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Surface and subsurface meltwater ponding and refreezing on the Bach Ice Shelf, Antarctic Peninsula

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There is growing concern about the stability and fate of Antarctic ice shelves, particularly those on the Antarctic Peninsula. Over the past few decades, of the original 12 major ice shelves, 4 have totally disintegrated, 3 have retreated significantly and 5 have remained relatively stable. It has been suggested that the boundary between instability and stability is marked by the −9oC mean annual temperature isotherm, that this isotherm is moving south, and that the Bach Ice Shelf (72°S 72°W), lying between Wilkins Ice Shelf and the southern ice front of George VI Ice Shelf, both of which have undergone major retreat in recent years, might be the next one under threat.

The proximal causes of ice shelf instability are not fully known but an increase in surface melting leading to ponding, flexure, fracture and calving has been implicated.

This study documents the changing surface hydrology of the Bach Ice Shelf over the last decade using a combination of Landsat optical and Sentinal-1A/B SAR data. It offers an opportunity to investigate the inter-annual variability in the area and volume of surface meltwater ponds, the area of subsurface ponds, the dates of pond onset and refreezing, and how this variability relates to climate. It provides a background against which future changes may be benchmarked.