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The effect of GIA observables in the determination of upper mantle structures

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The structure of the upper mantle can be constrained with seismology and gravity observations. However, due to the complex relations between seismic velocity and density, no unique upper mantle model can be devised. We propose to add another type of observation that is sensitive to structures in the upper mantle. The process of Glacial Isostatic Adjustment is sensitive to the viscosity, and therefore temperature distribution in the upper mantle. Thus, observations of GIA can help constrain the structure of the upper mantle.

Different upper mantle models are tested with a finite element model that is capable to investigate the GIA sensitivity to the 3D upper mantle viscosity structures. The Fennoscandian area is used, because of its large seismological dataset of the crust and mantle. Seismic velocities from different tomographical models (DR2012,S40RTS,SL2013sv) are analysed and combined to acquire the uncertainty in these observations. Seismic velocity to density/temperature relations are used for different mantle compositions. The density models are converted to gravity anomalies and compared with satellite gravity observations. The GIA modelling is done with the commercial finite element software ABAQUS, in which the viscosity is computed from the converted seismic velocity to temperature observations. We aim to show that the extra geophysical technique of introducing GIA in the loop can reduce the uncertainty in current mantle models.