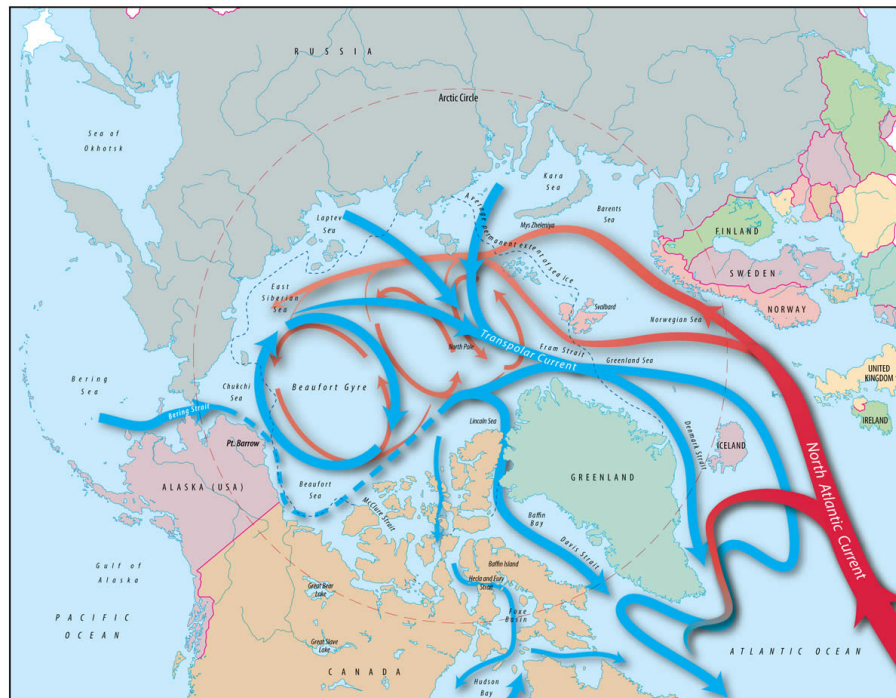


# The Real Arctic Story

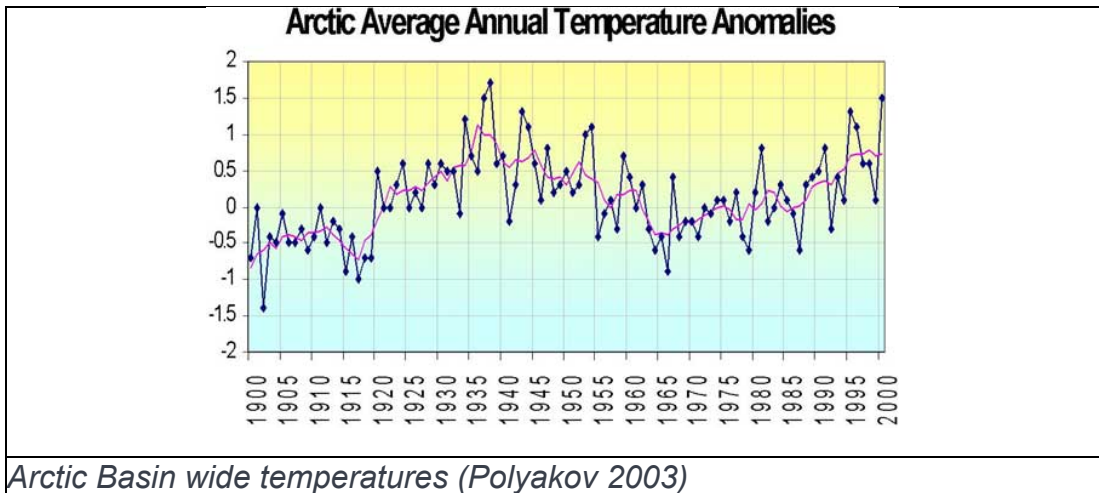
By Joe D'Aleo  
Friday, March 8, 2019

Arctic warming and the melting of the arctic ice are not at all unprecedented (they happen predictably on multidecadal scales with a period of around 60 years) and are in fact entirely natural. Warming results in part from the reduction of arctic ice extent because of flows of warm water into the arctic from the Pacific through the Bering Straits and from the Atlantic from the far North Atlantic Current. The warmer water thins the ice from beneath, slows the refreezing and limits to varying degrees the depth and extent of the ice.



The arctic ice unlike the Glaciers on land in Greenland, the Antarctic and in the world's mountain ranges is floating on water and the melting has no effect on sea level (much as ice in cold beverages doesn't cause the liquid to overflow the glass when it melts).

Polyakov et al (2002) created a temperature record using stations north of 62 degrees N. The late 1930s-early 1940s were clearly the warmest of the last century. In addition, the numbers of available observations in the late 1930s-early 1940s (slightly more than 50) is comparable to recent decades. '



## **MULTIDECADAL OCEAN CYCLES AND THE ARCTIC**

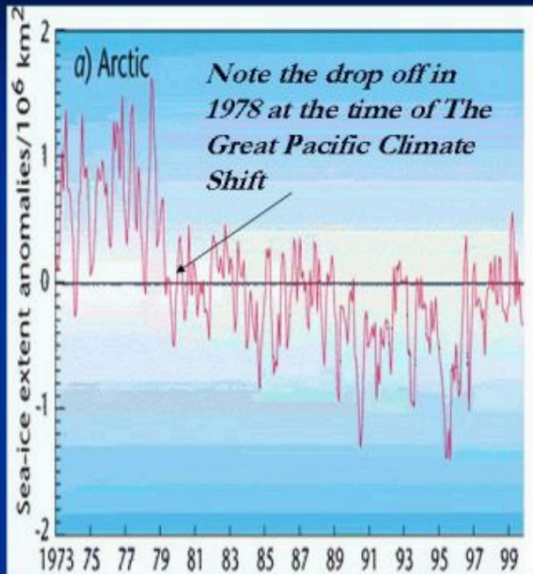
The Japan Agency for Marine-Earth Science and Technology in Yokosuka, Kanagawa Prefecture observed in a [story](#) in Yahoo Asia News in 2005 an ice shrinkage in the western Arctic Ocean from 1997 to 1998 that they attributed to "... by the flow to the area of warm water from the Pacific Ocean, not by atmospheric impact as previously thought". This was related to the super El Nino of 1997/98. JAMSTEC's Koji Shimada, the group's sub-leader, said the shrinkage was particularly severe in the Pacific side of the Arctic Ocean. The ocean's ratio of area covered with ice during the summer stood at about 60-80 percent from the 1980s to mid-1990s, but it went down to 15-30 percent after 1998, he said. Trenberth (1999) also has acknowledged this warming effect of El Nino on the arctic.

The cycle with respect to arctic temperatures and ice relate to multidecadal cycles in ocean temperatures in both the Pacific (Pacific Decadal Oscillation or PDO) and Atlantic (Atlantic Multidecadal Oscillation or AMO).

### **THE PDO**

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 repeating what happened in the 1910s to early 1940s time period.

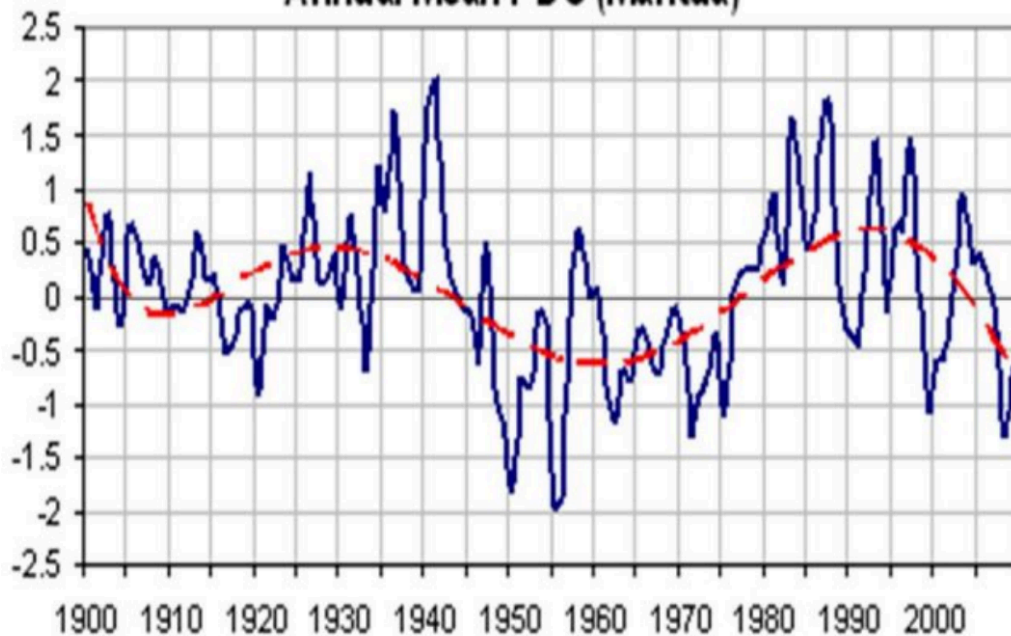
# Arctic



USGRCP, June 2000

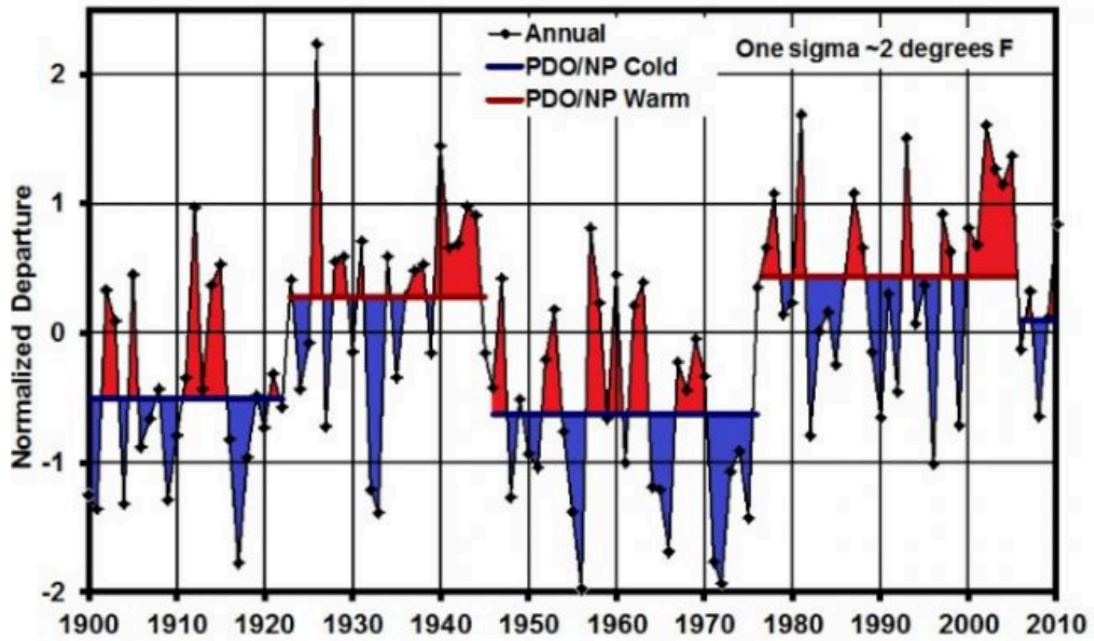
- Arctic ice has diminished in thickness and extent in the summer since the Great Pacific Climate shift in 1978 as warming North Pacific water made its way into the arctic through the Bering Straits
- Trenberth (1994) has suggested this El Nino arctic relationship.

## Annual Mean PDO (Mantua)



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

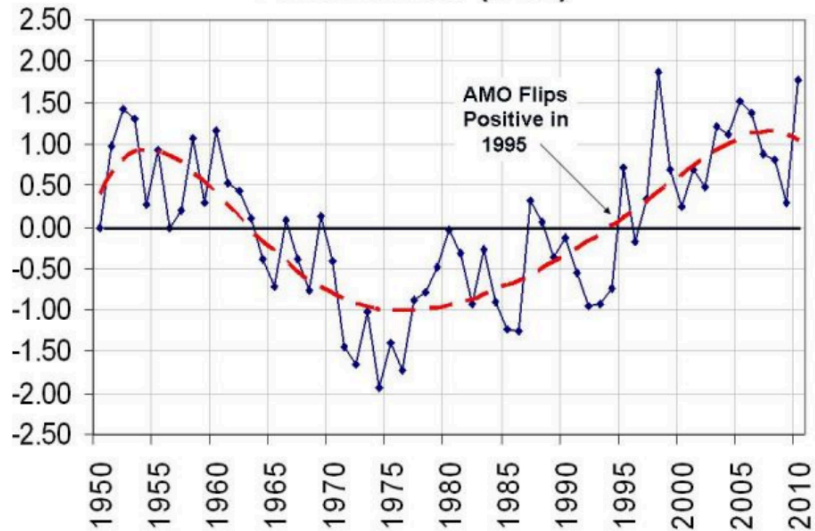
### Normalized Central Alaska Annual Temperatures Average of 9 stations, PDO/NP regimes superimposed



### THE AMO

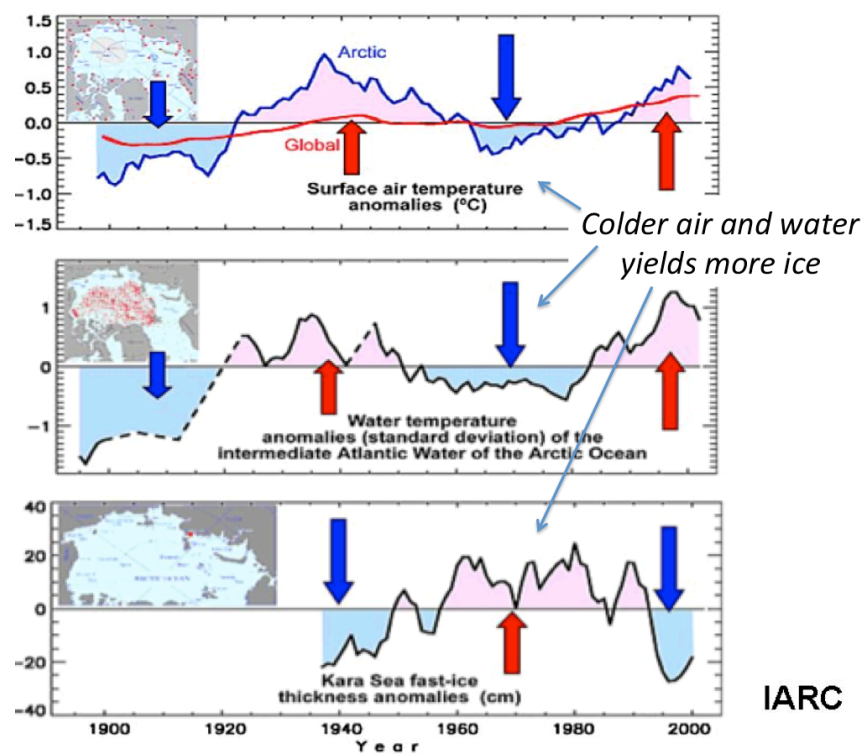
The Atlantic also cycles on a 60-70 year period. The Atlantic Multidecadal Oscillation or AMO returned to the positive warm mode in 1995.

### AMO Annual (STD)



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 beneath the ice.



### **THE IMPORTANCE OF THE ATLANTIC**

Of the two oceans, for the larger arctic basin, the Atlantic may be more important.

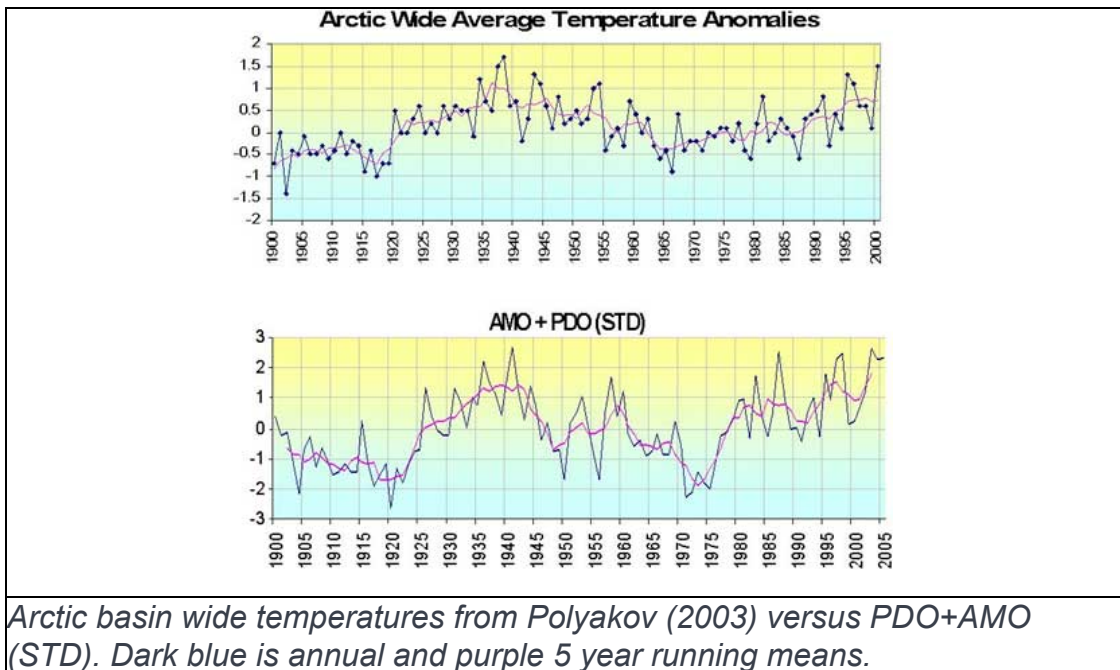
Pryzbylak (2000) says:

*“There exists an agreement in estimating temperature tendencies prior to 1950. Practically all (old and new) of the papers which cover this time period concentrate on the analysis of the significant warming which occurred in the Arctic from 1920 to about 1940....In the Arctic, the highest temperatures since the beginning of instrumental observation*

*occurred clearly in the 1930s. Moreover, it has been shown that even in the 1950s the temperature was higher than in the last 10 years."*

*"For arctic temperature, the most important factor is a change in the atmospheric circulation over the North Atlantic" The influence of the atmospheric circulation changes over the Pacific (both in the northern end and in the tropical parts) is significantly lower"*

As is the case for US temperatures, the combination of the PDO and AMO Indexes (PDO+AMO) again has considerable explanatory power for Arctic average temperature.



"In approximately the last 140 years, there have been two periods of significant temperature increases in the Arctic. The first began in around 1918–1920 and lasted until 1938 and has been called the '1930s warming' (Bengtsson et al. 2004). Other works have referred to this period as the 'Early Twentieth Century Warming' (ETCW, Brönnimann 2009) or the 'Early Twentieth Century Arctic Warming' (ETCAW, Wegmann et al. 2017, 2018)

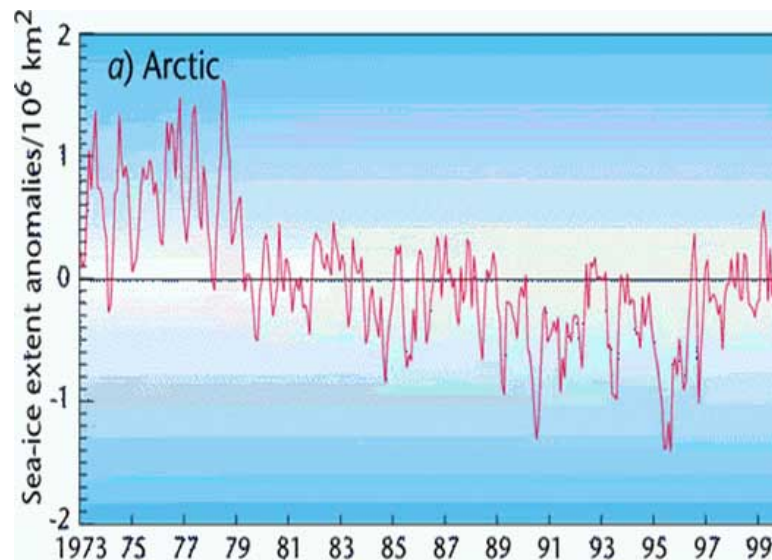
Karlen (2005) reported on historical temperatures in Svalbard (Lufthavn, at 78 deg N latitude), claiming that the area represents a large portion of the Arctic. It is reported that the "mean annual temperature increased rapidly from the 1910s to the late 1930s." Later, temperatures dropped, "and a minimum was reached around 1970." Once again, "Svalbard thereafter became warmer, but the mean temperature in the late 1990s was still slightly cooler than it was in the late 1930s."

Drinkwater (2006) concluded that "in the 1920s and 1930s, there was a dramatic warming of the air and ocean temperatures in the northern North Atlantic and the high Arctic, with the largest changes occurring north of 60°N," which "led to reduced ice cover in the Arctic and subarctic regions and higher sea temperatures." This was "the most significant regime shift experienced in the North Atlantic in the 20th century."

Hanna, et al (2006) estimated Sea Surface Temperatures (SSTs) near Iceland over a 119-year period based on measurements made at ten coastal stations located between latitudes 63°N and 67°N. They concluded that there had been "generally cold conditions during the late nineteenth and early twentieth centuries; strong warming in the 1920s, with peak SSTs typically being attained around 1940; and cooling thereafter until the 1970s, followed once again by warming - but not generally back up to the level of the 1930s/1940s warm period."

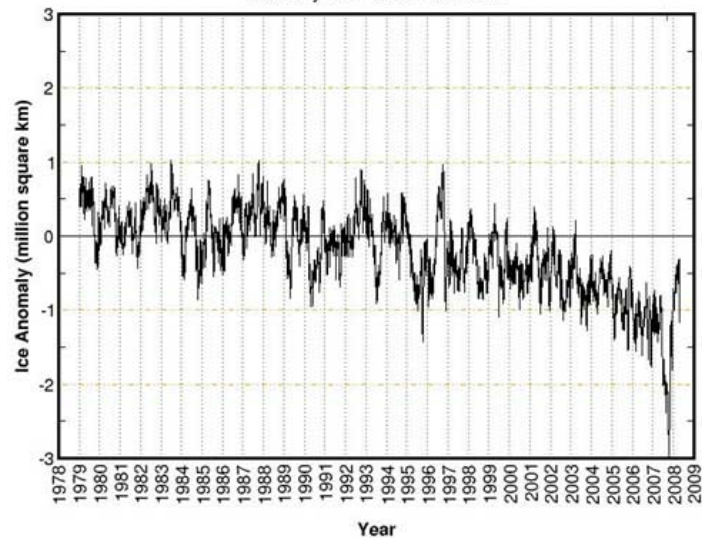
### ***THE EFFECT ON ICE COVER***

Both the Atlantic and Pacific play roles in arctic ice extent. The sea ice extent diminished following the Great Pacific Climate Shift (flip of the PDO to positive) in the late 1970s. It stayed relatively stable until early 2000s when a more precipitous decline began, related to a spike in North Atlantic warmth and a positive AO.



## Northern Hemisphere Sea Ice Anomaly

Anomaly from 1978-2000 mean



Dmitrenko and Polyokov (2003) observed that warm Atlantic water in the early 2000s from the warm AMO that developed in the middle 1990s had made its way under the ice to off of the arctic coast of Siberia where it thinned the ice by 30% much as it did when it happened in the last warm AMO period from the 1880s to 1930s.

The University of Colorado's National Snow and Ice Data Center (NSIDC) summarized the role of the ocean cycles very well in October 2007 in this way:

*“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.*

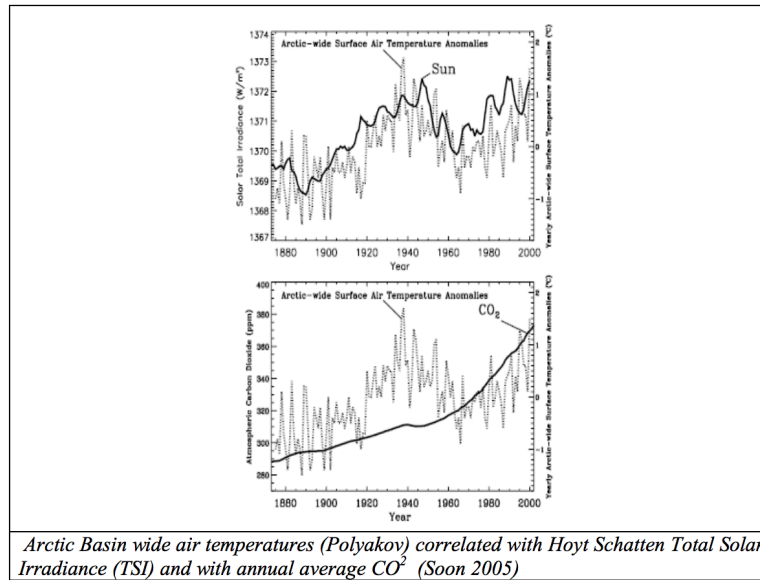
*Another scientist, Koji Shimada of the Japan Agency for Marine–Earth Science and Technology, reports evidence of changes in ocean circulation in the Pacific side of the Arctic Ocean. Through a complex interaction with declining sea ice, warm water entering the Arctic Ocean through Bering Strait in summer 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 SUN AS THE ULTIMATE DRIVER FOR CLIMATE IN ARCTIC

As to the driver for the multidecadal ocean cycles, Soon (GRL 2005) showed how the Arctic temperatures (Polyakov) correlated extremely well with the total solar irradiance (Hoyt-Schatten) (r-squared of 0.79). This compared to an r-squared correlation of just 0.22 with the CO<sub>2</sub> .



## SUMMARY

Multidecadal Oscillations in the Pacific and the Atlantic are acknowledged to be the result of natural processes. The warm mode of the Pacific results in warm water off Alaska that can enter the arctic through the Bering Strait and produce arctic ice melt. The warm mode of the AMO also results in warming in the North Atlantic waters, which are carried by the North Atlantic current into the arctic reducing ice depth and extent. When you combine the two cycles, you can explain the temperature and ice cover variances of the past 110 years for the Arctic.

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**ADDENDUM:**

Bloomberg, Washington Post and other media are reporting on the sudden loss of ice off Alaska in the Bering Sea. It is weather related as reported by the KTUU.

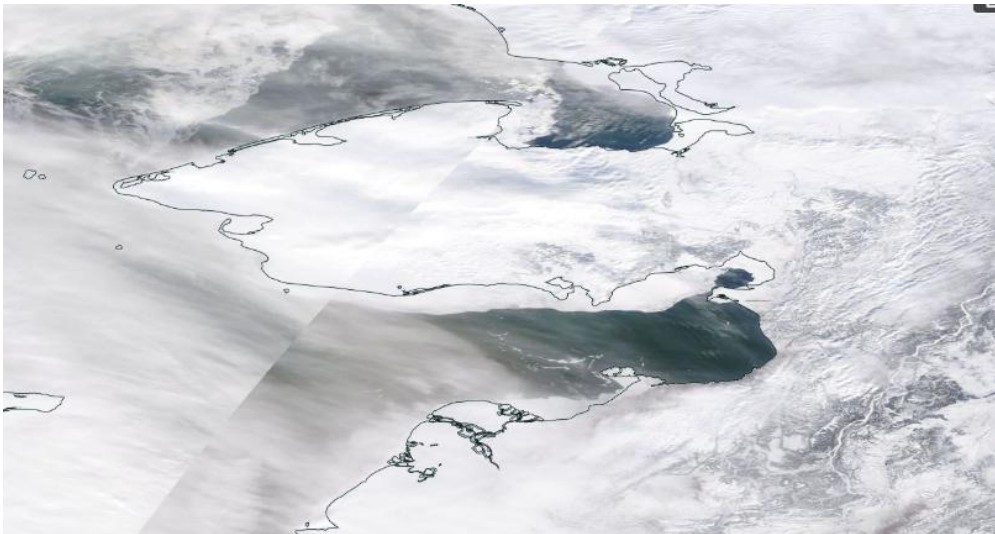
NOTE from [KTUU](#)

A parade of storms through the month of February has decimated the sea ice in the Bering Sea. At the end of January, sea ice extended south beyond Nunivak Island. With high pressure over the eastern half of Alaska, a series of strong storms were guided up the west coast of the state.

The storms that have moved through the Bering Sea are drawing warm air with them, which melts the ice. High winds and high seas also move the ice around and break it up.

There is open water in Norton Sound though some shore-fast ice remains in Norton Bay. There is also almost open water in Kotzebue Sound. There is still ice around the southern coast of the Seward Peninsula, but much of that has been pushed close to the shore by winds and high seas.

Mary-Beth Schreck, Sea Ice Program Lead with the Anchorage office of the National Weather Service, says she doesn't believe the ice will keep melting, and that as the weather pattern changes, which it's expected to do this week, the ice will rapidly rebuild.



Bering Sea March 2019

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Note in 2012, when Anchorage set an all-time snow (133.6 inches, breaking the record of 132.6 inches set in 1954-1955) in a brutal winter, Bering Sea ice set a new record that still stands.

### Bering Sea Ice Area

