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Direct heat flow measurements in Greenland corrected for paleoclimate and past evolution of the ice sheet

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Lack of direct heat flow measurements in regions currently covered by large ice masses complicates physical modelling of ice sheets and lithosphere, deep ice coring, and climate reconstruction from ice core isotope records. Direct ice temperatures measured from deep ice cores and estimates from ice-penetrating radar measurements suggest a highly inhomogeneous horizontal distribution of heat flow across Greenland, with regional values ranging from 20 – 40 mW/m2 in the south to over 140 mW/m2 in northern central Greenland. This range indicates either gross inaccuracies in heat flow estimates or lateral inhomogeneity in lithospheric structure on a scale that is atypical for stable Archaean to early Proterozoic lithosphere. Direct measurements of borehole temperatures suggest rather low heat flow of 30 to 40 mW/m2 in ice-free coastal areas of western and southern Greenland. A considerably higher heat flow estimated from borehole temperatures in eastern Greenland is still somewhat too low for a Neogene Igneous Province, which has been in close proximity to an active mid-oceanic ridge since 50 Ma. However, these estimates were derived from shallow boreholes and need to be corrected for paleoclimate. Here we present corrections to raw borehole temperature measurements for paleoclimate and thermal effects of the regional glaciation history over the last glacial period, the information which is crucial to heat flow-related studies and numerical modeling of the Greenland Ice Sheet.