



Modelling vegetation and fragmentation effects on rock falls

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Detailed and reliable rock fall modelling involve major steps and difficulties. Mathematical modelling of rock fall trajectories can be performed with different approaches: two dimensional and three dimensional, lumped mass and hybrid or fully dynamic models. Nevertheless, the type of available data for the simulation can strongly control the results. As a consequence it is possible to optimize the type of information and data to be collected according to the aims of the study. We have analysed some of the major problems in 3D modelling of rock falls and their role in controlling results of hazard zonation procedures. The Hy-Stone model can use both a lumped mass and a hybrid model, working with DTM of any resolution, with trajectories described in 3D, considering the presence of obstacle and countermeasures and with different algorithms to simulate energy loss at impact points. An elasto-visco-plastic impact model is implemented to simulate impact on soft ground (soil, loose debris, artificial loose material). Hy-Stone takes into account the possible presence of vegetation and the occurrence of fragmentation of main blocks into small flying rocks. Simulation of the vegetation can be both stochastic and deterministic and can include different conditions of forest cover (tree density, size and type of tree, absorbable energy). Fragmentation is modelled, as a first step, through a stochastic approach and it can be used for hazard zonation purposes. We present a series of results showing the performance of the model in simulating real rockfall events as well as in complex local conditions (trees, structures, and fragmentation).