

Local Earthquake Tomography (LET) of the Central Oregon Forearc using a large-N, short duration, nodal seismic dataset

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In Summer 2017, collaborators from the University of Utah, University of Oregon, University of New Mexico, and University of Arizona deployed 174 3-component, 5Hz Fairfield Nodal Seismometers (nodes) in a 130km trench perpendicular line from the coast of Central Oregon to the Western Cascades. These instruments have a dense station spacing of ~500m and continuously recorded for ~40days. The location of this deployment was chosen to fulfill two main goals (1) to examine the utility of large-N, short duration, nodal deployments to image crustal structure (2) and to enhance the resolution of previous studies to better understand the structure of the Central Oregon forearc, an important region in the study of seismic hazard of the Pacific Northwest. This nodal dataset has been used in a receiver function analysis to image discontinuities in the crust (Ward et al., 2018) as well as an ambient noise shear wave modeling study (Y. Wang et al., 2018). Here we are presenting a 2D local earthquake tomography study using 58 earthquakes that were detected and located within 6km of the nodal line. Vp and Vp/Vs model results show a high velocity anomaly at the eastern edge of the line, which we interpret as the Siletzia Terrane, a large igneous province that was accreted onto North America ~50Ma and influenced the subduction angle and timing of volcanism during the Laramide. To the west of this high velocity, there is a zone of low Vp and high Vp/Vs, which we interpret as fluids migrating from the slab into the crust. This low Vp, high Vp/Vs zone has been shown to be highly conductive in a magnetotelluric study by Wannamaker et al. 2014 and to have a low shear wave velocity from ambient noise tomography with the nodal array by Wang et al. 2018, supporting our hypothesis of the presence of fluids.

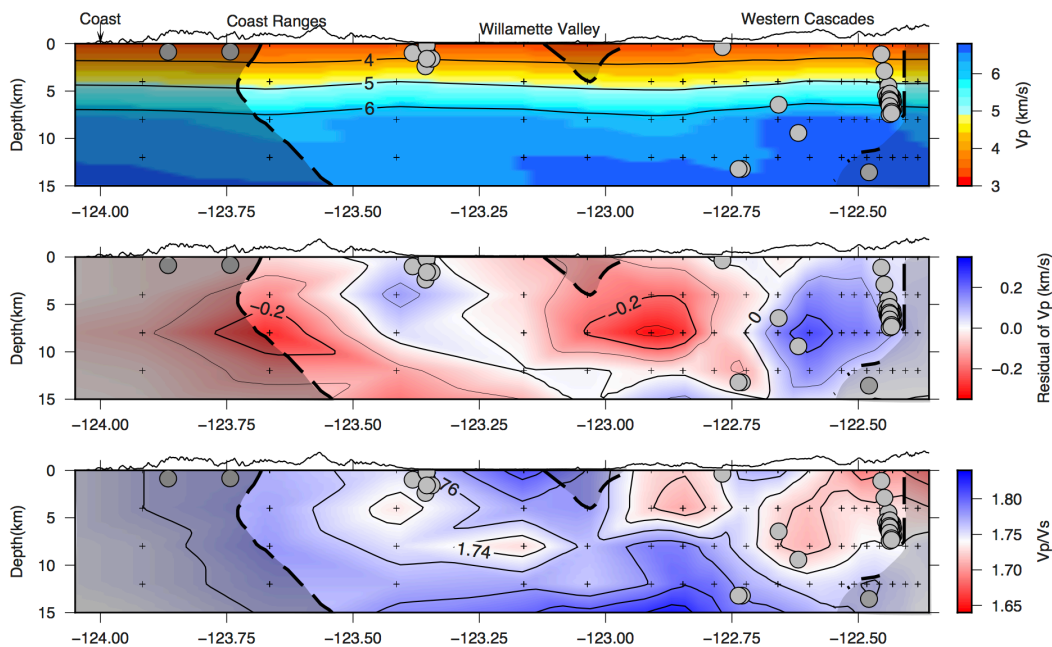


Figure 1: Preliminary 2D modeling results of the local earthquake tomography described in the text. Dark shaded regions are areas without enough data coverage to be interpreted. Gray circles are earthquakes used in the study. (top) Absolute Vp model (middle) laterally averaged residual from the absolute Vp model (bottom) Vp/Vs.

