

**MELT-FREEZE CONDITIONS UNDER THE AMERY ICE SHELF INFERRED FROM WAVEFORM ANALYSIS OF RES DATA AND MASS FLUX CALCULATIONS**

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An air-borne radio echo sounding survey was conducted over the Amery Ice Shelf, East Antarctica, in December 2003. Nine transverse profiles were obtained approximately normal to the flow direction, together with one longitudinal profile for a total length of flight lines of about 1000 km. We determined the spatial distribution of the characteristics of the RES signal returned from the ice-water interface at the base of the shelf. The key characteristics are described by the amplitude of the echo and the slope of the leading edge of the returned pulse.

For the mass flux we use ice thickness values extracted from our RES data, and velocities derived from InSAR maximum coherence tracking in pairs of Radarsat SAR images, with control provided by surface measurements. We calculate the mass budget for a set of discrete areas bounded by our RES survey lines across the shelf, and flow-lines derived from the velocity field (modified in the across shelf components of the velocity) and from linear flow-features identified in satellite images. Using available estimates of the snow accumulation rate at the upper surface, and assuming the ice thickness and velocity fields are stationary in time, we attribute the mass imbalance within a sub-area to be the result of melt or freeze at the base of the shelf.

Both, the distribution of values of melt-freeze rates, and of the characteristics of the basal echoes form distinct patterns that appear to be influenced by variations in the ice draft and conditions in the sub-shelf ocean cavity. We find a net melt regime associated with the deeper draft to the south and under the central part of the shelf, and net freeze conditions in the north and sides, particularly towards the western margin. The strength of the electromagnetic signal reflected from the ice water-interface shows a similar pattern of variation along all nine transverse profiles. We find a strong association with basal mass balance.