Greenland ice loss and its connection with a warmer, fresher North Atlantic Ocean

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ABSTRACT: The widespread speed up of Greenland's glaciers over the last two decades was unpredicted, revealing major gaps in our understanding of how ice sheets respond to a changing climate. Increased melting at the edge of glaciers, associated with warming ocean waters, has recently emerged as a key trigger – indicating that glacier/ocean exchanges must be accounted for in ice sheet variability reconstructions and predictions. In parallel, the discharge of additional freshwater into the ocean, associated with Greenland's ice loss, has the potential to impact the North Atlantic's circulation and climate. Thus glacier/ocean exchanges are also relevant to understanding drivers of past and future changes in the North Atlantic Ocean's circulation. Notwithstanding their importance, our understanding of glacier/ocean exchanges is limited due both to the scarcity of observations from these remote and hostile environments and to the challenge of modeling the wide range of processes and scales involved. Here, I will present recent findings from observations collected at the edge of several Greenland glaciers that reveal how melting is caused by intrusions of warm, subtropical waters into the fjords and enhanced by the release of surface melt hundreds of meters below sea level. Tracer data, furthermore, indicate that Greenland's meltwaters are rapidly mixed with ocean waters and that the export of this meltwater into the large scale ocean is governed by a complex interplay of fjord and glacier/ocean exchanges. Finally, I will discuss how these findings are being used to improve the representation of glacier/ocean exchanges in ice sheet and ocean models.

Dr. Fiamma Straneo is a Professor at the Scripps Institution of Oceanography of the University of California San Diego. Her research focuses on the high latitude North Atlantic and Arctic Oceans and their interaction with the atmosphere, sea-ice and the Greenland Ice Sheet. Straneo has lead over a dozen field expeditions to the Arctic and Greenland to collect data using icebreakers, local fishing vessels, helicopters, snowmobiles and autonomous vehicles. She is a fellow of the Leopold Leadership Program, a co-chair and founder of the Greenland Ice Sheet/Ocean Science Network (GRISO), and she was awarded the Sverdrup Lecturer Award by the Ocean Sciences Section of the American Geophysical Union in 2016. Straneo obtained her Ph.D. in Physical Oceanography from the University of Washington, USA, following a Laurea cum Laude in Physics from the University of Milan, Italy.