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The Greenland Ice Sheet at LGM, reconstructed from field evidence

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Based on evidence from the shelf and coastal mountains we have outlined the margin of the Greenland ice sheet at LGM (last glacial maximum, c. 24-16 kaBP, thousand years before present).
The LGM ice sheet in this reconstruction occupied an area of c. 2.8 ma km2, which is c. 65 % more than the present day extent. About 2/3 of the excessive area was located on the shelf while the remaining 1/3 occupied the present day ice free land. The configuration of the reconstructed ice margin suggests that the response of the ice margin to general climate change in different areas was modified by regional differences in local climate and physiography. In the north, on the Arctic Ocean coast, accumulation and ablation were probably low, but permanent stationary sea ice allowed the outlet glaciers to build an ice shelf along the coast. Along the north-eastern coast (c. 81°-71°N) ice streams from north to south apparently became less vigorous as a consequence of decreased cyclone passages and precipitation, caused by the restriction of Denmark Strait. Further south (c. 68°-51°N), LGM was characterized by major ice build-up on the shelf, where the growing ice sheet may have attracted the precipitation from cyclones that now hit the coastal ice sheet margin. In southern and central West Greenland (c. 51°-68°N) we interpret the lobate moraines to indicate a regime that was dominated by fast flowing ice streams that were able to discard their calving ice into Davis Strait and the Labrador Sea. In the northwest (c. 72°-80°N) the regime may have been ice stream dominated shelf glaciation in Melville Bugt and Smith Sund.

The varied ice sheet response to climate change in different areas is supported by the variation in marine limits around the ice margin. We have compiled 610 observations on the altitude of marine limits from all parts of the country. Maximum altitudes, c. 160 m, are attained in West Greenland, while minimum altitudes, c. 20 m, are found in Melville Bugt in the northwest. This shows that the unloading and neoglacial reloading have varied greatly in different areas.

The conclusion suggests that the Greenland Ice Sheet's response to climate change is highly complex which in turn can prove a difficult task in modelling studies.