

Antarctic Glacier and Ice Shelf Front Dynamics in a Changing Climate

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Outlet glacier terminus positions and ice shelf extents along Antarctica's coastline are very dynamic and constantly changing. Changes in ice shelf and glacier extent significantly influence ice sheet dynamics as decreasing buttressing caused by retreating ice shelves increases ice sheet flow velocities [1, 2]. This enhances ice discharge with contribution to global sea level rise [3]. At present, fluctuations in frontal glacier and ice shelf positions are only partly understood as they can either be linked to internal ice sheet dynamics [4, 5] or climate and oceanic forcing in a warming climate [6, 7]. The common choice for monitoring changes in frontal positions is earth observation imagery. So far, many glacier and ice shelf front positions were mapped via remote sensing imagery but no analysis for the entire Antarctic coastline exists. This study presents an unprecedented circum-Antarctic record of retreating and advancing glaciers and ice shelves compiled from all existing studies of frontal positions. The observed pattern of advance and retreat along Antarctica's coast improves our understanding of Antarctic ice sheet-ocean interactions and helps to assess the influence of climate change on Antarctic ice sheet dynamics.

References:

- [1] H. Pritchard, S. R. M. Ligtenberg, H. A. Fricker, D. G. Vaughan, M. R. Van den Broeke and L. Padman, "Antarctic ice-sheet loss driven by basal melting of ice shelves," *Nature*, vol. **484**, pp. 502-505 (2012).
- [2] E. Rignot, S. Jacobs, J. Mouginot and B. Scheuchl, "Ice-shelf melting around Antarctica," *Science*, vol. **341**, pp. 266-270 (2013).
- [3] R. M. DeConto and D. Pollard, "Contribution of Antarctica to past and future sea-level rise," *Nature*, vol. **531**, pp. 591-597 (2016).
- [4] H. A. Fricker, N. W. Young, I. Allison and R. Coleman, "Iceberg calving from the Amery Ice Shelf, East Antarctica," *Annals of Glaciology*, vol. **34**, p. 241-246 (2002).
- [5] A. M. Lovell, C. R. Stokes and S. S. R. Jamieson, "Sub-decadal variations in outlet glacier terminus positions in Victoria Land, Oates Land and George V Land, East Antarctica (1972-2013)," *Antarctic Science*, vol. **29**, p. 468-483 (2017).
- [6] A. J. Cook, A. J. Fox, D. G. Vaughan and J. G. Ferrigno, "Retreating glacier fronts on the Antarctic Peninsula over the past half-century," *Science*, vol. **308**, pp. 541-544 (2005).
- [7] B. W. J. Miles, C. R. Stokes and S. S. R. Jamieson, "Simultaneous disintegration of outlet glaciers in Porpoise Bay (Wilkes Land), East Antarctica, driven by sea ice break-up," *The Cryosphere*, vol. **11**, pp. 427-442 (2017).
- [8] A. J. Cook, P. R. Holland, M. P. Meredith, T. Murray, A. Luckman and D. G. Vaughan, "Ocean forcing of glacier retreat in the western Antarctic Peninsula," *Science*, vol. **353**, pp. 283-286 (2016).