EGU21-9403
https://doi.org/10.5194/egusphere-egu21-9403
EGU General Assembly 2021

Integrated geophysical and geotechnical monitoring for multiscale rock mass damaging investigation at the Acuto Field-Lab (Italy)

Guglielmo Grechi[1], Danilo D'Angiò[1], Matteo Fiorucci[1], Roberto Iannucci[1], Luca Lenti[2], Gian Marco Marmoni[1], and Salvatore Martino[1]

[1]Earth Sciences Department of "Sapienza" University of Rome and CERI - Research Centre for Geological Risk, P.le Aldo Moro n.5, I-00185 Rome, Italy. acutofieldlab.dst@uniroma1.it

[2]Cerema Méditerranée, Equipe-Projet MOUVGS, 500 route des Lucioles, Sophia-Antipolis F-06903, France

Rock mass damaging has become a topic of great interest in the engineering-geology research community during the last decades as it can significantly influence slopes stability. In this sense, the study of mechanics and dynamics of jointed rock masses represents a challenge because it will allow to better understand how external continuous and transient stressors can influence the short- to long-term stability controlling their pre-failure behavior. Consequently, the detection of permanent changes in physical and mechanical parameters, due to periodic or transient stressors, is an important target to mitigate the related geological risk as it can potentially lead rock masses to failure, especially when infrastructures and natural or cultural heritages are exposed elements. In this framework, the Acuto field laboratory (Central Italy) has been designed and implemented in 2016 within an abandoned quarry by employing an integrated geotechnical and geophysical monitoring system, with the aim of investigating how natural and anthropic conditioning factors could lead fractured rock masses to failure. The integrated monitoring system, which is installed on a potentially unstable 20-m^3 jointed rock block, is composed of several strain devices (i.e., strain gauges -SG- and jointmeters -JM-), one fully equipped weather station, one rock thermometer, eight high-sensitivity microseismic uniaxial accelerometers and optical and InfraRed Thermal cameras. The acquisition of long-term monitoring time-series, coupling multimethodological approaches, allowed to establish cause-to-effect relationships among different environmental stressors and induced strain effects, highlighting the continuous action of thermal stresses on rock mass deformations both at the daily and seasonal timescales. In fact, while the analysis of thermal and strain monitoring data allowed to characterize the cyclic contraction and relaxation response of major rock fractures and microcracks to temperature fluctuations, the microseismic monitoring array was able to detect during thermal transient (i.e., freezing conditions) the occurrence of microseismic emissions potentially related to the genesis or progressive growth of pre-existing cracks.

Starting from 2018, experimental activities at the Acuto field lab are supported by the "Dipartimento di Eccellenza" project of the Italian Ministry of Education Universities and Research funds attributed to the Department of Earth Sciences of the University of Rome "Sapienza". In this framework, the Acuto filed laboratory will undergo a structural upgrade that will be aimed at the

investigation of two new sectors of the abandoned quarry. These new sectors will be instrumented with innovative thermal profiles probe, fiber Brag grating sensors and traditional SG and JM for detailed stress-strain monitoring, acoustic emission sensors and high-frequency and low-frequency geophones for ambient seismic noise monitoring and microseismic events detection as well as accelerometers for evaluating the rock mass response in the case of seismic shaking. The main goal of such an improvement will be both technical and methodological, and will shed light on the application of integrated geophysical and geotechnical monitoring approaches in investigating the multiscale rock mass damaging process as well as the detection of rock mass failure precursors by using non-conventional combinations and configurations of geotechnical and broad-band geophysical devices.