

Ice streams stop and start: evidence from the Ross Ice Shelf, interpreted using numerical models of ice shelf flow

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Flow features on the surface of the Ross Ice Shelf record two episodes of ice stream stopping and re-starting within the last 1000 years. We document those events using maps of streaklines emerging from individual ice streams and of ice provenance, together with numerical models of ice shelf flow. Forward model experiments lead us to conclude that only a limited set of discharge scenarios could have produced the current streakline configuration. In particular, Whillans Ice Stream (formerly B) must have stopped its rapid flow about 850 calendar years ago and restarted about 400 years later and MacAyeal Ice Stream (formerly E) either stopped or slowed significantly between 800 and 700 years ago, restarting about 100 years later. Previously, ice-stream scenarios emphasized runaway retreat or stagnation on millennial time scales. Here, we identify a new scenario: century-scale off/on cycles. This introduces uncertainty into predictions for future sea-level withdrawals by the West Antarctic Ice Sheet, which are based in part on recent slowing of Whillans Ice Stream and the "stopped" condition of Kamb Ice Stream.