

Grounding line basal melt rates determined from internal stratigraphy

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We use ice-penetrating radar data across the grounding line of Siple Dome and Roosevelt Island, Antarctica to measure the spatial pattern and magnitude of sub-ice shelf melting at these locations. Layers are typically (although, not always) downwarped at the grounding line, likely due to basal melting from warm sub-ice shelf waters coming into contact with the base of the ice sheet. Downwarping occurs over a limited region of up to five kilometers downstream of the grounding line indicating that the pattern of melt may be much more focused than previously assumed. Further, localized downwarping indicates a temporal shift in the melt pattern; either the magnitude of the peak melt rate, the location of the grounding line and/or the shape of the melt pattern shifted at some point in the past. We also find that the pattern of basal melting is not spatially uniform -even over short distances. This heterogeneity may reflect small differences in the shape of the ice shelf cavity since the spatial distribution of melting is sensitive to the sub-ice shelf slope. When compared to melt rates obtained from modeling of sub-ice shelf circulation we find that our peak melt rates obtained from layer analysis agree with the model results around Siple Dome, but not for Roosevelt Island where we find much larger melt rates than expected.