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Climate Change over Greenland and Surrounding Seas in a High-Resolution Transient Simulation

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Climate and climate change over the Arctic in general and Greenland in particular have recently attained much attention. For a realistic assessment of the implications of the expected major climate changes for ecosystems and society, the resolution of both global climate models (GCMs) and contemporary regional climate models (RCMs) is too coarse, for the narrow coastal regions and the steep gradients between these and the inland ice cannot be resolved.

We report results for Greenland and surrounding seas from a transient RCM simulation covering the period 1950-2080 with an (for Greenland) unprecedented horizontal resolution of 25 km, forced by a state-of-the-art coupled GCM. Compared to the driving GCM, the RCM shows considerably stronger temperature increase in regions where sea ice retreats. Largest changes can be expected along the east coast, in particular in the Zackenberg region, where days with a positive average temperature are projected to become the rule rather than the exception. Most of Greenland, especially the north-east, will experience more precipitation. At lower elevations, an increasing percentage of this precipitation can be expected to fall as rain instead of snow. On the other hand, more extreme snow fall events than at present are projected on the ice sheet.

Arctic sea ice responds sensitively to global warming, and our regional simulation shows a significant reduction in winter and an even larger decrease in summer. Late summer ice is projected to disappear everywhere towards the end of the 21st century except in the far north, due to the ice-albedo feedback and the advection of warmer waters into the Arctic. The net rate of ice formation decreases in spite of the increase in the area of open water. With a projected decrease in ice formation by 2/3 to the end

of the century, thickness and age of perennial ice will decrease substantially.