Future rates of sea-level rise from long-term coupled climate-ice sheet projections

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Global mean sea level rose at an average rate of $\sim$3.1 mm yr^{-1} since the early 1990s and is projected to rise between 0.28 and 0.98 m until year 2100, strongly depending on the assumed anthropogenic forcing scenario (IPCC AR5). This global rise in sea level is a combination of contributions from ocean thermal expansion, glaciers and small ice caps, from the Greenland and Antarctic ice sheets and changes in land water storage. Except for the latter, all components are expected to contribute to further sea-level rise well beyond the end of this century due to the long residence time of CO_2 in the atmosphere.

In the present study we present results from long-term future sea-level change experiments over 1000 years with the Earth system model of intermediate complexity LOVECLIM version 1.3 forced by four extended RCP scenarios. The model includes fully coupled three-dimensional thermomechanical models of the Greenland and Antarctic ice sheets, a global glacier melt algorithm to account for the response of mountain glaciers and small ice caps, and a diagnostic for oceanic thermal expansion. A range of the model's sensitivity to greenhouse warming was sampled by systematic parameter variations leading to an ensemble of model versions that simulate the present-day climate consistent with observations, while producing contrasted results for the future period. We analyse sea-level rates of change for all components over the course of the third millennium for the entire ensemble of model versions and forcing scenarios.