Stability of Larsen C ice shelf, Antarctic Peninsula: insights from geophysics, remote sensing and numerical modelling

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Abstract: The collapses of the Larsen A and B ice shelves on the Antarctic Peninsula in 1995 and 2002, the ensuing acceleration of former feeding glaciers, and the concomitant contribution to sea-level rise, confirm the impact of southward-propagating climate warming in this region. Recent mass and dynamic changes of Larsen B's southern neighbour Larsen C, the largest ice shelf on the Antarctic Peninsula, may herald a similar instability. Using a numerical ice-shelf model constrained by satellite and in-situ geophysical data, we examine this potential instability. We demonstrate that the present-day spatial distribution and orientation of the principal stresses within Larsen C ice shelf are akin to those within pre-collapse Larsen B. When Larsen B's stabilising frontal portion was lost in 1995, the unstable remaining shelf accelerated, crumbled and collapsed in 2002. We hypothesize that Larsen C Ice Shelf may suffer a similar fate if it were not stabilised by warm and mechanically-soft marine ice, entrained from beneath by freezing of seawater within narrow suture zones.

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