Paleo influence of ocean temperatures on southwest Greenland Ice-Sheet margins

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We compare ^{10}Be surface exposure ages of southwest-south Greenland Ice-Sheet (GIS) margin retreat with proxies of ocean temperature to assess the impact of past ocean warming on the GIS during the last deglaciation and the late Holocene. We find that up-fjord retreat of marine-terminating margins from the coast to their present extent occurred between ~9 and 10 ka at retreat rates of kilometers per year. This abrupt retreat was concurrent with peak Holocene warmth in the northeast Labrador Sea. By contrast, retreat of land-terminating ice margins in southwest Greenland occurred over ~7 kyrs at rates of 10's of meters per year. Because atmospheric climate forcing influenced both terrestrial and marine ice margins, we attribute the rapid retreat of GIS marine margins to the additional influence of ocean warming. We have also dated ice-margin retreat from a late-Holocene moraine in south Greenland at ~1.5 ka that has marine-terminating segments. The timing of the ice advance is concurrent with the first arrival of cold Arctic waters into south Greenland fjords with the retreat coincident with the incursion of warm Atlantic waters into these fjords. Ice rafted debris records imply that other marine-terminating margins may have concurrently advanced and retreated. Documenting the spatial extent of this advance and retreat and determining late-Holocene atmospheric temperatures over south Greenland will allow for further testing of the role ocean temperature plays in driving centennial-scale GIS margin fluctuations.