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# Monitoring rockfall failure deformation in an active quarry, Switzerland

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On October 10th 2012 a massive rockfall of several thousands of cubic meters occurred in a quarry in western Switzerland.

The detection and quantification of pre- and post-failure deformation represent important tasks to understand the failure mechanisms and the geometry of the rock slope failure, aiming ultimately to assess its stability. Terrestrial Laser Scanner (TLS) was used to provide high resolution 3D surface of quarry. Several TLS acquisitions were made in 2009, 2010, 2012 and 2013 allowing a long term monitoring. Several ground-based InSAR campaigns were also performed to monitor the unstable rock face after the rockfall, showing millimeter order of deformation.

We were able to compute a precise volume estimation of the October 10th rockfall by LiDAR data treatment thanks to comparing pre-failure (2009 and 2010) and post failure (2012) TLS acquisition. Displacements of few centimeters suggesting pre-failure deformations were measured in a well-defined portion of the quarry and precursory rockfalls were detected around other potential instabilities. The TLS and ground-based InSAR approaches showed consistent results either on the extension of the moving area and on the length of the pre-failure deformation of the potential rockfall, showing small deformation on more recent GB-InSAR measurements compared to long-term LiDAR datasets. The challenge is now to quantify the influence of blasting on observed short-term and long-term displacements.

In such a case, the coupling of the TLS on long term monitoring and ground-based InSAR measurements on relatively short time showed that they are complementary techniques.