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The long wavelength gravity effect from multiple and combined tomography models

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Global density modelling is relying largely on conversion of seismic velocities to density. To combine the lithospheric and sub-lithospheric domains, the choice of an adequate seismic tomography model is crucial. Often such model do only cover a part of the Earth, e.g. the uppermost mantle or the deep Earth. If these models are not consistent, the combination might result in artefacts and consequently in artificial gravity signals not related to the real density structure of the Earth.
We calculated the gravity effect of multiple tomographic models to quantify the long wavelength gravity effect and the difference between the models. The differences are substantial and the choice of the model might highly influence the gravity residual and thus the lithospheric model.
To avoid the presence of spurious gravity signals, we present a method to test model goodness. The models and combinations are validated by forward calculating the ray paths through the model and compare this to a dataset of 1.5 million auto-picked seismic arrivals. The travel times from ∼4000 earthquake sources to 2000 broadband stations were calculated and compared to the observed S-wave arrival times of the combined models. This method shows that the combination of of the global models SL2013sv and SMEAN2 results in a consistent model, in contrast to the combination of SMEAN2 and some regional models, for example over Antarctica.