

# Subglacial lakes: They're (almost) everywhere

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A survey of the Antarctic ice sheet using satellite laser altimetry has detected 45 small regions of surface uplift or drawdown in thirteen different glacier drainages around Antarctica. Surface displacements are measured relative to the best-fitting plane passing through multiple (4-11) elevation measurements on the same repeat-track, allowing correction for across-track slopes. Volume displacements are derived by interpolating displacements from multiple tracks to a common grid.

These ECAs (Elevation Change Anomalies) range from less than four km to more than 60 km across, with vertical displacements ranging from a few decimeters to over ten meters. Typical volume displacements are on the order of 0.05 cubic kilometers over the three-year survey, and the largest displacement is more than 1.7 cubic kilometers. Although the majority of the ECAs are within the Filchner-Ronne catchment, others (including those discussed by Fricker and others, 2007), are found in the Ross Embayment, in the drainages of Byrd Glacier and Lambert Glacier, and in the interior of Wilkes Land. Notably, none are within the Amundsen Sea drainage.

As have other researchers who have observed ECAs, we take these features to result from water motion at the bed. In all cases where the ice sheet velocity structure is known, the ECAs are in regions of ice stream or tributary flow, which implies that they are associated with melting bed conditions. Some of the ECAs appear to be downstream of linear features in the ice sheet surface, suggesting that they are associated with localized reductions in glaciostatic pressure caused by cavitation when ice flows over obstructions at the bed. Others have no clear association with surface topography.

The relatively small number of ECAs precludes drawing strong conclusions about spatial and temporal correlations between filling and drainage events. However, a few conclusions are clear: Because adjacent ECAs are more likely to have correlated filling or drainage rates than to have anti-correlated filling or drainage rates, it does not appear that water is conserved among the ECAs. This suggests that the ECAs exchange water with other water systems at the bed. Of critical importance for our understanding of ice stream dynamics is whether inflation of the ECAs represents a withdrawal of water from the system that lubricates fast basal motion. If the correlation of drainage and filling over distances of hundreds of kilometers is not coincidental, it suggests either that large-scale channel systems connect the ECAs, or that filling or drainage is triggered by large-scale velocity variations.