RECENT ICE SHELF "DISINTEGRATION EVENTS" IN THE ANTARCTIC PENINSULA - POSSIBLE LINKS TO CHANGING SEA ICE CONDITIONS

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ABSTRACT:

Recent ice shelf break-up events along the Antarctic Peninsula have introduced a stunning new kind of glaciological phenomenon, previously unanticipated but with serious potential consequences for ice sheet mass balance and atmosphere-ocean interaction - "isintegration events". This phenomenon, typified by the retreat events of the Larsen A, Larsen B, and Wilkins ice shelves since 1995, is characterized by sudden late-summer increases in fine-scale calving leading to rapid disintegration of hundreds to thousands of square kilometers of shelf. While these events have been linked to increased summer surface melt (hydro-fracture processes), ice-shelf thinning (basal melt), and bending of the ice plate at the front by hydrostatic forces, a clear mechanism for the transition from quasi-stable shelf front in late summer to disintegrating ice shelf has not yet been described. An additional common factor, hitherto unstudied, is absence of a sea ice cover at the ice shelf fronts, preceding the events for several weeks to months and for consecutive years. Here, we present new results investigating the hypothesis that the anomalous absence of sea ice abutting the ice shelves, and driven by recent changes in atmospheric circulation patterns, has increased the exposure of ice shelves progressively weakened by melt processes to enhanced ocean wave activity. In particular, we examine the four disintegration events in detail with respect to ocean wave activity at their ice fronts, and model the process of wave-ice shelf interaction. The work compares four major break-up events and assesses the possible role played not only by pack ice but also by landfast sea ice (fast ice) in both a) the timing and nature of the disintegration events and b) the dispersal of the many small icebergs so produced.