

Why the Global Deep Freeze?

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As an Arctic frost chills two-thirds the nation and kills hundreds in Bangladesh, some answers may come from changes in the Arctic itself. First, if you had any doubts, we are in an unusually deep cold spell, with snow and records falling across the South. Driving conditions are hazardous (and sometimes tragic) as pedestrians and the homeless face bitter winds and icy "orthopedic weather." Ice dams are blocking Latvian ports, winds and storms are battering Europe, Portugal is freezing, Vietnam has lost one-third its rice crop, and the cold has caused close to 2,000 deaths in usually temperate South Asia.

As several scientists have warned, global warming will be full of surprises. Warming over the past half-century has already brought more erratic and extreme weather. Some climatologists are increasingly concerned about the stability of the climate system itself and the potential for abrupt shifts - to warmer or even much colder states. Can we make sense of the present cold snap?

Part of the explanation comes from changes to our north.

Warming causes ice to melt, forming cold fresh water. And increased input of cold fresh water to the ocean can affect weather patterns as well as global ocean circulation.

Recent warming in the Northern Hemisphere has melted a lot of North Polar ice. Since the 1970s the floating North Polar ice cap has thinned by almost half.

A second source of cold fresh water comes from Greenland, where continental ice is now melting at higher elevations each year. Some melt water is trickling down through crevasses; lubricating the base, accelerating ice "rivers," and increasing the potential for sudden slippage.

A third source of cold fresh water is rain at high latitudes. Overall ocean warming speeds up the water cycle, increasing evaporation. The warmed atmosphere can also hold and transport more water vapor from low to high latitudes. Water falling over land is enhancing discharge from five major Siberian rivers into the Arctic, and water falling directly over the ocean adds even more fresh water to the surface.

The cold, freshened waters of the North Atlantic accelerate transatlantic winds, and this may be one factor driving frigid fronts down the eastern US seaboard and across to Europe and Asia.

It is too early to know how long the current cold spell will last, and time and hindsight will be needed to reveal all the factors contributing to the present chill. But the ice itself and pollen and marine fossils reveal that cold reversals have interrupted warming trends in the past.

The North Atlantic Ocean can freshen to a point where the North Atlantic deep water pump - driven by sinking cold, salty water that is, in turn, replaced by warm Gulf Stream waters - can suddenly slow down. Some 13,000 years ago, when the globe was emerging from the last Glacial Maximum and continental ice sheets were thawing, the Gulf Stream abruptly changed course and shot straight across to France. The Northern Hemisphere refroze - for the next 1,300 years - before temperatures jumped again in just several years, warming the world to its present state.

In the past few years the northern North Atlantic has freshened, and since the 1950s the deep overflow between Iceland and Scotland has slowed by 20 percent.

Since cold reversals occurred naturally, one may ask whether humans can influence these cycles as well.

Natural variability and human influence together explain the observed changes in the North Atlantic. Calculations (of orbital cycles) indicate that our hospitable climate regime was not likely to end due to natural causes any time soon. But due to the burning of fossil fuels, atmospheric levels of carbon dioxide are now greater than at any time in the last half million years. The recent buildup of heat-trapping greenhouse gases is forcing the climate system in new ways and into uncharted seas.

The hopeful news is that unstable systems can be re-stabilized. But substantial reductions in greenhouse gas emissions will be needed in the next few years to stabilize the atmospheric concentrations and reduce the human-generated forces pushing on the climate system.

In order to change directions, however, we must first slow down. And slowing down means burning much less coal, oil, and gas and cutting far fewer trees.

Significant incentives will be needed to simultaneously solve the problems of energy, the environment, and the economy. But clean development through renewable energy can become the engine of growth for this 21st century and provide the best insurance for a healthier, more stable, and more secure future.

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