FAULT MATERIAL HETEROGENEITY CONTROLS DEEP INTERPLATE EARTHQUAKES IN KANTO, JAPAN

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Fault zones usually feature small-scale material heterogeneities that can strongly affect where earthquake ruptures initiate and terminate. However, such observations at scales relevant to earthquake sources are rare in subduction zones where large earthquakes are generated. Here we show that the subducted plate interface that repeatedly rupture seismically in Kanto, Japan also exhibits anomalous material properties. The Kanto region is situated in a special tectonic setting where the Philippine plate is "sandwiched" between the Okhotsk and Pacific plates, generating small to moderate-magnitude earthquakes at 60-70 km. We apply a waveform cross-correlation approach to measure the in-situ Vp/Vs ratios of earthquake patches along the plate interface between the Pacific plate and the Philippine Sea plate, and find highly anisotropic source medium with anomalously low Vp/Vs ratios ($\sim$1.44). We also estimate the stress drop of M$>$3.4 earthquakes using the spectral ratio method, leading to a median stress drop of 4.6 MPa. The low, anisotropic Vp/Vs ratios and typical stress drop values suggest the fault medium is damaged, foliated, and enriched with fluid. Assuming an effective normal stress of 50 Pa as a result of high fluid pressure, our earthquake cycle simulations can reproduce M$\sim$4 earthquakes that alternate between full and partial ruptures every 2-5 years, which are similar to the recurrence intervals of M$\sim$4 Kanto earthquakes along the Pacific slab. Our work demonstrates that such localized structures may cause stress perturbations on faults that in turn favor the frequent occurrence of deep interplate earthquakes in Kanto, Japan.