

1<sup>st</sup> Regional Symposium on Landslides in the Adriatic-Balkan Region

3<sup>rd</sup> Workshop of the Croatian-Japanese Project 'Risk Identification and Land-Use Planning for Disaster Mitigation of Landslides and Floods in Croatia'

# Landslide and flood

hazard assessment

March 6-9, 2013 / Zagreb / Croatia

## ABSTRACT PROCEEDINGS

Editors: Snježana Mihalić Arbanas and Željko Arbanas

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Planning for Disaster Mitigation of Landslides and Floods in Croatia'

## LANDSLIDE AND FLOOD HAZARD ASSESSMENT

Zagreb, Croatia, 6-9 March 2013

### Organized by

International Consortium on Landslides (ICL)  
ICL Adriatic-Balkan Network (ICL ABN)  
University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering  
City of Zagreb, Emergency Management Office  
University of Zagreb  
University of Rijeka, Faculty of Civil Engineering  
Niigata University, Research Institute for Natural Hazards and Disaster Recovery  
Kyoto University, Disaster Prevention Research Institute (DPRi)  
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**'Landslide and Flood Hazard Assessment'**  
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## **Abstract Proceedings**

**Editors:**

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**Project Workshop Institution:**

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Kyoto University, Disaster Prevention Research Institute (DPRI)

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## Session 2: Landslide Hazard Mapping: Inventories, Susceptibility, Hazard and Risk

Friday, 8 March 2013, 14:00-16:30, The Aula, University of Zagreb

CHAIRS: HIDEAKI MARUI (NIIGATA UNIVERSITY) AND SNJEŽANA MIHALIĆ ARBANAS (UNIVERSITY OF ZAGREB)

### S2-01 – Specification of East-European landslide terminology and classification systems

O.V. Zerkal

*Geological Faculty, Moscow State University, Moscow, Russia*

**ABSTRACT:** Elaboration of the unified terminology that should be used for landslides' description and forms the basis for slope deformations classification is an important stage of systematizing of our knowledge of the landslide phenomena. Landslide-related Eastern-European scientific school is characterized by integrity of description and systematization of landslides formed in quite variable environmental conditions. Climate varies from subtropical to arctic; geology and geomorphology – from mountain ranges and areas of modern volcanic activity to ancient cratonic plains incised by river valleys and to coastal regions.

Numerous landslide classifications developed within the frames of Eastern-European scientific school can be divided in several groups:

- Universal classifications based on wide range of classification criteria;
- Morphogenic classifications for which displacement mechanism and types of rocks/soils affected by landslide are used as classification criteria;
- Regional classifications that take into consideration local geological and geomorphic conditions of the study area;
- Special classifications based on one or several specific parameters used as classification criteria (for example, plan shape of landslide, nature of scarps, etc.).

Use of morphogenic classifications is the present-day mainstream in the international landslide studies. Such classifications elaborated in Eastern Europe consider geological conditions preceding slope deformations that are inherited during landslide evolution and affect its motion.

### S2-02 – BeoSLIDE – Belgrade landslide inventory

P. Lokin, U. Đurić, B. Trivić, R. Pavlović

*Faculty of Mining and Geology, University of Belgrade, Belgrade, Serbia*

**ABSTRACT:** After huge number of landslide events in Serbia during 2006 (some of them with catastrophic damage on households), Belgrade City Government has initiated defining a strategy for landslide damage prevention. City Government and Assembly adopted suggested proposal to finance new landslide inventory, since the old inventory has been made 30 years ago. By project proposal, task was to create modern landslide inventory in a GIS oriented software for Belgrade General Plan area (approx. 360 km<sup>2</sup> with more than 1,2 mil. population). All noted landslides were categorized by level of hazard and risk of their activation. This information system and landslide

database should enable continuous monitoring of the landslide processes and possibility of early warning system development. Such information should be at disposal to: planners, investors and builders. In others words, it should enable rational landslide risk management. Inventory should also enable possibility to define priorities objectively, which would ease the management effort of the local authorities, when preventing and stabilizing active landslides or protecting affected structures. Basic goals for creating a new inventory were: to archive all documentation of Belgrade landslides in one place and to make data publically available; to collect data in digital form (database) in order to have them continuously updated during time; to make a database searchable by various parameters which are crucial for city governance (by municipality location, different urban zones, infrastructure locations etc.); to generate full .pdf or .doc format reports with quality data about inventoried landslides (with included maps, diagrams, laboratory data, core sampling etc); to provide local decision makers with information on priorities in landslide investigations for civil engineer projects or for landslide prevention and remediation, in different stages of project design. Landslide inventory was funded by Belgrade Land Development Public Agency and it was developed by University of Belgrade, Faculty of Mining and Geology science/research team with support of numerous external associates, experts in different geological engineering disciplines. During two and a half years of developing and field investigations the following has been done: collecting, systematization, critical analysis and reinterpretation of available landslide data; photogeological analysis of terrain; additional field investigations engineering-geological mapping and reambulation; creation of land stability maps; landslide hazard and risk assessment; developing and programming information system and database for inventory; inputting collected data into digital inventory and alpha-testing of developed application. Digital landslide inventory with database and information system for Belgrade General Plan area was made during 2008-2010 yr. 1150 individual landslides were registered and for each of them the following information has been added to the database: location, geological conditions, existing exploration works and their results and works on prevention and stabilization. Beside geological and engineering-geological data, various datasets important for decision makers and City Government branches have been inputted in the database. These included: 89 sheets of Belgrade topographic maps (scale 1:5000, in raster .jpg and .tif format); orthophoto images of Belgrade with 30 cm resolution; Complex Geological map of Belgrade (digitalized from sheets in 1:10000 scale); 89 scanned maps from old landslide inventory (scale 1:5000, in raster .jpg and .tif format); photogeological map for comparing data in time series. Final product was land stability map with generated level of landslide hazard and risk. Inventory was created as tool/sub-shell inside ArcGIS© software, with localization on Serbian language (Latin script).

## S2-03 – Landslide database on the road network in Serbia

**S. Milenković, M. Jotić, V. Vujanić, B. Jelisavac, Z. Berisavljević**

*The Highway Institute, Geotechnical department, Belgrade, Serbia*

**ABSTRACT:** The landslides as one of the most frequent slope gravitational processes not only exert direct influence onto the safety of traffic operation, but at the same time they cause great material damages on the road network in the Republic of Serbia. In the last few decades, very important geotechnical focus and investigation field has been methodological approach regarding landslide dynamics and consequently its damage potential on human life and material goods. Related to that, in the most of the countries, landslide hazard and risk assessment are essential