Tested: Idea that sea ice steadies jet stream, blocking cold winters

Enlarge / Cold weather for the Midwest on January 29, 2019.

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A lot has been made of the possibility that the loss of Arctic sea ice could make mid-latitude weather weirder by causing wriggling meanders in the jet stream. One possible manifestation of that is bitter cold snaps in winter, as Arctic air slides south along with the jet stream boundary. There is a correlation between cold mid-latitude winters and low sea ice cover in the Arctic. But does the one really cause the other?

The possible relationship between a warming Arctic and changing behavior of the jet stream is still a matter of real scientific debate. For a number of reasons, it’s a difficult question to resolve. In this case, a team led by the University of Exeter’s Russell Blackport tried to disentangle the chain of events with a clever analysis.

Checking causality

Ultimately, the question is whether shrinking sea ice allows the ocean to warm the atmosphere, or whether the warm air forms separately and then melts the sea ice. The researchers

used a pair of climate models and global maps of observed weather; the measurement gaps were filled in by simulated physics. First, the team categorized each winter in North America and Asia based on two measures: cooler or warmer mid-latitude temperatures and lower or higher Arctic sea ice. As in other studies, they found a correlation between the two.

They then turned to calculating the flow of heat between the Arctic atmosphere and ocean, categorizing winters dominated by heat moving into the atmosphere or heat moving into the ocean. If lower sea ice coverage was responsible for the cold mid-latitude winters, you'd expect to see heat moving from the ocean into the atmosphere (and bullying the jet stream) in those years. But instead, they saw the opposite—low sea ice winters were associated with heat coming in the atmosphere that would cause the sea ice to melt.

The researchers did the same thing on shorter timescales, looking to see what came first. They found that the mid-latitude cold weather—and movement of heat from the atmosphere into the ocean—was present about a month before drops in sea ice extent. One month after, they could see heat moving from the newly exposed ocean into the atmosphere, but the cold weather in the mid-latitudes had already ended.

A single cause

In other words, unusual atmospheric circulation patterns would start the wiggle in the jet stream, which both brings cold air south to the mid-latitudes and warm air north to melt sea ice. So the correlation between low sea ice coverage and cold mid-latitude winters is actually because they are both being caused by the same thing.

For a third way of checking this, the researchers ran climate model simulations where Arctic sea ice coverage was set to be smaller than it is today, just without any further greenhouse gas increases and global warming. The idea was to isolate the

effect of the sea ice itself. In the simulation, there was still a correlation between low sea ice winters and cold in the mid-latitudes, but the mid-latitudes didn’t get any colder than they were with modern, greater sea ice coverage—supporting the overall conclusion.

This doesn’t mean there’s no connection between global warming and a wriggly jet stream. That research will continue. It does, however, mean that suggestions of a link between shrinking Arctic sea ice and wilder mid-latitude winters were off the mark.

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