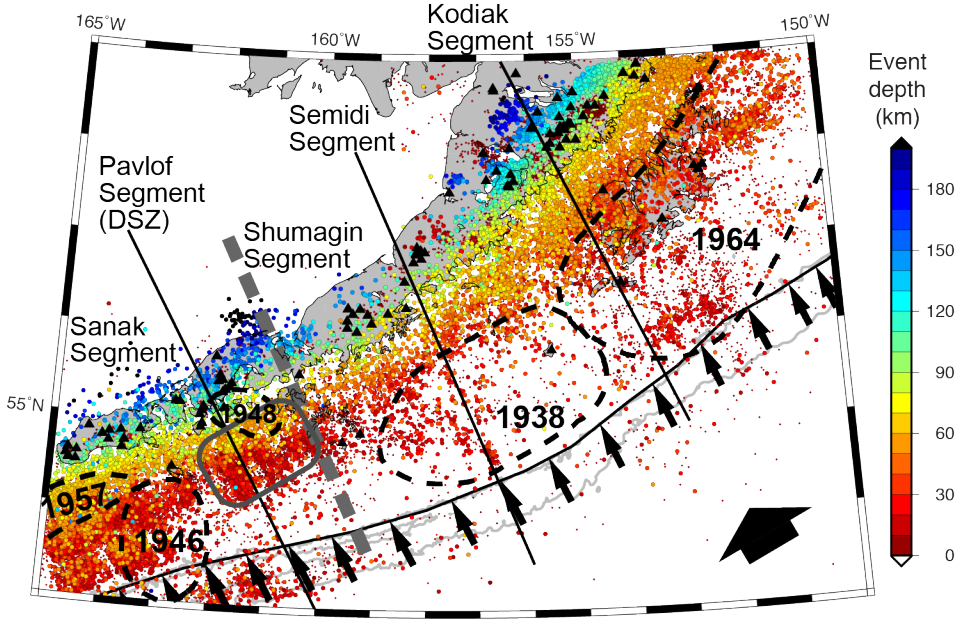
Along-strike segmentation of intermediate-depth seismicity along the Alaska Peninsula

S. Shawn Wei[1], Sydney Gable[1], Natalia Ruppert[2], Haijiang Zhang[3]
[1] Michigan State University
[2] University of Alaska Fairbanks
[3] University of Science and Technology of China

The Alaska Peninsula section of the subduction zone exhibits significant along-strike variations in terms of rupture history, plate coupling, and background seismicity. Here we use regional data from the Alaska Earthquake Center since 1990 and teleseismic data from the International Seismological Centre to investigate intermediate-depth seismicity at the Alaska Peninsula. More than 16,000 earthquakes deeper than 30 km are relocated using a double-difference method with 3D ray tracing (*teletomoDD*). New results show that the Alaska double seismic zone (DSZ), initially discovered by *Hudnut* and *Taber* in 1987, is confined to the Pavlof segment between the Shumagin and Sanak Islands. The DSZ converges to a single layer under the Shumagin Islands. This transition in intermediate-depth seismicity coincides with a sharp boundary of plate coupling from creeping to partially locked as revealed by geodetic observations. Additionally, the magnitude-frequency relation shows an along-strike systematic change in *b*-values of seismicity below 50 km: the Pavlof segment with a DSZ is characterized by a higher $b = 0.93$, whereas the Semidi segment with much fewer intermediate-depth earthquakes has a lower $b = 0.82$. These along-strike variations correlate with the inferred hydrous state of the subducted slab that is controlled by the pre-existing fabrics of the incoming plate.



Earthquakes recorded at the Alaska Earthquake Center (AEC) color-coded by depth. Preliminary segmentation is roughly determined based on intermediate-depth seismicity. Bold gray dash line indicates the sharp transition of plate coupling from creeping to partially locking constrained by geodetic observations [*Li and Freymueller*, 2018].