Geophysical Research Abstracts
Vol. 20, EGU2018-7445, 2018
EGU General Assembly 2018

Finding the best locations of monitoring devices based on visibility analysis with 3D point clouds

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Monitoring systems are essential to predict the behavior of landslides and, especially when associated with early warning systems, to reduce risks. Between all the technologies available, some require free line of sights, e.g. total stations, LiDAR, GBInSAR and wireless sensor networks including cameras or ultra-wideband sensors.
To correctly implement these types of systems, a viewshed analysis can be essential to evaluate the best sensors positioning and design, since the viewshed is defined as the area observable from a viewing location.
Nowadays many researchers in the field of urban design, landscape planning as well as GIS technology focus on the study of visibility analysis, and most of them are based on the use of gridded digital terrain and elevation models (DTM & DEM).
With the development of LiDAR and SfM technologies, there is an opportunity to use directly 3D point cloud data to perform visibility analyzes. Doing so, many disadvantages of traditional modelling and analysis methods can be bypassed.
This works aims to determine the visible points in a point cloud, as viewed from a given position in order to be able to locate the best viewpoints to visualize the full landslide surface or a network of mutually visible instruments. In particular, a point has been considered as visible from an observation point if its inverted point lies on the convex hull.
This leads to skip the process of generating a surface model avoiding errors and approximations. Furthermore, point cloud data can provide much more detailed information than traditional raster data or a TIN model, especially on steep, hummocky, vegetated or/and overhanging terrain.