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A 3D lithospheric model of Antarctica and its implications on mantle viscosity

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Several study results from different geophysical methods, probing the lithospheric structure of Antarctica, do not agree. In particular, estimations regarding the depth and geometry of the crust-mantle boundary differ strongly. In order to reduce the inconsistencies and ambiguities from separate geophysical methods, we created a new 3-dimensional model of the Antarctic lithosphere and upper mantle, integrating seismological and gravity gradient data in a thermodynamically self-consistent framework.
According to our results, Antarctica is largely in isostatic equilibrium, however, the topography of some regions seem to have (possibly dynamic) components which cannot be explained by pure isostasy. Based on this, we establish new estimations of the crustal and lithospheric thickness of the Antarctic continent. The derived temperature distribution of our model is used to estimate mantle viscosity, which shows low values at shallow depth (150 km) in the south part of the Ross Sea and East Antarctic coastal areas. This increases the importance of late Holocene ice mass changes in these areas and underlines the requirement of improving mantle viscosity estimates from a combination of geophysical methods.