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Impact of ocean stratification and glacial run-off on submarine melting of Greenland's glaciers

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Submarine melting is an important contributor to the mass balance of tidewater glaciers in Greenland and increases in its rate have been implicated as a likely trigger for the recent acceleration of several major outlet glaciers. Yet our understanding of this important process and of how it is affected by changes in the ocean or the glaciers is very limited – to a large extent because of a lack of data from the ice-ocean boundary. Here, we use summer and winter data collected at the margins of three major East Greenland glaciers (Helheim, Kangerdlugssuaq and Nioghalvfjerdsfjorden) to show that the amplitude and vertical distribution of submarine melting is strongly affected by the layering of water masses in the fjords and by seasonal glacial run-off. The presence of cold, Arctic Waters above warm, Atlantic Waters near the glaciers, in particular, shapes the melt water plume and the transport of heat along the ice margin. The implication is that the shape and stability of East Greenland's glaciers is strongly influenced by the properties on the East Greenland shelf and their variability.