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The sea-level fingerprint of the Antarctic ice sheet: an ensemble GIA modelling approach

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During the last decade, Glacial Isostatic Adjustment (GIA) modelling has seen a considerable development, stimulated by the increasing number and quality of sea-level observations and of various geodetic constraints. The fundamental equation of GIA (the Sea Level Equation) accounts for a number of physical ingredients that make GIA modelling quite realistic, such as rotational effects on sea-level change, the migration of the shorelines, and the time-evolving topography in the presence of marine based ice. However, concerning the spatiotemporal distribution of the late-Pleistocene ice sheets, the GIA models published in the literature by different groups are characterised by significantly different features. These are the volumes of the ice sheets at the Last Glacial Maximum, the presence and the duration of abrupt melting episodes (meltwater pulses) and the timing of the end of deglaciation. These differences can be mainly attributed to the different sets of proxies employed to constrain the melting chronology and, sometimes, to different assumptions about the Earth's viscosity profile. One of most important sources of uncertainty is the melting chronology of the Antarctic ice sheet, which is poorly constrained by the limited amount of relative sea-level data available in the near field of the ice sheet. To test whether the GIA models developed so far for the deglaciation of Antarctic ice sheet are converging or not towards a unique solution, here we collectively consider the models of the melting history of Antarctica published in the literature so far and for each of them we solve the Sea Level Equation. Following a multi-model ensemble approach, we estimate the ensemble mean and its uncertainty, in terms of the geometry and of the time history of the sea-level fingerprints.