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## Subduction zone heterogeneity observed across the magnitude spectrum for megathrust earthquakes

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Observations from recent great subduction zone earthquakes highlight the influence of spatial geologic heterogeneity on overall rupture characteristics, such as areas of high co-seismic slip, and resulting tsunami generation. Defining the relevant spatial heterogeneity is thus important to understanding potential hazards associated with the megathrust. The more frequent, smaller magnitude earthquakes that commonly occur in subduction zones are often used to help delineate the spatial heterogeneity. Here we provide an overview of several subduction zones, including Costa Rica, Mexico, and Cascadia, highlighting connections between the small earthquake source characteristics and rupture behavior of larger earthquakes. Estimates of small earthquake locations and stress drop are presented in each location, utilizing data from coastal and/or ocean bottom seismic stations. These seismicity characteristics are then compared with other geologic and geophysical parameters, such as upper and lower plate characteristics, geodetic locking, and asperity locations from past large earthquakes. For example, in the Cascadia subduction zone, we find clusters of small earthquakes located in regions of previous seamount subduction, with variations in earthquake stress drop reflecting potentially disrupted upper plate material deformed as a seamount passed. Other variations in earthquake location and stress drop can be correlated with observed geodetic locking variations.