Geophysical Research Abstracts
Vol. 13, EGU2011-12592, 2011
EGU General Assembly 2011

A method to evaluate floods damage and consequences to network infrastructure and associated uncertainty

Julian Eleutério (1,2), Cyriaque Hattemer (3), and Anne Rozan (1)

(1) UMR GESTE Territorial Management of Water and Environment, ENGEES, 1 Quai Koch, 67000, Strasbourg, France (julian.eleuterio@engees.unistra.fr), (2) FRE 3240 Fluid and Solid Mechanics Institute, 2 rue Boussingault, 67000, Strasbourg, France, (3) UFR III, Geography Department, University Paul Valéry, Route de Mende, 34199 Montpellier, France

The actual knowledge of existing infrastructure networks and their vulnerability is an essential step toward the construction of schemes for reducing associated risks, assuring the good functioning of services in case of floods and improving the resilience of urban systems. The estimation of potential damage and consequences of floods is also an important element to support decision-making process. Even thought network infrastructure represents the main structural element in an urban system, few methods have been developed in order to forecast network damage potential linked to floods (IIBRBS, 1998; Penning-Rowsell et al., 2005; Jonkman et al., 2008). In addition, they adopted large-scale analyses or concentrate on only one network at a time. Meanwhile, the understanding of critical infrastructure at risk became an important risk management related issue, inciting the improvement of existing methods (Røstum et al., 2008).

The objective of this work is to propose a new method to evaluate networks infrastructure direct damage and consequences in case of floods taking into account the network internal functioning. The method we developed here is constructed in an elementary scale, considering the network as an ensemble of elements with specific functions, susceptibilities and interdependencies. The method have three complementary purposes: (1) to rank the elements of an individual network according to their direct damaging potential and the element functional importance inside the network itself; (2) to evaluate the way these elements can suffer damage or not respond to their function (damaging/disruption process); and (3) to estimate the potential damage of each element at risk and its probable consequences inside the network itself. The method has been constructed in the base of expert interviews and bibliographic research. Sixty network experts i.e. local managers, engineers and technical stuff, have been consulted during several detailed interviews carried out in order to analyse different network elements vulnerability. 25 damage-functions have been developed identifying the damaging process, the relevant hazard criteria and the damage/dysfunction potential for different elements studied of the following networks: drinkable water supply, waste water, public lighting, gas supply and electricity supply. A case study, in Alsace (France) is used to illustrate the method proposed: we applied the method in order to evaluate network infrastructure floods damage in six towns of the Urban Community of Strasbourg.

The elementary description of networks should help network and risk managers to better understand how critical infrastructure can fail with their function and to quantify the risk. The network elements ranking process considering their importance in terms of monetary damaging potential helps to identify the elements which function can play important roles inside the network. The monetary value and function of elements are generally correlated. However, the disruption of a network is sometimes independent of the direct damage potential, which implies the needs of distinct probabilities linked to the way damage/dysfunction can occurs. We notice through the case study that feedback on former events should be necessary to fill this gap. The level of uncertainties in the evaluation of damage and consequences is completely dependent of the amount of data, its quality and the local managers experience with flood events. The application of the method must integrate direct involvement of network managers in order to reduce global uncertainty. The method developed here can be applied to other contexts, taking care of the significant variables. It highlights the needs of better knowledge of the network itself and promotes the multi-network analyses: when analysing individual elements we are able to identify the relationships between different networks.

The authors thank to the financial support of MAIF foundation and to knowledge and time of all the experts having participated in this work.