Registration code: *PwrOoy7XJU*
Title: *Incoming Plate Seismicity and Relation to the Seismic Cycle at the Alaska Subduction Zone*
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We investigate incoming plate hydration along the Alaska subduction zone using ocean bottom seismic data from the Alaska Amphibious Community Seismic Experiement (AACSE), the Earthscope Transportable Array, and other land-based seismic networks. We use manually picked arrivals from the AACSE catalog along with arrival picks from a machine-learning algorithm (EarthquakeTransformer). Earthquakes are relocated in a three-dimensional velocity model based on Rayleigh wave tomography using a nonlinear relocation package (NonLinLoc). The incoming plate seaward of the Shumagin Gap is characterized by normal faulting and high seismicity. Those earthquakes extend from the surface to depths greater than 35 km, with a peak around 20 km, suggesting that at least the upper 15 km of the mantle is partially serpentinized by water circulating along plate-bending faults. This represents a large subducted water flux in the Shumagin Gap that is consistent with structural studies of the region using active and passive techniques. Those studies show low upper mantle seismic velocities in the Shumagin Gap but not further east in the Semidi and Kodiak segments. In those regions, the seismicity rate is much lower and focal mechanisms are more diverse, including normal, strike-slip, and reverse faulting events.

Incoming plate faulting may influence megathrust earthquake properties and seismic hazards along the Alaska subduction zone. The subduction of water in fault zones in the Shumagin Gap may facilitate aseismic slip. Increased interplate coupling in the Semidi and Kodiak segments may cause the more heterogeneous stress pattern on the incoming plate compared to the extensional stress in the Shumagin Gap. The absence of significant incoming plate normal faulting seismicity after the July 28, 2021 Mw 8.2 Chignik earthquake in the Semidi Segment suggests that the shallowest parts of the megathrust were locked during the earthquake rupture, which is consistent with source studies of that event.

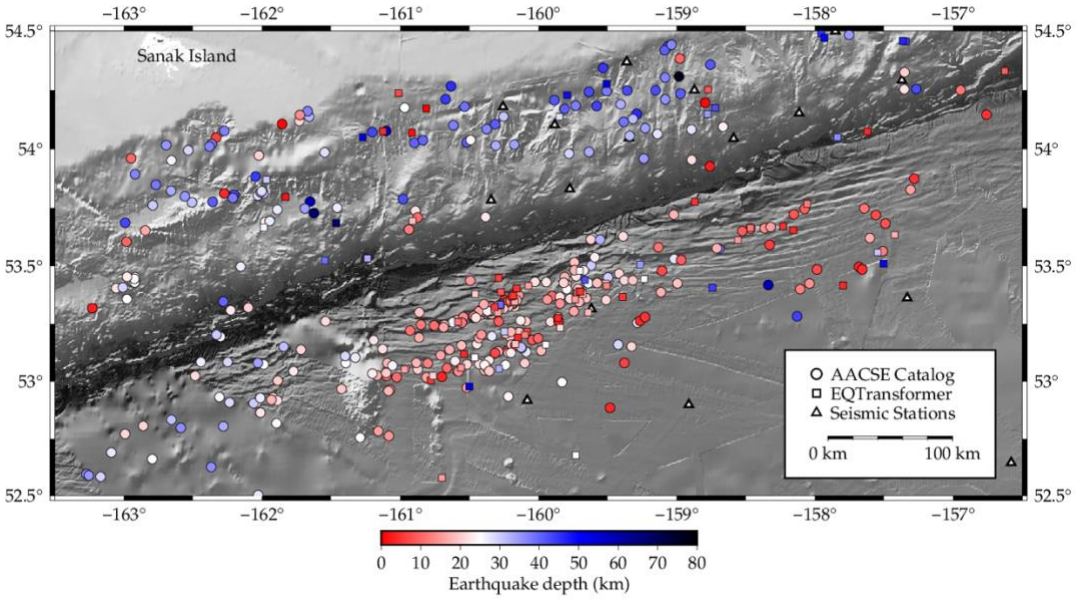

Figure 1. The high seismicity in the Shumagin Gap is mainly confined within the heavily faulted section of the incoming plate, with earthquake clusters following individual fault scarps.