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A comparative modeling study of the Brunt Ice Shelf – Stancomb-Wills Ice Tongue System

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Two diagnostic, dynamic ice-shelf models, the Darmstadt (DA) and the Münster (MS) model, are applied to the Brunt Ice Shelf - Stancomb Wills Ice Tongue System (BIS-SWIT), located off Caird Coast, Oates Land, Antarctica. The BIS-SWIT is characterized as a thin, unbounded ice shelf with an untypical, highly hetereogenous structure. In contrast to other ice shelves, BIS and SWIT are linked by a discontinuous mass of icebergs bound together by a melange of extraordinarily thick sea ice (up to 50 m), covered by a thick accumulated snow layer, and smaller meteoric ice blocks. We perform numerical simulations of the present flow regime of the ice shelf that results from the ice-thickness distribution and the inflow at the grounding line. We use a high-resolution ice thickness distribution derived from ICESat (Ice, Cloud, and Land Elevation Satellite) GLAS (Geoscience Laser Altimeter System) surface elevation data, reflecting the hetereogenous structure of the ice mass. Ice velocities derived by means of feature tracking (British Antarctic Survey, Humbert and Pritchard, 2006) and inSAR (Canada Center of Remote Sensing, Gray, 2001) are used along the grounding line as input quantities. The simulated speeds of both models are in very good agreement with each other. Focus of this study is the incorporation of two dominant rift systems in the finite difference MS-model and the finite element DA-model. This is done by two different approaches, numerical decoupling in the MS model and physical softening in the DA model. Our main findings are that the incorporation of the rift system improves the modelling results in both model approaches, as it leads to increased

velocities of the SWIT area and decreased velocities in the adjacent slow moving part. However, the extreme velocity contrast across the rift, as seen in observational data, cannot fully be simulated. A major result of this study is that both implementations of the rifts into the numerical simulations lead to similar effects on the flow field.