

Quantitative Risk Analysis of Fragmental Rockfalls

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Rockfalls are ubiquitous diffuse hazard in mountain regions, cliffs and cutslopes, with the potential of causing victims and severely damaging buildings and infrastructures. A vast majority of detached rock masses break up when impacting the ground, generating multiple trajectories of rock fragments. In this paper, we present the quantitative risk analysis (QRA) of fragmental rockfalls. Fragmentation in rockfalls requires the redefinition of the probability of reach and the evaluation of the effect of multiple rock blocks trajectories on the exposure. An example of QRA was carried out at the Monasterio de Piedra, Spain using RockGIS, a rockfall propagation model that takes fragmentation into account (Matas et al. 2017). The results show that fragmentation has a significant but contrasting effect in the calculation of risk. The risk is reduced if the slope where blocks propagate is sufficiently long and gentle. The reason for this is that, compared to the unfragmented rock masses, the new fragments generated travel shorter distances with lesser kinetic energy. The effect disappears in case of large rockfalls. Conversely, the risk increases if the rock fragments propagate over steep slopes. The reason is that few blocks stop along the way while the generation of a cone of fragments increases the exposure. Our simulations also show that assuming a continuous flow of visitors or segregating the flow in groups of different number of people, has only a minor influence on the results. Finally, we observed that the capability of the protection barriers to stop rockfalls of up to a few tens of cubic meters increases with fragmentation.

Jordi has recently been awarded with the first LARAM Honor Lecture (Sept 2018) and the talk he will present to us will be derived from the material presented at that lecture.

LARAM - Landslide Risk Assessment and Mitigation (Salerno University, Italy) - Jordi was also one of the founders of the LARAM school.

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