DIGITAL TERRAIN MODEL RESOLUTION AND ITS INFLUENCE ON ESTIMATING THE EXTENT OF ROCKFALL AREAS

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Abstract

As rockfall can cause a great deal of damage, it is essential to know its spatial propagation. Rockfall models are sensitive to the resolution of input data i.e. the used digital terrain models (DTM). Nowadays, high resolution elevation data are area widely available from airborne laser scanning (ALS). ALS can even provide very accurate terrain information in forested areas. However, rockfall models are designed for analysis in a certain scale, which means that high resolution input might not necessarily improve model results (e.g. for regional scale studies). Our aim is to estimate the reach of rockfall by analysing different input resolutions of an ALS DTM. The presented model, implemented in Python 2.7, is a modified version of the zenital method including an iterative random walk trajectory model, which is designed for rockfall hazard assessment on the regional scale. First potential rupture cells are located by a slope criterion. In the next step the trajectory is calculated for each rupture cell. Subsequent cells are chosen randomly by fall height and the previous fall direction. Finally, the trajectory stops when it reaches a sink or the slope angle of the straight line between the rupture cell and the stopping cell (geometrical slope angle) falls below a defined angle criterion. This value is derived by field observations and can be extracted from literature. When computed with a sufficient number of iterations reach and spatial propagation of rockfall are derived. The model is calibrated by comparison of the modeled rockfall reachs with silent witnesses mapped in the field. Trajectories and rockfall probability maps are generated for selected DTM input resolutions. The comparison shows that high resolution DTMs do better consider local topography and thus lead to more realistic results than low resolution DTMs. However for detailed risk interpretation at object level a high resolution physical rockfall model is still required.

Keywords: rock fall modelling, digital terrain model, resolution, geometrical slope angle

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