

S21E-0340 Inferring Fault Zone Structure at Parkfield from the Azimuthal Variation in the Stacked P-wave Velocity Spectra of Earthquake Clusters



Tuesday, 12 December 2023



08:30 - 12:50



Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

Fault damage zones can influence various aspects of the earthquake cycle, such as the recurrence intervals and magnitudes of large earthquakes. Hence, our research aims to develop a novel method to image fault damage zones using high-frequency P-waves reflected within them. Previous studies have demonstrated that fault damage zones can amplify high-frequency waves along directions close to fault strike. The associated frequency band of the amplified secondary peak may be used to estimate the width and velocity contrast of the fault damage zone. Here we use the stacked P-wave velocity spectra of M1.5–3 earthquakes in the Parkfield region to identify the azimuthal variation in high-frequency energy. Our preliminary results show that for 62% of the Parkfield clusters, stations close to the fault strike record more high-frequency energies around 10–20 Hz. The frequency band is lower than what we observed for the 2019 Ridgecrest earthquakes region, and corresponds to a fault zone velocity reduction of ~50% assuming a fault zone width of 200m. We also observe along-strike differences in our results, where clusters along some fault sections show greater azimuthal variation than clusters in other sections.

Moreover, to account for the possible effects of site conditions underneath the stations, we will quantify their effects using the spectra of regional earthquakes. We will compute the root-mean-square spectra at different frequency bands for each event, and calculate the average deviation in spectra at each station. We can then generate an empirical correction term for each station as a function of frequency. By applying these corrections to

the stacked P-wave velocity spectra of our earthquake clusters, we can separate the contribution of site effects from fault zone structures. Our results demonstrate that the new method can be applied to search for fault damage zone structures in different tectonic regions with broadband stations in order to enhance our understanding of the co-evolution of fault zones and earthquake cycle.

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