Geophysical Research Abstracts
Vol. 17, EGU2015-10723, 2015
EGU General Assembly 2015

Contribution of terrestrial and helicopter based laser scanning for studying the Sechilienne rock slope instability (Isère, France)

Cindy Vulliez (1), Antonio Abellan Fernandez (1), Antoine Guerin (1), Michel Jaboyedoff (1), Marc-Henri Derron (1), Marie-Aurélie Chanut (2), Laurent Dubois (2), and Jean-Paul Duranthon (2)

(1) Risk Analysis Group, Institute of Earth Sciences, Faculty of Geosciences and Environment, University of Lausanne, Switzerland (Cindy.Vulliez@unil.ch), (2) Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement (CEREMA), Bron, France

The Sechilienne landslide, which is located in the Romanche valley (France) is a well instrumented mass movements of about 650 m high and 250 m wide, with a potential volume of 3 million cubic meters of material in the active part (Duranthon, 2004; Kasperski, 2010). The slope, which is mainly composed of micaschist, is characterized by the presence of a NE-SW sub-vertical fracturing system involved in the destabilization of the area. Several investigations are being performed by different research groups on this landslide, including fieldwork investigations, remote sensing, seismic acquisitions, geochemistry, deformation analysis by extensometers, etc. There exists a current concern related with the development of a failure that could dam the Romanche River, which could cause flooding with significant consequences for the valley downstream. The rock slope has continuously moving since the eighties decade, with a progressive acceleration during the last years. Furthermore, a higher rockfall activity has been observed in 2013, with two main events within the upper most active part of the landslide, with volumes of 1500 and 2500 m3.

In this work, we used Terrestrial Laser Scanning to obtain high resolution point clouds of the rock slope geometry in order to monitor the rock slide displacements in three dimensions. Eight different fieldwork campaigns were performed during the last five years, as follows: Aug. 2009, Jul. 2010, Nov. 2011, Nov. 2012, Jun. and Nov. 2013, Jul. and Oct. 2014, which provides a set of 3D representations of the rock slope topography over time. Furthermore, three helicopter-based laser scanning campaigns were performed in Jan. 2011, Feb. 2012 and Feb. 2014 (Chanut, 2014). Both the type of data are complementary for the study of the movement and allow to have a good spatial vision of the evolution of the most active part.

Data processing was carried out through several steps using Polyworks software, as follows: (a) cleaning of scans, (b) alignment of the scans using only the stable areas of the slope, (c) georeferencing, and (d) comparisons among all the scans. As for the results, we obtained positive and negative values of surface changes between the period of study, which enabled us to characterize rockfalls and displacements on the rock slope. In the upper part, we observed that several areas (from 1 to 1000 m3) suffered higher values of displacements (from several decimeters to a maximum value of 4 meters), indicating the presence of a progressive failure in these parts of the slope. The failure mechanism observed on this areas correspond to a toppling. On the lower part of the rock slope we observed the accumulation of the fallen material and a series of surface processes on the talus. Furthermore, we carried out the tracking of hundred blocks in the upper part of the slope in order to identify potential events. Once the individual blocks fell, we used 3DReshaper for calculating their volumes and for determining a power law distribution of rock falls in the slope.

The acquisition of dense and accurate terrain information using LiDAR for study the Sechilienne landslide has been useful for investigating the unstable area as regards the failure mechanism, the magnitude of displacements, the rockfall frequency of the most unstable areas, etc.