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The contribution of the Antarctic Ice Sheet to global sea level from the Last Glacial Cycle to the future

Santiago Tesouro[1], Jorge Álvarez-Solas[2], Javier Blasco[3], Alexander Robinson[3], Jan Swierczek-Jereczek[1], and Marisa Montoya[1,2]

[1]Department of Earth Physics and Astrophysics, Complutense University of Madrid, Madrid, Spain, (stesouro@ucm.es)
[2]Geosciences Institute, CSIC–UCM, Madrid, Spain
[3]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Potsdam, Germany

The Antarctic Ice Sheet (AIS) is the largest potential contributor to future sea-level rise, with an ice volume equivalent to 58 m of global-mean sea level. However, high uncertainties arise from the representation of key physical processes in ice-sheet models, such as basal sliding, ice-ocean interactions, and feedback mechanisms associated with glacial isostatic adjustment (GIA). Previous studies have estimated the future Antarctic sea-level contribution (SLC) by forcing an ice sheet spun up to a present-day equilibrium state. However, observations of the last decades indicate that the AIS is not in equilibrium, as it is undergoing net mass loss as a result of both ongoing anthropogenic climate change and its long-term adjustment following the last deglaciation. Here, we study the future SLC of the AIS using simulations that span a complete Last Glacial Cycle. To this end, we use the ice-sheet model Yelmo coupled to the GIA model Fastisostasy, and construct an ensemble that accounts for uncertainties in process representation. The model is forced using the PMIP3 ensemble-mean reconstruction of the Last Glacial Maximum (LGM) and the present-day climate, weighted by an index derived from Antarctic ice-core records. The simulations are initiated in the Last Interglacial and evaluated based on their consistency with geological constraints from the LGM and the deglaciation, as well as present-day observations of the AIS. Using these paleo-constrained model configurations, we then investigate the response of the AIS to different future climate-change scenarios.