

On the role of canyons on pathways of Atlantic Water towards the glaciers of Northwest Greenland

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Warm Atlantic Water is resulting in significant retreat of marine terminating glaciers in Northwest Greenland. We use the FESOM ocean model, together with observations of salinity, temperature, and bathymetry from NASA's Ocean Melting Greenland mission, and Mankoff's discharge estimates to understand the pathways of Atlantic Water towards these glaciers. Using the model we explore the role of the southern and northern canyons of Melville Bay on the pathways of Atlantic Water. We find these pathways are crucial for understanding the increase in discharge of certain glaciers over the 'ocean warming period'. We explore how the susceptibility of a marine terminating glacier in Northwest Greenland to Atlantic Water depends on the location of the channel entrance of the fjord with respect to head of the Southern or Northern canyon. It also depends on whether the fjord channel is deep enough to be a pathway for Baffin Bay Intermediate Water. The Upernavik N and C glaciers are in the most vulnerable location. They contribute 10% to the total discharge change of Northwest Greenland. Moreover, the glaciers that exhibited the largest normalised discharge change, showed a correspondence between their discharge estimates and the observed changes in fjord geometry, during the retreat of the glacier calving front. Warming of deep Atlantic Water during the warming period impacted the normalised discharge estimates, but the sensitivity to the fjord geometry also controlled large parts of the observed trends too.

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