Geophysical Research Abstracts
Vol. 16, EGU2014-16848, 2014
EGU General Assembly 2014

Detecting Slow Deformation Signals Preceding Dynamic Failure: A New Strategy For The Mitigation Of Natural Hazards (SAFER)

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Rock slope monitoring is a major aim in territorial risk assessment and mitigation. The high velocity that usually characterizes the failure phase of rock instabilities makes the traditional instruments based on slope deformation measurements not applicable for early warning systems. On the other hand the use of acoustic emission records has been often a good tool in underground mining for slope monitoring. Here we aim to identify the characteristic signs of impending failure, by deploying a "site specific" microseismic monitoring system on an unstable patch of the Madonna del Sasso landslide on the Italian Western Alps designed to monitor subtle changes of the mechanical properties of the medium and installed as close as possible to the source region.

The initial characterization based on geomechanical and geophysical tests allowed to understand the instability mechanism and to design the monitoring systems to be placed. Stability analysis showed that the stability of the slope is due to rock bridges. Their failure progress can results in a global slope failure. Consequently the rock bridges potentially generating dynamic ruptures need to be monitored. A first array consisting of instruments provided by University of Turin, has been deployed on October 2013, consisting of 4 triaxial 4.5 Hz seismometers connected to a 12 channel data logger arranged in a 'large aperture' configuration which encompasses the entire unstable rock mass. Preliminary data indicate the occurrence of microseismic swarms with different spectral contents.

Two additional geophones and 4 triaxial piezoelectric accelerometers able to operate at frequencies up to 23 KHz will be installed during summer 2014. This will allow us to develop a network capable of recording events with Mw < 0.5 and frequencies between 700 Hz and 20 kHz.

Rock physical and mechanical characterization along with rock deformation laboratory experiments during which the evolution of related physical parameters under simulated conditions of stress and fluid content will be also studied and theoretical modelling will allow to come up with a full hazard assessment and test new methodologies for a much wider scale of applications within EU.