Geophysical Research Abstracts, Vol. 8, 09875, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09875

Detection of a thick water sheet beneath an ice stream tributary in West Antarctica

D. Blankenship, M. Peters, D. Young and D. Morse

The University of Texas Institute for Geophysics Jackson School for Geosciences, 4412 Spicewood Springs Rd. Bldg. 600, Austin TX 78759, United States (blank@ig.utexas.edu)

The shutdown 150 years ago of the main trunk of Kamb Ice Stream (formerly Ice Stream C), on West Antarctica's Siple Coast, has been attributed to subglacial water piracy, basal shear stress/melting feedbacks, or thermal advection feedbacks. Basal water systems are a key component of most hypotheses of shutdown; until recently, mapping these 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 [Peters et al.2005 doi:1029/2004JB003222], and here we use 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 interpret this as a pervasive and essentually continous basal water sheet. Electromagnetic theory implies that to be detected with a 60 MHz radar system, a low-salinity water layer thicker than 10 cm is required. Such a layer is much thicker that that implied by gap conduit models of subglacial water systems. 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. These flat regions, however, are connected by narrow hydraulic ramps on which the bright reflector is also observed. The thickness restriction on detection combined with the steep gradient at the ramps implies a high flux of water through the onset region of Kamb Ice Stream, supporting observations of rapid surface elevation change upstream. The large scale ponding of water, however, suggests that contemporary water piracy

by neighboring ice streams is not occurring.