Ambient Noise-derived Rayleigh Wave Phase Velocities along the Southern Cascadia Forearc Using a Distributed Nodal Array

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The Cascadia margin is a relatively long-lived subduction zone (~55 My), characterized by a young and warm subducting oceanic plate (the Juan de Fuca plate) beneath the North American plate. The thermal and seismogenic characteristics of this margin indicate that fluids play an important role in the rheology of the plate interface, however, there exist many along-strike variations in the geological and geophysical expression of the forearc, such as uplift rates, non-volcanic tremor (NVT), gravity anomalies, and seismic velocities. Previous studies have inferred that variations in “subcretion” (basal accretion) may be an important control on these variations. Southern Cascadia represents the least instrumented portion of the Cascadia forearc despite having the broadest forearc high elevations, highest density of NVT, and shortest slow-slip recurrence intervals. To better understand the seismic structure and seismogenic behavior of this region, an array of 60 3-component nodal seismometers was deployed in March-April of 2020. In this study, we perform ambient noise tomography on this nodal dataset and other contemporaneously-operating broadband stations in the region. Vertical cross correlations were computed and analyzed using frequency time analysis (FTAN) to extract interstation Rayleigh wave phase velocities between 2-14s. We then performed a tomographic least-squares inversion on the resulting dataset, the results of which show consistency with surface geologic features and past, lower resolution studies. In the future, we plan to incorporate these Rayleigh wave dispersion data with P-wave receiver functions to place better constraints on the shear-wave velocity structure of the southern Cascadia forearc.