Towards a better understanding of the coefficient of restitution of a rockfall rebound

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Rockfall hazard assessments are increasingly done with rockfall simulation models. A key parameter in such models is the coefficient of restitution. This parameter determines the energy loss of falling rock during a rebound on the slope surface. The problem is that values for coefficients of restitution are very hard to estimate in the field.

In our research we try to develop objective rules for determining these values. The governing parameters of a rebound are thought to be the rock shape, its relative size to those of the particles covering the slope surface and the incident kinematics parameters of the rock.

Four types of investigations on rock rebounds have been carried out.

Firstly, we have done small-scale rockfall experiments on a 40° talus slope in the French Alps. The volume of the used rocks varies from 0.005 to 0.01 m3 and the rock forms are rectangular, spherical and disc shaped. The particles covering the slope surface are pebbles (size-range or diameter: 16 – 64 mm).

Secondly, single rockfall rebounds are registered with a high-speed video camera during small-scale rockfall laboratory experiments. The diameter of the used spherical rocks is about 10 cm and the impacted surface consists of similar material.

Thirdly, a numerical study of soil/boulder interaction during the impact phase is being done to develop an accurate stochastic impact model. The soil is modelled as a non cohesive granular medium using the discrete element method. A simulation campaign is being carried out for different boulder and medium characteristics (impact loca-

tion, grain size distribution, particles size and shape...). The stochastic impact law is defined further to a complete statistical analysis of the obtained results.

Fourthly, 3D rockfall simulations using different rebound algorithms will be carried out and validated with real-size rockfall experiments.

The available results of these four types of investigations will be presented and a preliminary synthesis of the effect of the different governing parameters of a rebound will be given.