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Empirical estimation of present-day Antarctic glacial isostatic adjustment and ice mass change

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This study explores an empirical approach that simultaneously estimates Antarctic mass balance and glacial isostatic adjustment (GIA) through the combination of satellite gravity, altimetry and climate data.
Antarctic ice mass loss estimates are contaminated by large uncertainties associated with GIA. The impact of this ice loss on the global climate cycle is substantial, as the resulting change in sea level and ocean currents could have global environmental and societal consequences.
In this study, estimates of present-day GIA and ice mass changes are generated using reprocessed and extended satellite gravity and altimetry data sets. The key elements of the combination approach are an improved estimate of surface processes by incorporating a regional atmospheric climate model RACMO2 and accompanying firn densification model, as well as a calibration of the results to a low-precipitation zone in East Antarctica. Through formal error propagation techniques, the uncertainties for both the GIA and ice mass change estimates are obtained. The empirically derived GIA models are compared to a set of Antarctic GNSS site displacements, as well as to traditionally derived Antarctic GIA models.
The main result is an empirically derived regional Antarctic GIA model with corresponding uncertainties, which suggests the presence of strong uplift in the Amundsen Sea and Philippi/Denman sectors, as well as subsidence in large parts of East Antarctica.