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Seasonal basal melting at Nivlisen Ice Shelf, East Antarctica, inferred from autonomous phase-sensitive radars

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Thinning rates of ice shelves vary widely around Antarctica and basal melting is a major component in the mass loss of ice shelves. In this study, we present observational data of the spatial and temporal varying basal melting of Nivlisen Ice Shelf, central Dronning Maud Land, in 2017 and 2018, using autonomous phase-sensitive radars. These unique records for East Antarctica show in general moderate yearly melt rates of approximately 1 m/yr. High melt rates (4 m/yr) were observed close to a grounded feature near the ice shelf front. Daily time-varying measurements of basal melt rates show a strong seasonal signal 3 km from the ice shelf front, with the highest melt rates (5 m/yr) occurring in summer. Comparing with atmospheric reanalysis data, we hypothesize that the seasonality was caused by summer-warmed surface water pushed by wind into the ice shelf cavity. 35 km into the ice-shelf cavity, we observe a clear tidal signal and no melt seasonality. Radar profiling of the ice-shelf show variable ice thickness from smooth beds to basal crevassing and down-warping englacial features. We conclude that warm deep ocean waters have a limited effect on the basal melting of this relatively thin ice shelf, in contrast to thicker (>400 m) ice shelves elsewhere in Antarctica. On the other hand, warmer surface water, affected by decreased sea-ice cover, have the potential to increase basal melting.