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A simulation of small to giant Antarctic iceberg evolution: differential impact on climatology estimates

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We present a simulation of Antarctic iceberg drift and melting that includes small (<2.2 km), medium-sized, and giant tabular icebergs with lengths of more than 10km. The model is initialized with a realistic size distribution obtained from satellite observations. Our study highlights the necessity to account for larger and giant icebergs in order to obtain accurate melt climatologies.

Taking iceberg modeling a step further, we simulate drift and melting using iceberg-draft averaged ocean currents, temperature, and salinity. A new basal melting scheme, originally applied in ice shelf melting studies, uses in situ temperature, salinity, and relative velocities at an iceberg's keel.

The climatology estimates of Antarctic iceberg melting based on simulations of small, 'small-to-medium'-sized, and small-to-giant icebergs (including icebergs > 10km) exhibit differential characteristics: successive inclusion of larger icebergs leads to a reduced seasonality of the iceberg meltwater flux and a shift of the mass input to the area north of 58°S, while less meltwater is released into the coastal areas. This suggests that estimates of meltwater input solely based on the simulation of small icebergs introduce a systematic meridional bias; they underestimate the northward mass transport and are, thus, closer to the rather crude treatment of iceberg melting as coastal runoff in models without an interactive iceberg model.

Future ocean simulations will benefit from the improved meridional distribution of iceberg melt, especially in climate change scenarios where the impact of iceberg melt is likely to increase due to increased calving from the Antarctic ice sheet.