



Vegetated landslide monitoring: target tracking with terrestrial laser scanner

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Monitoring landslides with terrestrial LiDAR is currently a well-known technique. One problem often encountered is the vegetation that produces shadow areas on the scans. Indeed, the points behind the obstacle are hidden and are absent from the point cloud. Thereby, locations monitored with terrestrial laser scanner are mostly rock instabilities and few vegetated landslides, being difficult or even impossible to survey vegetated slopes using this method. The Peney landslide (Geneva, Switzerland) is partially vegetated by bushes and trees, and in order to monitor its displacements during the drawdown of the Verbois reservoir located at its base, which activates the movement, an alternative solution has to be found.

The Goal of this study are: (1) to illustrate a technique to monitor vegetated landslides with a terrestrial laser scanner and (2) to compare the both manual and automatic methods for displacement vectors extraction.

We installed 14 targets, four of which are in stable areas which are considered as references. Targets are made of expanded polystyrene, two are spherical and 12 are cubic. They were installed on metallic poles ranging between 2 to 4 meters high. The LiDAR device was located on a fixed point on a pontoon on the reservoir opposite bank. The whole area, including the targets, needed three scans to be entirely covered and was scanned 10 times along on two weeks (duration of drawdown – filling).

The acquired point clouds were cleaned and georeferenced. In order to determine the displacements for every target, two methods (manual and automatic) were used. The manual method consists on manual selection of, for example, the apex of the cubes, and so to have its 3D coordinates for a comparison in time. The automatic method uses an algorithm that recognises shapes trough time series.

The obtained displacements were compared with classical measurement methods (theodolite and extensometer) showing good resemblance of results, indicating the validity of this method.

The low cost of the additional field equipment and the relatively low time of installation makes it interesting and deserve to be further developed. The automatic data analysis method considerably lowered the errors and was way faster than a manual operation. Those combined methods offer new application field for vegetated landslide monitoring using terrestrial laser scanner, including a more accurate and faster treatment.