The characterization of a rock instability phenomenon is a fundamental task in the understanding of its evolution and the forecasting of possible further slope failure. The first step towards a complete study of the unstable slope consists in its detailed geometrical, geomechanical and kinematic characterization in order to generate a high resolution 3D digital model of the investigated area, recognize the main discontinuity sets of the rock mass, evaluate displacements and deformations occurred between subsequent surveys. This kind of study can be carried out by means of remote sensing techniques like terrestrial (TLS) and airborne laser scanner (ALS), which allow detailed investigations of a rock cliff in remote and safe mode.

Terrestrial and airborne laser scanner techniques applied to rock slope instability analysis: the case of Einser-Cima Una (Sexten Dolomites, Italy)

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At 8:40 a.m. October 12, 2007, a large rock wedge detached from the northern wall of Einser-Cima Una (Sesto Pusteria, Bolzano, Italy). The rock mass fell down from the upper part of the rock wall (Top at 2.698 m a.s.l.) to the Fischleintal-Val Fiscalina, nearly 900 m far down from the top.

During the fall, the calcareous and dolomitic landslide materials fragmented and generated a dense sandy cloud travelling in the Val Fiscalina up to 4 km far from the base of the rock wall.

The detritic accumulation at the base of the rock wall is composed only by several rock blocks, mainly by fine material.

The 12 October 2007 rockfall event

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Volume estimation by TLS and ALS

By comparison between the two scans, the volume of the fell mass has been reconstructed (using CAD instruments and Polyworks software) and estimated in about 40,000 m³.

TLS survey of the failure surface

The TLS surveys of the failure surface were performed using the Riegl LMS Z-420i instrument, coupled with a GPS receiver. A second GPS receiver was used for georeferencing purposes.

Two view points were considered, the first one about 225 m far from the source area, was surveyed in November 2007 and September 2008. The second one, about 115 m far from the source area, was surveyed only September 2008. The obtained point clouds have a sampling rate of 50 cm on the rock wall.

Multitemporal analysis

The comparison between the two TLS-based point clouds acquired from the same view point along the analysis of the displacement field. This analysis, performed by using the automatic alignment method at 10-months time scale, do not recognize any displacements on the rock mass of the failure surface and the surrounding slope sectors.