



## **Dynamic thinning of outlet glaciers on the Antarctic and Greenland ice sheets**

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The mass balance of the ice sheets is threatened primarily by acceleration of glaciers along their coastal margins. While measurements of acceleration have been made at a high resolution, equivalent measurements of thinning have not previously been possible because radar altimeters have a large footprint and operate reliably only over shallow slopes. The laser altimeter on the Icesat satellite has a much smaller footprint, allowing measurement of surface elevation over narrow outlet glaciers up to the coastal margin but overlapping footprints are scarce, making change measurement difficult. We have developed a simple technique for interpolation of Icesat measurements that allow us to measure elevation change with high spatial resolution and vertical precision. These measurements reveal in detail the pattern of coastal thinning for Greenland and Antarctica. We find a striking correspondence between thinning rate and flow rate over the glaciers of the Amundsen Sea Embayment and some major outlets of the East Antarctic ice sheet. We also find locally very high rates of thinning over the former ice shelf tributaries on the Antarctic Peninsula and some tributaries of existing ice shelves, and widespread thinning of major Greenland outlets. We are able to distinguish by their geographic distribution and rate that these changes are unambiguously dynamic in cause. These measurements complement recent calculations of basin-scale mass imbalance from budget analysis using flow and accumulation rates, and improve estimates of the ice sheet contribution to contemporary sea level rise.