Natural Hazards and Earth System Sciences
European Geosciences Union

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Preface

Methods for risk assessment and mapping in Germany

Increasing losses due to disasters represent a worrying trend. For example, severe disasters occurred in Germany in the last decades: Flooding at the Rhine in 1993 and 1995, at the Odra in 1997 and in the Elbe and Danube catchments in 2002, 2005 and 2006. Earthquakes hit the Black Forest region in 1978 and 2004 as did the storms "Wiebke" and "Lothar" in 1990 and 1999. Industrial accidents at the Sandoz Company in Basel, Switzerland in 1986 and at the Hoechst Company in Frankfurt/Main in 1993 caused heavy contamination of the rivers Rhine and Main, respectively.

Although different, man-made (human-induced) and natural disasters have much in common. Both lead to human loss, environmental and/or economic damage and reveal the urgent need of improved risk management and mitigation strategies. Fundamental for the necessary improvements are comprehensive risk assessments and risk maps. Extreme scenarios have to be considered and a synoptical view of all relevant hazards in a region is needed in order to support adequate decisions on risk reduction and loss prevention programs.

The project "Risk Map Germany" was undertaken in the framework of the Centre for Disaster Management and Risk Reduction Technology (CEDIM), which was founded in 2002 and is a joint venture between the GeoForschungsZentrum Potsdam (GFZ) and the Universität Karlsruhe (TH) (http://www.cedim.de). CEDIM aims are understanding and assessing hazards and risks, detecting hazardous events in near real time and providing tools for effectively coping with the consequences of disasters. In the project "Risk Map Germany", new methods and techniques for risk assessment of natural hazards (storm, earthquake and inundation) as well as of man-made hazards have been developed. The project brought together the fields of geosciences, engineering, informatics, economics and social sciences to analyse the various disasters and risks in an interdisciplinary way. Despite the different characteristics of hazards, the disciplines dealing with them learnt much from each other, and new perspectives for the understanding and tackling of catastrophic events have arisen.

Within the project risk was defined as the loss that will be exceeded with a certain probability in a given timeframe. Therefore the analyses automatically combine hazard and vulnerability assessments. The aim was to develop methods that allow countrywide risk assessments and to apply these methods to Germany. The pilot area of the project was the Federal State of Baden-Wuerttemberg, located in southwest Germany at the border to France and Switzerland.

This special issue contains papers showing the main results of the CEDIM-Project "Risk Map Germany". The first papers present the prerequisites for high-quality and comparable results, i.e. the data management strategy as well as the estimation and regionalisation of asset values. Subsequently the results of the individual risk assessments are presented next to each other. Finally, the "CEDIM Risk Explorer", a web-based map service that summarises all project results, is described.

Köhler et al. describe the basic information infrastructure for CEDIM and the "Risk Map Germany". An integrated data base was prepared as foundation for cross-discipline but common risk assessments. Additionally, a web-based project platform offers information and communication facilities for the project members and also for the presentation of CEDIM to the public. Kleist et al. present new methods and results on financial appraisals of residential buildings for all communities in Germany. The calculated values are defined as replacement values for the reference year 2000 and represent the assets potentially at risk. This common database is an important prerequisite for a comparable quantitative risk assessment for different types of hazards. Thieken et al. show dasymetric maps of the population density and a unit value of residential assets for whole Germany. They adapt a dasymetric mapping approach, which uses land cover data (CORINE Land Cover) as ancillary variable. This technique bridges the gap between hazard data that are commonly modelled on an explicit raster level and exposure data that are often only available for aggregated units, e.g. communities. The data and services outlined in these three papers serve as an input for the hazard and risk assessments undertaken by other research groups.

Borst et al. analyze man-made (or human-induced) risks in Germany. They focus on disastrous accidents that have a potential to affect extended geographic areas; in particular accidents at nuclear power plants and in air traffic as well as terrorist attacks on embassies. Risk is modelled by considering the population density in affected areas. Büchele et al. describe improved methods for hazard and risk assessments for extreme floods. A regionalization approach for flood peak discharges is further developed, especially regarding recurrence intervals of 200 to 10 000 years and a large number of small ungauged catchments. The hydrodynamic simulation

is directly coupled with a GIS, which enables estimation of the direct flood damage to single buildings or areas based on different stage-damage functions. Furthermore, a new multifactorial approach for damage estimation is presented. Heneka et al. describe a new method for the assessment of storm damage risk in Baden-Wuerttemberg. Highly resolved simulations of storm wind fields with the Karlsruher Atmospheric Mesoscale Model (KAMM) are performed and a new damage model is developed based on empirical damage data. For every community a risk curve for damage to residential buildings including an indication of uncertainty is calculated. Tyagunov et al. present a method to calculate the seismic risk from intensity based probabilistic seismic hazard and vulnerability composition models, which are based on the distribution of residential buildings of various structural types in representative communities.

Finally, Müller et al. implemented the Web-GIS solution "CEDIM Risk Explorer" which integrates results from the interdisciplinary work as maps of hazard, vulnerability and risk in one application and offers therefore new cognitions to the user by enabling visual comparisons.

As a final remark, we would like to point out, that the Project "Risk Map Germany" and the resultant special issue show the high value of reliable and scientifically based quantitative methods for risk assessments and mapping as well as the clear need to continue the research in this direction. As a next logical step, a regional comparative quantitative risk assessment for different types of hazards is to be undertaken on the basis of the research done so far.

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Special Issue Editors