# Developing a comprehensive model of subduction and continental accretion at Cascadia

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A full-wave ambient noise seismic tomography reveals distinct low-velocity volumes in the upper mantle along the Cascades back-arc, which suggest subduction-driven upwelling, decompression melting, and the 3D small-scale mantle convection beneath the back-arc. The project provided a velocity model for the community through IRIS EMC and training for a female postdoc, Haiying Gao, who recently started a tenure-track faculty position at the University of Massachusetts Amherst in 2013. Gao and Shen also validated the recent shear-wave velocity models in the Pacific Northwest and the United States with full-wave simulation under the support of this project.

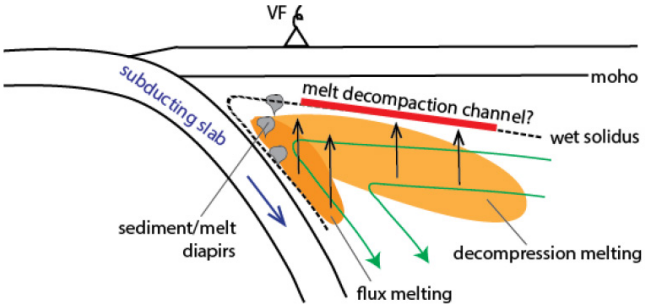


Figure 1. Schematic illustration of possible melt generation and migration processes at general subduction zones, Thin lines with open arrows indicate melt paths, while those with solid arrows represent mantle flow lines. VF stands for the volcanic front. Gao and Shen (EPSL, 2014).

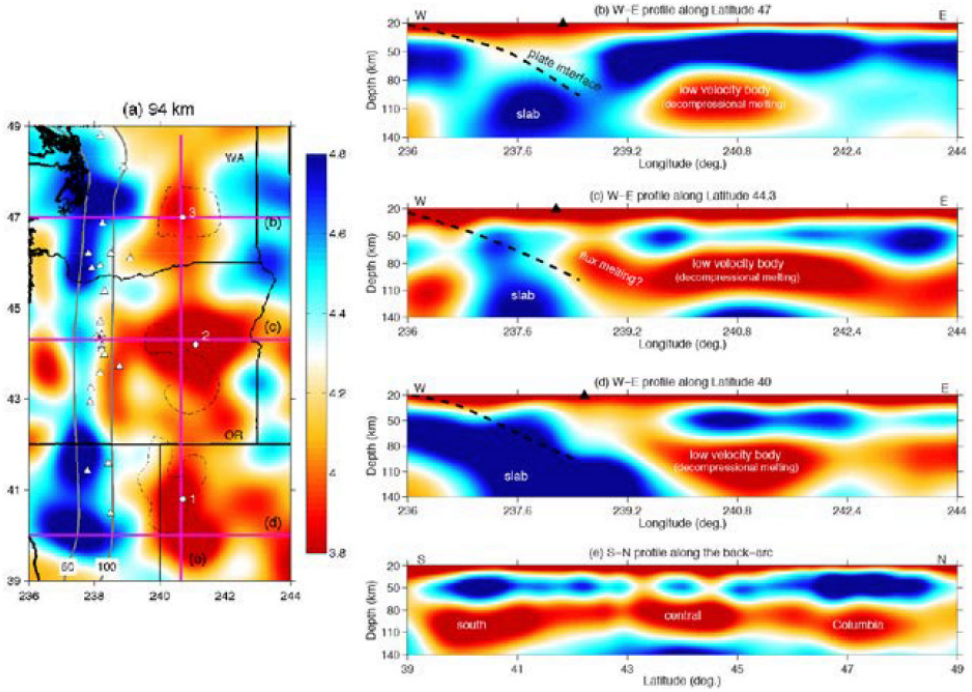


Figure 2. Segmented low-velocity anomalies along the Cascade back-arc. (a) Horizontal slice at depth of 94 km (Vs in km/s). The black dashed lines outline the amplitude of largest negative Sp phase from receiver functions. The magenta lines mark profile locations in (b)-(e), respectively. All the panels share the same color bar. (b-d) W-E profiles across the back-arc anomalies. The triangles mark the volcano centers. The Juan de Fuca plate interface at depths of 20-100 km is projected. (e) S-N profile along the back-arc low-velocity anomalies, which spatially correlate with the three volcano clusters as in (a). Gao and Shen (EPSL, 2014).

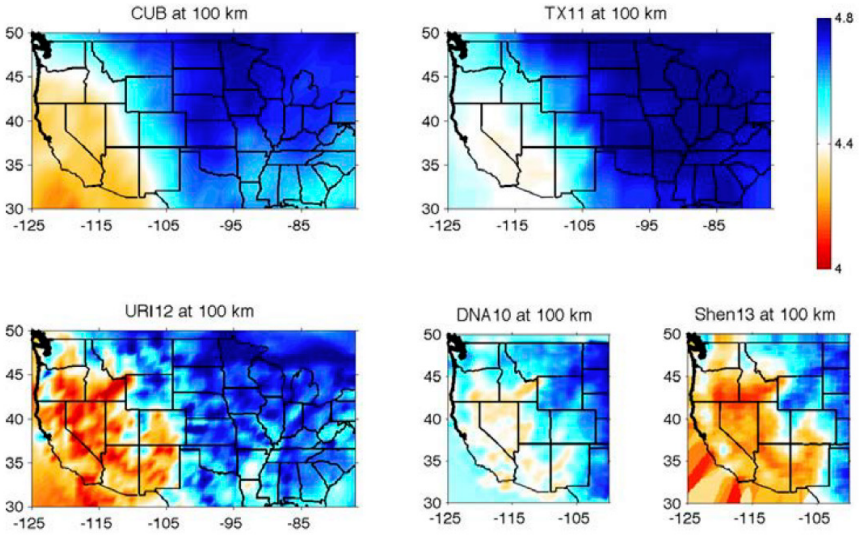


Figure 3. Shear-wave velocity models for model validation at depth of 100 km. CUB, TX11 and URI12 cover the entire US while DNA10 and Shen13 cover the western and central US. Gao and Shen (JGR, 2015).

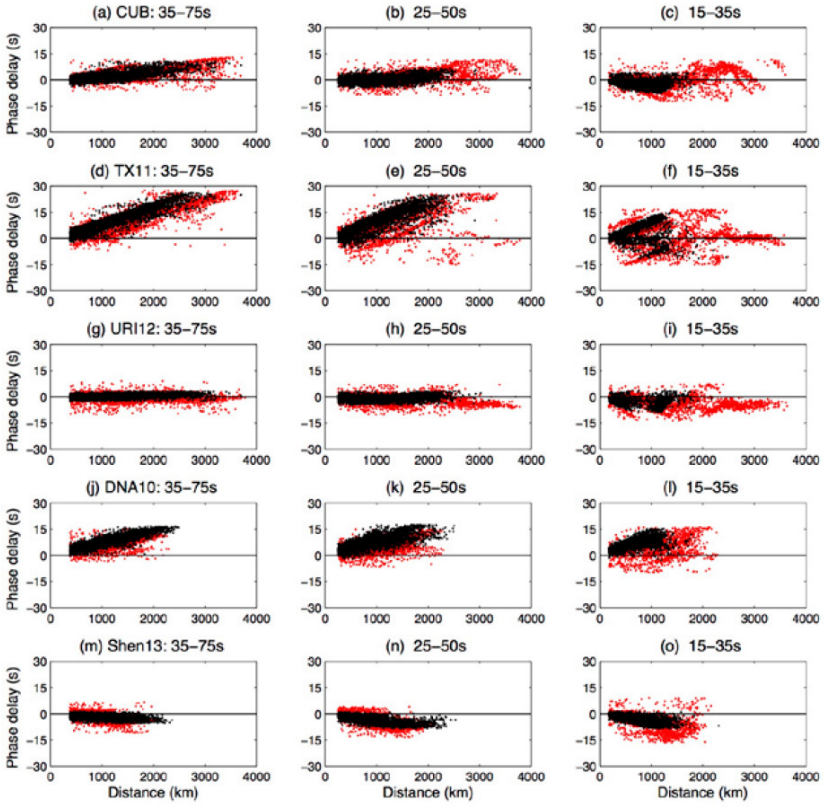


Figure 4. Phase delays versus source-receiver distance filtered at three period bands. Each row represents one model and each column represents one period band. Black and red dots are measurements from ambient noise and regional earthquakes, respectively. A positive linear trend indicates that the synthetics arrive earlier than the observations, which prefers a relatively slower Earth structure. Gao and Shen (JGR, 2015).

## References


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