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Stability of Larsen C Ice Shelf is controlled by Ice Mechanical Heterogeneity

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The MODIS Mosaic of Antarctica (MOA) reveals several instances of rift tip alignment on the Larsen C ice shelf, Antarctic Peninsula, matching those observed previously on other Antarctic ice shelves. In the southeastern sector of Larsen C, the tips of more than 15 sub-parallel rifts align along a narrow flow band of ice; SAR interferometry reveals that the ice wedges between these rifts move independently. This flow band originates in the lee of a pinning point near the ice shelf grounding line and, in the zone of rift tip alignment, it coincides with an increase in marine ice thickness and a corresponding decrease in meteoric ice thickness. Both pinning-point derived meteoric ice and marine ice are expected to be softer than ice advected into the ice shelf by feeding glaciers. We infer that these coinciding softness anomalies decrease the local stress intensity in this sector of the ice shelf, thereby significantly limiting rates of rift propagation. Investigations of other instances of rift tip alignment on the Larsen C ice shelf confirm this finding. We conclude that ice mechanical heterogeneity controls the stability of the Larsen C ice shelf, and possibly also the dynamics of many other Antarctic ice shelves.