Geophysical Research Abstracts
Vol. 20, EGU2018-4901, 2018
EGU General Assembly 2018

Basal melt rate variability across ice-shelf channels in Dronning Maud Land, Antarctica

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Antarctic ice shelves buttress the grounded ice sheet, and so the spatial and temporal variability in their basal mass balance, driven by their interaction with the ocean, is of significant interest. ApRES (Autonomous phase-sensitive radio-echo sounder) measurements have been conducted at a series of sites on Roi Baudouin Ice Shelf (RBIS), Dronning Maud Land, East Antarctica. Vertical strain and basal melt rates are inferred from the vertical displacements of internal reflecting layers and the base. Radar sites were distributed across ice-shelf channels between the grounding line and the ice front, where the highest basal melt variability was suspected (Berger et al., 2017). Repeat visits were made to these sites over periods of several weeks in January 2016. Melt rates range from -0.09 $\pm$ 0.06 m a^{-1} to 6.25 $\pm$ 0.08 m a^{-1} in the channel, and the magnitude and variability in melt rates decreases with distance from the grounding line. The spatial variability of basal melting confirms the pattern inferred from space-borne remote sensing. At two sites, continuous measurements were made over a whole year, from which the seasonal trend and short-term variability was derived. Although our measurements remain sparse, there is a clear correlation between basal melt rates and the topography of the ice-shelf base. From these time series, we see what appears to be a seasonal variability in melt rates. Both vertical strain and basal melt rates have high power at semi-diurnal and diurnal frequencies, which imply the influence of tides.