# Scientists Back Off Theory of a Colder Europe in a Warming World

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Gradual melting of the Greenland ice sheet, above left, might weaken the North Atlantic Current, which bathes parts of Europe with equatorial water. But any cooling effect in Europe would be overwhelmed by a general warming of the atmosphere.

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Published: May 15, 2007



OSLO — Mainstream climatologists who have feared that global warming could have the paradoxical effect of cooling northwestern Europe or even plunging it into a small ice age have stopped worrying about that particular disaster, although it retains a vivid hold on the public imagination.

The idea, which held climate theorists in its icy grip for years, was that the North Atlantic Current, an extension of the Gulf Stream that cuts northeast across the Atlantic Ocean to bathe the high latitudes of Europe with warmish equatorial water, could shut down in a greenhouse world.

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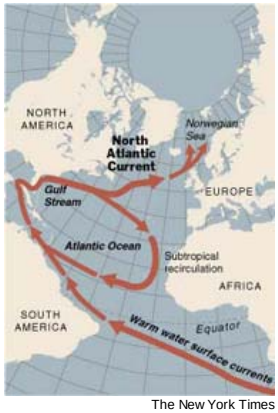


The New York Times

Without that warm-water current, Americans on the Eastern Seaboard would most likely feel a chill, but the suffering would be greater in Europe, where major cities lie far to the north. Britain, northern France, the Low Countries, Denmark and Norway could in theory take on Arctic aspects that only a Greenlander could love, even as the rest of the world sweltered.

All that has now been removed from the forecast. Not only is northern Europe warming, but every major climate model produced by scientists worldwide in recent years has also shown that the warming will almost certainly continue.

“The concern had previously been that we were close to a threshold where the Atlantic circulation system would stop,” said Susan Solomon, a senior scientist at the National Oceanic and Atmospheric Administration. “We now believe we are much farther from that threshold, thanks to improved modeling and ocean measurements. The Gulf Stream and the North Atlantic Current are more stable than previously thought.”

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After consulting 23 climate models, the United Nations Intergovernmental Panel on Climate Change said in February it was “very unlikely” that the crucial flow of warm water to Europe would stall in this century. The panel did say that the gradual melting of the Greenland ice sheet along with increased precipitation in the far north were likely to weaken the North Atlantic Current by 25 percent through 2100. But the panel added that any cooling effect in Europe would be overwhelmed by a general warming of the atmosphere, a warming that the panel said was under way as a result of rising concentrations of carbon dioxide and other heat-trapping gases.

“The bottom line is that the atmosphere is warming up so much that a slowdown of the North Atlantic Current will never be able to cool Europe,” said Helge Drange, a professor at the Nansen Environmental and Remote Sensing Center in Bergen, Norway.

Temperate Europe is vulnerable because of its northern perch. The latitude of Britain equals that of frigid Newfoundland. Norway corresponds to the southern half of Greenland. The annual mean temperature difference of 10 to 20 degrees across the North Atlantic (all temperature units shown here are in Fahrenheit) is often entirely attributed to the North Atlantic Current.

But in recent years, climatologists have said prevailing winds and other factors independent of the current are responsible for at least half of the temperature anomaly.

For the European warm-water current to stop altogether, the Greenland ice sheet would have to melt fast enough to create a vast freshwater pool in the North Atlantic. Freshwater dilution on that scale would make the current less dense, preventing its two main strands from sinking south of Iceland and west of Norway as they must before they can double back toward the Equator on the underside of what is often called the Atlantic conveyor belt.

“The ocean circulation is a robust feature, and you really need to hit it hard to make it stop,” said Eystein Jansen, a paleoclimatologist who directs the Bjerknes Center for Climate Research, also in Bergen. “The Greenland ice sheet would not only have to melt, but to dynamically disintegrate on a huge scale across the entire sheet.”

The worst imaginable collapse would likely take centuries to play out, he said. Any disruption to the North Atlantic Current — whose volume is 30 times greater than all the rivers in the world combined — would thus occur beyond the time horizon of the United Nations climate panel.

The last big freshwater dilution is thought to have occurred 8,200 years ago, when a huge lake atop the retreating North American ice sheet burst through to the Atlantic. For about 160 years, Dr. Jansen said, Europe experienced a severe chill that today would “stress society quite a lot.”

If the North Atlantic Current weakened 25 percent this century, fractionally offsetting the effect of global warming, Britain in 2100 would still be about 4 degrees warmer than today, the United Nations panel estimated. In France, the net warming would be 5 degrees and here in Norway a bit more, depending on latitude.

When climate modelers simulate a 50 percent slackening of the North Atlantic Current, they still see a net warming in those countries. It is when they completely switch off the current, as they say nature is disinclined to do, that the European climate cools to a level below that of today.

Scientists at the Hadley Center for Climate Prediction and Research near London found that a shutdown of the North Atlantic Current in 2049 would cause temperatures in most of Britain and Norway to fall from a level several degrees warmer than today to a level 4 or 5 degrees chillier than today. That would be enough to curtail agriculture sharply. France, though, would still be slightly warmer than it is now.

In a 1998 cover article for The Atlantic Monthly titled “The Great Climate Flip-flop,” William H. Calvin spelled out a worst-case scenario for Atlantic Ocean dynamics and concluded, “I hope never to see a failure of the northernmost loop of the North Atlantic Current, because the result would be a population crash that would take much of civilization with it, all within a decade.”

In 2004, the makers of the Hollywood blockbuster “The Day After Tomorrow” imagined

the sudden icing over of Manhattan after a disruption in North Atlantic currents. Europe's fate was alluded to by the implied flash-freezing of the British royal family in Balmoral Castle.

Preparing for a cold future has never been high on the political agenda. Perhaps understandably, European leaders have been more preoccupied with responding to the 2003 summer heat wave that killed 15,000 people across France and the need for new dike technology to keep the Netherlands from being inundated by rising seas associated with melting ice caps.

Richard Seager, a senior research scientist at the Lamont-Doherty Earth Observatory of Columbia University in Palisades, N.Y., said that Europeans should trust what they feel in the air. “Britain and western Europe have had one heat wave after another so far this century,” Dr. Seager said. “It's phenomenal. The idea that anyone is worried about a new ice age I find rather odd.”



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