



## Rockfall exposures in Montserrat mountain

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This study shows the developed methodology to analyze the exposure level on a 1:25000 scale, and the results obtained by applying it to an important part of the Monaña de Montserrat Natural Park for vehicles with and without considering their occupants. The development of this proposal is part of an ongoing study which focuses more in-depth in the analysis of the rockfall risk exposure in different scales and in different natural and social contexts.

This research project applies a methodology to evaluate the rockfall exposure level based on the product of the frequency of occurrence of the event by an exposure function of the vulnerable level on a 1:25,000 scale although the scale used for the study was 1:10,000.

The proposed methodology to calculate the exposure level is based on six phases:

- 1- Identification, classification and inventory of every element potentially under risk.
- 2- Zoning of the frequency of occurrence of the event in the studied area.
- 3- Design of the exposure function for each studied element.
- 4- Obtaining the Exposure index, it can be defined as the product of the frequency of occurrence by the exposure function of the vulnerable element through SIG analysis obtained with ArcGis software (ESRI)
- 5- Obtaining exposure level by grouping into categories the numerical values of the exposure index.
- 6- Production of the exposition zoning map.

The different types of vulnerable elements considered in the totality of the study are: Vehicles in motion, people in vehicles in motion, people on paths, permanent elements and people in buildings. Each defined typology contains all elements with same characteristics and an exposure function has been designed for each of them. For the exposure calculation, two groups of elements have been considered; firstly the group of elements with no people involved and afterwards same group of elements but with people involved.

This is a first comprehensive and synthetic work about rockfall exposure on the Montserrat Mountain. It is important to mention that the exposure level calculation has been obtained from natural hazard data do not protected by defense works.

Results of this work enable us to consider best strategies to reduce rockfalls risk in the PNMM. It is clear that, apart from the required structural defense works, some of them already made, implementation of strategies not involving structural defense is, in the medium and long term, the best policy to mitigate the risk. In the PNMM case, rethinking of mobility and traffic management on the mountain access would be definitely helpful to achieve a minimized geological risk.