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ISMIP6 Antarctica: a multi-model ensemble of the Antarctic ice sheet evolution over the 21st century

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Ice flow models of the Antarctic ice sheet are commonly used to simulate its future evolution in response to differ- ent climate scenarios and inform on the mass loss that would contribute to future sea level rise. However, there is currently no consensus on estimated the future mass balance of the ice sheet, primarily because of differences in the representation of physical processes and the forcings employed. This study presents results from 18 simulations from 15 international groups focusing on the evolution of the Antarctic ice sheet during the period 2015-2100, forced with different scenarios from the Coupled Model Intercomparison Project Phase 5 (CMIP5) representative of the spread in climate model results. The contribution of the Antarctic ice sheet in response to increased warming during this period varies between -7.8 and 30.0 cm of Sea Level Equivalent (SLE). The evolution of the West Antarctic Ice Sheet varies widely among models, with an overall mass loss up to 21.0 cm SLE in response to changes in oceanic conditions. East Antarctica mass change varies between -6.5 and 16.5 cm SLE, with a significant increase in surface mass balance outweighing the increased ice discharge under most RCP 8.5 scenario forcings. The inclusion of ice shelf collapse, here assumed to be caused by large amounts of liquid water ponding at the surface of ice shelves, yields an additional mass loss of 8 mm compared to simulations without ice shelf collapse. The largest sources of uncertainty come from the ocean-induced melt rates, the calibration of these melt rates based on oceanic conditions taken outside of ice shelf cavities and the ice sheet dynamic response to these oceanic changes. Results under RCP 2.6 scenario based on two CMIP5 AOGCMs show an overall mass loss of 10 mm SLE compared to simulations done under present-day conditions, with limited mass gain in East Antarctica.

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