Basal conditions at two sticky spots along Kamb Ice Stream, West Antarctica

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We present the results of seismic observations made upstream of the trunk of Kamb Ice Stream, West Antarctica, that point to sticky spots, basal freeze-on, and a discontinuous basal water system as reasons for the ongoing shutdown of Kamb Ice Stream. Seismic data from two 10.8 km profiles were collected during the 2002 - 2003 Antarctic field season: one crossed the south flank of the pronounced sticky spot visible in satellite imagery and near the CalTech boreholes, and the other was oriented transverse to ice flow about 30 km upstream. Both seismic profiles reveal considerable variations in basal topography, highlighting the fact that basal highs are present in the region that act as sticking points and resist fast ice flow. Each location also exhibits variable basal conditions, ranging from frozen sediments to soft, dilatant till to water. These variations in the basal regime of the ice stream arise from spatial discontinuities in the subglacial water system, as well as basal freeze-on. This discontinuity of soft, dilatant till and water at the bed, along with the presence of sticky spots, leads to unfavorable conditions for fast ice flow and the observed ongoing shutdown of Kamb Ice Stream.