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Modelling rockfall impact on structures

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Rockfalls are widespread phenomena that cause lots of damages to structures and threaten human beings. The assessment of rockfall impact on structures is therefore very important for the management of mountainous areas. In order to assess the hazard related with rockfall impact on a certain structure, it's necessary to define: (1) the source areas of blocks that can potentially propagate toward the structure, (2) the intensity of the impact, and (3) the spatial probability distribution of the impacts on the structure. The main difficulty in assessing the potential source areas of blocks is related to the irregular propagation of rock masses on a complex topography. In order to overcome this limitation, we used a numerical model (HY-STONE) to simulate the propagation of blocks along a 3D topography. The same model allowed us to include explicitly the structures into the simulation, in order to calculate the energy and the spatial distribution of the impacts. We applied the model to study a rockfall event that hit the village of Fiumelatte (Lecco, Italy) on November 13, 2004, causing 2 deaths and the destruction of several houses. The simulation of this event permitted us to calibrate the model, that we successively applied the simulate the rockfall impacts on some selected structures in the neighbouring of Fiumelatte village. This allowed us to assess the degree of risk for each studied structure, and to design defensive works on the basis of a priority that derives from the degree of risk.