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A new Glacial Isostatic Adjustment model for Antarctica

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We present a new glacial isostatic adjustment (GIA) model which has been developed using a combination of ice sheet modelling and GIA modelling. The glacial history of Antarctica was generated using a numerical ice sheet model, driven by spatial and temporal variations in temperature, accumulation rate and relative sea level. The relative sea level forcing was derived by solving the sea-level equation for a pre-existing deglaciation history. We acknowledge that this method is not internally consistent, but we believe this is an improvement on previous methods. The ice sheet reconstruction was tuned using glacial geological and glaciological data, and then incorporated into a global deglaciation history for use within a GIA model. Predictions of local relative sea-level change and land uplift rates are derived by solving the sea-level equation for our new loading history and a range of mantle viscosity profiles. By comparing predictions to observations of near-field relative sea-level change we attempt to determine the best-fitting rheology for East and West Antarctica, respectively, given this loading history.

The sparse distribution of both relative sea-level data and glacial geological data limits the degree to which we can constrain past ice mass changes and Earth structure using the above procedure, therefore, a range of uncertainty will feed into our new GIA model parameters. We estimate this range, and attempt to differentiate between possible solutions using a newly reprocessed data set of GPS-determined vertical rates.

Our new model will be used to provide improved estimates of present-day gravity changes due to GIA in Antarctica. In the future these results will be applied to the interpretation of GRACE data; thus enabling tighter constraints to be placed on the magnitude and source of present-day ice mass change in Antarctica.

This work is a contribution to COST Action ES0701: Improved Constraints on Models of Glacial Isostatic Adjustment.