Geodynamic models of the (potential) West Antarctic mantle plume

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The observed gravity change and GPS uplift rates beneath the Amundsen Sea Embayment in western Antarctica can only be explained by glacial isostatic adjustment (GIA) in the presence of a thin elastic lithosphere and low upper mantle viscosity. Different geological concepts exist to explain the upper mantle structure. The low viscosity might relate to a warm upper mantle, which might in turn relate to the West Antarctic Rift Zone or the previously proposed West Antarctic mantle plume.
To address which of the suggested processes is responsible for the low upper mantle viscosity, we combine a 3D lithospheric scale model with geodynamic modelling of the large-scale mantle structures underneath Antarctica. The 3D lithospheric model is established for the Antarctic continent by combing satellite gravity gradients and seismological data. The geodynamic models are calculated with the mantle convection code ASPECT, an open-source code based on finite elements. It features an adaptive mesh refinement that considerably improves the resolution at regions of interest. Our models focus on West Antarctica and explore how to reconcile a possible plume with the lithospheric structure. Another aspect that is investigated is the importance of the sublithospheric composition and temperature on the upper mantle viscosity structure.