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# What tomographic-geodynamic comparisons teach us about lower mantle composition and dynamics

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Seismic tomography and geodynamic modelling are two complementary approaches to further our understanding of Earth's internal structure. Geodynamic models predict the thermal and compositional evolution of the mantle, aiding the interpretation of tomographic images. Tomography, on the other hand, provides a snapshot of the present state of seismic heterogeneity, yielding important observational constraints on mantle dynamics.

Here, we aim to identify the nature of large-scale lower mantle heterogeneity by analyzing the statistical properties of global tomographic models and geodynamic predictions of mantle structures. For this purpose, we compare model SP12RTS (Koelemeijer et al., GJI, 2016) with synthetic tomography images, derived from both thermal and thermochemical mantle convection models that were converted to seismic velocity structures using mineralogical lookup tables.We account for the limited resolution of global tomography by using the tomographic filter of SP12RTS (Koelemeijer et al., EPSL, in revision), thus enabling meaningful, direct model comparisons. We focus our analysis on the ratios and correlations of seismic velocities, which are independent of the plate reconstructions used in the geodynamic modelling.

Our tomographic-geodynamic model comparisons suggest that several, large-scale seismic features could be explained by the presence of the lower mantle post-perovskite phase, both inside and outside the large-lowvelocity provinces. Consequently, our comparisons do not allow us to discriminate between isochemical and thermochemical models of mantle convection. We also identify a large-scale discrepancy between SP12RTS and the geodynamic models at mid-mantle depths, which could be due to uncertainties in the mineralogical model, the spin transition in ferropericlase or changes in mantle viscosity.