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Background Essay: Fastest Glacier

Although ice is generally perceived to be rigid, glaciers are never stationary. Because the weight of their accumulated snow and ice is so great, gravity actually forces glaciers to spread outward and downslope. Thus, glaciers are rightly said to "flow" just like rivers—down mountain valleys, across plains, or into the sea.

Scientists familiar with glaciers expect to see movement of about 10 inches per day. The mechanism of ice movement varies. In all glaciers, movement along the underside of a glacier is slower than movement at the top due to the friction created as it slides along the ground's surface. For glaciers whose base is frozen to the bedrock, ice can move only by slow deformation. A thin layer of water forms under other glaciers, allowing ice to slide downslope at a much faster rate as it meets far less resistance from the bedrock.

Greenland's continental ice sheet contains the second largest amount of frozen fresh water in the world (after Antarctica). A part of this ice sheet, the Jakobshavn Glacier, is located on the western coast of Greenland. According to GPS measurements, this glacier is presently flowing as fast as 113 feet per day, making it the world's fastest-flowing glacier. As its leading edge reaches the Arctic Ocean, more than 20 million tons of icebergs calve off from it each day. This addition of fresh water to the sea—the equivalent of 12 trillion gallons each year—contributes to rising sea level. In fact, this glacier alone is responsible for 4 percent of the global sea-level rise we have seen in recent times.

Researchers investigating the Jakobshavn for clues as to why it moves so fast monitor various climate factors, including wind speed and humidity. The main influencing factor, however, appears to be surface temperature, which is rising in both summer and winter. In the warmer summer months, melted snow and ice pools in a surface lake. This then drains down a hole that leads to the bedrock. There, the water lifts the glacier fractionally and provides a lubricating layer on which the glacier slides downhill.

The poles are extremely sensitive to environmental changes, and temperatures have been increasing more rapidly there than anywhere else on the globe. Should icebergs and glaciers melt and spill large quantities of fresh water into the ocean, the freshening could influence global ocean circulation patterns. Cold North Atlantic Deep Water sinks because of its high salt content and density and travels southward. At the same time, the warmer Gulf Stream travels north, redistributing heat from the Equator. If sufficient fresh water entered the oceans, impeding development of the North Atlantic Deep Water, the Atlantic thermohaline conveyor and the Gulf Stream current could shut down in just a few years, dramatically altering climate worldwide.