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Diverse landscapes beneath Pine Island Glacier influence ice flow

Robert G Bingham (1), David G Vaughan (2), Edward C King (2), Damon Davies (1), Stephen L Cornford (3), Andrew M Smith (2), Robert J Arthern (2), Alex M Brisbourne (2), Jan De Rydt (2), Alastair GC Graham (4), Matteo Spagnolo (5), Oliver J Marsh (6), and David E Shean (7)

(1) School of GeoSciences, University of Edinburgh, UK (r.bingham@ed.ac.uk), (2) British Antarctic Survey, Natural Environment Research Council, Cambridge, UK, (3) Department of Geography, Swansea University, UK, (4) College of Life and Environmental Sciences, University of Exeter, UK, (5) School of Geosciences, University of Aberdeen, UK, (6) Gateway Antarctica, University of Canterbury, New Zealand, (7) Applied Physics Laboratory, University of Washington, USA

The retreating Pine Island Glacier (PIG), West Antarctica, presently contributes ∼5–10% of global sea-level rise. PIG's retreat rate has increased in recent decades with associated thinning migrating upstream into tributaries feeding the main glacier trunk. To project future change requires modelling that includes robust parameterisation of basal traction, the resistance to ice flow at the bed. However, most ice-sheet models estimate basal traction from satellite-derived surface velocity, without a priori knowledge of the key processes from which it is derived, namely friction at the ice-bed interface and form drag, and the resistance to ice flow that arises as ice deforms to negotiate bed topography. Here, we present high resolution maps, acquired using ice-penetrating radar, of the bed topography across parts of PIG. Contrary to lower-resolution data currently used for ice-sheet models, these data show a contrasting topography across the ice-bed interface. We show that these diverse subglacial landscapes have an impact on ice flow, and present a challenge for modelling ice-sheet evolution and projecting global sea-level rise from ice-sheet loss. The outcomes are of pertinence for forthcoming attention to Thwaites Glacier.

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