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Estimating Antarctic Geothermal Heat Flux using Gravity Inversion

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Geothermal heat flux (GHF) in Antarctica is very poorly known. We have determined (Vaughan et al. 2012) top basement heat-flow for Antarctica and adjacent rifted continental margins using gravity inversion mapping of crustal thickness and continental lithosphere thinning (Chappell & Kusznir 2008). Continental lithosphere thinning and post-breakup residual thicknesses of continental crust determined from gravity inversion have been used to predict the preservation of continental crustal radiogenic heat productivity and the transient lithosphere heat-flow contribution within thermally equilibrating rifted continental and oceanic lithosphere. The sensitivity of present-day Antarctic top basement heat-flow to initial continental radiogenic heat productivity, continental rift and margin breakup age has been examined. Knowing GHF distribution for East Antarctica and the Gamburtsev Subglacial Mountains (GSM) region in particular is critical because: 1) The GSM likely acted as key nucleation point for the East Antarctic Ice Sheet (EAIS); 2) the region may contain the oldest ice of the EAIS - a prime target for future ice core drilling; 3) GHF is important to understand proposed ice accretion at the base of the EAIS in the GSM and its links to sub-ice hydrology (Bell et al. 2011). An integrated multi-dataset-based GHF model for East Antarctica is planned that will resolve the wide range of estimates previously published using single datasets. The new map and existing GHF distribution estimates available for Antarctica will be evaluated using direct ice temperature measurements obtained from deep ice cores, estimates of GHF derived from subglacial lakes, and a thermodynamic ice-sheet model of the Antarctic Ice Sheet driven by past climate reconstructions and each of analysed heat flow maps, as has recently been done for the Greenland region (Rogozhina et al. 2012).

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