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Surface melt on Antarctic ice shelves driven by wind-albedo interactions

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Surface melt and subsequent firn air depletion is considered an important precursor for disintegration of Antarctic ice shelves, causing grounded glaciers to accelerate and sea level to rise. Recent studies have highlighted the impact of surface winds on Antarctic ice shelf melt, both on the Antarctic Peninsula and in East Antarctica. In the Antarctic Peninsula, foehn winds enhance melting near the grounding line, which in the recent past has led to the disintegration of the most northerly ice shelves. On the East Antarctic ice shelves, on the other hand, meltwater-induced firn air depletion is found in the grounding zone as result of persistent katabatic winds, regionally warming the atmosphere and inducing a melt-albedo feedback.

Here, we use a combination multi-source satellite imagery, snow modelling, climate model output and in-situ observations to highlight the importance of this wind-induced melt and to show its widespread occurrence across Antarctica. The satellite imagery gives insight in the meltwater drainage systems, showing spatio-temporal changes in both supraglacial and englacial water throughout the melt season and during the subsequent winter.

Although the wind-induced melt is a regional phenomenon with strong inter-annual variability, it is strongly correlated to larger scale climate parameters, such as summer surface temperature. Based on these correlations and snow model output driven by future climate scenarios, we can constrain the future changes to this local melt near the grounding line.