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Coupled ice, water and crustal systems beneath the West Antarctic ice sheet with implications for fast glacier flow and habitats.

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Abundant subglacial water has been hypothesized as a key control on the existence and evolution of fast glacier flow within the West Antarctic Ice Sheet (WAIS). In addition, the origin of this water will dictate the diversity of life that can exist beneath the ice sheet. Large scale basal melting of the ice is controlled by glaciological stresses and the regional distribution of geothermal flux whereas subglacial hydrothermal systems will be controlled by local geology and a local concentration of high geothermal flux. In this talk, airborne measurement of ice thickness and surface slope coupled with radar reflection coefficients are used to characterize the water systems associated with both local and regional geology beneath the Ross and Amundsen Sea Embayments of the WAIS inferred from airborne gravity and magnetics observations. In addition, we utilize the internal layering of the ice sheet to evaluate candidates for subglacial hydrothermal systems. We conclude that 1) the upper reaches of Kamb ice stream in the Ross Sea Embayment of the WAIS are underlain by a pervasive water sheet that is “energetic”; 2) the regional geologic framework for this water sheet is an adjacent intrusive/extrusive complex that lies less than 1000 meters below the ice surface and is characterized by significant mantle upwarping; 3) there is direct evidence from layer downdraw within the ice that this complex is both a source of water for Kamb ice stream’s pervasive water sheet and that this water may arise from a subglacial hydrothermal system; and, 4) similar features, often associated with subglacial lakes, exist at depths up to several thousand meters beneath the Amundsen Sea Embayment

of the WAIS.