

IceCube Polar Science Workshop



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Polarimetric radar-sounding methods to characterise ice birefringence, fabric anisotropy, and flow history

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Ice-penetrating radar is able to detect anisotropy through exploiting the birefringence of ice crystals, and this technique has aided quantification of the horizontal properties of the ice crystal orientation fabric (COF) at multiple sites across the Antarctic Ice Sheet. These techniques have not only been verified through multiple comparisons with ice cores, but also have been subsequently applied at sites with more dynamic and complex ice flow that are unsuitable for drilling operations. Because the bulk COF of ice sheets records the past history of ice sheet deformation and influences present-day ice flow dynamics, radar observations of ice anisotropic properties provide an opportunity for accurate and widespread mapping of bulk COF across a diverse range of flow regimes. The applications for radar measurements of ice anisotropy are diverse and important. Accurate measurements of ice fabric strength and orientation not only places constraints on present and past ice flow history, but also aids in the incorporation of anisotropic rheology in ice flow models. Separately, the characterisation of ice birefringence, as previously applied in radar-sounding, shows promise for application in radio neutrino experiments.

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Session Classification: Modeling and measurements of optical and radio propagation in birefringent ice