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Modelling the spatial variability of accumulation across ice rises in Dronning Maud Land, Antarctica

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During two field campaigns (austral summer of 2008 and 2010), we collected radar data across two ice rises within the ice shelf in Dronning Maud Land (Antarctica), i.e. the FranKenny ice rise (promontory still connected to the main ice sheet) and the Derwael Ice Rise, using both a 5 and 2 MHz radar system. Moreover, during the 2010 season, a number of profiles were carried out with a high-frequency radar (400 MHz), penetrating to depths of 10-20m from the surface. Besides the bed reflection, a number of internal radar reflection layers could be identified from the low-frequency radar data across both ice rises. These layers show a remarkable variability in layer depth at both sides of the dome, pointing to a variability in surface accumulation rates. This difference is also confirmed in the high-frequency data. Based on several numerical ice sheet models of different complexity (ranging from the Nye time scale to fully thermomechanically coupled shallow-ice and higher-order ice sheet models), we modelled the geometry of several identified isochrones either close to the surface and/or further down. Local accumulation rates were obtained through inverse modelling. Results show that accumulation rate vary with more than 40 % across the ridges. Although the precise reason of this variation is still unknown, the distribution seems closely related with katabatic wind redistribution. An analysis of the difference in accumulation distribution at both sites as a function of the general pattern in katabatic wind distribution is presented.