A New Mantle Adjoint Tomography Model for North/Central America

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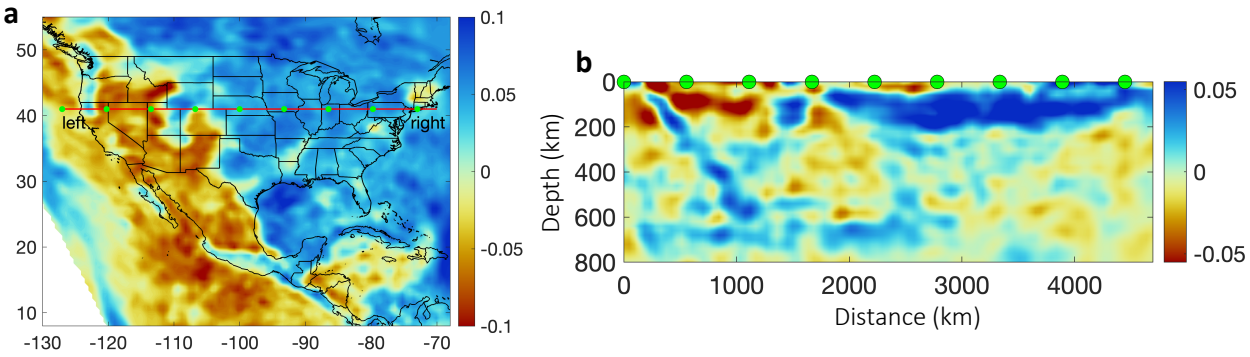
The mantle beneath North and Central America contains many interesting features, including subducting slabs beneath Cascadia and Central America, the thick lithospheric mantle beneath continental shield regions, and the Yellowstone hotspot. In this study, we obtained a new high-resolution model of mantle seismic structures beneath the North American Plate through adjoint waveform tomography with the help of dynamic mini-batches. All available seismic networks in the region including the USArray, the Cascadia Initiative (ocean-bottom seismometers), the Mexican National Seismic Network etc. were utilized. Together, for the 204 selected earthquakes, 1,467,361 effective waveform segments were fit through 200 iterations. With the new velocity model, a continuous Juan de Fuca slab is found to subduct into the mantle transition zone south of 44°N, but it is torn apart with the slab that is north of ~45°N, and hot materials beneath Yellowstone happens to also interact with the slab at ~45°N. In continental shield regions, the model reveals a sharp lithosphere-asthenosphere boundary at ~200 km depth, and clear mid-lithospheric discontinuities are also observed. The model also clearly reveals the Mexican flat-slab subduction, and plume-like features beneath New England and Virginia.



(a) The map view of shear velocity perturbation ($\delta V_S/V_S$) at 100 km depth. The red line with green markers shows the location of the cross-section in (b). (b) $\delta V_S/V_S$ cross-section at 41°N.