



Marie Byrd Land glacier change driven by inter-decadal climate-ocean variability

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Recent studies have revealed that ice along much of West Antarctica's coastline from the Antarctic Peninsula to the Ross Sea is undergoing dynamic thinning, likely in response to oceanic forcing. As part of a wider goal to understand how these forcings operate, and how they may vary in nature along West Antarctica's coastline, it is necessary to quantify indicators of dynamic thinning along the entire region, including those parts of West Antarctica that have traditionally received less attention. Here, we capture changes in the position of the grounding-line along coastal Marie Byrd Land between 2003 and 2015, which comprises approximately 50% of West Antarctica's Pacific-facing margin, and incorporates the ~650 km wide Getz Ice Shelf and the coastline stretching westwards to the Ross Ice Shelf.

Changes in grounding-line position are derived from optical satellite imagery. Using Landsat ETM+/OLI and ASTER L1T imagery, we derive advance and retreat values along the coastline during 2003-2008 and 2010-2015, corresponding to the ICESat and early CryoSat-2 satellite altimeter campaign periods, respectively.

We find that: i) the grounding line fringing Getz Ice Shelf has retreated notably over the observational period, in contrast with negligible change farther west along Nickerson and Sulzberger Ice Shelves; and ii) there is a strong correspondence between temporal variability in grounding-line retreat rate at Getz Ice Shelf with other recent evidence of glaciological change, including ice-thinning rates as inferred from ICESat and CryoSat-2.

Collectively, these observations suggest that there is a regional organisation of ice, ocean and climate interaction along the Marie Byrd Land margin, wherein the timing and magnitude of glacial change varies from east to west. This hypothesis is substantiated by observations of marked variability in the offshore wind field (from ERA-interim climate reanalysis data), consistent with variability in Circumpolar Deep Water intrusion rates towards Marie Byrd Land between 2003 and 2015. Mirroring the pronounced, inter-decadal variability in ocean forcing witnessed in the neighbouring Amundsen Sector in recent years, our findings underscore the requirement for continued, close observation of this important coastline in the future.