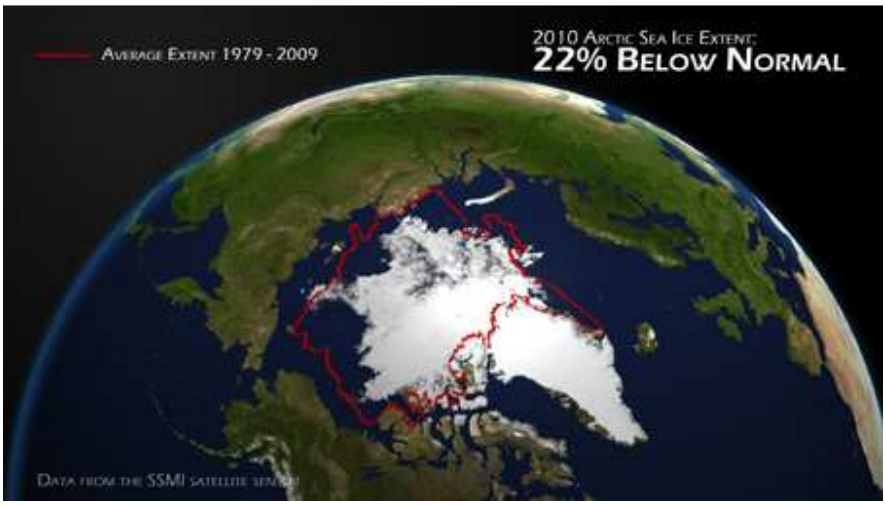
Arctic sea ice loss linked to severe U.S. winters

*** Warm, a bit showery: Full Forecast | The Mall in fall ***



Arctic sea ice extent at the end of the 2010 melt season (solid white) was 22 percent below the 1979-2000 average (red outline) and the third-lowest in the satellite record.

Last winter's record wallops of heavy snow had many in the mid-Atlantic wondering what happened to global warming. If the planet were warming as scientists say it is, shouldn't we be receiving less snow? (Not necessarily, I reported at the time). Now comes word that, paradoxically, cooler winters with heavier snowfall in regions such as the mid-Atlantic may be connected to rapid warming and sea ice loss in the Arctic.

In other words, Arctic climate change, which studies have concluded is likely due in part to human activities, could favor cooler and snowier winters in places far removed from the far north.

Of course, this would not hold true in every winter, since multiple natural climate factors, such as El Nino in the Pacific Ocean and the North Atlantic Oscillation (NAO) in the Atlantic, compete for influence over the region's weather, in addition to longer-term climate change. But a new "Arctic Report Card" released last week by the National Oceanic and Atmospheric Administration (NOAA) and prepared by an international team of researchers contains curious insights into how Arctic climate change, which may at first seem disconnected from events here at home, may be influencing weather patterns in the northern mid-latitudes.

As Nick Sundt reports on the WWF climate blog, the Report Card discusses the aptly named "Warm Arctic-Cold Continents" pattern that existed last winter, and ties it in part to sea ice loss from a warming climate.

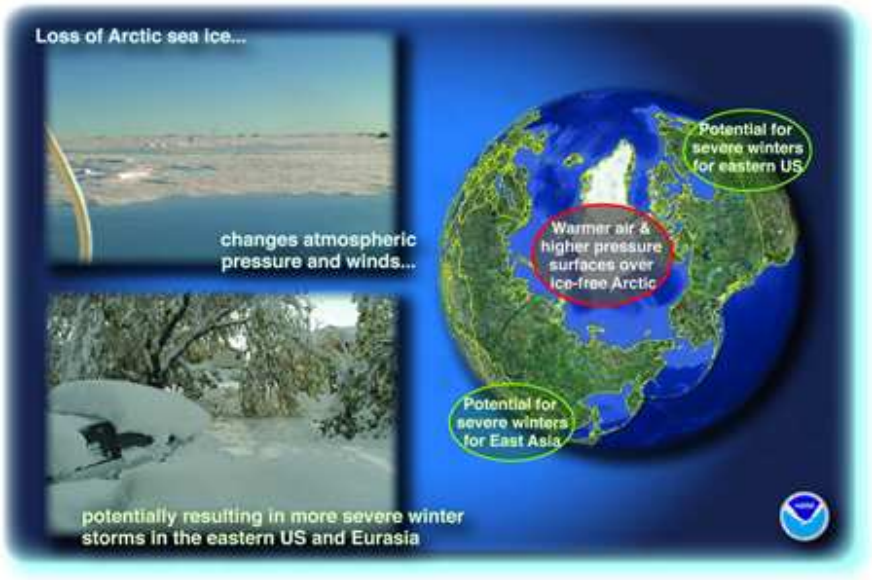
In the atmosphere section of the lengthy report, the authors write: "There is evidence that the effect of higher air temperatures in the lower Arctic atmosphere in fall is contributing to changes in the atmospheric circulation in both the Arctic and northern mid-latitudes. Winter 2009-2010 showed a new connectivity between mid-latitude extreme cold and snowy weather events and changes in the wind patterns of the Arctic; the so-called Warm Arctic-Cold Continents pattern."

Two of the three authors of the atmosphere section of the report - Jim Overland of NOAA and Muyin Wang of the University of Washington - published a study last year on changes in atmospheric circulation related to Arctic warming and sea ice loss that came to similar conclusions, but without the benefit of observations during the anomalous winter of 2009-2010.

As detailed in the Report Card, a key reason why Arctic air temperatures have warmed in the fall and winter is because of greater sea ice loss during the summer melt season. Sea ice is white in color, and therefore it efficiently reflects incoming solar radiation, cooling the ocean and lower atmosphere. But when sea ice melts, the darker ocean waters are exposed to the sun, which boosts both water and air temperatures. This phenomenon is known as "Arctic amplification."

The ensuing warming raises the height of atmospheric pressure surfaces (known to meteorologists as "geopotential heights") over the North Pole. In fact, the report notes that the winter of 2009-2010 featured "one of the three largest Arctic high-pressure events

since 1850." The higher pressure surfaces are thought to change large-scale wind patterns and can lead to bouts of severe winter weather in the eastern United States and East Asia.



Possible impacts of sea ice loss on atmospheric circulation in the northern mid-latitudes. Credit: NOAA.

A related NOAA website states: "Although progress towards a comprehensive understanding of the connection between Arctic sea ice and climate has been slow, sea ice has been recognized as the primary means by which the Arctic can impact the global climate."

Arctic sea ice at the end of the 2010 melt season was the third-lowest in the satellite record, which dates back to 1979. In a study published in June researchers used "proxy" records, such as sediment cores, to extend the record of sea ice extent much further back in time, and found that recent ice loss is unmatched over at least the last few thousand years. The causes of sea ice loss include both warming related to emissions of greenhouse gases as well as natural variability.

The Report Card appropriately cautions that Arctic warming is just one factor influencing U.S. and Eurasian weather, but it notes that it may become a more prominent driver in coming years if recent warming and melting trends continue. It states:

"While individual weather extreme events cannot be directly linked to larger scale climate changes, recent data analysis and modeling suggest a link between loss of sea ice and a shift to an increased impact from the Arctic on mid-latitude climate. Models suggest that loss of sea ice in fall favors higher geopotential heights over the Arctic. With future loss of sea ice, such conditions as winter 2009-2010 could happen more often. Thus we have a potential climate change paradox. Rather than a general warming everywhere, the loss of sea ice and a warmer Arctic can increase the impact of the Arctic on lower latitudes, bringing colder weather to southern locations."

The Arctic Report Card contains richly detailed information on all aspects of the rapidly changing Arctic environment, including updated data on the melting of Greenland's ice sheet. It is well worth reading in order to understand the profound, and potentially irreversible, transformation taking place at the top of the planet.

The views expressed here are the author's alone and do not represent any position of the Washington Post, its news staff or the Capital Weather Gang.