

Mantle tomography beneath USArray: slab segmentation, deep roots of the Yellowstone hotspot, and lithospheric instabilities

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Seismic tomography in the wake of EarthScope's USArray provides a view of mantle heterogeneity across an unprecedented range of length-scales. This results in new insight into convective processes beneath the continental interior and how those processes relate to geological events recorded at the surface. Several research groups have produced tomography models. Methods and datasets vary among the models, though most prominent velocity structures are consistently imaged. In general the geometric characteristics of velocity heterogeneity are more consistent between different models than the magnitude of heterogeneity. Three main topics will motivate model comparisons in this presentation: 1) Present day segmentation of subducted slabs and the potential legacy of segmentation events in triggering geologic transitions including initiation of the Yellowstone hotspot and cessation of the Laramide orogeny; 2) Mantle seismic structure indicative of active upwelling of lower mantle beneath Yellowstone; 3) intense lateral heterogeneity at depths near the base of the lithosphere (about 50-250 km) and implications for preservation and modification of continental mantle lithosphere. Comparison of tomography models with each other will highlight robust features that have advanced understanding of convective processes beneath the continent, and also identify areas where structural ambiguity stimulates debate with significant implications for tectonic evolution of North America.

