Geophysical Research Abstracts, Vol. 9, 02741, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02741

Flood risk analysis using Cross-Impact Matrix

A.Winterscheid

Darmstadt University of Technology, Germany (winterscheid@ihwb.tu-darmstadt.de / Fax: +49 6151-163243 / Phone: +49 6151-162043)

It is now commonly accepted that flood risk management has to be fulfilled within an integrated framework. This requires a planning and assessment procedure that takes into account the complexity of the issue under investigation. Flood risk is considered as a coupled human-environment system. The environmental sub-system is mainly constituted by the physical processes of the hydrological cycle. The dynamics of the human subsystem is driven by social interactions and individual behaviour. A multitude of hydrological models exists to analyse the probability of design water levels. Also a number of methods are available to assess present damage potential and vulnerability to flood damage.

However, this pool of models and methods does not constitute a sufficient basis for an assessment of flood risk over the long-term. Firstly, their application does not facilitate any conclusions about the long-term development of damage potential and vulnerability of human assets located on floodplains. Secondly, they do not take into account any cause-effect relationships, which are crossing the social-environmental interface that links both sub-systems (e.g. risk awareness or policy frameworks that steer land use on floodplains) and significantly impact future levels of flood risk.

Structural analysis is a fundamental step towards long-term assessment of complex and wicked problem frameworks like the management of flood risk. It aims at representing the 'system' by highlighting key variables and their mutual relationships, which (potentially) influence the problem under study. Also structural analysis is used to create a common culture when working in a multidisciplinary team. Using Cross-Impact Matrix is a common approach to structural analysis. In the Cross-Impact Matrix, the variables are placed in rows and columns, in order to work out systematically whether there are any causal relationships between them.

The here presented study applies Cross-Impact Analysis to flood risk management. The river Rhine between Karlsruhe and Cologne in Germany serves as a study area. A list of system variables was determined by means of a literature review of respective policy documents. Experts on flood risks were asked to fill in the Cross-Impact Matrix using a four point scale to rate the impact that one variable has on every other variable. In total 25 Cross Impact Matrices received form the basis for the analysis. Each matrix is a representation of the author's personal view on the most determinant cause - effect relationships. All matrices jointly analysed provide a common understanding of these relationships from an expert's point of view.

Structural analysis is a time-consuming process. The definite analysis would require the study to include representative stakeholder groups and other main actors as well. Therefore, the here presented investigation is considered as a preliminary study. Despite this limitation, the findings of this study demonstrate that structural analysis by means of Cross-Impact Analysis can significantly contribute to a better understanding especially of the social-environmental interactions related to flood risk. Subsequently, the deepened structural insight could improve the development of tools which provide better support for carrying out integrated flood risk management.