EGU21-9751
https://doi.org/10.5194/egusphere-egu21-9751
EGU General Assembly 2021

Role of asperities on the transition from seismic to aseismic slip using an experimental fault slip system

Weiwei Shu, Olivier Lengliné, and Jean Schmittbuhl
Institut Terre et Environnement de Strasbourg (ITES), UMR 7063, Université de Strasbourg, CNRS, Strasbourg, France
(ww.shu.uds@gmail.com)

Faults are common geological structures distributed at various depths within the Earth with different behaviors: from seismic to aseismic. The frictional stability of faults is linked to the properties of asperities that make the contact between fault surfaces. Investigating the interaction between asperities and its link with the frictional stability of faults aims at a better understanding of the intrinsic relationships between the observations of earthquake swarms and the slow local aseismic transient. Here we propose an experimental approach, which allows a customized interface sliding slowly under a well-controlled normal load, to study this problem. This interface consists of asperities modeled by poly-methyl-methacrylate (PMMA) balls in a softer, polymer base representing the parts of the fault that are easily deformed, facing a transparent flat PMMA plate. We employ a high-resolution camera for in-situ optical monitoring of the local deformation of the interface while loaded. We also attach acoustic sensors to capture the dynamics events attesting to local dynamic ruptures. We connect our observations with a mechanical model derived from a high-precision topography of the customized interface. We investigate the effects of various internal parameters of natural fault systems, including the density of asperities, their rigidity or the contrast of rigidity compared to the base, on the evolution of the frictional stability under variable normal load and of the behavior of the population of asperities at the transition between seismic and aseismic slip. Our results, bring new observations on the mechanics of swarm and fault transient.