REGIONAL DELINEATION OF POTENTIAL SOURCE AREAS AND RUNOUT DISTANCES OF ROCKFALLS AS A PLANNING BASIS FOR DETAILED ASSESSMENT

Sandra Melzner[1], Luuk Dorren[2], Arben Kociu[3] and Richard Baek[4]

INTRODUCTION

As part of the INTERREG IVA Project MASSMOVE (Project Code 1381-08-1: *"Minimal standards for compilation of danger maps like landslides and rock fall as a tool for disaster prevention"),* an area of approximately 120 km² in the Upper Moelltal (Carinthia, Austria) was investigated concerning a potential rockfall susceptibility.

Spatially continuous field mapping/investigations for such a large study area (regional study) are expensive and time-consuming. Hence the project applied and evaluated various methods at regional extent in order to identify, as efficiently as possible, potential conflict areas within the study area, for which a comprehensive, detailed assessment at local extent was carried out subsequently.

METHODOLOGY

A comprehensive map of potential source areas is an important basis for any rockfall susceptibility and hazard assessment. Within this project the delineation of source areas was conducted on the basis of field experiences, a geotechnical-lithological map, a high-resolution DTM and orthophotos. Then, for each geotechnical-lithological unit, a characteristic mean slope threshold value for rockfall source area was determined. The outcomes were compared with the results of a second method, the so-called slope-angle distribution (SAD) analysis (Loye et al. 2009).

Potential runout distances of falling processes were determined, on the one hand, through the application of an empirical model (Melzner et al. 2010B & 2010C), and on the other, by performing a 3D simulation with Rockyfor3D (Dorren 2010). For the energy line principle only a DTM and the locations of potential source areas were required. This empirical approach was calculated in 1-degree steps, from 28 to 44 degrees with a cell size of 5m. The data basis for the 3D simulation consisted of strongly generalised parameter maps which were prepared by calculating mean values from samples of a restricted number of punctual information of mapped parameters in predefined homogeneous classes. A finer resolution than 5m would not have been appropriate due to the low quality of the available input data. Furthermore the coarser resolution reduced the computational effort significantly, especially when it comes to a few simulations (total of eight different simulations: one scenario "with forest" and one scenario "without forest", each simulated with four different block diameters [0.5 m, 1 m, 2 m, 4 m]).

The potential runout distances determined with these approaches were overlaid with information on infrastructure and inhabited areas in order to delineate potential conflict areas as targets for detailed mapping. The possible conflict areas identified in this way are studied with respect to the actual existing rockfall susceptibility: whether, where, and to what extent a conflict may exist due to fall processes. This requires, on the one hand, an evaluation of the lithologic-structural geologic settings (see Melzner et al. 2010A) of the source areas and location of boulder of past rockfall events, on the other hand process- based runout simulations.

[1] Sandra Melzner. Department of Engineering Geology, Geological Survey Austria, Vienna, Austria (email: sandra.melzner@geologie.ac.at)
[2] Luuk Dorren. ecorisQ, Saint Hilaire du Touvet, France
[3] Arben Kociu. Department of Engineering Geology, Geological Survey Austria, Vienna, Austria
[4] Richard Bäk, Federal State Government of Carinthia, Klagenfurt, Austria

CONCLUSIONS

GIS-based automated identification of rockfall source areas using slope angle threshold-values determined with the slope-angle distribution (SAD) method proved to be a very efficient method that provides satisfying results. Since, for the regional modelling of rockfall runout zones originating from the identified rockfall source areas, an empirical model or rather generalised data were used, the resulting maps have to be used as susceptibility maps. The use of Rockyfor3D for computing potential runout zones allows greater spatial differentiation than an empirical approach. However, more input data is required, which calls for a significantly greater assessing and computational complexity.

Reliable delimitation of conflict areas is only possible if all potential source areas and damage potential are taken into account. Depending on the project goal, e.g. hazard zoning as basis for landuse planning or dimensioning of protective measures, a damage potential catalogue ("Schutzgutkatalog") must be established before the assessment begins. An increase in the number of "protection categories" also increases the complexity of detailed assessment.

A combination of the applied methods enables the delineation of potential conflict areas and results in a considerable reduction of time and cost concerning the assessment at local extent. The data validity domain of the resulting output maps can be evaluated as medium-quality, which at maximum will allow semiquantitative, more spatially differentiated indications of the hazard potential. These maps are particularly important to define priorities for large scale investigations at slope scale, e.g. hazard assessment and the proposal of protective measures.

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