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Monitoring the Lavina di Roncovetro (RE, Italy) landslide by integrating traditional monitoring systems and multiple high-resolution topographic datasets

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Tha Lavina di Roncovetro landslide is located in the Enza Valley (Reggio Emilia, Italy). It extends from the top of Mount Staffola down to the Tassobbio River. Since the clay fraction is dominant, it follows that the landslide can be considered as a fluid-viscous mudflow, which can reach a down flow maximum rate of 10 m/day. The landslide started between the middle and the end of the XIX century and since then it has had a rapid evolution mainly characterized by the rapid retrogression of the crown to the extent that now reaches the top of Mount Staffola. In the last 20 years, about 100,000 m3 of bedrock descended from the main scarp into the landslide body. The total volume of the landslide is inferred to be of $\sim 3 \times 106$ m3.

In the frame of EU Wireless Sensor Network for Ground Instability Monitoring - Wi-GIM project (LIFE12 ENV/IT/001033), the Roncovetro landslide is periodically monitored by traditional monitoring systems and Unmanned Aerial Vehicle (UAV) survey. In addition, an airborne LIDAR survey and a photographic acquisition from a small aircraft were carried out on April 2014 and October 2014, respectively. The traditional monitoring system consists of a terrestrial laser scanning (TLS) survey and a robotized total station (RTS). TLS acquisitions have focused on the upper and more active sector of the earthflow and were carried out since May 2014. By comparing TLS data taken at different times, the general deformational field of the landslide can be reconstructed and the displacements affecting the retaining structures built on the landslide crown quantified. The time resolution of both TLS and RTS acquisition is about 6 per year. .

Three high-resolution photogrammetric surveys performed using an UAV were carried out on November 2014, July 2015 and January 2016. Starting from the acquired photos and applying photogrammetry and Structure From Motion (SFM) algorithms integrated in the Photoscan Agisoft software, the high-resolution 3D models of the Roncovetro Landslide were generated at different times. The 3D models are then georeferenced and the digital elevation models (DEMs) created. By comparing the obtained DEMs, changes in the investigated area were detected and the sediment volumes, as well as the 3D displacement at the most active parts of the landslide quantified.

In this work, we test the performance of the SFM techniques applied on active landslide by comparing them with the traditional monitoring systems, highlighting the strengths and weaknesses of both methods. In addition, we show the preliminary results obtained integrating the traditional monitoring systems and the multiple high-resolution topographic datasets, over a period of more than one year, used for investigating the spatial and the temporal evolution of the upper sector of the Roncovetro landslide.