Azimuthal anisotropy along the Alaska Subduction Zone revealed from Rayleigh wave

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The Alaska subduction zone is a tectonically active region characterized by distinct along-strike variations in structure and seismicity. The Shumagin Gap and Semidi segment have been focused to reveal the role of hydration state, faulting, and paleo-spreading directions. The Alaska Amphibious Community Seismic Experiment (AACSE; May 2018 – September 2019) and existing broadband seismic stations on the Alaska Peninsula (e.g., the EarthScope Transportable Array, the Alaska regional network) provide a well-distributed seismic array to analyze the controlling factor on megathrust behavior. We retrieved the Rayleigh wave phase velocity dispersion from both the ambient noise cross-correlations and the teleseismic surface waves, covering a broadband period of 8 to 100 sec. Apart from constructing a 3-D isotropic shear velocity model using this dataset, we analyzed the azimuthal anisotropic patterns from 10 to 80 sec periods. The frequency-dependent azimuthal anisotropy shows the variations of fast direction at different depths. At shorter periods (~10-15 sec), the fast direction of the incoming plate follows the trench-normal direction on the Semidi segment and Kodiak segment, but changes to the trench-parallel direction on the Shumagin Gap. At longer periods (~20-30 sec), the fast directions of the incoming plate are mostly sub-parallel to the trench, although small differences still exist for that in the Semidi segment and Shumagin Gap. At even longer periods (>50 sec), the incoming plate fast axis is close to that predicted by the paleo-spreading directions. The changing of anisotropy patterns with depths at the Shumagin Gap could result from its stronger hydration state, which is consistent with more outer-rise faults observed at the incoming plate of Shumagin Gap and distinct shear velocity reduction observed from the tomographic model. Besides, the forearc region shows more complex anisotropic patterns, but the segment near Kodiak Island always shows a trench-parallel fast direction, and the Semidi segment including the surrounding Alaska Peninsula constantly shows a fast direction normal to the trench.