

Expect more extreme winters thanks to global warming, say scientists

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Scientists have established a link between the cold, snowy winters in Britain and melting sea ice in the Arctic and have warned that long periods of freezing weather are likely to become more frequent in years to come.

An analysis of the ice-free regions of the Arctic Ocean has found that the higher temperatures there caused by global warming, which have melted the sea ice in the summer months, have paradoxically increased the chances of colder winters in Britain and the rest of northern Europe.

The findings are being assessed by British climate scientists, who have been asked by ministers for advice on whether the past two cold winters are part of a wider pattern of climate change that will cause further damaging disruption to the nation's creaking transport infrastructure.

Some climate scientists believe that the dramatic retreat of the Arctic sea ice over the past 30 years has begun to change the wind patterns over much of the northern hemisphere, causing cold, Arctic air to be funnelled over Britain during winter, replacing the mild westerly airstream that normally dominates the UK's weather.

The study was carried out in 2009, before last year's harsh winter started to bite, and is all the more prescient because of its prediction that cold, snowy winters will be about three times more frequent in the coming years compared to previous decades.

The researchers used computer models to assess the impact of the disappearing Arctic sea ice, particularly in the area of the Barents and Kara seas north of Scandinavia and Russia, which have experienced unprecedented losses of sea ice during summer.

Their models found that, as the ice cap over the ocean disappeared, this allowed the heat of the relatively warm seawater to escape into the much colder atmosphere above, creating an area of high pressure surrounded by clockwise-moving winds that sweep down from the polar region over Europe and the British Isles. Vladimir Petoukhov, who carried out the study at the Potsdam Institute for Climate Impact Research in Germany, said the computer simulations showed that the disappearing sea ice is likely to have widespread and unpredictable impacts on the climate of the northern hemisphere.

One of the principal predictions of the study was that the warming of the air over the ice-free seas is likely to bring bitterly cold air to Europe during the winter months, Dr Petoukhov said. "This is not what one would expect. Whoever thinks that the shrinking of some far away sea-ice won't bother him could be wrong. There are complex interconnections in the climate system, and in the Barents-Kara Sea we might have discovered a powerful feedback mechanism," he said.

In the paper, submitted in November 2009 but published last month in the *Journal of Geophysical Research*, Dr Petoukhov and his colleague Vladimir Semenov write: "Our results imply that several recent severe winters do not conflict with the global warming picture but rather supplement it."

Arctic sea ice has been in retreat over recent decades, with record lows recorded in September 2007. The normal recovery of the sea ice during winter has also been affected, especially in the Barents and Kara seas which have seen significant losses of ice cover over the past decade.

Stefan Rahmstorf, professor of physics of the oceans at the Potsdam Institute, said the floating sea ice in winter insulates the relatively warm seawater from the bitterly cold temperatures of the air above it, which can be around -20C or -30C.

"The Arctic sea ice is shrinking and at the moment it is at a record low for mid-to-late December, which provides a big heat source for the atmosphere," Professor Rahmstorf said. "The open ocean actually heats the atmosphere above because the ocean in the Arctic is about 0C, and that's much warmer than the atmosphere about it. This is a massive change compared with an ice-covered ocean, where the ice operates like a lid. You don't get that heating from below.

"The model simulations show that, when you don't get ice on the Barents and Kara seas, that promotes the formation of a high-pressure system there, and, because the airflow is clockwise around the high, it brings cold, polar air right into Europe, which leads to cold conditions here while it is unusually warm elsewhere, especially in the Arctic," he explained.

The scientists emphasised that the climate is complex and there were other factors at play. It is, they said, too early to be sure if the past two cold winters are due to the ice-free Arctic.

"I want to be cautious, but basically in the past couple of months the sea ice cover has been low and so, according to the model simulations, that would encourage this kind of weather pattern," Professor Rahmstorf said.

"The last winter of 2009-10 turned out to be fitting that pattern very well, and perhaps this winter as well, so that is three data points. I would say it's not definite confirmation of the mechanism, but it certainly fits the pattern," he said.

The computer model used by the scientists also predicted that, as the ice cover continues to be lost, the weather pattern is likely to shift back into a phase of warmer-than-usual winters. Global warming will also continue to warm the Arctic air mass, Professor Rahmstorf said.

"If you look ahead 40 or 50 years, these cold winters will be getting warmer because, even though you are getting an inflow of cold polar air, that air mass is getting warmer because of the greenhouse effect," he said. "So it's a transient phenomenon. In the long run, global warming wins out."

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