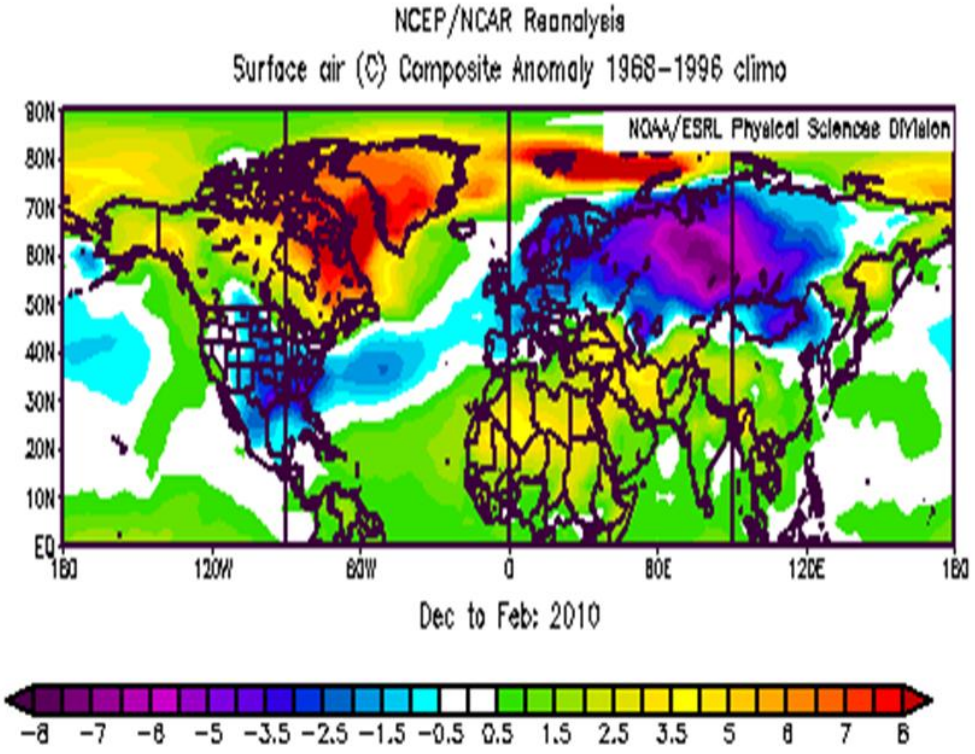
Overall Warming Of The Earth's Northern Half Could Result In Cold Winters

Article: Petoukhov, V., and V. A. Semenov (2010), A link between reduced Barents-Kara sea ice and cold winter extremes over northern continents, J. Geophys. Res., 115, D21111[doi:10.1029/2009JD013568]

Press Release by the Potsdam Institute for Climate Impact Research (PIK) here. Here are excerpts from the release/paper:

"The overall warming of the earth's northern half could result in cold winters. The shrinking of sea-ice in the eastern Arctic causes some regional heating of the lower levels of air - which may lead to strong anomalies in atmospheric airstreams, triggering an overall cooling of the northern continents, a study recently published in the Journal of Geophysical Research shows. "These anomalies could triple the probability of cold winter extremes in Europe and northern Asia," says Vladimir Petoukhov, lead author of the study and climate scientist at the Potsdam Institute for Climate Impact Research. "Recent severe winters like last year's or the one of 2005-06 do not conflict with the global warming picture, but rather supplement it."

Here is the surface temperature pattern in 2009/10:



The researchers base their assumptions on simulations with an elaborate computer model of general circulation, ECHAM5, focusing on the Barents-Kara Sea north of Norway and

Russia where a drastic reduction of ice was observed in the cold European winter of 2005-06. Those surfaces of the sea lacking the ice cover lose a lot of warmth to the normally cold and windy arctic atmosphere. What the researchers did was to feed the computer with data, gradually reducing the sea ice cover in the eastern Arctic from 100 percent to 1 percent in order to analyze the relative sensitivity of wintertime atmospheric circulation.

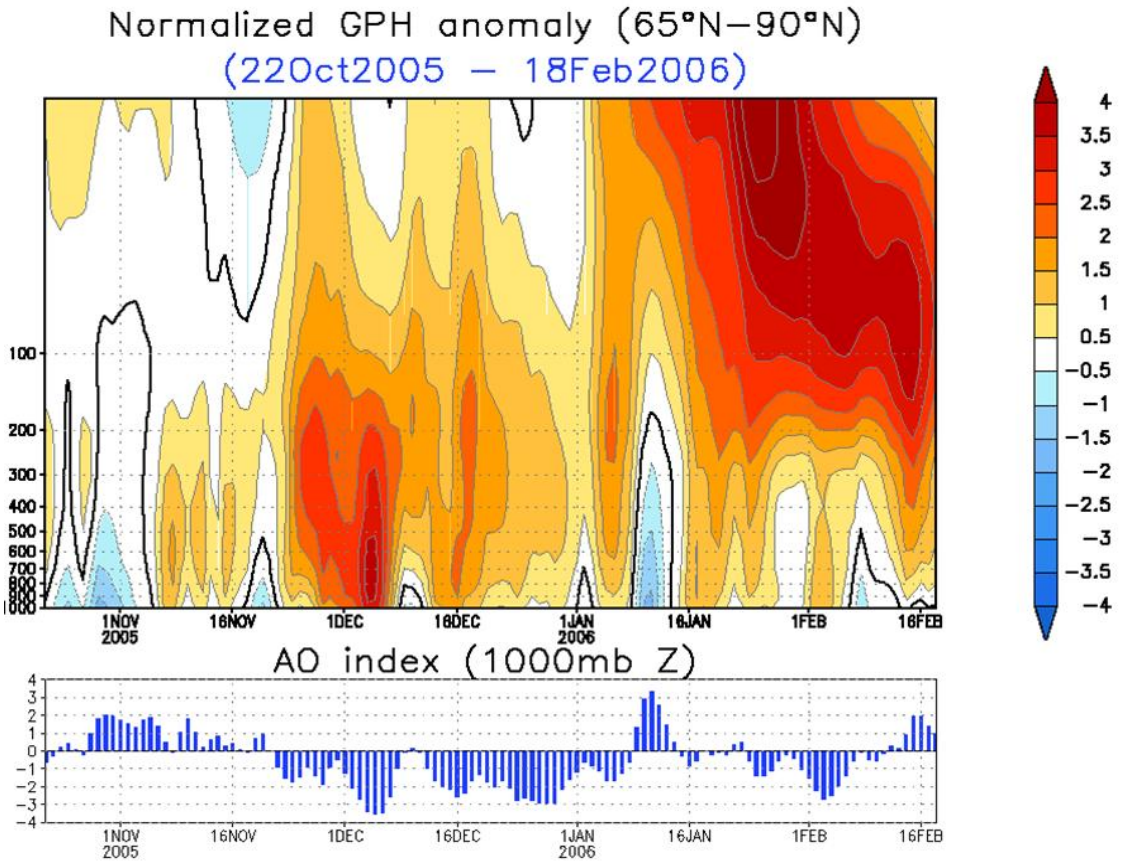
“Our simulations reveal a rather pronounced nonlinear response of air temperatures and winds to the changes of sea-ice cover,” Petoukhov, a physicist, says. “It ranges from warming to cooling to warming again, as sea ice decreases.” An abrupt transition between different regimes of the atmospheric circulation in the sub-polar and polar regions may be very likely. Warming of the air over the Barents-Kara Sea seems to bring cold winter winds to Europe. “This is not what one would expect,” Petoukhov says.

“Whoever thinks that the shrinking of some far away sea-ice won’t bother him could be wrong. There are complex teleconnections in the climate system, and in the Barents-Kara Sea we might have discovered a powerful feedback mechanism.”

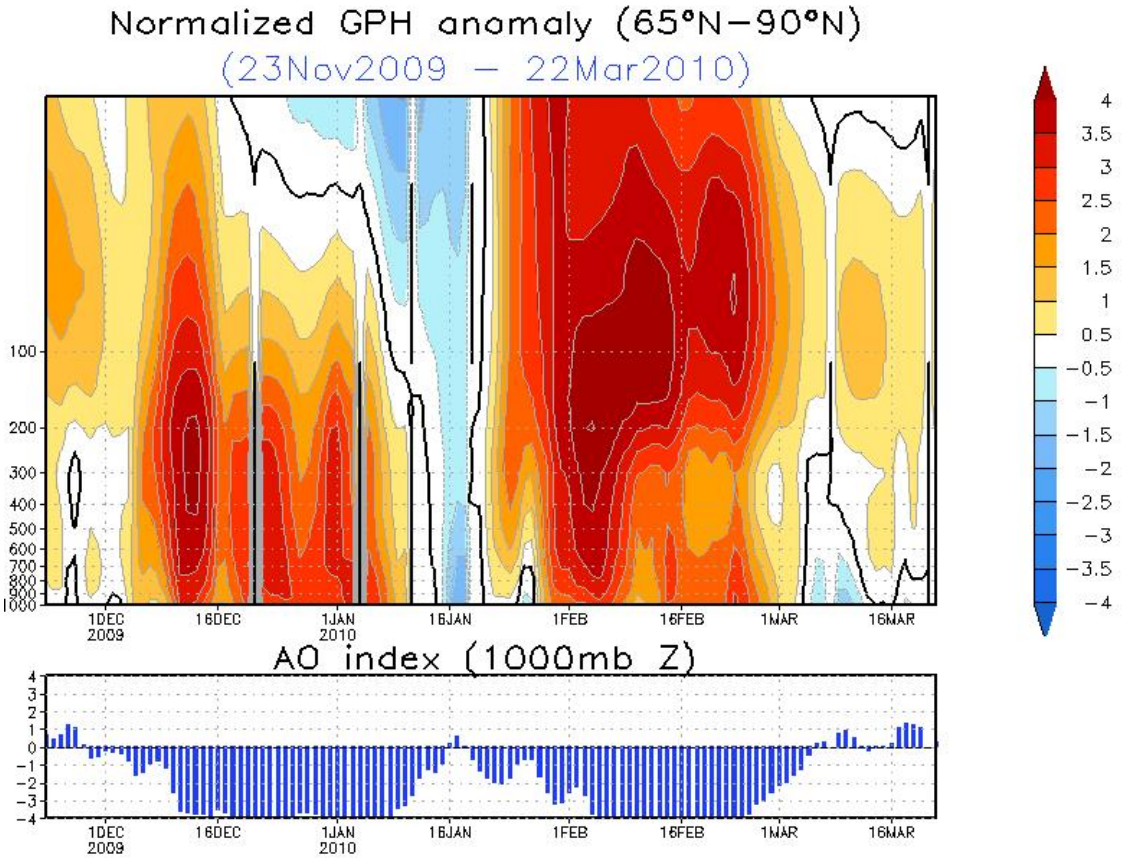
Other approaches to the issue of cold winters and global warming referring to reduced sun activity or most recently the gulf stream “tend to exaggerate the effects,” Petoukhov says. The correlation between these phenomena and cold winters is relatively weak, compared to the new findings referring to the processes in the Barents-Kara Sea. Petoukhov also points out that during the cold winter of 2005-06 with temperatures of ten degrees below the normal level in Siberia, no anomalies in the North Atlantic Oscillation have been observed.

Comments:

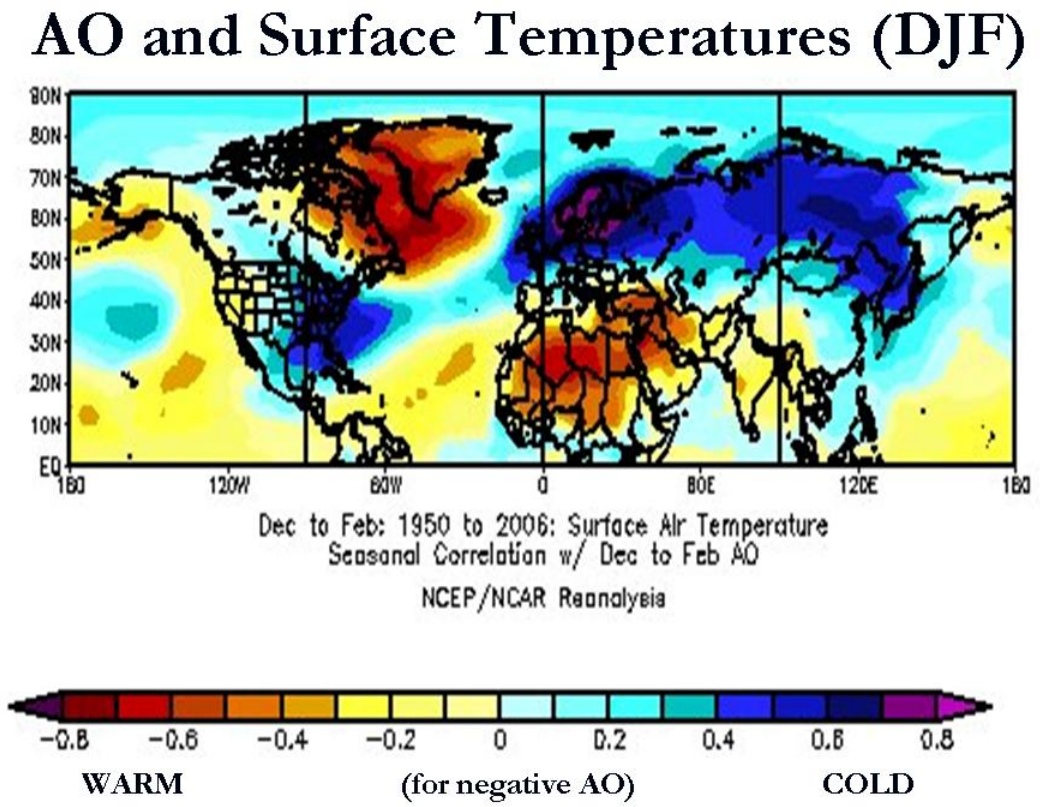
We agree that the arctic oscillation and the Atlantic component (the NAO) has a profound effect on winter temperatures. T he arctic oscillation corresponds very well with Siberia temperatures. The AO was profoundly negative in 2005/06 (with a brief exception in January, much like in 2009/10) thanks to a strong stratospheric warming event (anomalies 65-90 N for the 2005/06 winter with depiction of AO below). Note the dominance of this warming and of the negative AO that winter as was the case in 2009/10, the other example given by the authors.



An even stronger warming in 2009/10 led to an even more negative AO.



The AO correlation with temperatures shows a very cold Siberia.

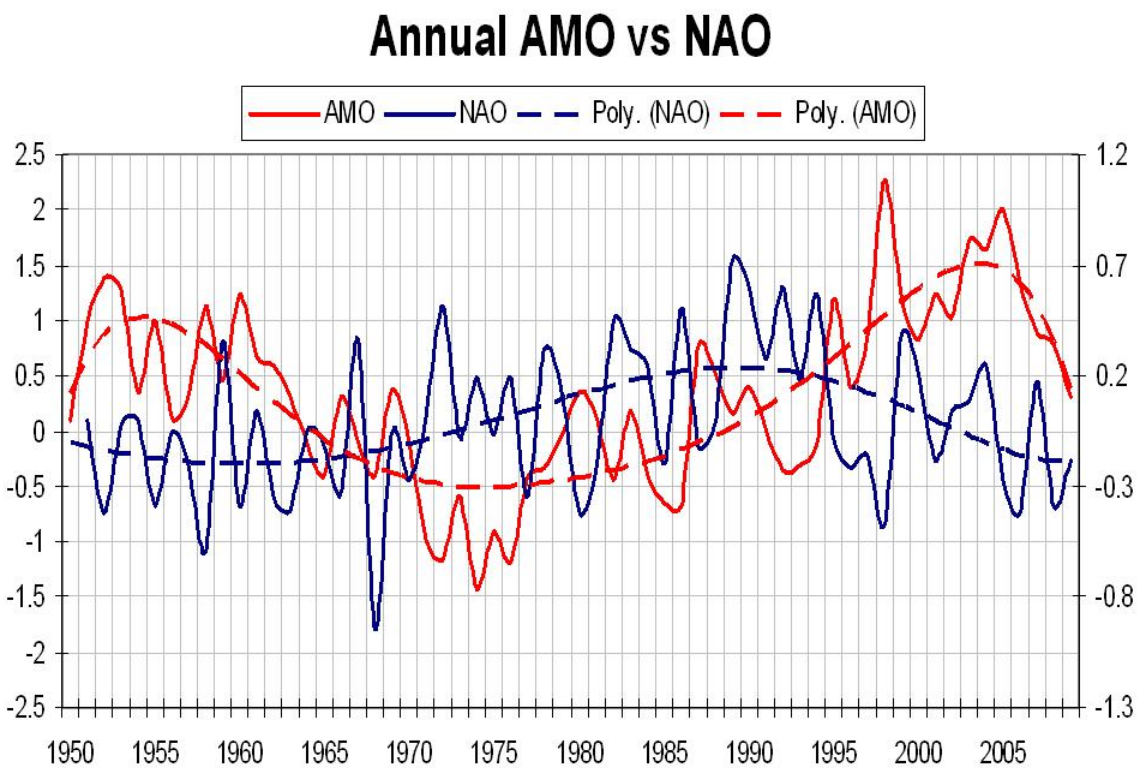


The study says the NAO was not supporting the cold. This was true in January (again like the AO), but the NAO was negative in November, December, February and March. See NOAA table column 3 here.

This finding is not new. Frances 2005 showed how warm water in the Barents Sea makes its way into the arctic and produces melting of arctic ice near Siberia several years later. A peak in warming in the Barents Sea in 2004 and 2005 led to the record (since 1979) melt in 2007.The accompanying changes in albedo, enhance the warming and feedback to at least early winter blocking. See how the NAO (and most times the AO which correlates well with NAO with a Pearson coefficient of 0.75) relates to the Atlantic warming as indicated by the AMO (Atlantic Multidecadal Oscillation) which represents the Atlantic Basin temperatures from 0 to 70N. A positive AMO usually means a warm tropical Atlantic and warm water in the Barents Sea. As the authors have found, the warm Atlantic correlates with a greater tendency for a negative AO and NAO. The cyclical nature suggests natural causation.

Levitus (2009) suggested this AMO driven cyclical behavior of the North Atlantic sea surface temperatures. The abstract suggested

“We present area-averaged time series of temperature for the 100–150 m depth layer of the Barents Sea from 1900 through 2006. This record is dominated by multidecadal variability on the order of 4_C which is correlated with the Atlantic Multidecadal Oscillation Index."



The authors have ‘discovered’ a relationship operational forecasters have been using for many years.

Additional Reference:

Francis, J.A. and E. Hunter, 2007: Drivers of declining sea ice in the Arctic Winter, Geophysical Research Letters,34, L17503, doi:10.1029/2007GL030995. PDF

Levitus, S., et al "Barents Sea multidecadal variability" Geophysical Research Letters Vol 36 published 9 October 2009 L19604