Earthquake stress drop measures the background stress changes on a fault before and after an earthquake, and accurate estimation of stress drop leads to significant implication on earthquake self-similarity. Though it is superficially easy to estimate stress drop from corner frequency and seismic moment by assuming a circular fault model. For example, sampling rate, rupture complexity and model assumption may give rise to such uncertainties. In this study, we try to apply multi-scale approach to selected dataset along Parkfield segment to systematically evaluate contributing factors to the uncertainties in stress drop.

We first compare stacking approach with individual EGF approach for 3 repeating clusters using borehole stations which record mainly magnitude 0-3 earthquakes at an amount of ~5000 near Parkfield area (Figure 1a). We find a nearly constant shift with a factor of 1.5 on corner frequency, likely reflecting the averaging effect from stacking. We then compare stacking rates at different spatial scales of 1 km, 5 km and 10 km radius. The average results are similar; however, individual event comparison shows that the results are strongly affected by moment calibration, which infers that when comparing stress drops among different scales, moments for common earthquakes should be unified. Next, we further investigate the 10km earthquake subset, observing that stress drops change with depth (Figure 1b, red dots), which is considered to be resulted from a constant shear velocity when computing stress drops (Allmann and Shearer, 2007). However, in our recent tests the stress drops present to be overall constant over depth when applying a selection and binning over depth for the whole subset (Figure 1b, black dots), which can be explained by a depth-varying empirical Green's function against an average one applied to the whole subset. Our next step is to validate the tests and explore the relationship between the two factors that both lead to depth correction of stress drops.

(a) (b)

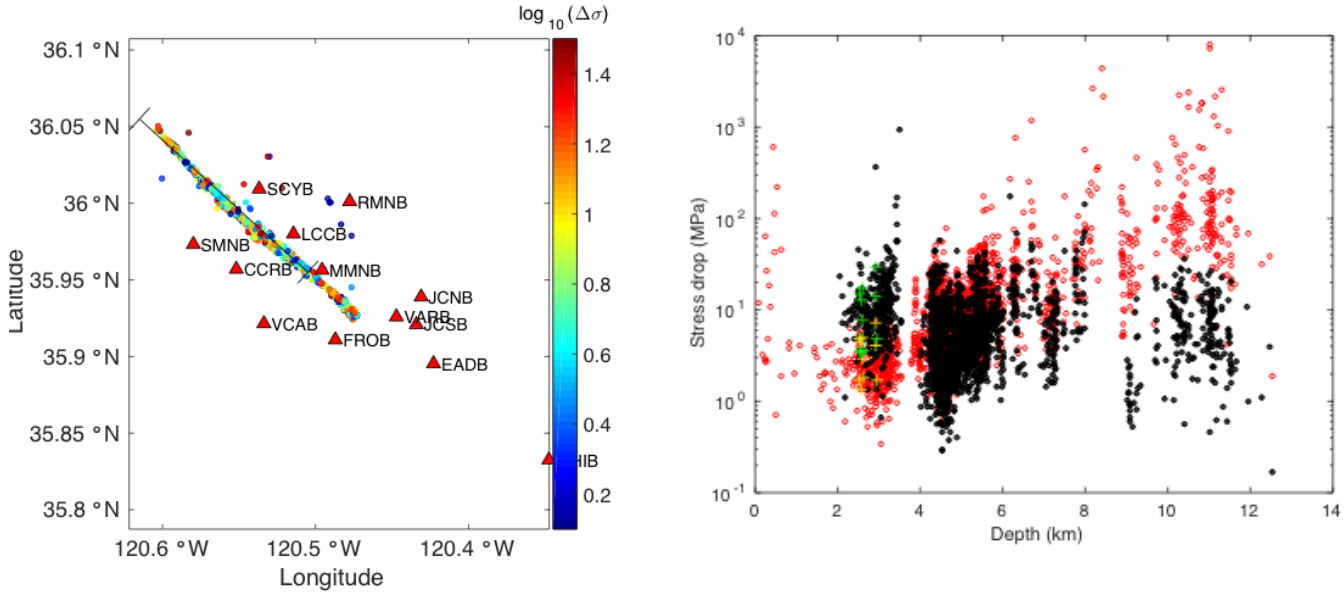

Figure 1: (a) Earthquake distribution in the study colored by log10 stress drops after depth binning, red triangles are HRSN stations; (b) Stress drop changing with depth, red dots: before depth binning, black dots: after depth binning.