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Pine Island Glacier ice shelf melt distributed at kilometre scales

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Thinning and acceleration of West Antarctic ice streams are presently contributing about 10% of the observed global sea level rise. A primary source is from Pine Island Glacier, which has thinned since at least 1992, driven by changes in ocean heat transport beneath its ice shelf and unpinning from a seabed ridge. Details about the ice-ocean interaction driving this change, however, remain largely elusive, hampering our ability to predict the future behaviour of this and similar systems. Here, high-resolution satellite and airborne observations of ice surface velocity and elevation are used to measure patterns of basal melt under the ice shelf and the associated adjustments to ice flow. At the broad scale, melt rates up to 100 m/yr occur near the grounding line, reducing to 30 m/yr just 20 km downstream. At smaller scales, a network of basal channels typically 500 m to 3 km wide is sculpted by concentrated melt, such that kilometre-scale anomalies reach 50% of the area-averaged basal melt. Basal melting enlarges the channels close to the grounding line, but further downstream melting tends to diminish them. Spatially variable melt is a key component of the complex ice-ocean interaction beneath this glacier-restraining ice shelf.