Geophysical Research Abstracts
Vol. 16, EGU2014-15170, 2014
EGU General Assembly 2014

Observation of fatigue in sandstone samples exposed to repeated freeze-thaw cycles

Jia Hailiang (1,2), Xiang Wei (1), and Michael Krautblatter (2)

(1) Engineering Faculty, China University of Geosciences (Wuhan), Wuhan, China , (2) Technische Universität München, Chair of Landslide Research, Munich, Germany

The effect of rock fatigue is one of the key elements in the analysis and evaluation of rockfall preparation. We performed a series of laboratory freezing-thawing cycles experiments on an array of identical sandstone samples (cylinder samples with diameter of 5cm and length of 10cm). During each cycle we measured surface deformations and effective porosity for three samples, and after each thawing phase we removed two samples for destructive testing (uniaxial compressive and tensile strength). Our results indicate that: (1) frost action causes primarily reversible strain in samples with maximum magnitudes of $\sim 1*10^{-4}$, we suggest low-cycle fatigue causes minor plastic deformation (2) with the increase of cycles, we observed a marked increase of effective porosity and a sharp decrease of uniaxial tensile strength. The decrease in uniaxial compressive strength was not as significant as that of the tensile strength in response to this frost action; (3) Curves describing effective porosity increases demonstrate a rapid increase during the first 3 – 4 freeze-thaw cycles, followed by a more linear increase, with steps in the porosity profile indicating discrete cycles with increased fatigue damage. Here we show how 17 freeze-thaw cycles cause progressive fatigue in sandstone samples and how this affects effective porosity and uniaxial compressive strength.