New technologies for landslide monitoring. Examples from the Greek territory

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Abstract

Active landslides can be monitored using many different methods such as classical geotechnical measurements including inclinometers, topographical survey measurements with total stations or Global Navigation Satellite Systems (GNSS) receivers. Newer methods include Airborne Light Detection and Ranging (LiDAR) systems, Terrestrial Laser Scanners (TLS), photogrammetric techniques using airphotos or high resolution satellite images, Differential Interferometry using radar images (DInSAR). A recently emerged methodology is the computer vision technique using data from Unmanned Aerial Vehicles (UAVs). The advantages and drawbacks of those different methodologies for landslide monitoring are described and analyzed in several studies highlighting the existence of a high resolution and accurate representation of the relief as a prerequisite in order to achieve a proper displacement identification (Nikolakopoulos et al., 2017; Nikolakopoulos et al., 2018; Nikolakopoulos and Koukouvelas, 2017; Kyriou and Nikolakopoulos, 2016; Kyriou and Nikolakopoulos, 2018). Additionally, all the studies agreed that a key point in active landslide monitoring is the performance of repeated surveys, as the transient geomorphology of the sliding area changes resulting in the requirement of precise mapping over time. The current study presents the exploitation of new technologies including TLS, UAV and DInSAR for landslide monitoring that were applied in different sites within the Greek territory.

Figure 1. Landslide mapping with UAV at Analipsi village, Western Peloponnese. Orthomosaic is the resulting product of each flight campaign. Image A: a historical image of Google Earth. Image B: the orthoimage of the last campaign (3/11/2016).

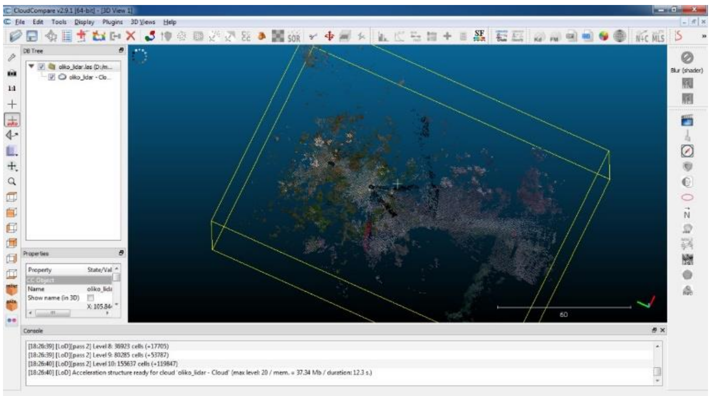

Figure 2. Moira landslide mapping with Terrestrial Laser Scanner. Point cloud generated from the TLS measurements.

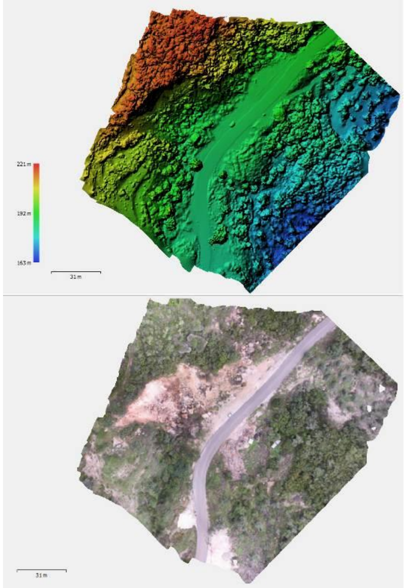

Figure 3. Landslide Mapping with UAV. Top image: DSM with 4cm spatial resolution from the Agios Petros landslide in Lefkada. Bottom image: the respective orthophoto with a spatial resolution of 2cm.

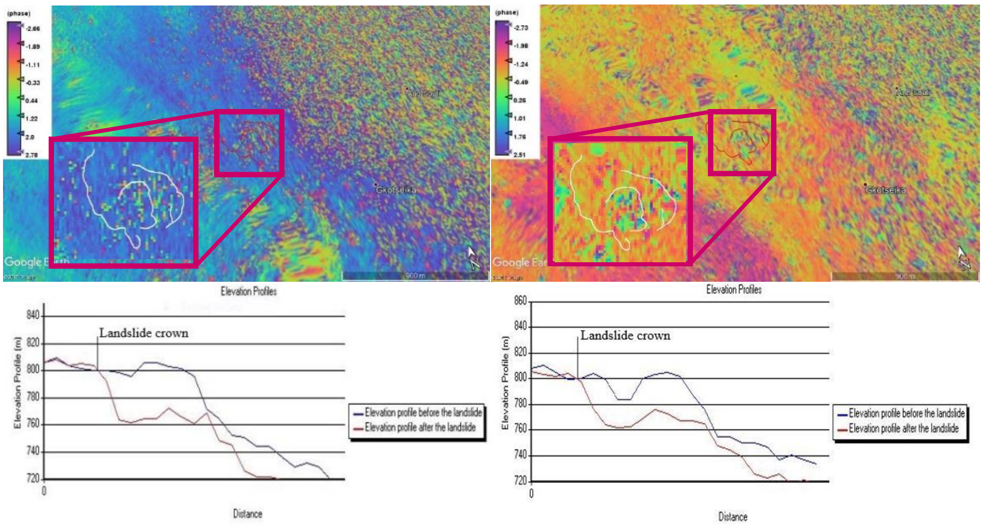

Figure 4. Top images: Interferograms displaying the ground deformation caused by the landslide is mapped (alterated colors within the landslide boundaries). Bottom images: Elevation profiles of interferometric DSMs showing the relief change at Moira area after the landslide.

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