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DURHAM, N.H. -- New research, published in the journal Science, finds the average annual discharge of freshwater from the six largest Eurasian rivers into the Arctic Ocean to have increased 7 percent since 1936.

The authors, including the University of New Hampshires Charles Vorosmarty, have correlated these changes to historic patterns of climate change, and find that, if these patterns hold, there will likely be an eighteen to 70 percent increase in river discharge over the next 100 years based on Intergovernmental Panel on Climate Change projections for global temperature rise.

An increase of such magnitude may have large-scale impacts on the ocean circulation pattern that brings heat to the northern latitudes.

"Too much freshwater 'leaking' from the land into the Arctic Ocean could reduce or shift the patterns of Atlantic deep water formation and stall the ocean 'conveyor belt' that helps to bring heat to the northern latitudes," explains Vorosmarty, professor of Earth sciences at UNH's Institute for the Study of Earth, Oceans, and Space. "England, for example, without the beneficial effect of this ocean circulation, would plunge into a deep freeze due to its high latitude."

Vorosmarty is referring to the "Atlantic thermohaline circulation" pattern of the ocean, which is sensitive to changes in freshwater loading. As temperatures warm globally, evaporation of surface water will increase and more moisture will be held in the atmosphere. This moisture will lead to more precipitation at high

latitudes, such as the Arctic, and more river runoff. If global surface temperatures have increased 0.6 degrees Celsius over the past century, then moisture transport and precipitation to the Arctic would likely have increased as well.

This research finds 128 cubic kilometers per year more river discharge today entering the Arctic Ocean from its six largest Eurasian rivers -- which include three of the largest rivers on Earth -- then in 1936. The study also finds that the discharge correlates with increases in global surface air temperature and the North Atlantic Oscillation (NAO), both indicators of global climate change.

The NAO is often described as "a seesaw of atmospheric mass" which dominates winter climate variability; a positive NAO is associated with more and stronger winter storms crossing the Atlantic and warm and wetter winters in Europe and the Eastern U.S.

Says Vorosmarty, "We find that if this correlation holds for the next 100 years, we could possibly load enough additional freshwater into the Arctic Ocean to affect the thermohaline circulation."

While this scenario is alarming, it should not be considered a prediction per se, but rather a first indication that observed changes in Arctic river flow are of sufficient magnitude to have important implications for both ocean circulation and its feedback upon climate.

This study, unlike previous investigations into the relationship between river discharge and the changing climate, provides insight into long-term trends in discharge over a large area. Due to a decline in the availability of high quality historical discharge records, it has become increasingly difficult to conduct studies of this nature.

These findings are described in the report, "Increasing River Discharge to the Arctic Ocean" in the December 13 issue of Science.

Bruce Peterson from the Marine Biological Laboratory is lead author, and collaborators include the State Hydrological Institute in Russia, the Potsdam Institute

for Climate Impact Research in Germany, and the Water Systems Analysis Group at the University of New Hampshire. Co-authors from UNH include Vorosmarty, Richard Lammers, and Alex Shiklomanov.

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