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STRUCTURAL INFLUENCES ON CASCADIA RUPTURE PATCHES AND WIDTH

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The Cascadia forearc is composed of an Eocene-Pliocene accretionary complex, outboard of which lies a Pleistocene-Holocene wedge of low taper, mixed vergence, and high pore fluid pressure. The young wedge is widest off northern Oregon, tapering both north and south. Mixed vergence, open folds, mud volcanoes and backstop parallel trends indicate poor coupling of the young wedge. By comparison, the older complex is seaward vergent, has tighter folding, and trends are closer to convergence normal, suggesting stronger basal coupling. We suggest the updip seismogenic limit may be localized by this boundary. The long-term average downdip limit of significant coupling appears to be consistent with thermal, geodetic, and structural evidence of a transition from arc normal to arc parallel contraction. An average boundary consistent with these disparate data suggest significant heterogeneity in along strike width and or magnitude of coupling. Modeling of elastic deformation and tsunami runup for several recent events is more consistent with slip loci beneath forearc highs, and inconsistent with slip beneath forearc basins.

Onshore and offshore paleoseismic evidence from 40 Cascadia earthquakes strongly suggest that structural segmentation plays a significant role only along the southernmost margin. Southern segments may be controlled by some of the obvious structural boundaries such as the Blanco Fracture zone, and two pseudo faults. Where resolution is adequate, these data also suggest that ruptures underlie forearc highs, and die out into the basins similar to that observed in the 2004, 2005, and 2007 earthquakes in Sumatra. The difference between the rupture modes observed for Nankai, Sumatra, and suggested here for Cascadia may be linked to the sediment supply for these systems. Cascadia and Sumatra are both systems where massive submarine fans are accreting to the margin in their northern regions, with incoming sections of 3-4 km thickness that taper southward. These thick sections smooth the plate interface with respect to structures in both the downgoing and upper plates, likely promoting long ruptures. We suspect, supported by paleoseismic data, that northern Cascadia and northern Sumatra may be prone to large ruptures due to the masking of other structures by large influxes of sediment on the subducting plate

