

InitMIP-Antarctica experiments with the ice sheet model SICOPOLIS

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The Ice Sheet Model Intercomparison Project for CMIP6 (ISMIP6) brings together a consortium of international ice sheet and climate models to explore the contribution from the Greenland and Antarctic ice sheets to future sea level rise. For such projections, initialisations are required that provide initial states of the respective ice sheet. InitMIP-Antarctica is an early initiative within ISMIP6 in order to explore this issue for the Antarctic ice sheet across a variety of models and initialisation techniques. We contribute to InitMIP-Antarctica with the ice sheet model SICOPOLIS and a spin-up-type initialisation, that is, a paleoclimatic simulation over 135 ka until the present. A major new component of the model is a physically-based parameterisation of ice shelf basal melting. In this parameterisation, basal melting of ice shelves is computed as a function of both the depth of ice below mean sea level and far-field ocean temperatures. The parameterisation is tuned differently for eight Antarctic sectors in order to achieve reasonable agreement with the modern spatial distribution of ice shelf basal melting. InitMIP-Antarctica also comprises three future climate scenarios, all to be run over 100 a: ctrl (present-day climate), asmb (prescribed schematic surface mass balance anomaly) and abmb (prescribed schematic basal melting anomaly under ice shelves). We present and discuss the performance of the spin-up in terms of agreement between simulated and observed present-day geometry and flow. Further, we investigate the response of the Antarctic ice sheet to the three future climate scenarios.

Keywords: Antarctica, Ice sheet, Ice shelf, Basal melting, Climate change, Modelling