

Englacial Seismic Reflectivity – Imaging Crystal Orientation Fabric in West Antarctica

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Active-source seismic observations from West Antarctica offer insight into the evolution of Crystal Orientation Fabric (COF) within ice-sheets. We observe abrupt changes in COF in seismic data acquired at WAIS Divide, mid-stream and down-stream on Thwaites Glacier, and the onset region of Bindschadler Ice Stream. These data reveal a prevalence of englacial seismic-reflectivity in the bottom quarter of the ice sheet. We determine the origin of the reflectivity to be abrupt changes in the COF of ice. We base this on the following: i) seismic character is in keeping with current knowledge of COF within ice sheets, ii) COF requires the simplest genesis, especially at ice divides, and iii) amplitude analysis shows that all the reflectivity can be explained by contrasts in seismic velocity due to COF changes. The observed englacial seismic-reflectivity is complex but largely bed-conformable. Where prominent bed features are observed, distinctive englacial structures are also observed. We note that the increase in the quantity and complexity of COF observations downstream indicates that direct observations of COF at ice divides likely underestimates the role that fabric plays in ice sheet dynamics.