Landslide Vulnerability

Geo-information technologies (GeoIT) play an important role in all phases of the risk-management chain in hazards such as flood, forest fire, windstorm, earthquake, volcano and landslide. The application of GeoIT in hazard management has been successfully investigated in various projects and at different levels, for example at European level by preview-risk, a project in the Sixth EU Framework Programme for Research and Technological Development (FP6), and orchestra, to mention but two. The establishment of Early Warning Systems is of special interest as a means of decreasing damage to people and environment. It is thus a topic extensively addressed, for example in Germany at national level in the 'Geotechnologien' programme funded by the Federal Ministry of Education and Research (BMBF) and the German Research Foundation (DFG). An overview may be found at www.geotechnologien.de/forschung_en/forsch2.12_en.html.

Landslide

In this programme the joint project 'Development of suitable information systems for early warning systems' (EGIFF) addresses the issue of using information systems for early recognition of various aspects of geological hazard, including landslide. Although, as mentioned above, this has been examined in several projects, there remain some important and still unsolved research questions, mainly relating to prediction and decision making. Concerning the latter, the responsible decision-makers are usually confronted with huge amounts of data, both structured and unstructured. To enable reliable early warning this data must be pre-selected, analysed and prepared. Decision-makers should be provided with a reliable and manageable amount of information for their warning decision and for taking preventive measures. In particular, improvement in information analysis and preparation is being broadly researched, for which techniques including GIS, numerical simulation, spatial-data mining, geo-databases and linguistics will be combined (Breunig et al., 2007).

Numerical Simulation

One of three EGIFF sub-projects, SLIDE (Coupling Simulations of Landslides with Geo Information Systems for Decision Support and Early Warning), aims at prediction and support of decision making and is being carried out by the Geo Information (GI) research group, in co-operation with the soil-mechanics group at Bundeswehr University, Munich. It is difficult to predict that parts of a slope or rock will fracture and cause a landslide; the mechanism is barely understood. Existing early-warning systems are mostly based on direct measurements using, for example, geodetic techniques, which leads to very short reaction times in case of detected landslide. A new approach has thus been introduced: numerical simulations in 3D by the Finite Element Method (FEM). This requires many different forms of input, including soil information, temperature and precipitation data, Digital Terrain Models, soil types and geological structure. This information fills the FEM meshes and, after numerical simulation, itself an extremely complex process, output results include hazard potential, deformation, movement vectors and stability indices. A GIS controls the whole process, and handles the results in such a way that they support decision making.

Testing

This new method requires intensive testing with real data to come to a better understanding of the hazard and forecasting of impending events. For this purpose a test area has been established south of Munich where the Bavarian Ministry has collected a great deal of data over the past fifteen years. The project has been provided with this data, allowing calibration with retrospective analysis of past events. Numerical simulations have begun and results will soon be published. More information at:

- http://bit.ly/v3637A

- Breunig, M., Reinhardt, W., Ortlieb, E., Mäs, S., Boley, C., Trauner, F.-X., Wiesel, J., Richter, D., Abecker A., Gallus, D. and Kazakos, W., 2007; Development of Suitable Information Systems for Early Warning Systems (EGIFF). In: GEOTECHNOLOGIEN Science Report: Early Warning Systems in Earth Management, pp 113-123.

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