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# Contrasting response of West and East Antarctic ice sheets to Glacial Isostatic Adjustment

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The Antarctic ice sheet (AIS) lies on a solid Earth that displays large spatial variations in rheological properties, with a thin lithosphere and low-viscosity upper mantle (weak Earth structure) beneath West Antarctica and an opposing structure beneath East Antarctica. This contrast is known to have a significant impact on ice-sheet grounding-line stability. Here, we embedded a modified glacial-isostatic ELRA model within an Antarctic ice sheet model that considers a weak Earth structure for West Antarctica supplemented with an approximation of gravitationally-consistent local sea-level changes. By taking advantage of the computational efficiency of this elementary GIA model, we assess in a probabilistic way the impact of uncertainties in the Antarctic viscoelastic properties on the response of the Antarctic ice sheet to future warming by using an ensemble of 2000 Monte Carlo simulations that span a range of plausible solid Earth structures for both West and East Antarctica.
We show that on multicentennial-to-millennial timescales, model projections that do not consider the dichotomy between East and West Antarctic solid Earth structures systematically overestimate the sea-level contribution from the Antarctic ice sheet because regional solid-Earth deformation plays a significant role in promoting the stability of the West Antarctic ice sheet (WAIS). However, WAIS collapse cannot be prevented under high-emissions climate scenarios. At longer timescales and under unabated climate forcing, future mass loss may be underestimated because in East Antarctica, GIA feedbacks have the potential to re-enforce the influence of the climate forcing as compared with a spatially-uniform GIA model. In this context, the AIS response might be an even larger source of uncertainty in projecting sea-level rise than previously thought, with the highest uncertainty arising from the East Antarctic ice sheet where the Aurora Basin is very GIA-dependent.