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New insights into West Greenland ice sheet/stream dynamics during the last glacial cycle.

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Onshore and offshore geomorphological mapping and deglacial chronologies from West Greenland constrain the nature and magnitude of ice advance and decay of the Greenland Ice Sheet (GrIS) during the last glacial cycle.

Several ice stream troughs are known to have fed ice to the shelf edge during the last glacial cycle. Their offshore expression suggests that many were coalescent systems fed by smaller outlet glaciers and ice streams onshore but their central flow pathways were also controlled by geology and preglacial topography. The bed morphology of these large ice streams shows they operated over soft, deforming beds with drumlins, mega-scale glacial lineations and grounding zone wedges marking an offshore transition from predominant areal scour onshore.

Records of offshore deglacial chronology remain sparse but the Uummannaq and Disko Bugt ice stream corridors are now well constrained. The Uummannaq ice stream (UIS) completely deglaciated from the continental shelf between 14.8 ka and 11.0 ka in response to rising air temperatures, increasing JJA solar radiation and sea-level rise, but temporary standstills and the asynchronous retreat history of its feeder zones suggest that topography/bathymetry strongly modulated retreat rates as ice became 'locked' back into the coastal fjord system. Initial reconstructions of behaviour UIS discounted an oceanic role in early deglaciation and favoured retreat from the mid-shelf and inner-shelf prior to the Younger Dryas but both these concepts remain under investigation.

In Disko Bugt, Jakobshavn Isbrae deglaciated later than the UIS and remained on the outer shelf during the Younger Dyras stadial (12.8 – 11.7 cal. kyrs BP) only reaching in the inner coast fjords at approximately 10.0 ka. The later deglaciation of the Disko system (despite similar external forcing mechanisms) was controlled by regional topographic/bathymetric contrasts in their respective trough morphologies. This hypothesis is supported by recent model output which indicates that non-linear retreat, grounding line stability and up-ice surface thinning is heavily influenced by both vertical and lateral constrictions in marine trough systems.

While the offshore ice stream corridors are beginning to reveal their dynamic retreat history, knowledge of the inter-stream areas on the continental shelf remains very poor. The western, onshore sector of the GrIS has a much improved deglacial chronology derived from radiocarbon and new cosmogenic surface exposure dating undertaken in the last decade, but the deglacial history of wide swathes of the inner, mid and outer continental shelf remains completely unknown. The Hellefiske moraines on the West Greenland shelf were described in the late 1970's but little is known of ice sheet retreat behaviour across these areas. Understanding the deglacial signature of such regions is important if we are to use palaeo-reconstructions to understand ice sheet collapse/retreat mechanisms and to inform future model predictions.