



The influence of continental shelf bathymetry on Antarctic Ice Sheet response to climate forcing

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We investigated whether shelf-depth changes would have influenced Antarctic Ice Sheet (AIS) response to climate forcing using the Parallel Ice Sheet Model (PISM). The simulations confirm that this would have indeed been the case. For the last-glacial-cycle (LGC) type forcing we prescribed, a modern-like polar AIS surrounded by shallow and intermediate bathymetries experiences rapid grounding-line advance early during the transition from interglacial to glacial forcing. This is in contrast to our baseline simulation of AIS response on the currently overdeepened bathymetry, which showed the expected gradual advance of grounding lines to the same climatic forcing. In the simulation, the more-positive mass balance for the shallower bathymetry is primarily a result of significantly lower calving fluxes from smaller-area ice shelves. On the basis of these results, we suggest that shelf bathymetry is an important boundary condition that should be considered when reconstructing AIS behavior since at least the middle Miocene. We note that caution should be used when applying these concepts because the particular way in which AIS mass balance is altered by shelf depth depends on how the changes in accumulation and ablation at the marine terminations combine with accumulation and ablation on land.