Arctic Thawing May Jolt Sea's Climate Belt
By WILLIAM K. STEVENS
New York Times (1923-Current file); Dec 7, 1999; ProQuest Historical Newspapers: The New York Times
pg. F3

Arctic Thawing May Jolt Sea's Climate Belt

By WILLIAM K. STEVENS

Evidence continues to accumulate that the frozen world of the Arctic and sub-Arctic is thawing, and the findings are spotlighting two increasingly important questions:

Can what is happening in the Great White North touch off sudden shifts in climate that will transform weather and disrupt life throughout the Northern Hemisphere? Is the Arctic a key to the way in which global warming might be translated into region-by-region climatic changes?

The answers, many experts believe, may depend on how much fresh water flows into the North Atlantic Ocean as a result of melting Arctic ice and the runoff from an increase in Northern Hemisphere precipitation that some scientists say is already resulting from global warming.

The theory behind this view holds that the climate of the North Atlantic region, including Europe and eastern North America, is controlled by great ocean currents that transport heat northward from the tropics. This oceanic conveyor belt is set in motion when saltier, and therefore heavier, surface water sinks to the deep ocean in the vicinity of southern Greenland. It is replaced by warm water from the tropics that warms the North Atlantic region. Without it, the relatively mild climate of England, for instance, might be as cold as that of northern Canada.

The worry is that a great influx of fresh water from the thawing Arctic might dilute the salty current and so either halt or weaken the heat-bearing conveyor belt. This could result in a sudden, long-term drop in the North Atlantic region's temperature, a climatic disruption that would probably reverberate around the hemisphere by altering large-scale atmospheric circulation.

Last week, scientists reported that the current did indeed weaken or stop at least twice in the past, plunging the region, which each time had been warming, into cold comparable to that of an ice age.

Other researchers, focusing on the present, last week produced the latest in a lengthening string of studies documenting the thawing of the vast sheet of ice that covers the far northern seas, a potential source of fresh water that, once it melts, could help weaken the heat conveyor.

A third research group, using computerized simulations of the ocean-atmosphere system, concluded that the present-day thawing of Northern Hemisphere sea ice could not be explained by natural causes. The most obvious possible cause, they said, is global warming produced by heat-trapping waste industrial gases like carbon dioxide, which result from the burning of fossil fuels like coal, oil and natural gas. And they said the rate of sea-ice melting was likely to increase in the decades ahead if emissions of the heat-trapping gases continued at today's rates.

Sudden influxes of fresh water from the Arctic appear to have shut down or weakened the oceanic heat conveyor twice in the relatively recent geological past, according to a study reported in the current issue of Nature by Dr. Carsten Rühlemann of the University of Bremen, Germany, and colleagues. By examining chemical clues in ocean sediments, they determined that in each case, the western tropical North Atlantic was relatively warm while waters farther north were relatively cold — as would be expected if the conveyor stopped or weakened.

The apparent shutdowns occurred as the world was coming out of the last ice age. The North Atlantic region's rebound was twice interrupted by sudden reversions to glacial conditions, once around 15,000 years ago and again around 12,000 years ago, before settling into the relative warmth that has prevailed for the last 10,000 years. The first reversion to glacial cold coincided with an invasion of the North Atlantic by vast quantities of fresh water in the form of icebergs, which were released from North America as temperatures warmed.

Another influx is believed to have touched off the second reversion to cold, called the Younger Dryas event. That event set off far-flung reverberations. The climate of the Middle East dried out so much that food became scarce, forcing the invention of agriculture, many scientists believe. The New York region became so chilly that cold-weather trees like spruce took over the landscape from species like oak.

Could an influx of fresh water brought about by global warming make that happen again? Recent studies lend the question new urgency. In one, reported in the December issue of the journal Geophysical Research Letters, scientists analyzed data collected by sonar aboard nuclear submarines and found that the floating ice cover of the Arctic Ocean has become about 40 percent thinner than it was two to four decades ago.

In another, reported in the current issue of the journal Science, researchers led by Dr. Ola M. Johannessen of the Nansen Environmental and Remote Sensing Center in Bergen, Norway, used satellite data to measure the area of the Arctic ice sheet. They found that the perennial ice cover had shrunk by 14 percent over the last two decades.

The third study, by nine researchers headed by Dr. Konstantin Y. Vinnikov of the University of Maryland, analyzed data from five different sources and found that sea ice in the Northern Hemisphere as a whole had decreased by about 7 percent in the last 46 years.

Computer models of the ocean-atmosphere system reconstructed this trend accurately, said Dr. Alan Robock of Rutgers University, a member of the research team. The model simulations also determined that the trend was much larger than what would be expected to result from the climate system's natural variability. This assumes that the models can reproduce natural variability with some accuracy, an assumption that many experts question.

> Fresh water flow may hold a key in global warming.

Nevertheless, Dr. Robock said that the study provides "strong support for the theory that humans are causing the climate to change."

If the climate is indeed warming because of human activity, many scientists say, the influx of fresh water to the North Atlantic could increase. Melting ice in the Arctic is not the only potential contributor. Water from melting glaciers in Greenland and other Arctic and sub-arctic islands could also contribute. Last year, scientists reported that the southern half of the Greenland ice cap was melting back by about two cubic miles a year, enough to cover Maryland with a sheet one foot thick.

(Runoff from melting glaciers contributes to a rising global sea level. Melting sea ice does not; like an ice cube in a glass of water, its change in state does not raise the water level.)

A third contributor to an influx of fresh water could be increased precipitation. A warmer atmosphere causes more water to evaporate from the oceans, and some scientists believe that some of this increased atmospheric moisture would be transported to the far north, where it would produce a heavier runoff of fresh water into the North Atlantic. This alone, some computer models indicate, would be enough to weaken the North Atlantic heat conveyor drastically in the 21st century.

How much fresh water might be necessary to halt, slow or weaken the conveyor is a crucial question that scientists cannot yet answer. Nor do they know how close the world might be to an abrupt change in the conveyor's behavior.

"I don't think there's any accurate assessment out there that would tell us," said Dr. Peter Schlosser, a geochemist at the Lamont-Doherty Earth Observatory.

If a warming atmosphere pumped enough fresh water into the ocean to shut down the conveyor, what would it mean? Dr. Schlosser and others say the magnitude of the resulting climate change might be different from those observed in the last glacial cycle. But, he said, "It might put the system into a state that might be a precondition for further change."

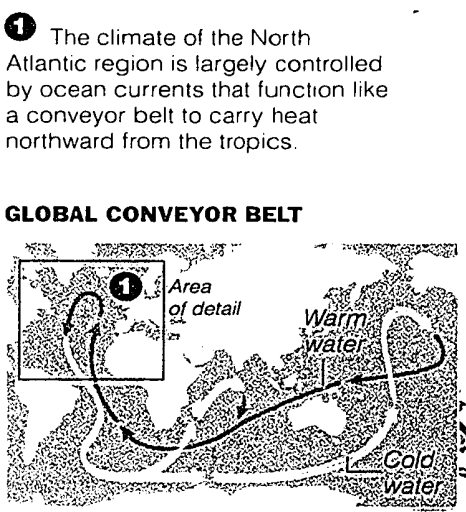
What might such a change entail?

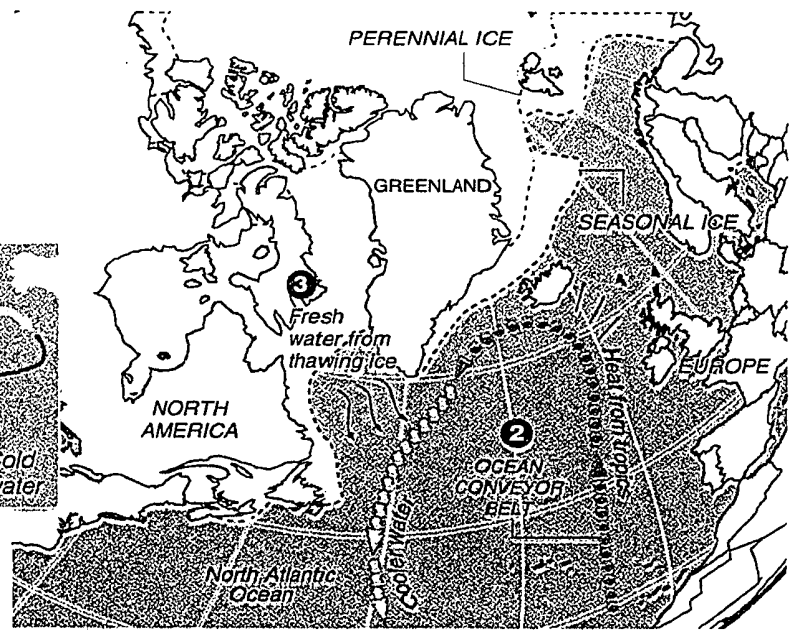
Temperature and precipitation patterns could be drastically altered, much as El Niño alters them, and Dr. Schlosser says the alteration's effects would probably be felt throughout the Northern Hemisphere. But exactly how the patterns would change and therefore what their down-to-earth effects would be, he said, is an open question.

The Arctic as Catalyst for Global Climate Change

Some experts believe that changes in the North Atlantic Ocean can drastically affect climate around the globe. Now, there is new evidence that global warming is thawing Arctic ice. Some scientists fear this could eventually touch off major changes.

1 The climate of the North Atlantic region is largely controlled by ocean currents that function like a conveyor belt to carry heat northward from the tropics.





2 The conveyor belt derives its power from waters south of Greenland. Saltier, heavier water in the region sinks and is replaced by a current of warmer, fresher water from the tropics. This exchange warms the North Atlantic region.

3 There is concern that an influx of fresh water from thawing ice in the Arctic might weaken the conveyor belt and halt or diminish the amount of heat it brings to the region.

4 As a result, temperatures in the North Atlantic region could plummet and remain low, possibly disrupting the climate elsewhere by affecting atmospheric circulation.

The New York Times