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Differential Synthetic Aperture Radar Interferometry in monitoring large landslide (La Frasse, Switzerland)

C. MICHOUD (1), T. RUNE LAUKNES (2), A. PEDRAZZINI (1), M. JABOYEDOFF (1), R. TAPIA (1), and G. STEINMANN (3)

(1) Institute of Geomatics and Risk Analysis, University of Lausanne, Switzerland, (2) Norut, Tromsø, Norway, (3) Soil Mechanics Laboratory, Swiss Federal Institute of Technology of Lausanne, Switzerland

Spaceborne Differential Interferometric Synthetic Aperture Radar (DInSAR) is able to detect quasi vertical movements covering very large areas in a continuous way; it can be considered as an efficient tool to detect and monitor slope instabilities.

The La Frasse landslide is located in the Canton of Vaud (Switzerland). It has a length of 2 km, a width of 500 m and its sliding surface is located at a depth of 60 to 100 m. With high velocities (presently at 40 cm/y in the active lower part), La Frasse landslide is in highly hazardous area according to the Swiss legislation. According to Varnes classification, it is a complex slide composed of tertiary flysch material and flowing over on flysch and limestone bedrock. The landscape is occupied by forests, pastures, some habitations and two main roads to touristic areas. The foot of the landslide is continuously eroded by the river “Grande-Eau”.

First of all, two interferometric pairs are constructed with data provided by the satellite Alos. The big wavelength (24 cm) of ALOS’ PALSAR sensor gives good results in the foot of the landslide, where the movements are highest. Afterwards, fifty-three interferometric pairs are constructed with twenty-two images acquired with the European satellite Envisat. With the shorter wavelength (5.6 cm) of the Envisat’s ASAR sensor, but the higher number of interferograms, the analysis provides the mean velocities of landslide’s scaterrers by using the Small Baseline Subset (SBAS) methodology.

The DInSAR results were compared to ground displacements measured every 2h by an optical total station (Robovec™ System). The results of this study are coherent with the amplitude of the deformations monitored by Robovec™. Moreover, the computation of the mean velocities shows that today, total displacements are measured in the active lower part of the landslide; the data complete Robovec™ results. But the accuracy of the measured displacements and the number of scatterers could be improved by synthetizing the topographic phase from an aerial laser scanning DEM instead of the STRM DEM. The number of scatterers can also be increased by installing corner reflectors in the fastest-moving area of the landslide.

At present, a draining gallery is being constructed under the active part of the landslide. As soon as the construction is finished, it would be interesting to measure displacements by SBAS to control the efficiency of the gallery.