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# Warm seas around Greenland may indicate cold European winter

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Past changes in ocean currents around Greenland coincided with climate change in Northern Europe. The researchers behind the discovery suggest a possible ice-cold winter in Northwestern Europe.

A new study shows how ocean currents around Greenland have changed over the past 5,800 years.

The study also shows how, over history, periods with warm water around Southeast Greenland coincide with cold winters in Northern Europe.

“The sea south of Greenland has been very warm this summer. If the correlation between warm water around Greenland and cold weather in Europe holds true, it could indicate that we may have a cold winter in store this year,” says Camilla Andresen, a senior researcher at Department of Marine Geology and Glaciology at the Geological Survey of Denmark and Greenland (GEUS).

“Having said that, the weather is the result of a fairly complex interplay between ocean currents and differences in atmospheric pressure. But since we don’t yet have a full picture of this interplay, this is obviously merely a guess.”

The findings have just been published in the journal *The Holocene*.

## Study of 5,800-year-old organisms

The GEUS researchers have analysed sediment cores drilled from the continental shelf off the coast of East Greenland.

In the sediment samples, the researchers have determined the species of tiny organisms known collectively as *Foraminifera*. Some species of *Foraminifera* thrive in warmer temperatures, while others prefer cold water.

Based on the species composition of the *Foraminifera* and radiocarbon dating of the sediment, the researchers could determine whether in a given period it has been relatively warm around Greenland as a result of increased inflow from the Gulf Stream or cold as a result of increased inflow from the Arctic.

This enabled them to create a calendar of water temperature and the strength of ocean currents in the sea around Greenland covering the past 5,800 years.

## Warm water around Greenland during the Little Ice Age

Historical sources enabled the researchers to infer the coincidence between Greenland ocean currents and the

Northern European weather.

The period known as the Little Ice Age, ranging from the 16th to the 19th century, is of particular interest in this context.

Historical reports indicate that the Little Ice Age had some distinctly colder winters than we do today, but the new study also shows that during this period the warm Gulf Stream travelled towards Greenland in greater magnitudes.

“The link between warm currents around Greenland and the climate in Europe partly has something to do with a weakening of the westerly winds. Instead of pulling the Gulf Stream eastwards and blowing warm winter air over Northwestern Europe, the wind system will undergo periods with a more north-south-oriented curved course,” explains Andresen.

The result is that the warm Gulf Stream is directed in greater masses westwards towards Greenland and the Labrador Sea, she adds. Meanwhile, it gets easier for cold polar air to blow into Northwestern Europe.


#### **Ocean currents and rising sea levels**


The new mapping could also become an important step towards understanding how ocean currents around Greenland affect the melting of the inland ice, and thus how much the oceans will rise during the ongoing climate change.

“The contribution from the outlet glaciers to the total ice loss from Greenland is currently one of the really hot topics among climate researchers. We know that the current contribution from the outlet glaciers makes up about half of the total ice loss from the ice sheet, but there is some debate about how this will develop in the future as the climate gets warmer,” says the researcher.

“In the latest report from the IPCC (Intergovernmental Panel on Climate Change) the contribution from the outlet glaciers is probably underestimated in the calculations of future sea level rise due to the poor quality of the outlet glacier models used at the time. So there’s a need for improved models, and that’s something our findings could contribute with.”

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 [Tiny organisms in marine sediments off the coast of Southeast Greenland could help scientists forecast the weather this winter. \(Photo: Camilla Andresen\)](#) [12]

 [The continental shelf is the extended perimeter of a continent that lies below sea level. These so-called shelf seas are usually relatively shallow, with depths of up to 200 metres. The Gulf Stream is saltier than the East Greenland Current coming from the cold North. Therefore, since saltwater is heavier than freshwater, the warm Gulf Stream slides underneath the cold current when the two bodies of water come into contact off the southeast coast of Greenland. In periods where the Gulf Stream has been particularly strong, however, the amount of warm water has been so huge that the warm currents have moved into the continental shelf and into the deep Greenlandic fjords and bays in greater quantities. This has enabled the GEUS researchers to observe changes in the composition of organisms that prefer either warm or cold water in the sediment on the continental shelf. \(Photo: Wikimedia Commons\)](#) [13]

 [ice melting.jpg](#) [14]

There are two primary reasons why the Greenland ice sheet is losing mass from melting.

Firstly, there is the ice sheet surface melt. Here it is the difference between the ice formed during cold periods and the ice that's melted away in warmer periods that makes up the annual ice loss.

Secondly, the ice disappears in what's known as dynamic ice loss, which occurs when outlet glaciers break and send huge icebergs out into the sea.

The loss of ice from these outlet glaciers is linked to ocean temperatures as warm water helps undercut the glaciers and makes them more likely to break.

Previous research has shown that Greenland's outlet glaciers have shown great variation in their production of icebergs in the past few millennia. Camilla Andresen believes that a significant part of the explanation lies in the changing ocean temperatures and currents around Greenland.

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Dann Vinther

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