

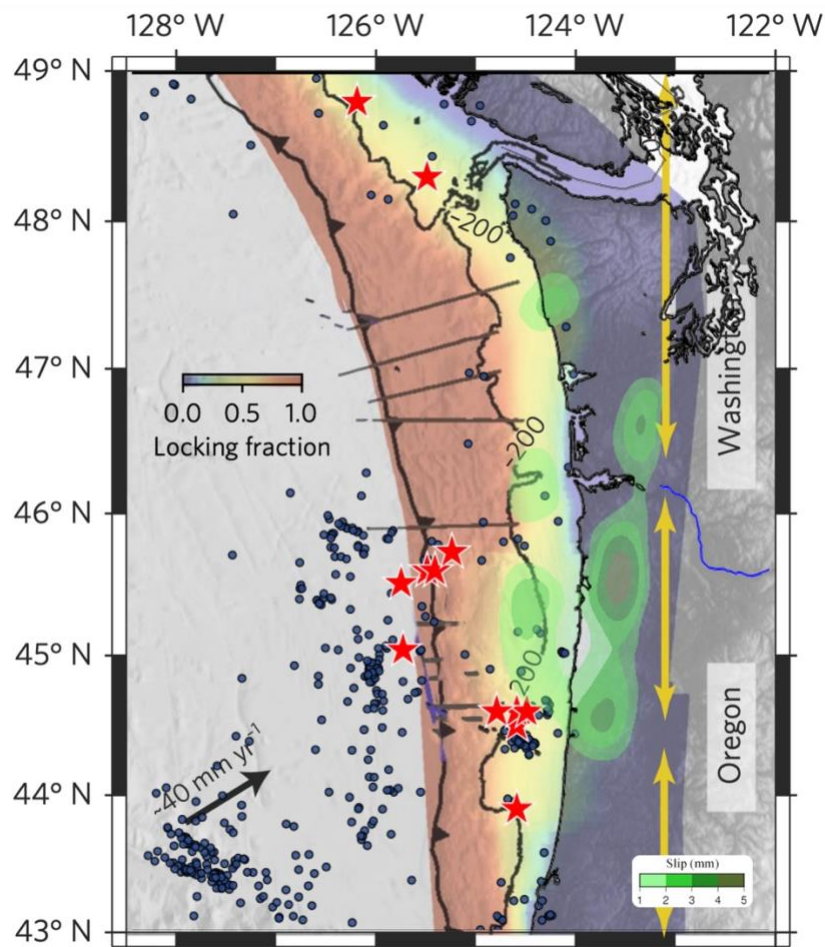
Offshore very low frequency earthquakes (VLFs) in Cascadia – frictional patchwork in seismogenic zone?

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Large damaging earthquakes in a subduction zone occur in seismogenic zone, which typically lies offshore. This zone is thought to be locked during interseismic period, and characterized by velocity weakening frictional behavior. Here, we have discovered VLFs offshore Cascadia subduction zone showing that such slow events may play an important role in the seismogenic zone. VLFs are the largest distinct seismic slow events found so far with M_w of individual event generally ranging between 3 and 5. They are, however, notoriously hard to detect and locate. We show VLFs offshore Cascadia subduction zone are widely distributed along the entire margin to the extent covered by the ocean bottom seismometers (OBS) network used in this study. We used a combination of moment tensor inversion algorithm and match filter technique to detect and locate offshore VLFs. They occur quasi-continuously even in the areas thought to be highly locked. Offshore VLFs may provide important insights into the seismic and frictional variability and heterogeneity in the seismogenic zone.



The map shows detected VLFs (red stars) and regular seismicity (blue dots) as cataloged by Stone et al. (2018) using OBS data. The color gradient offshore shows the locking fraction along the Cascadia subduction zone (Han et al., 2017; Schmalzle et al., 2014). Green contour shows slow slip area constrained by geodetic data (Nuyen & Schmidt, 2021).