Ice rises: The double role of imprinting and archiving ice-dynamics at the sheet-shelf boundary of Antarctica

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Almost three-quarters of the Antarctic ice-sheet boundary is in contact with the ocean. Floating ice shelves extend the continental ice seawards and provide an interface for the interaction of ice and ocean. Ice rises are grounded features embedded within ice shelves. They typically develop a local ice-flow regime which on the one hand buttresses the large-scale ice flow from the Antarctic continent, and on the other hand may stabilize the grounding-line position on a inland facing bedrock slope. As a consequence of the nonlinear ice rheology, the stratigraphy of ice rises is often arched-upwards beneath the divides (referred to as the “Raymond effect”). Using radar and ice-flow models, this feature can be visualized and interpreted as a proxy for the ice-flow history in the surrounding. Additionally ice rises are of particular interest for upcoming ice-core arrays.

This study presents the results of airborne and ground-based radar surveys on ice rises situated along the Dronning Maud Land coast. The dataset is complemented with satellite remote-sensing (SAR and InSAR) and serves as input for different ice-flow models. We synthesize the data in order to check the suitability of a proposed ice-core site, to investigate the role of anisotropic ice flow, and to derive characteristic time scales for the temporal (non-)stability of the divide position. Eventually we also aim to clarify the role of ice rises in defining the grounding-line location. The various parameters that can be derived from ice rises help to constrain the extent and volume of the Antarctic ice sheet in the past, and also contribute to an enhanced forecast for the future contribution of Antarctica to sea level rise.