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Abrupt ice-front retreat induced by disintegration of adjacent ice shelf in Antarctica

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Antarctic ice discharge constitutes the largest uncertainty in future sea-level projections. Floating ice shelves, fringing most of Antarctica, exert a retentive force onto the grounded ice and thereby hinder dynamic ice discharge from the continent. The stability of these ice shelves is thus crucial to understand past and future changes in ice-sheet dynamics and Antarctica′s future sea-level contribution. While abrupt ice-shelf retreat has been observed, it is generally considered to be a localized phenomenon, Here we show that adjacent ice shelves may communicate through their stress field and the disintegration of one can lead to an abrupt front-retreat of the other. Using a recently proposed calving law18 we reproduce the spontaneous but continuous retreat of the Larsen-B ice-front as observed between 1995 and 2000, merely by inducing the previously observed disintegration of the adjacent Larsen-A ice-shelf. The altered stress field due to the Larsen-A collapse, yields a change in the spreading rate in the Larsen-B ice-shelf via their connecting ice-channels. The altered spreading rate induces enhanced calving and thereby a retreat of the calving front to its observed metastable state of the year 2000. The presented mechanism may be relevant for a possible future sea-level contribution via East Antarctica's fringing ice shelves, which are more exposed to oceanic warming and largely interconnected via ice channels.