Contribution ID: **16** Type: **60s-Pitch + Scientific Poster**

Laboratory-scale investigation of fluid-induced fault slip: Effect of initial effective pressure and injection rate

Injecting high-pressure fluid into deep reservoirs could promote natural fault reactivation and induce damaging earthquakes. Recent observations suggest that fluid injection rate and effective confining pressure (ECP) could affect the slip behavior; however, their coupling effect on slip patterns is still unclear. We report triaxial laboratory experiments aimed to investigate the combined effect of fluid injection rate and initial ECP on the characteristics of injection-induced fault slip behavior on cylindrical Bentheim sandstone samples containing precut faults, with varying values of fluid pressurization rate and initial confining pressures. Our results show that the fluid injection rate controls fault slip mode at low initial ECP, whereas at high initial ECP, high fluid pressure accelerates fault slip. The acoustic emissions source types, determined from the P-wave first-motion polarity, reveal that shear failure is dominant at low initial ECP, while at high initial ECP the source types are dominated by shear and compaction. A transition from slip strengthening to slip weakening was observed in samples with low initial ECP, while consistent slip strengthening was documented in samples with high initial ECP. At the same injection rate, high initial ECP impedes fast fault slip due to the stabilizing effect of a wider developed gouge layer. Under the same initial ECP, a faster fluid injection rate promotes a higher fault slip rate. We applied a one-dimensional numerical model to study the effect of initial ECP and injection rate on injection-induced slip behavior by considering the rate-strengthening effect. Our results show that the fault slip features are controlled by the coupling between fluid pressurization rate and initial ECP.

Authors: HAN, Xu (GFZ Helmholtz Centre for Geosciences); Dr WANG, Lei (GFZ Helmholtz Centre for Geosciences); Prof. BOHNHOFF, Marco (GFZ Helmholtz Centre for Geosciences); Prof. DRESEN, Georg (GFZ Helmholtz Centre for Geosciences)

Presenter: HAN, Xu (GFZ Helmholtz Centre for Geosciences)