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Seismic constraints on the firn and upper ice structure of the central Amery Ice Shelf, East Antarctica

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The structure of the firn and upper ice contains a wealth of information on the recent glaciological and deformation histories of a given glacial environment. The observed thickness and densification of the firn provides details on surface accumulation, temperature and local ice dynamics; thus, observations of the firn from multiple locations can highlight how climate and ice dynamics may vary across a glacier or ice shelf. Seismic observations of the firn offer a simple means for imaging the physical properties of the firn, as the firn column can be seismically imaged in a matter of hours at a given location.

Here we present seismic results of the firn and upper ice from extensive campaigns conducted across the Amery Ice Shelf, East Antarctica, between 2002 and 2006. Seismic observations were made within a 100 km $\times$ 50 km grid extending along the central portion of the ice shelf; a series of these observations targeted the shear zone between the Lambert Glacier and Mawson Escarpment ice units. We observe that the depth to pore close-off is highly variable across this region, ranging from $\sim$10 m in the south to >45 m in the north. The targeted shear zone observations detect seismic anisotropy of up to 4% in the lower firn and upper ice, highlighting a change in crystal orientation fabric across this shear zone between the Lambert Glacier and Mawson Escarpment ice units. We discuss the glaciological implications of these new seismic observations, which demonstrate that active seismic methods provide a fast and effective means of imaging firn and upper structure across a given glacial region.