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Understanding variations in early Holocene retreat pattern along the fjord- and land-terminating ice sheet margin in West-Greenland

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In West Greenland, the early Holocene retreat-pattern of the Greenland ice sheet margin from the coast inland and into the fjords is spatially highly variable and asynchronous, but the related processes beyond climate forcing are not well understood.
We present new evidence from 10Be and radiocarbon dating indicating early deglaciation of the ice sheet into Ata-Sund Fjord, north of Jakobshavn by 9300 kyBP, which is 1000 years earlier than previous minimum-age reconstructions suggested. The dated moraine complex around Eqip Sermia, a medium sized tidewater outlet glacier, is very close to the present margin of the ice sheet and can be traced to the 'Fjord Stade' moraines to the south near Ilulisat. There, the ice sheet margin was at 9300 kyBP and 8200 kyBP still at the mouth of the Jakobshavn fjord, almost out at the coast. Although, similar to Eqip Sermia, early far-inland retreat has been reconstructed for the very deep Torsukattak Fjord to the North, the Ata-Sund Fjord leading to Eqip Sermia is relatively shallow and such rapid early retreat is here difficult to reconcile through the retreat instability mechanism related to strongly overdeepened fjords.
We investigate this early and far inland retreat at Eqip Sermia in context of the wider regional retreat (Jakobshavn to Torsukattak Fjord) using a simple but quantitative model that includes the effect of bed topography, calving and climate forcing. We find that beside dynamic effects from the marine terminus, the ice flux at the margin and hence the contributing ice sheet catchment areas and their changes over time are essential in explaining the observed retreat pattern in West-Greenland.