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Observing the oceanic heat flux toward retreating outlet glaciers in NE-Greenland

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Warming of subsurface water of Atlantic origin has been suggested to be a major driver of the ongoing retreat of marine terminating glaciers around the coast of Greenland. In recent years, also the outlet glaciers of the Northeast Greenland Ice Stream have undergone major changes leading to an increased mass flux from the ice sheet into the ocean. Both, the thinning of the 80-km long floating tongue of the 79 North Glacier and the collapse of the floating tongue of the adjacent Zachariæ Isstrøm have been attributed to increasing ocean temperatures. However, it has been unclear whether the bathymetry was sufficiently deep to allow warm Atlantic water to reach Zachariæ Isstrøm. Here we report on the first station-based bathymetric and oceanographic measurements carried out in summers 2016 and 2017 close to the calving front of Zachariæ Isstrøm. They reveal 1°C-warm waters of Atlantic origin in a layer between 300 to 600-m depth to be in direct contact with the calving front of the glacier. Also, 12-month long mooring based observations demonstrate Atlantic origin waters to flush the cavity beneath the 79 North Glacier causing high basal melt rates along the 80-km-long glacier base. Based on moored measurements further offshore on the Northeast Greenland continental shelf we discuss the processes that govern the oceanic heat transport toward both glaciers. A better understanding of these processes is relevant to distinguish short-term variability from long-term changes in the oceanic heat flux toward the glaciers.