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Impact of surface melt and ponding on the stability of Larsen C Ice Shelf, Antarctic Peninsula

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Several ice shelves on the Antarctic Peninsula have disintegrated rapidly in recent decades, and surface meltwater is strongly implicated as a driver. The Larsen C Ice Shelf is the largest ice shelf on the peninsula and one of the largest in Antarctica, and is subject to pronounced surface melting and meltwater ponding, especially in the northern sectors and landward inlets. As part of the MIDAS project we have investigated the structure and physical properties of the firn and ice layers in the 2014/15 and 2015/16 austral summers, using a combination of radar and seismic geophysical surveys together with hot water drilling and borehole optical televiewing and temperature measurements. We found that Larsen C's firn column and ice temperatures are modified strongly by surface melting and ponding, including the presence of massive ice bodies in the Cabinet and Whirlwind inlets. Numerical modelling reveals that these modifications have been altering ice shelf deformation, flow and fracture significantly. The findings from our MIDAS project thus suggest that the response of Antarctic ice shelves to climatic warming is more complex than previously thought.