[JJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS15]Fault Rheology and Earthquake Physics

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The goal of this session is to integrate theoretical, experimental, observational, and numerical perspectives from various fields such as seismology, geodesy, geology, mineralogy, and so on, to define what is known about earthquake source processes and the physical and chemical elementary processes of faulting. This session welcomes studies that address such issues as pre-, co-, and post-seismic processes, the rheology of seismogenic faults and fault rocks, laboratory experiments on elementary processes, numerical models based on frictional laws, and estimates of the stress field in the seismogenic zones. We also welcome studies on fault-zone drilling projects and in situ stress measurements.

[SSS15-P07]Variation in stick-slip behavior with normal stress and loading rate: insights from bi-axial friction experiments on submeter-sized rock samples

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Stick-slip behaviors of rocks observed in friction experiments, which have been considered to be analogue as earthquake occurrence, are of great interest in understanding the earthquake dynamics that can help predict the timing and the magnitude of impending earthquake. Here, we conducted bi-axial friction experiments on submeter-sized rock with varying loading rate (1µm/s to 1mm/s), normal stress (1MPa to 10MPa), with displacement up to 50mm, in order to examine the variation in their stick-slip behaviors such as recurrence interval, friction level and stress drop.

For the experiments, we used a pair of granite blocks from Tamil Nadu, China, of which the contacting surfaces simulate a fault of 0.5m in length and 0.1m width. The experiments were done using a single direct shear geometry (Yamashita et al., 2015). The sample interfaces were ground with #200 ~ 300 grit abrasive before the experiments. A constant normal stress was applied to the fault using three hydraulic actuators, and one of the blocks was fixed while the other was moved parallel to the longitudinal direction of the fault plane to apply shear load (max=1000kN) on the fault using a servo motor-driven linear actuator. Throughout the experiment, the whole normal and shear forces applied on the fault plane, which were measured by two load cells attached outside of the fault plane, were digitized with a 1–48kHz sampling rate and 24bit resolution.

The results on the behavior variation showed that for the experiments under the same normal stress (1MPa) an increase in loading rate from 1µm/s to 1mm/s caused a decrease in friction coefficient drop (ratio of shear stress to normal stress) from more than 0.4 to less than 0.07, although the maximum friction level is similar value (~ 0.82) between them. Also, the fault at 1mm/s loading rate and 10MPa normal stress produced periodic stick-slip motion with a constant event interval of 0.08 seconds and friction coefficient drop of 0.11, whereas we found irregular stick-slip occurrence with the interval ranging from 0.01 to 0.04 and the drop ranging from 0.02 to 0.07 for the fault at the identical loading rate but the different normal stress (1MPa). We suggest that the stick-slip behaviors on submeter-sized rock samples were dependent on

loading rate and normal stress. We will conduct the similar experiments on centimeter-sized sample and compare with the above results on the larger samples to discuss the scale dependence of the stick-slip occurrence.