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Challenge in determining the impact of warming limited to 1.5/2°C for Antarctica

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To assess the impact of various future climate scenarios (1.5°C, 2°C, RCP4.5, RCP8.5) on the Antarctic ice sheet and its contribution to the global sea level, we exploit a large ensemble of ice sheet simulations. It covers the period from 1850 to 5000 to determine short-term and long-term implications of different future climate paths. To sample the uncertainty range, we use atmospheric and oceanic output of three CMIP5 models, two initial ice sheet states, and different ways in applying the climate forcing. Two major challenges are detected: First, the oceanic and atmospheric conditions of global climate models are too warm for pre-industrial and present-day climates. Hence the forcing cannot be applied directly, while our simulations driven by the widely established method of anomaly forcing are generally more realistic. Second, we detect a very large uncertainty of near future projections up to 2100 and more so for the far future projections. This uncertainty makes conclusions on the impact of global climate warming limitation difficult to impossible. Some ensemble members lose the West Antarctic Ice Sheet or even parts in the east, while others do not. Ultimately, realizations with instabilities project sea level rises significantly larger than CMIP5 estimates. On the other hand, some of the realizations even show a negative sea level contribution due to mass accumulation in the interior of the Antarctic.