Geophysical Research Abstracts
Vol. 20, EGU2018-17116, 2018
EGU General Assembly 2018

Fluid migration into the fault as the earthquake trigger: Insight from laboratory experiments at spring-block systems

Victor Novikov and Elena Novikova

Joint Institute for High Temperatures of Russian Academy of Sciences, Laboratory of Pulsed MHD Power Systems for Geophysics, Moscow, Russian Federation (novikov@ihed.ras.ru)

Field experiments, laboratory studies, and theoretical models clearly showed a possibility of earthquake triggering by fluid injection into the crust due to increase of pore pressure resulted in decrease of efficient strength of rocks. Nevertheless, there are some indications of earthquake triggering by strong rainfalls due to penetration of fluids into the earthquake generating fault. It is evident that such fluid migration cannot increase the pore pressure in rocks, and, if such triggering really exists, it may be explained by another phenomena, e.g. by fault friction reduction or Rehbinder effect resulted in weakening the fault.

For verification of this hypothesis laboratory experiments were carried out on the spring-block model with water migration into the contact area between movable and fixed blocks. Because the simulated fault gauge for the applied spring-block system is an "open" system, then the fluid pressure in the block contact area does not raise. The obtained experimental results confirmed a possibility of laboratory "earthquake" triggering without increase of pore pressure. It was shown that at the shear stress level in the block contact area closed to critical stress value (98-99%) when the lab earthquake (slip of movable block) occurs the threshold value of fluid action is about of 1% of contact area/volume. For triggering the slip of the spring-block model it is sufficient to feed 0.2–0.3 g of water into contact area that is 0.5% of weight of granulated material (fault gauge) filled the contact area.

It was shown that depending on the material of the simulated fault gouge (quartz sand, halite, or clay) the influence of water migration into the fault may result in laboratory "earthquake" triggering (for quartz sand and halite), or transformation of "stick-slip" behavior of the spring-block model into occurrence of slow-slip events or creep (for clay).