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Cold Is Tied to Weaker Arctic 'Fence'

By **JUSTIN GILLIS**

Judging by the weather, the world seems to have flipped upside down.

For two winters running, an Arctic chill has descended on Europe, burying that continent in snow and ice. Last year in the United States, historic blizzards afflicted the mid-Atlantic region. This winter the deep South has endured unusual snowstorms and severe cold, and a frigid Northeast is bracing for what could shape into another major snowstorm this week.

Yet while people in Atlanta learn to shovel snow, the weather 2,000 miles to the north has been freakishly warm the past two winters. Throughout northeastern Canada and Greenland, temperatures in December ran as much as 15 to 20 degrees Fahrenheit above normal. Bays and lakes have been slow to freeze; ice fishing, hunting and trade routes have been disrupted.

Iqaluit, the capital of the remote Canadian territory of Nunavut, had to cancel its New Year's snowmobile parade. David Ell, the deputy mayor, said that people in the region had been looking with envy at snowbound American and European cities. "People are saying, 'That's where all our snow is going!'" he said.

The immediate cause of the topsy-turvy weather is clear enough. A pattern of atmospheric circulation that tends to keep frigid air penned in the Arctic has weakened during the last two winters, allowing big tongues of cold air to descend far to the south, while masses of warmer air have moved north.

The deeper issue is whether this pattern is linked to the rapid changes that [global warming](#) is causing in the Arctic, particularly the drastic loss of sea ice. At least two prominent climate scientists have offered theories suggesting that it is. But many others are doubtful, saying the recent events are unexceptional, or that more evidence over a longer period would be needed to establish a link.

Since satellites began tracking it in 1979, the ice on the Arctic Ocean's surface in the bellwether month of September has declined by more than 30 percent. It is the most striking change in the terrain of the planet in recent decades, and a major question is whether it is starting to have an effect on broad weather patterns.

Ice reflects sunlight, and scientists say the loss of ice is causing the Arctic Ocean to absorb more heat in the summer. A handful of scientists point to that extra heat as a possible culprit in the recent harsh winters in Europe and the United States.

Their theories involve a fast-moving river of air called the jet stream that circles the Northern Hemisphere. Many winters, a strong pressure difference between the polar region and the middle latitudes channels the jet stream into a tight circle, or vortex, around the North Pole, effectively containing the frigid air at the top of the world.

“It’s like a fence,” said Michelle L’Heureux, a researcher in Camp Springs, Md., with the [National Oceanic and Atmospheric Administration](#).

When that pressure difference diminishes, however, the jet stream weakens and meanders southward, bringing warm air into the Arctic and cold air into the midlatitudes — exactly what has happened the last couple of winters. The effect is sometimes compared to leaving a refrigerator door open, with cold air flooding the kitchen even as warm air enters the refrigerator.

This has happened intermittently for many decades. Still, it is unusual for the polar vortex to weaken as much as it has lately. Last winter, one index related to the vortex hit its lowest wintertime value since record-keeping began in 1865, and it was quite low again in December.

James E. Overland, a climate scientist with NOAA in Seattle, has [proposed](#) that the extra warmth in the Arctic Ocean could be heating the atmosphere enough to make it less dense, causing the air pressure over the Arctic to be closer to that of the middle latitudes. “The added heat works against having a strong polar vortex,” he said.

But Dr. Overland acknowledges that his idea is tentative and needs further research. Many other climate scientists are not convinced, saying that a two-year span, however unusual, is not much on which to base a new theory. “We haven’t got sufficient insight to make definitive claims,” said Kevin Trenberth, head of climate analysis at the [National Center for Atmospheric Research](#) in Boulder, Colo.

Judah Cohen, director of seasonal forecasting at a company called [Atmospheric and Environmental Research](#) in Lexington, Mass., has spotted what he believes is a link between increasing snow in Siberia and the weakening of the polar vortex. In his theory, the extra snow is creating a dense, cold air mass over northern Asia in the late autumn, setting off a complex chain of cause and effect that ultimately perturbs the vortex.

Dr. Cohen said in an interview that the rising Siberian snow might, in turn, be linked to the decline of Arctic sea ice, with the open water providing extra moisture to the atmosphere — much as the Great Lakes produce heavy snows in cities like Buffalo and Syracuse.

He is [publishing](#) seasonal forecasts based on his work, supported by the [National Science Foundation](#). Those forecasts correctly predicted the recent harsh winters in the midlatitudes. But Dr. Cohen acknowledges, as does Dr. Overland, that some of his ideas are tentative and need further research.

The uncertainty about what is causing the strange winters highlights a core difficulty of climate science. While mainstream researchers are sure that greenhouse gases released by humans are warming the

Earth, they acknowledge being on shakier ground in trying to predict the regional effects of that change. It is entirely possible, they say, that some regions will cool temporarily, because of disruption of the atmospheric and oceanic circulation, even as the Earth warms over all.

Bloggers who specialize in raising doubts about climate science have gleefully pointed to the recent winters in the United States and Europe as evidence that climatologists must be mistaken about a warming trend. These commentators have not been as eager to write about the strange warmth in parts of the Arctic, a region that scientists have long predicted will warm more rapidly than the planet as a whole.

Without doubt, the winter weather that began and ended 2010 was remarkable. Two of the 10 largest snowstorms in New York City history occurred last year, including the one that disrupted travel right after Christmas. The two snowstorms that fell on Washington and surrounding areas within a week in February had no known precedent in their overall impact on the region, with total accumulations of 40 inches in some places.

But the winters were not the whole story. Even without them, 2010 would have gone down as one of the strangest years in the annals of climatology, thanks in part to a weather condition known as El Niño, which dumped heat from the Pacific Ocean into the atmosphere early in the year. Later, the ocean surface cooled, a condition known as La Niña, contributing to heavy rainfall in many places.

Despite cooling from La Niña, newly compiled **figures** show that

2010 was among the two warmest years in the historical record. It featured a blistering heat wave in Russia, all-time high temperatures in at least 17 countries, the [hottest summer](#) in New York City history, and devastating floods in Pakistan, China, Australia, the United States and other countries.

“It was a wild year,” said Christopher C. Burt, a weather historian for [Weather Underground](#), an Internet site.

Still, however erratic the weather may have become, it is not obvious to most people how global warming could lead to frigid winters. Many scientists are hesitant to back such assertions, at least until they gain a better understanding of what is going on in the Arctic.

In interviews, several scientists recalled that in the decade ending in the mid-1990s, the polar vortex seemed to be strengthening, not weakening, producing mild winters in the eastern United States and western Europe.

At the time, some climate scientists wrote papers attributing that change to global warming. Newspapers, including this one, printed laments for winter lost. But soon after, the apparent trend went away, an experience that has made many researchers more cautious.

John M. Wallace, an atmospheric scientist at the [University of Washington](#), wrote some of the earlier papers. This time around, he said, it will take a lot of evidence to convince him that a few harsh winters in London or Washington have anything to do with global warming.

“Just when you publish something and it looks like you’re seeing a connection,” Dr. Wallace said, “nature has a way of humbling us.”