Geodynamically Consistent Interpretation of Seismic Tomography under the Hawaiian Hotspot.

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Recent theoretical developments as well as increased data quality and coverage have allowed seismic tomographic imaging to better resolve narrower structures at both shallow and deep mantle depths.
However, despite these improvements, the interpretation of tomographic images remains problematic mainly because of: (1) the trade off between temperature and composition and their different influence on mantle flow; (2) the difficulty in determining the extent and continuity of structures revealed by seismic tomography.

We present a study on mantle thermal plumes, which illustrate the need to consider both geodynamic and mineral physics for a consistent interpretation of tomographic images in terms of temperature composition and flow.

We focus on the identification of thermal plume by seismic tomography beneath the Hawaiian hot spot: a set of 3D numerical experiments is performed in a spherical shell to model a rising plume beneath a moving plate. The thermal structure obtained is converted into body waves seismic velocities using mineral physics considerations. We then build synthetic travel time data by propagating front waves in the obtained seismic structure. This synthetic data will be used to construct a travel time tomographic model, which is compared with actual tomographic models based on data from the ongoing PLUME seismic experiment.
This comparison will allow a more consistent and quantitative interpretation of seismic tomography and plume structure under Hawaii.