

INDEPENDENT FLOW REGIMES IN THE SOUTHERN MCMURDO AND ROSS ICE SHELVES – NEW EVIDENCE FROM VELOCITY ANALYSIS OF LANDSAT IMAGES AND NUMERICAL MODELLING.

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Previous velocity observations in this region reveal a 100 fold difference in velocity magnitudes of Southern McMurdo and Ross Ice Shelves, while gravity measurements indicate a sharp rise in the bathymetry north of the eastern tip of Minna Bluff leading to the suggestion that the ice shelf is grounded in this region. Glacial geological features of the Southern McMurdo Ice Shelf have been used to indicate the past configuration of a grounded Ross Ice Shelf - however the connection between these two ice shelves is not fully known. For these reasons a study has been undertaken of the flow regime and interaction at the boundary between these two ice shelves.

Ice shelf velocity was determined using autonomous tracking techniques applied to three Landsat 7 ETM+ images. Errors in this process due to incorrect matching of features were minimised by removing inconsistent data values and using a judicious choice of matching parameters.

A finite element model of the region was then constructed using the derived ice velocity data as input to the model. The ice shelf is modelled as a nonlinear viscoelastic material, with restricted movement at those boundaries which meet land. Internal velocities produced by the model are in good agreement with measured values.

A distinct shear zone runs from the tip of Minna Bluff to White Island which accommodates the large difference in velocities present. East of this shear zone, northward ice velocities in excess of 500 m a^{-1} are observed, reducing to 200 m a^{-1} adjacent to Minna Bluff. Immediately west of the shear zone, flow rates into the Southern McMurdo Ice Shelf are 20 m a^{-1} to the northwest, and diminish in magnitude further west.

These results reveal that the eastern end of Minna Bluff is restricting the flow of the Ross Ice Shelf and, together with White Island, is generating the shear zone.

This work has implications for studies of the Southern McMurdo Ice Shelf as it shows the limited interaction that the flow regimes of these two ice shelves share.