Geophysical Research Abstracts
Vol. 13, EGU2011-6574, 2011
EGU General Assembly 2011

An example of integrated approach to flood risk management: the case of Navaluenga (Central Spain)

Juan Antonio Ballesteros (1), Mauricio Sánchez-Silva (2), Jose María Bodoque (3), and Andrés Díez-Herrero (1)

(1) Department of Research and Geoscientific Prospective, Geological Survey of Spain (IGME), Ríos Rosas 23, Madrid E-28003, Spain , (2) Associate Professor, Department of Civil and Environmental Engineering, Universidad de Los Andes, Bogotá, Colombia, (3) Mining and Geological Engineering Department, University of Castilla-La Mancha, Campus Fábrica de Armas, Avda. Carlos III, Toledo E-45071, Spain

Catastrophic flood events have been increased during last decade in Europe. It has obliged to European Commission to provide a regulatory framework for flood risk management (Flood Directive 2007/60 / EC), which aims to reduce flood damages to people and goods to acceptable levels. However, main uncertainty sources are involved in this assessment. They are related to the variability of model input data and with the insufficient knowledge of the flood processes. Scientific community agrees on the difficulty of describing all uncertainties involved in flood risk assessment. However, due to the dominance of the extreme value of flood frequency statistics, the incorporation and search of evidence of past flood events seem to be essential to define flood hazards. In this sense, one possibility to extend flood frequency is tree ring research among other palaeoflood and documentary data sources.

In this communication we are presenting a study case of flood risk assessment using a newfangled integrated methodology. We have focused on a reach of the Alberche River and its tributaries passing through Navaluenga village (Central Spain), which has suffered repeated flooding in the past and, therefore, planning measures defense are required. To this end, an integrated approach based on deterministic models and a stochastic model for the management of uncertainties were employed for the economical decision making concerning to the choice of the optimal defense measure.

Flood hazard was assessed by using a semi-distributed hydrological model combined with a 1D/2D hydraulic model. Using different scenarios, we have checked the operability of several structural measures taken into account by Water Authorities at a design project level (i.e. dams planned on the Alberche river) as well as other defined by engineering criteria (i.e. smaller structural measures like dikes and storm tank on tributary torrents). To assess aleatory uncertainties, we compare the flood frequency obtained with a hydrological model in a natural streamflow regime with those obtained by extending the existing flow record from dendrogeomorphological analysis of riparian trees. Next, flood damages were assessed by means of depth-damage functions, whereas the flooded urban areas were obtained running a 1D/2D coupled numerical hydrodynamic flow model. Epistemic uncertainties at this step were assessed as a result of applying different empirical depth-damage functions as well as the consideration of differences in the results of roughness calibration using the flow gauge (only one benchmark) and those obtained using scars on trees (several benchmarks). Best defense strategies were obtained by means of a cost-benefit procedure, where uncertainties from analytical process were incorporated to estimate expected losses.

As main results, we have obtained that large structural measures (i.e. reservoirs) are not economically viable regarding other smaller structural measurements (i.e. dikes and storm tank). This is presumably because of the location of dams within the basin system, which makes them ineffective for flood mitigation. In addition, we have also observed that, under some circumstances, the bottom outlets of dams could even increase the flood risk at Navaluenga village. More scenarios related to global changes and its non stationary conditions must be incorporated; but preliminary results and experiences here obtained should help to an adequately water management in the basin.