Climate scientists find more evidence linking Arctic warming to jet stream movement

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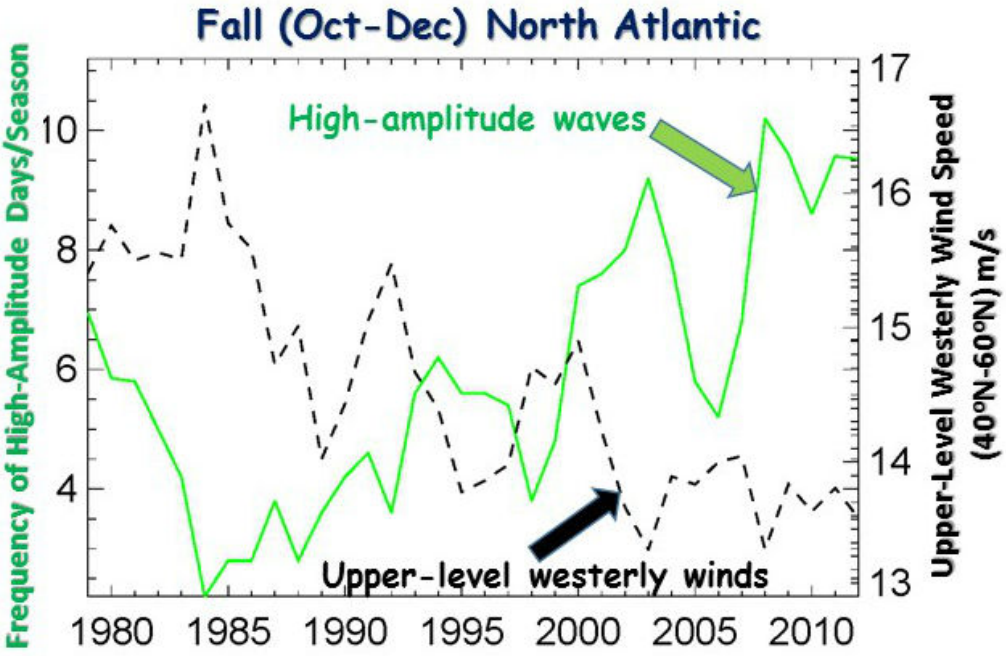

A chart showing the increase in the frequency of highly amplified jet-stream patterns, which scientists believe is related to extreme weather events. Credit: Jennifer Francis

Findings from a new Rutgers University climate change study support

previous research that shows a link between the rapidly warming Arctic and an increase in extreme weather events.

Using self-organizing maps – statistical tools to help identify characteristic patterns in a data set – Rutgers climate scientists Jennifer Francis and Natasa Skific studied 48 years worth of daily atmospheric information to detect weather patterns that occur repeatedly.

The patterns they found validated previous study findings that the polar jet stream has been meandering more north and south in the past two decades rather than traveling in a relatively straight path. Scientists are studying the relation of changing jet stream patterns and Arctic warming to extreme weather conditions.

"When the jet stream has large northward bulges (called ridges), strong Arctic warming intensifies the ridge, causing it to become more persistent," Francis said. These large waves have become more frequent in recent years and many studies, including these two from Rutgers, link them to extreme weather events, such as the severe cold spells in the northern hemisphere this winter, the enduring drought in the west, and major storms like Hurricane Sandy in 2012.

"The analysis we just did with the self-organizing maps revealed that, yes indeed, we see the wavy jet stream patterns are becoming more amplified," Francis said.

The study, "Evidence Linking Rapid Arctic Warming to Mid-latitude Weather Patterns," was published June 1 in the science journal, *Philosophical Transactions of the Royal Society*. The data also allowed researchers to determine whether the increased waviness is because high-amplitude patterns are happening more often, or if each of the characteristic patterns is becoming wavier. Francis said the second effect is what is occurring, "because the warming Arctic is elongating those

ridges."

That, Francis said, is contributing to the extended drought problems in California and other western states, as well as the persistent snowy weather patterns in the Northeast this winter. "When those ridges get stronger, they become much more persistent," she said.

The study notes that while it is difficult to say with certainty that the Arctic's amplified sensitivity to temperature change is the cause of any specific extreme weather event, "these are the types of phenomena that are expected to occur more often as the world continues to warm and the Artic continues to lose its ice." In the past 30 years, the volume of Arctic sea ice has declined by about 60 percent.

"These changes in circulation are expected to lead to persistent weather patterns that are known to cause extreme weather events," the paper says. "As emissions of greenhouse gases continue unabated, therefore, the continued amplification of Arctic warming should favor an increased occurrence of extreme events caused by prolonged weather conditions."

More information: Evidence linking rapid Arctic warming to mid-latitude weather patterns, DOI: 10.1098/rsta.2014.0170

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