Geophysical Research Abstracts
Vol. 17, EGU2015-7430, 2015
EGU General Assembly 2015

Microseismic monitoring of soft-rock landslide: contribution of a 3D velocity model for the location of seismic sources.

Provost Floriane (1), Malet Jean-Philippe (1), Doubre Cécile (1), Gance Julien (1), Maggi Alessia (1), and Helmstetter Agnès (2)

(1) Institut de Physique du Globe de Strasbourg, CNRS UMR 7516, University of Strasbourg, Strasbourg, France., (2) Institut des Sciences de la Terre, CNRS UMR 5275, University J. Fourier, Grenoble, France.

Characterizing the micro-seismic activity of landslides is an important parameter for a better understanding of the physical processes controlling landslide behaviour. However, the location of the seismic sources on landslides is a challenging task mostly because of (a) the recording system geometry, (b) the lack of clear P-wave arrivals and clear wave differentiation, (c) the heterogeneous velocities of the ground. The objective of this work is therefore to test whether the integration of a 3D velocity model in probabilistic seismic source location codes improves the quality of the determination especially in depth.
We studied the clay-rich landslide of Super-Sauze (French Alps). Most of the seismic events (rockfalls, slide-quakes, tremors...) are generated in the upper part of the landslide near the main scarp. The seismic recording system is composed of two antennas with four vertical seismometers each located on the east and west sides of the seismically active part of the landslide. A refraction seismic campaign was conducted in August 2014 and a 3D P-wave model has been estimated using the Quasi-Newton tomography inversion algorithm. The shots of the seismic campaign are used as calibration shots to test the performance of the different location methods and to further update the 3D velocity model. Natural seismic events are detected with a semi-automatic technique using a frequency threshold. The first arrivals are picked using a kurtosis-based method and compared to the manual picking. Several location methods were finally tested. We compared a non-linear probabilistic method coupled with the 3D P-wave model and a beam-forming method inverted for an apparent velocity.
We found that the Quasi-Newton tomography inversion algorithm provides results coherent with the original underlaying topography. The velocity ranges from 500 m.s-1 at the surface to 3000 m.s-1 in the bedrock. For the majority of the calibration shots, the use of a 3D velocity model significantly improve the results of the location procedure using P-wave arrivals. All the shots were made 50 centimeters below the surface and hence the vertical error could not be determined with the seismic campaign. We further discriminate the rockfalls and the slidequakes occurring on the landslide with the depth computed thanks to the 3D velocity model. This could be an additional criteria to automatically classify the events.