

Is Arctic warming influencing the UK's extreme weather?

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Snowy weather. Credit: University of Lincoln

Severe snowy weather in winter or extreme rains in summer in the U.K. might be influenced by warming trends in the Arctic, according to new findings.

Climate scientists from the U.K. and the U.S. examined historic data of extreme weather events in the U.K. over the past decade and compared them with the position of the North Atlantic polar atmospheric jet stream using a measure called the North Atlantic Oscillation (NAO) index.

The NAO indicates the position of the jet stream – which is a giant current of air that broadly flows eastwards over mid-latitude regions around the globe – through a diagram which shows 'negative' and 'positive' spikes, similar to how a heart monitor looks.

The researchers highlight that the exceptionally wet U.K. summers of 2007 and 2012 had notably negative readings of the NAO, as did the cold, snowy winters of 2009/2010 and 2010/2011, while the exceptionally mild, wet, stormy winters experienced in 2013/2014 and 2015/2016 showed pronounced positive spikes.

The scientists also highlighted a correlation between the jet stream's altered path over the past decade – so-called jet stream 'waviness' – and an increase during summer months in a phenomenon called Greenland high-pressure blocking, which represents areas of high pressure that remain nearly stationary over the Greenland region and distort the usual progression of storms across the North Atlantic.

Increased jet waviness is associated with a weakening of the jet stream, and the accompanying 'blocking' is linked to some of the most extreme U.K. seasonal weather events experienced over the past decade. The strength and path of the North Atlantic jet stream and the Greenland blocking phenomena appear to be influenced by increasing temperatures in the Arctic which have averaged at least twice the global warming rate over the past two decades, suggesting that those marked changes may be a key factor affecting [extreme weather conditions](#) over the U.K., although an Arctic connection may not occur each year.

Edward Hanna, Professor of Climate Science and Meteorology at the University of Lincoln's School of Geography, carried out the study with Dr. Richard Hall from the University, and Professor James E Overland from the U.S. National Oceanographic & Atmospheric Administration Pacific Marine Environmental Laboratory.

Professor Hanna said: "Arctic warming may be driving recent North Atlantic atmospheric circulation changes that are linked to some of the most [extreme weather events](#) in the U.K. over the last decade.

"In winter, a positive North Atlantic Oscillation (NAO) is linked with a more northward, vigorous jet and mild, wet, stormy weather over the U.K., while a negative NAO tends to be associated with a more southerly-positioned jet and relatively cold and dry but sometimes snowy conditions. In summer the jet stream is displaced further north, so a positive NAO is typically associated with warm dry weather, while a negative NAO often corresponds to wetter, cooler U.K. weather conditions.

"While part of the uneven seasonal North Atlantic Oscillation changes might be due to natural random fluctuations in atmospheric circulation, the statistically highly unusual clustering of extreme NAO values in early winter, as well as extreme high summer Greenland Blocking Index values since 2000, suggest a more sustained, systematic change in the North Atlantic atmospheric circulation that may be influenced by longer-term external factors. This includes possible influences from the tropical oceans and solar energy changes as well as the extreme warming that has recently occurred in the Arctic.

"Of course, weather is naturally chaotic, and extremes are a normal part of our highly variable U.K. climate, but globally there has recently been an increase in the incidence of high temperature and heavy precipitation extremes. The cold U.K. winter episodes we noted are not so intuitively linked to global climate change but reflect part of a long-term trend towards more variable North Atlantic atmospheric circulation from year to year during winter months, especially early [winter](#).

"This trend has culminated in the last decade having several record negative and positive December values of the North Atlantic Oscillation,

with lots of resulting disruption from extreme [weather](#) over the U.K.. On the other hand there has been no really notably dry, hot, sunny [summer](#) in the U.K. since 2006; summers overall have either been around average or exceptionally wet, and this appears to be linked with strong warming and more frequent high pressure over Greenland in the last decade."

The study has been published in *Weather*, the magazine of the Royal Meteorological Society.

Provided by University of Lincoln

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