LANDSLIDE SUSCEPTIBILITY MAPS FOR LOWER AUSTRIA

METHODS AND CHALLENGES

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BACKGROUND

Recent landslide events such as the event in the Italian region Massa (Tuscany) at end of October 2010 (with two fatalities), or events in Styria, Austria (Feldbach June 2009, Gasen/Haslau August 2005) demonstrate that landslides can cause fatalities as well as high economic losses. Often, these events are not purely of scientific interest. Also responsible institutions recognise that the focus on remedial work is not sufficient, rather some information for preparedness in terms of spatial planning is beneficial as decision support for future developments. This has also been recognised in Austria by the state of Lower Austria. Within the area of their responsibility, approximate 2,000 entries in the "building ground register" of the Geological Survey of Lower Austria indicate that about fifty percent of the municipalities are affected by landslides. Hereby, landslide types range from rock fall to shallow translational and deep seated rotational slides. This number of events and afflicted municipalities emphasise the need of prevention measures on a regional scale in order to minimize the landslide hazards for inhabitants and their living environment. Powerful tools for enhancing spatial preparedness are landslide susceptibility maps, which can be implemented in spatial planning processes such as the "area zoning plans" of municipalities.

Methods for landslide susceptibility modelling form a comprehensive research field which mainly covers the development of proper modelling methods, datasets and validation techniques in order to obtain reliable landslide susceptibility maps. However the implementation of the resulting maps in regional or local spatial planning is often missing because both modelling processes on regional scale and implementation of these maps into practise are challenging tasks for geoscientists as well as for spatial planners. Additionally the limited availability of appropriate spatial and temporal data on landslide events and explanatory parameters is a major restricting factor when performing modelling on regional scales.

The research project MoNOE (Method development for landslide susceptibility modelling in Lower Austria) has been designed to address this gap and to develop proper methods of modelling and map-design. One major focus is to produce susceptibility maps which are end-user optimized and user-friendly arranged to be ready for implementation in spatial planning. The project is funded by the Geological Survey and the Department of Spatial Planning and Regional Policy of the Federal State Government of Lower Austria.

OBJECTIVES

The main objective of this project is to develop best suited methods for the generation of regional landslide susceptibility maps. With regard to landslide types the analyses focus on rock fall and soil and debris slides (Cruden and Varnes 1996). These maps will be finally implemented in spatial planning strategies on federal state and municipality level. To achieve this main objective, further aims have been identified. In particular datasets of explanatory factors are assembled, prepared and homogenised. Additionally, the given data are integrated and checked by detailed field mapping. The

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compilation of a landslide inventory that is sufficiently complete to meet the requirements of statistical modelling is of major importance and defines heavily the quality of the resulting maps. Considerable effort will also be taken on different validation techniques in order to estimate the quality of the derived landslide susceptibility maps. Finally, the analysis of human impact on landslide occurrence and the possible representation in the final maps is a crucial part of the research objectives. Several ways of implementation of such human interference in the statistical model will be tested.

DATA AND METHODS

The study region "Lower Austria" covers an area of approx. 10,200km² and is located in the east of Austria. The preparation of high quality spatial dataset is a fundamental prerequisite. The compilation of data on landslide events and on explanatory parameters is a time consuming task and simultaneously decisive for the quality of modelling results later on. Therefore a comprehensive collection and analysis of requirements on landslide inventories for statistical modelling is performed (Petschko et al. 2010). Especially the analysis of the available high resolution LIDAR DTM (1m x 1m) proved to be of highest potential to check the quality of existing landslide inventories and to generate highly accurate explanatory parameters of topographic derivates, such as slope angle, aspect or landform classification, even when modelled at 10m resolution.
The suggested methods and tools for landslide and rock fall susceptibility modelling include weights of evidence, logistic regression, and empirical approaches. The CONEFALL (Jaboyedoff 2003) and RockHazardZone (Wichmann 2006) software were used for the definition of rockfall runout zones. The combination of these is tested in three representative districts of Lower Austria in order to develop a convenient method for the entire study area. The selected districts are Waidhofen/Ybbs, Amstetten and Baden. The lessons learned while analysing different methodologies in these districts provide important inputs for the design of a proper method for the entire study area.
Due to the size of the study area and the available data sets the project team had to face different challenges while generating the susceptibility maps. These challenges rose especially in terms of availability of sufficiently complete and accurate data sets but also concerning computing capacities. Therefore special adaptations of the applied methods were carried out to permit the modelling for the entire study area according to consistent standards.

RESULTS

Various combinations of parameters have been applied to test the model performance with respect to the minimum requirements on the landslide inventories. Furthermore the validation of the first landslide susceptibility maps gives adequate success and prediction rates. The expected final results are combined landslide susceptibility maps for the incorporated processes, which are prepared in the scale of 1:25,000 for each municipality. These maps are well fitted to the needs of the end-users such as spatial planners and local authorities. The new designed methods and results in terms of the best solution of the combined susceptibility maps will be completed until the conference.

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