

Preliminary estimation of Mencui landslide volume using LIDAR data. Case study from Pyrenees (Spain).

Jordi Pinyol^{*}, Jordi Montilla^{*} and Marta González^{*}

^{*} Cartographic and Geological Survey of Catalonia, Barcelona, Spain

ABSTRACT

The 25th of May 2018, after an extraordinary rainy season (500 mm of rainfall during spring, 170% more than the average amount for the 1961-1990 period), a significant landslide occurred in the Assosiats hillside. It is located near Mencui, a small town of the Central Pyrenees (ETRS89: 42.3764° N/ 1.0427° E) on the south side of the Aigüestortes and Estany de Sant Maurici National Park. The Mencui landslide covers an area of 6.1 ha and its altitude ranges from 1,270 m to 1,080 m. a.s.l. It is one of the most important events inventoried by its dimensions in recent times in Catalonia.

In this abstract we present a preliminary result of the geomorphological cartography and the mobilized material estimation made by space-time comparison of Digital Terrain Models (DTM) obtained from data LiDAR (Light Detection and Ranging) before and after the landslide event. We used this methodology in a significant debris flow in 2013 acquiring optimal results [1].

From a geological point of view, the slope is in the Pyrenean Axial Zone and it is part of an Alpine W-E oriented antiformal stack and a thrust fault structure. The bedrock is formed by Buntsandstein facies (lutite, sandstone and conglomerate) and Stephanian-Permian volcanic-sediments.

To analyse the landslide, three types of information have been used:

- 5 days of work field to identify the lithologies and the geomorphological features.
- Datasets made periodically by the Cartographic and Geological Survey of Catalonia (ICGC). We used 2 sets of orthophotos (0.5m spatial resolution) and DTMs (cell size of 2 x 2m) obtained from airborne data LiDAR, acquired in 2009 and 2016, before the landslide event.
- High resolution orthophotos (0.1 m spatial resolution) and DTM (cell size of 0.15 x 0.15m) obtained from UAV data LiDAR in 2019, after the movement.

Mapping of landslide was carried out from the 2019's orthophoto and from field observations. The area obtained was used as an area of analysis for the comparison of DTMs. Through geomorphological interpretation, the landslide has been classified as a complex movement, with a rotational sliding component in the upper part and a fluidal behaviour in the lower part of the slope.

By comparing the DTMs of 2009 and 2016, we have observed that the slope moved before the failure. This point agrees with the field observations of a forestry agent in 2017. Comparing the DTMs of 2009 and 2019, we have obtained a difference in elevation map that has allowed the sediment budget estimation. We have gotten approximately 164,000 m³ of sediment as removed volume and 160,000 m³ as accumulated volume, without distinguishing which one is filling up the volume previously slid [2]. To know the total volume mobilized in the event, the surface of rupture has been interpreted from all available information. We have obtained 357,000 m³ as a total landslide volume.

REFERENCES

- [1] J. Pinyol, M. González and M. Moysset, "Preliminary estimation of Aubeta debris flow deposition and erosion volumes using LIDAR data", JTC1 Workshop on Advances in Landslide Understanding, Barcelona, (2017).
- [2] Z. Chen, B. Zhang, Y. Han, et al., "Modeling accumulated volume of landslides using remote sensing and DTM data", *Remote Sensing* 6, pp. 1514–1537, (2014).