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GIS AND DATABASE MANAGEMENT SYSTEM FOR MASS MOVEMENTS DOCUMENTATION IN AUSTRIA

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Abstract. GEORIOS is one of the key programs of the Geological Survey of Austria, carried out by the Department of Engineering Geology. In accordance with the National Law of Research of the year 2000, all available data and information on mass movements in Austria are collected and maintained. These data are undergoing reprocessing and then displayed via GIS as cartographic features. The relevant extended information is also stored in the GIS-connected relational databases. The available features and data are undergoing a primary evaluation in order to provide geohazards susceptibility maps at a scale of 1:50,000.

Key words: GIS, data management system, mass movements, Austria.

Abstrakt. GEORIOS jest jednym z głównych programów Służby Geologicznej Austrii, realizowanym przez Departament Geologii Inżynierskiej. Zgodnie z zaleceniami Narodowego Prawa Nauki z 2000 roku są zbierane i przechowywane wszystkie informacje dotyczące ruchów masowych w Austrii. Dane te są opracowywane i udostępniane w formacie GIS. Wszystkie dane uzupełniające są również przechowywane w relacyjnych bazach danych, połączonych z systemem GIS. Dane te są wykorzystywane do konstrukcji map podatności terenu na zagrożenia naturalne, w skali 1:50 000.

Słowa kluczowe: GIS, system zarządzania danymi, ruchy masowe, Austria.

INTRODUCTION

Over 70% of Austria territory is mountainous one. Their geology is very heterogenic, generated by multiple, generally complex, orogenic processes. Especially in the young and slowly ascending Eastern Alps, the intensity of the geomorphological processes sometimes result in catastrophic phenomena, hazardous for population and infrastructure, and causing considerable economical losses. Annually, enormous economical damage results from the mass movements in Austria and, therefore, the existence of the human population is often threatened. This was confirmed recently, in August 2005, in many regions of Austria. Therefore, the national and regional governments require basic information for planning and decision-making to properly assess the risks.

The Geological Survey of Austria represents the geo-management of the public sector of Austria. One of the main tasks is to document geogenic hazards. This is based on the National Law of Research of the year 2000 (Zit. change of the research organization law, BGBl. I, NR. 47/2000):
"§ 18(2): Their tasks cover in particular:

1. Investigations and research within the ranges of the geosciences and geotechnics by means of appropriate state of the art technologic and scientific methods. This concerns especially the geoscientific land survey, the collection and evaluation of geogene induced natural hazards, the occurrences of mineral resources and raw materials with the special purpose of researching the territory of Austria on usable deposits, as well as the collection and evaluation of the occurrence and distribution of drinking and industrial water resources.
2. Elaboration of expertises and planning documents within these fields.
3. Collecting, adapting and keeping evident the results of its investigations and research as well as documentation in these fields by the means of modern information technologies.
4. Cooperation with the institution of the national crisis management.

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DATA MANAGEMENT SYSTEM

Since the year 2000, in accordance with the tasks defined by the research organisation law, the Department of Engineering Geology is developing a GIS-connected relational database management system (Fig. 1) to record and document indicating-features, phenomena, documents and information of mass movements in Austria (Schönlaub, Heim, 2002; Heim *et al.*, 2003):

— the cartographic visualisation of the relevant phenomena is carried out by a geographical information system (GIS);
— by means of a relational data base system (Archive Data Base of the Department of Engineering Geology) all available data, information and documents are administrated. This system is linked with the mentioned above GIS, so that queries, search functions and evaluations are enabled from both sides, from the database as well as from the digital map;
— production of a literature database on mass movements.

The above screenshots give an overview of the digital archive components concerning mass movements, which consist of digital maps (based on a scale of 1:50,000), a relational database system (ORACLE), and a literature database (combined MS-ACCESS — ORACLE).

This modular system contains the following data and particular information:

1. GIS:
— type of phenomena;
— details about locality;
— geographic information;
— date/time;
— source of data
— query functions.
2. Archive Database Geohazards:

The input form is subdivided into the following thematic registers:

- Basics
  — extended information;
  — relevant literature or other source of information;
  — triggering factors (natural, other);
  — type of land use;
  — other remarks.
- Information on the related GIS-objects
  — displaying the data described above (GIS).
- Relevant events, hazard potential, economic consequences
  — type/process, date and time, spatial and economic dimension;
  — dimension of damage, affected objects, responsibility and competence, remarks.
- Geology
  — tectonic and stratygraphical unit, type and specific name of rock, other remarks.
- Hydrogeology
  — type and characteristics.
- Geotechnics
  — basic geotechnical properties of rocks or rock units, friction angle, cohesion, uniaxial compressive strength, water resistivity, grain size distribution, texture;
  — rounding of components.
- Related documents
  — full text papers (various file-formats), scans, pictures, movie files.
- Multiple query function
  — geographical;
  — thematic;
  — source.

3. Literature Database:
— detailed reference (author, title, content, …);
— geographic relevance;
— type of literature (book, proceedings, print media, …);
— source (archive, library, …), signature;
— query functions.

Currently, the database management system contains approximately 35,000 objects (polygons, lines and points) with information on several types of mass movements (e.g. deep creeping mass movement, rockfall, landslide, soil creep) and on the detailed objects (e.g. landslide scar, sliding block and other internal structures). This basic work is very important to estimate

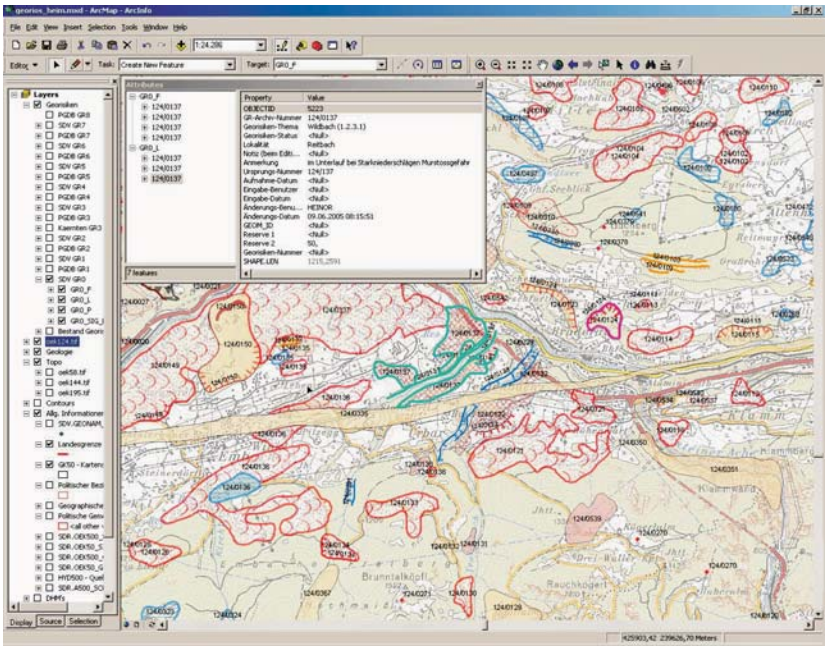

Fig. 1. A view on the GIS-tool for cartographically recorded phenomena of mass movements, connected to a relational database

risk and develop susceptibility maps of mass movements: (a) the digital maps of mass movement and (b) generally available, adequate digital data with spatial resolution, such as geological maps and digital elevation models.

The spatial resolutions of the resulting maps are designed for a usable scale of 1:50,000.

Furthermore, extensive area studies are carried out annually by the Department of Engineering Geology. The main target of these investigations is to improve the existing data records, to consolidate them and edit cartographically. Apart from recent and actual mass movements, also certain areas are explored and captured where mass movements occurred in the past. This is very important, because various investigations showed that actual mass movements frequently appear in or in the surrounding of those areas where old, at present inactive, mass movements took place.

CONCLUSIONS AND FUTURE WORK

The presented poster describes the objectives and the workflow from analogue archive data to the relational database management system.

By digitally processing the analogue archive data with the help of a developed data management system, consisting of a GIS and a relational database, various extensive data and information relating to geogonic natural hazards for the whole of Austria (mass movements, erosion, etc.) are now digitally available. It should however be taken into account that in certain areas the data available is of an adequate quality. In particular along the borders of the maps there are inconsistencies with the geometry, attributes and number/density of objects and other phenomena. This can primarily be justified due to the subjective perception and function of the field geologists, as well as the different objectives in the course acquiring the data. In order to remedy these deficiencies, future extensive verifications and new mapping in the terrain are essential.

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