Greenland's Shear Margins in a Warming Climate: A Summary of Recent Work

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The Greenland Ice Sheet has experienced unprecedented changes in the past couple of decades, resulting from regional warming and enhanced surface melting. The increased melting has activated a dynamic surface hydrologic system contributing to significant mass loss. Surface melt runoff contributes directly to Greenland's mass loss, as well as infiltration which impacts ice dynamics and mass discharge. The ice sheet has a few critical bounding forces that can influence the rate of mass loss, including the loss of ice shelves/tongues, enhanced calving at marine-terminating outlet glaciers, and an evolving basal hydrologic system due to infiltration of surface melt. In particular, the impact of surface melt water on ice dynamics via supraglacial lake drainage and runoff has been well documented.

Little attention has been focused on direct injection of surface melt water into the shear margins of fast flowing, marine-terminating outlet glaciers that are a critical control on mass flux. Our initial work was the first to characterize water-filled crevasse ponds within the shear margins of Jakobshavn Isbræ and assess the volume of infiltrated melt water potentially reaching the bed. In the intervening years since this seminal work, we have utilized satellite observations and numerical models to decode the impact of hydrologic shear weakening due to melt water injection from these structures with implications for the evolution of Greenland's other marine-terminating outlet glaciers under a warming climate.

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