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Tomographic properties from mantle convection in a 3-D spherical shell with the self-consistently calculated mineralogy

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We use numerical thermo-chemical mantle convection simulations in a 3-D spherical shell with the self-consistently calculated mineral physics to investigate various statistical properties using global tomography models (root-mean-square, cross-correlations and spectral amplitude of seismic anomalies). Four compositional models are assumed here, which has been already used in a paper published recently [Nakagawa et al., 2012]. In order to be the similar resolution to current global tomographic images, we use spherical harmonic filter technique instead of tomographic filtering technique [e.g. Davies, et al., 2012]. The truncation of spherical harmonic filter is used as degree of 16, 24, 32 and 40 to compare with the original resolution (96x288x96x2, which is equivalent to 384x192x96 or degree of 192 of spherical harmonic expansion). The statistical properties of tomographic image could be explained by thermo-chemical cases (e.g. RMS amplitude and anti-correlation in the deep mantle). However, it would be difficult to explain the ratio of Vs and Vp or Vb for thermo-chemical origin of mantle heterogeneities, which is similar profiles to isochemical cases. On the other hand, the ratio of Vs and density could explain the mineral physics constraint [e.g. Karato and Karki, 2001] with thermo-chemical origin of mantle heterogeneity. In conclusion, in order to assess global tomographic image as a consequence of mantle convection, RMS amplitude, cross-correlation and the ratio of Vs and Vb ratio might have useful information to understand what happens in a convecting mantle inferred from tomographic images in the deep mantle.

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