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A multi-temporal image correlation method to characterize landslide displacement fields

J. Travelletti (1), C. Delacourt (2), G. Koval (1), J.-P. Malet (1), J. Schmittbuhl (1), and D.B van Dam (3)

(1) CNRS – University of Strasbourg, School and Observatory of Earth Sciences, Strasbourg, France (julien.travelletti@eost.u-strasbg.fr), (2) European Institute of Marine Studies, University of Western Brittany, Brest, France, (3) Utrecht University, Faculty of Geosciences, Utrecht, Netherlands

A monitoring system using a high resolution optical camera to characterize the displacement field of the Super Sauze mudslide through time. The mudslide exhibits a strong activity, with velocity values ranging from 0.01 m.day^{-1} to 0.4 m.day^{-1} in periods of acceleration.

The monitoring system is operational since 2007, and consists of a high resolution optical camera installed on a fixed concrete pillar located on a stable crest in front of the mudslide. The camera is controlled by a datalogger, and registers 3008 x 2000 pixels photographs at 11:00 AM, 12:00 PM, 13:00 PM and 14:00 PM each 4 days.

The objective of this work is to discuss the possibility of deriving the displacement field from the multi-temporal images by using two algorithms of image correlation (MicMac; CORRELI^{2D}), and to present the first analysis of the landslide dynamics.

The quality of the image correlation is controlled by (i) changes of illumination angles and intensities through time leading to specific shadow patterns, (ii) surface texture changes and (iii) possible slight movements of the camera. These possible errors can be corrected by the image correlation procedure.

The correlation results are first interpreted in terms of pixel displacements, pixel velocity and direction of movements in the camera image plane. The computed pattern of displacement is in good accordance in terms of direction and amplitude with the benchmarks displacement observed in the field. The velocity pattern of the mudslide is very well differentiated from the stable parts where the displacement amplitudes tend to be zero and the directions are randomly distributed. The main challenge is to convert the pixel displacements into metric displacements for which the critical point is to characterize accurately the image geometry.