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3D high resolution mineral phase distribution and seismic velocity structure of the transition zone: predicted by a spherical-shell compressible mantle convection model.

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We present high resolution 3D results of the complex mineral phase distribution in the transition zone obtained by numerical modelling of mantle convection.
We extend the work by [Jacobs and van den Berg, 2011] to 3D and illustrate the efficiency of adaptive mesh refinement for capturing the complex spatial distribution and sharp phase transitions as predicted by their model. The underlying thermodynamical model is based on lattice dynamics which allows to predict thermophysical properties and seismic wave speeds for the applied magnesium-endmember olivine-pyroxene mineralogical model. The use of 3D geometry allows more realistic prediction of phase distribution and seismic wave speeds resulting from 3D flow processes involving the Earth's transition zone and more significant comparisons with interpretations from seismic tomography and seismic reflectivity studies aimed at the transition zone.
Model results are generated with a recently developed geodynamics modeling application Aspect, based on dealII (www.dealii.org). We extended this model to incorporate both a general thermodynamic model, represented by P,T space tabulated thermophysical properties, and a solution strategy that allows for compressible flow.