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Solid images generated from UAVs to analyze areas affected by rock falls

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The study of rock fall affected areas is usually based on the recognition of principal joints families and the localization of potential instable sectors. This requires the acquisition of field data, although as the areas are barely accessible and field inspections are often very dangerous. For this reason, remote sensing systems can be considered as suitable alternative. Recently, Unmanned Aerial Vehicles (UAVs) have been proposed as platform to acquire the necessary information. Indeed, mini UAVs (in particular in the multi-rotors configuration) provide versatility for the acquisition from different points of view a large number of high resolution optical images, which can be used to generate high resolution digital models relevant to the study area. By considering the recent development of powerful user-friendly software and algorithms to process images acquired from UAVs, there is now a need to establish robust methodologies and best-practice guidelines for correct use of 3D models generated in the context of rock fall scenarios.
In this work, we show how multi-rotor UAVs can be used to survey areas by rock fall during real emergency contexts. We present two examples of application located in northwestern Italy: the San Germano rock fall (Piemonte region) and the Moneglia rock fall (Liguria region). We acquired data from both terrestrial LiDAR and UAV, in order to compare digital elevation models generated with different remote sensing approaches. We evaluate the volume of the rock falls, identify the areas potentially unstable, and recognize the main joints families. The use on is not so developed but probably this approach can be considered the better solution for a structural investigation of large rock walls. We propose a methodology that jointly considers the Structure from Motion (SfM) approach for the generation of 3D solid images, and a geotechnical analysis for the identification of joint families and potential failure planes.