Rockslide distribution and cliff retreat: discrete element simulations

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The survey of cliffs through terrestrial laser scanning or photogrammetry now makes it possible to identify rockfalls of small volume, and to investigate their distribution in size and time. We propose a numerical approach to this issue, based on discrete elements simulations. We model the dynamics of an assembly of particles initially bound together by cohesive beams, which can be irreversibly broken when strain exceeds a given threshold. This method has already been applied successfully to the modeling of the spontaneous collapse of a brittle column [Langlois *et al.,* 2015].

We here extend this model in order to compute the long-term behaviour of a stable rock mass, whose cliff is progressively altered by randomly weakening some of the cohesive beams at each timestep. This allows us to investigate the properties of the rockfalls that are spontaneously and stochastically triggered. We study the retreat of the cliff and the dynamics of its profile, and predict the distribution of rockslide events in volume and time, in relation to the thickness and dip of strata. The results are then compared to available field data.

Mots-Clés : cliff dynamics ; rockfalls ; discrete element simulations