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GPS measurements during two major calving events at Bowdoin Glacier, Greenland

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Future mass loss predictions, and thereby sea level rise predictions, are strongly affected by the representation of iceberg calving in numerical ice sheet models. Despite recent advances, gaps in our understanding of calving mechanisms remain and there exists a lack of data to constrain mechanical properties related to ice fracturing. For instance, observed critical strain rates for crevasse initiation span two orders of magnitude.

Bowdoin Glacier in Northwest Greenland provides a unique opportunity to conduct in-situ measurements near the calving front due to its accessibility via a crevasse-free walkable moraine. In July 2019, two major calving events were surveyed by 10 GPS stations installed along the front in close vicinity to the calving events. Measurements show glacier uplift prior to the first calving event and horizontal compression prior to the second major calving event.

In contrast to previously observed major events, no precursor such as a large surface crack was visible on the field. Our data suggest a change in calving behaviour from surface crevasses due to hydro-fracturing to basal crevasse formation due to buoyancy, which may be favoured by observed thinning (~4 m yr^{-1} since 2013).