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Geothermal heat flux uncertainties and the search for million year-old ice in Antarctica

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The geothermal heat flux is one of the least well known parameters of subglacial Antarctica. Several techniques exist to obtain this essential information. However, since direct measurements are only limited to a few deep drillings to the bed, there is always a substantial amount of ice sheet and thermodynamical modeling involved. This can either be done based on a fully coupled thermomechanical ice sheet model, or a thermodynamical model coupled to present-day ice sheet geometry and environmental conditions. The latter technique was recently employed by Pattyn (2010) in an attempt to determine the likelihood of basal temperate conditions of the Antarctic ice sheet using a series of existing datasets on mass balance and geothermal heat flux. Here, we present an update of this estimate using new data on bedrock elevation and ice thickness (Bedmap2; Fretwell et al., 2012) and observed surface velocities obtained from interferometric analysis (Rignot et al., 2011). The latter were further constrained by a hybrid ice sheet/ice shelf model to correct for the interior ice flow (where error of observations are to high) and for correcting the ice flow across subglacial lakes. We coupled the model with a new lake inventory from Wright et al. (in review) to improve the contribution of the geothermal heat flux to the temperature. This revised calculation of the temperature allows us to improve our knowledge of basal melting.
We determined different areas with a high likelihood to find million year-old ice, further constrained by low horizontal flow velocities and relative thick ice to ensure a straightforward climatic signal over such long period of time.