Basal topography of the Institute and Möller ice streams, West Antarctica: assessing the risk of grounding-line retreat.

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Grounding-line retreat into deep subglacial basins over reversed bed slopes is seen as a fundamental process by which marine-based ice sheets, such as the West Antarctic Ice Sheet (WAIS), undergo retreat and dynamic thinning. The potential risk posed by marine-ice-sheet instability has been assessed for the Ross and Amundsen Sea sectors of WAIS, where airborne radio-echo sounding (RES) datasets provide a comprehensive definition of basal topography. Since a reconnaissance aerogeophysical survey undertaken in the late 1970s, however, little new data have been acquired over large parts of the Weddell Sea sector of WAIS, significantly precluding evaluation of the risk posed by marine-ice-sheet instability within the third major drainage basin of WAIS.

During the austral summer 2010-11 a new geophysical dataset was acquired over the catchments of the Institute and Möller ice streams. 25,000 km of survey line were flown, acquiring RES, gravity, magnetic and lidar measurements. We use the RES data to describe the underlying geomorphology of these ice streams. Inland of their present grounding lines, the Institute and Möller ice streams are underlain by deep linear troughs (>1500 m below present sea level), characterized by steep reversed slopes with gradients exceeding those determined for the ice streams of the Amundsen Sea sector of WAIS. Basal reflections suggest the Institute and Möller troughs are floored with weak unconsolidated subglacial sediments, believed to have been deposited when the WAIS was less extensive than it is today. We use these findings to assess the sensitivity of the Institute and Möller ice streams to future grounding line retreat.