Geophysical Research Abstracts
Vol. 15, EGU2013-7515, 2013
EGU General Assembly 2013

Projections of grounding line retreat in West Antarctica carried out with an adaptive mesh model

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Present and future sea level rise associated with mass loss from West Antarctica is typically attributed to marine glaciers retreating in response to a warming ocean. Warmer waters melt the floating ice shelves that restrain some, if not all, marine glaciers, and the glaciers themselves respond by speeding up. That
leads to thinning and in turn grounding line retreat. Satellite observations indicate that Amundsen Sea Embayment and, in particular, Pine Island Glacier, are undergoing this kind of dynamic change today. Numerical models, however, struggle to reproduce the observed behavior because either high resolution or some other kind special treatment is required at the grounding line.

We present 200-year projections of three major glacier systems of West Antarctica: those that drain into the Amundsen Sea , the Filchner-Ronne Ice Shelf and the Ross Ice shelf. We do so using the newly developed BISICLES ice sheet model, which employs adaptive mesh refinement to maintain sub-kilometer resolution close to the grounding line and coarser resolution elsewhere. Ice accumulation and ice shelf melt-rate are derived from a range of models of the Antarctic atmosphere and ocean forced by the SRES A1B and E1 scenarios. We find that a substantial proportion of the grounding line in West Antarctica retreats, however the total sea level rise is less than 50 mm by 2100, and less than 100 mm by 2200. The lion's share of the mass loss is attributed to Pine Island Glacier, while its immediate neighbor Thwaites Glacier does not retreat until the end of the simulations.