Imprints of air bubbles & crystal orientation fabric on RES signature?

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Introduction

Radio echo sounding (RES) enables mapping of bedrock topography and internal structure in large ice bodies. Via multi-frequency and multi-polarization sounding, internal reflections can be assigned to non-uniformities in density, conductivity and crystal orientation fabric (COF). This allows to deduce a multitude of glaciological parameters (e.g. accumulation, linking of ice cores). Similar as [1], [2], and [3], we analyse polarization dependent backscatter from ground based measurements in Antarctica and on an cold alpine glacier (Colle Gniffetti, Monte Rosa, Swiss-Italian Alps).

The Antarctic example displays anisotropic backscatter which changes its direction with increasing depth. We suspect that this is caused by changing COF or by anisotropic distribution of air bubbles in the ice matrix since the change in direction coincides with the clathrate transition observed in the nearby EPICA-DML ice core. We compare the results with a multi-polarization and multi-frequency experiment on the Colle Gniffetti. There, the anisotropic response is visible, but far less pronounced. Eventually, this study aims to link the observed anisotropy in the RES data to stress and strain rates in ice sheets.

Observation

1) High resolution (~1-2 m) COF measurements in Dronning Maud Land

For the alpine example an anisotropic response is harder to evaluate and still work in progress.

Discussion

• Dronning Maud Land
• Colle Gniffetti

References

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