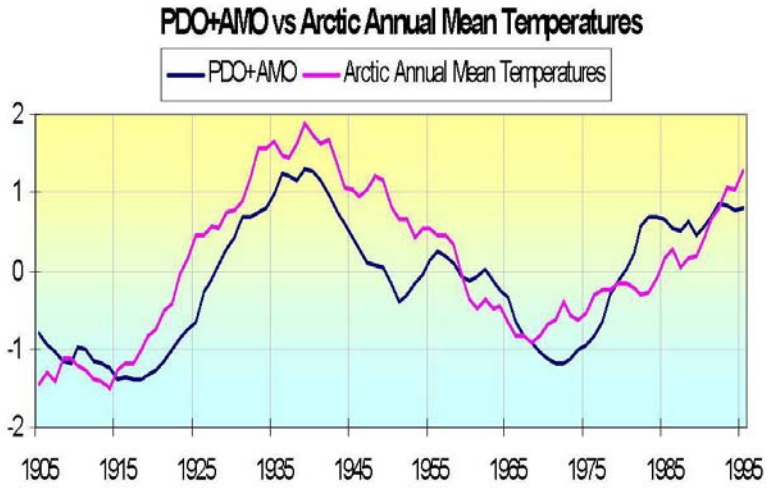
The correlation was also confirmed by [Juraj Vanovcan.]



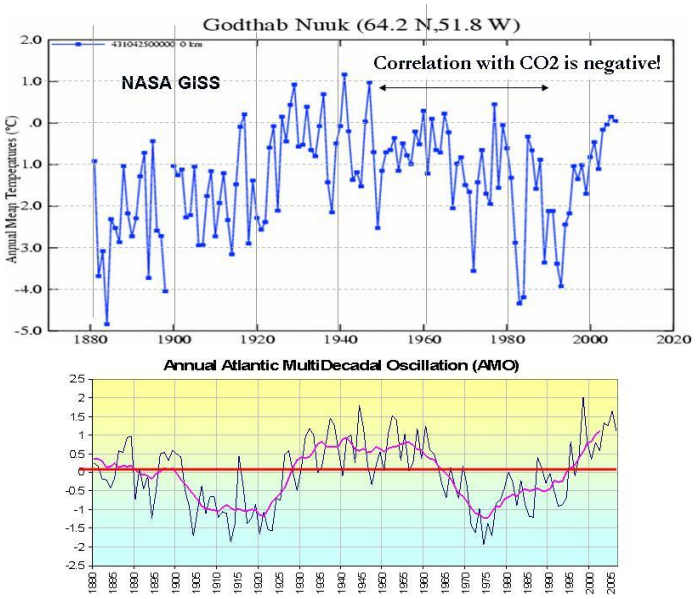
See how quickly the arctic ice reacts to warming of the Atlantic sea surface temperatures in 1995 (source Cryosphere Today). This marked a second leg down. We have seen large swings after the big dip in 2007 following a peak in Atlantic warmth in 2004-2005.



Although the PDO and AMO are measured differently, both reflect a tri-pole of ocean temperatures. Both have warm north and tropics and cool relative to normal in between in the positive phase and cold north and tropics and warm in between in the negative phase. By normalizing the two data sets and then adding the two, you get a measure of net warmth or cooling potential for both global and arctic temperatures. See how well the sum tracks with the arctic temperatures. Though we don't have measurements of ice extent, there are many stories and anecdotal evidence that arctic ice was in a major decline from the 1920s to 1940s.

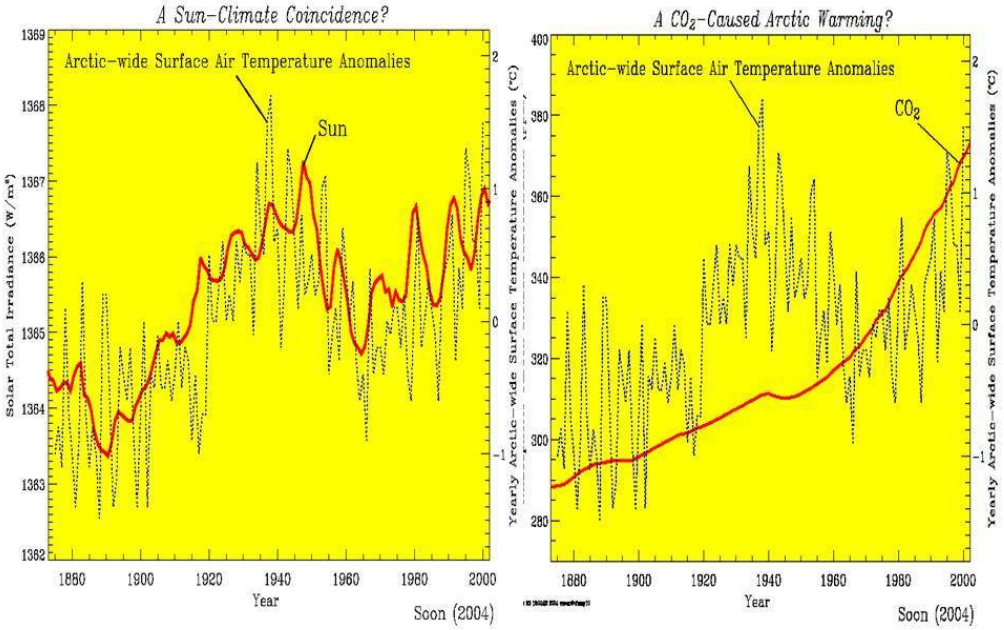


At the edge of the arctic Greenland behaves in the same way – with warming and cooling tied to the AMO.

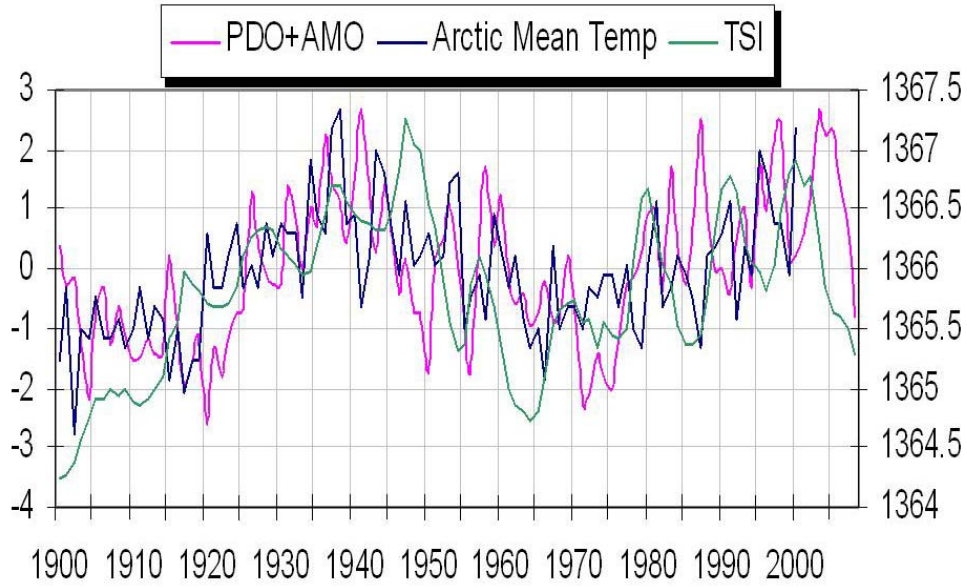


Dr. Willie Soon has shown how the arctic temperatures match the solar Total Solar Irradiance (Hoyt/Schatten/Willson) well. Correlation is poor with CO2.

The Sun is more likely the dominant driver of the recorded Arctic temperature variations



We see here how the annual TSI and annual PDO+AMO track together with arctic temperatures.



Though the current spike in the Atlantic temperatures and more high latitude blocking may cause another spike of melting in the next few winters as warm water from the AMO pop the last year works its way into the arctic, longer term you can expect arctic

temperatures to decline and ice to rebound as the Pacific stays cold and the Atlantic cools and the sun stays in its 213 year Eddy minimum.

That doesn't preclude some very cold and snowy winters short term. In 2008 glaciologist Bruce Molnia reported a bitterly cold Alaskan summer of 2008 following a La Nina winter with extreme cold and heavy snows resulted in area glaciers to expand, rather than shrink for the FIRST TIME IN RECORDED HISTORY. Summer temperatures, which were some 3 degrees below average, allowed record levels of winter snow to remain much longer, leading to the increase in glacial mass for the first time in at least 250 years.

See more on glaciers and icecaps here.