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The effect of Antarctic ice-shelf extent on ice discharge

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The buttressing strength of Antarctic ice shelves directly effects the amount of ice discharge across the grounding line, with buttressing strength affected by both the thickness and extent of an ice shelf. Recent work has shown that a reduction in ice-shelf buttressing due to ocean induced ice-shelf thinning is responsible for a significant portion of increased Antarctic ice discharge (Gudmundsson et al., 2019, but few studies have attempted to show the effect of variability in ice-shelf extent on ice discharge. This variability arises due to ice-shelf calving following a cycle of long periods of slow, continuous calving interposed with calving of large, discrete sections. These discrete calving events tend to occur on a comparative timeframe to that of the observational record. As such, when determining observed changes in ice discharge it is crucial that this natural variability is separated from any observed trends.

In this work we use the numerical ice-flow model Úa in combination with observations of ice shelf extent to diagnostically calculate Antarctic ice discharge. These observations primarily date back to the 1970s, though for some ice shelves records exist back to the 1940s. We assemble an Antarctic wide model for two scenarios: 1) with ice shelves at their maximum observed extent and 2) with ice shelves at their minimum observed extent. We then compare these two scenarios to differences in the observed changes in Antarctic ice-discharge to determine how much can be attributed to natural variance .

Gudmundsson, G. H., Paolo, F. S., Adusumilli, S., & Fricker, H. A. (2019). Instantaneous Antarctic ice sheet mass loss driven by thinning ice shelves. *Geophysical Research Letters*, 46, 13903– 13909.