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# MONTE GENEROSO ROCKFALL FIELD TEST (SWITZERLAND): Real size experiment to constraint 2D and 3D rockfall simulations

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In numerical rockfall simulation, the runout of rockfall is highly dependent of the restitution coefficients which are one of the key parameters to estimate the energy and simulate the rebounds of the blocks during their travel. Restitution coefficients values derived from literature may however not be adapted to every rockfall area as they do not integrate some of the influencing parameters as, among others, block shape rock size, soil cover...
The aim is to illustrate how real size rockfall experiment can improve the reliability of computational trajectory simulations of rockfall propagation by calibrating these latter with experiment extracted results.
Experimental rockfall tests were performed in the slopes of Monte Generoso area (lat 720850/ long 84830) which is located in the canton of Ticino in south Switzerland above a highway. The field site is a forested area with a thin soil cover on a bedrock characterized by massive carbonates. The elevation ranges between 894m and 322m above see level with a slope of 35 to 40° in the upper part, 60 to 89° in the medium part and 28 to 38° in the lower part.
22 blocks with different size and shape were manually released down, imparting little or no initial velocity. The failing blocks were coloured to make the impacts easier to recognize. The paths of the failing blocks are recorded using two high speed cameras and the impacts of the blocks were sampled using dGNSS. The rockfall trajectories were analysed based on the movies. As the movies have to be referenced in x and y direction, the distance between two known point in the terrain as well as the position of the cameras were measured prior to the blocks throws. Measurements of bounce height, angular and translational velocity (as well as energy) and restitution coefficients (normal kn and tangential kt) were attempt to be deduced from the movies.
First, a-priori simulations are compared with the real size experiment throw. Then a-fortiori simulations taking into account the results of the experimental testing are performed and compared with the a-priori simulations. 3D simulations were performed using a software that takes into account the effect of the forest cover in the blocky trajectory (RockyFor 3D) and an other that neglects this aspect (Rotomap; geo&soft international). 2D simulation (RocFall; Rocscience) profiles were located in the blocks paths deduced from 3D simulations.
The preliminary results show that: (1) high speed movies are promising and allow us to track the blocks using video software, (2) the a-priori simulations tend to overestimate the runout distance which is certainly due to an underestimation of the obstacles as well as the breaking of the failing rocks which is not taken into account in the models, (3) the trajectories deduced from both a-priori simulation and real size experiment highlights the major influence of the channelized slope morphology on rock paths as it tends to follow the flow direction. This indicates that the 2D simulation have to be performed along the line of flow direction.