



The effects of mountain building in Greenland on the initiation of the ice sheet

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We investigate the effects of a new hypothesis about mountain building in Greenland on ice sheet initiation using an ice sheet model in combination with a climate model. According to this hypothesis, the present-day mountains formed after two phases of uplift since the Late Miocene where the Greenland topography was close to sea level. Ice sheet initiation is studied using the Greenland topography before uplift and after each phase of uplift by applying different forcing conditions relevant for the time period.

We find a large response of ice sheet growth to the cooling and precipitation increase related to the local effect of elevation change, but also that a Föhn effect is induced which inhibits ice sheet expansion into the interior Greenland. Despite this, the second phase of uplift facilitates ice-sheet initiation. The area of main ice sheet nucleation is relocated from the northern tip of Greenland to the eastern coastal mountains following the second phase of uplift. The period where uplift occurred was a time characterized by a long term cooling trend but with cold and warm excursions superimposed on this. We compare our results with observations of ice sheet extent over this period. We find that they represent conditions well, and that the mountain building history augments the effect in Greenland of the climatic deterioration leading to the Northern Hemisphere glaciations.