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Rockfall mitigation effects by forests - a comparison between field tests and simula-tion with ROCKFALL

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Rockfall is a common phenomenon in steep rock slopes. Trees can stop rock blocks and dissipate their energy, depending on impact energy and the strength of the tree. This fact is known since long time and used to protect settlements by forests. The protective effects of forests depend on the tree's strength, pattern and distances between the trees. Field tests by Dorren et al. (2005) on a forested slope in the French Alps showed that the relationship between stem diameter at breast height and maximum amount of energy a tree can dissipate, is highly correlated for all the experimental data. Furthermore a strong relationship exists between the amount of energy the tree dissipates and the horizontal distance between impact center and the vertical axis of the tree. Since the nineteen-seventies rockfall simulation has become a standard design tool for rockfall mitigation measures. Only few rockfall simulation programs can deal with forests, one of them is ROCKFALL6.X, which calculates the energy loss and the reduction of velocity due to rock impact on trees. A statistical approach is applied to the input parameters (tree density and mean diameter) and to the parameters determining rockfall-tree-slope-interaction (friction angle, restitution coefficients, rolling resistance, surface roughness, maximum break energy). The process itself is treated deterministically, by solving the equations of impact mechanics. This leads to a physically exact modeling of impacts on trees. The results of the simulation model are systematically compared to the findings of the field tests. Differences have been analyzed and the findings have been used to improve the model for rock-tree impact. An example is presented using the above mentioned test slope.