Geothermal controls on a pervasive water sheet at the head of Kamb Ice Stream, West Antarctica

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The availability of basal melt water has been hypothesized as a key control on the existence and evolution of localized ice streams within the West Antarctic Ice Sheet. Basal melting is controlled by glaciological stresses and the distribution of geothermal flux. While advances in interferometric mapping of surface velocities have improved estimates of ice stresses, the detailed geothermal contribution has proven more difficult to assess.

Until recently, mapping water systems through radar sounding was limited by a lack of fully quanitified reflection coefficients. Using airborne coherent radar sounding profiles, we have sucessfully derived absolute reflection coefficients for the Siple Coast region, and have we used that work to calibrate the radar sounding data for a densely gridded airborne survey over the onset region of Kamb Ice Stream, within the limits of a simple vertical advection temperature model for ice column losses. The validated basal reflection coefficients for the base of the C2 tributary of Kamb Ice Stream reveal an extensive highly reflective region, covering approximately 2000 km2.

We calculate high resolution hydraulic potentials using concurently acquired ice surface and bed elevations constrained by dual carrier phase GPS, and find that the reflective sheet is mostly restricted to three discrete regions of low hydraulic gradient, connected by ramps. We interpret this feature to be an pervasive, energetic water sheet.

Simultaneously acquired potential fields and radioglacialogical observations allow the modeling of the structure of the surrounding crust as well as the ice sheet's response to it. We present evidence for the association of this extensive sub-glacial water sheet with overlying ice column reduction, together with a geological context consistent with local enhancement of geothermal flux.