Multidisciplinary studies of the Puigcercós historical landslide in the Catalan Pyrenees

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More than a century ago, the Puigcercós village located in the region of Pallars Jussà (Catalonia, Spain), suffered a large-scale landslide that occurred on January 13th, 1881. More than 5 million m³ of sediments and rocks were displaced and a 200 m long and 25 m high rock scarp was formed. Luckily, during the main event, the nearby village was not affected, and due to a prompt evacuation and re-location of the entire village, no casualties were reported. Nevertheless, consequent retreat of the main scarp did destroy the big part of the old village, which confirmed not only the necessity for its relocation, but also gave one of the first clearly described and confirmed examples of a successful geologic risk prevention.

During the last decade, the members of the RISKNAT-UB group have chosen this site to conduct pilot studies of rockfalls and landslides using a multidisciplinary approach. The utilized observational techniques include Terrestrial Laser Scanner (TLS), photogrammetry, GPS, seismic monitoring and geophysical prospecting techniques. The work presented here is an overview of these activities, including the main milestones of the ongoing research. Special emphasis will be given to the use of geodetic techniques for investigating changes on the depositional area of the landslide and around the crown cracks at the upper level of the main scarp. As a result of the GPS observations, for the first time, 130 years after the occurrence of the event, it was possible to observe a continuing geomorphological activity of the depositional zone of this historical landslide, Currently, the RISKNAT-UB group operates cost-effective, high-resolution and low-cost photogrammetric instruments and seismic continuous records at the site, in order to monitor the evolution of the Puigcercós rock scarp. The correlation of the seismic and the photogrammetric data and intermittently obtained LiDAR images enables us to monitor and characterize frequent rockfalls and premonitory deformations occurring at the site. These observations have allowed quantifying the rate of retreat of the rock scarp at a rate of 10 to 11 cm/yr and a slow motion of the depositional zone up to 6 mm/yr. Since the geologic risk at the study area is not significant, due to the absence of population and/or infrastructures, this site is an ideal natural laboratory for developing new observational techniques, which can be used to develop early warning systems for rockfalls and landslides.
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