



Heterogeneous basal conditions beneath Pine Island Glacier sounded by radar

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Understanding the behaviour of Pine Island Glacier has been a significant scientific imperative over the last decade, with remote sensing measurements exposing rapid thinning and acceleration of ice in this part of West Antarctica. These trends show no sign of abating, and, with ablation from the vulnerable lower basin holding the potential to raise global sea level by ~ 24 cm, numerical models need to be constructed to predict the likely future behaviour of this highly dynamic catchment over the next century. Critical to such modelling will be a good representation of the basal boundary conditions. In the austral season of 2007-08 we operated the British Antarctic Survey's oversnow radar system DELORES (DEep-LOOK Radar Echo Sounder) across Pine Island Glacier, successfully sounding the bed in all 1500 km of profiles obtained. Variations in the amplitudes of the basal returns, corrected for ice thickness – a property termed Bed Reflection Power (BRP) – represent variations in basal conditions beneath the ice, and are commonly interpreted as variations in subglacial geology and sediment distributions, and variations in basal water content, with brighter returns reflecting higher water content and warmer conditions at the basal interface. Overall, BRP is heterogeneous and generally bright beneath Pine Island Glacier, albeit with two trends: (i) the basal interface becomes brighter downstream, with a positive step in brightness coinciding with flow out of a deep upstream basin; and (ii) brighter basal echoes are observed on the southern flanks of the basin, towards the neighbouring Thwaites Glacier catchment. The correspondence of variations in BRP with subglacial topographic features suggests a subglacial geological influence, and subglacial volcanism, known to exist in Pine Island Glacier and thought to exist beneath Thwaites Glacier, may be responsible for some particularly bright spots. The findings suggest that subglacial water is widespread in significant quantities beneath Pine Island Glacier.