FLOOD HAZARD ASSESSMENT VALIDATION BASED ON THE FLOOD RISK DIRECTIVE 2007/60EU – A CASE STUDY IN RAFINA (ATTICA, GREECE) CATCHMENT

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INTRODUCTION

Increasing flood losses have shown to the European Commission the importance of protection of the environment and the citizens against those threats. There is a strong scientific evidence of an increase in mean precipitation and extreme precipitation events which imply that flood event may become more frequent. In parallel, exposure to flood might increase across Europe due to the population and wealth moving into flood prone areas. These circumstances have produced a reaction in the European commission, and a Directive on the Assessment and Management on Flood Risks was issued. In order to have an effective tool available for technical, financial and political decisions regarding flood risk management. The European Flood Directive sets out the requirement for the Member States to develop three products, (1) a preliminary flood risk assessment, (2) Flood mapping comprising of flood hazard maps and flood risk maps and (3) Development of flood risk management plans.
In our study, we focus to introduce the philosophy of flood hazard and flood danger mapping as a methodological framework and important tool for the flood risk mapping and the flood management plans in Greece and to present the way in which the general requirements have been met. This study carried out in the densely populated region of Rafina, 25km east of Athens, Greece (approx. 11.000 inhabitans; Hellenic Statistical Autohority 2001). The catchment size is 150km^2 and reaches from 0 to 915 m a.s.l.. The economic development of this area is closely related to the construction of the international airport of Athens in 2001. The Rafina region suffered from severe flood events during recent years, i.e. in 1989, 1997 and 2004, which were amplified not only by land-use changes but also by multiple forest fires in recent years.

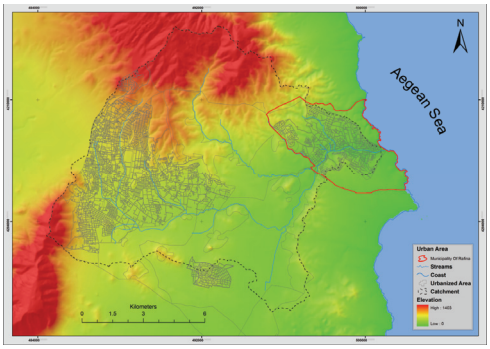

Fig. 1 Catchment of Rafina

METHODOLOGY

The model developed is based on a basin scale approach combining loss data, data on elements at risk exposed, and data on flash flood intensities. The model based in two basic parts, the qualification of flood hazard via hydrologic and hydraulics calculations and the evaluation of flood intensity for

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various flood scenarios, (2) the determination of exposure to flood hazard using a semi-quantitative method for the determination of the danger level, which serves the purpose for the spatial evaluation of corresponding quantities.

Based on the directive for the determination of flood extent maps a hydrologic simulation developed for flood scenarios corresponding to return periods of 5, 20, 50 and 100 years. For this simulation necessary data was taken by the different services in Greece and a 1-dimensional (Hec-HMS) program used. The Hydrologic Modeling System (Hec-HMS) is designed to simulate the precipitation run-off processes of dendritic watershed systems. It is designed to be applicable in a wide range of geographic areas for solving the widest possible range of problems. To calibrate the model, rainfall data from Markopoulos Station (Ministry of Environment Energy & Climate Change) used for the estimation of precipitation depths. Moreover, watershed parameters such as infiltration coefficient, time of concentration and base flow, estimated based on data from Hellenic Military Geographical service (Digital Elevation Model, 20m), Institute of Geology & Mineral Exploration (Geologic and Hydro-geologic data, in scale 1:50000) and European Environmental Agency (Land use data, Program Corine 2000).

A GIS program, HEC-GeoRAS was used to create cross sections of floodplain elevations from a Digital Elevation Model (4m resolution, Hellenic Cadastre Office) of the selected area acquired from a high-resolution, topographical survey (Ministry of Environment Energy & Climate Change). A hydraulic model embedded in the HEC-RAS software program performed the hydraulic calculations to estimate water levels at the cross-section locations. HEC-GeoRAS was used again to process the hydraulic model results to create flood hazard maps of the area.

In order to get an impression of the overall flood hazard, parameters can instead be aggregated into qualitative classes, resulting in a so-called flood danger map. This is commonly done using matrices or formulas to relate different flood parameters into a single measure for the "danger". In this study a semi-quantitative method has been used based on the Swiss method. The purpose of this method is the spatial evaluation of respective qualities using a danger matrix. The level of the danger is determined in a similar way: it's a combination of the magnitude of the process in a particular location and its probability of occurrence in the location. The procedure is algorithmized using GIS tools.

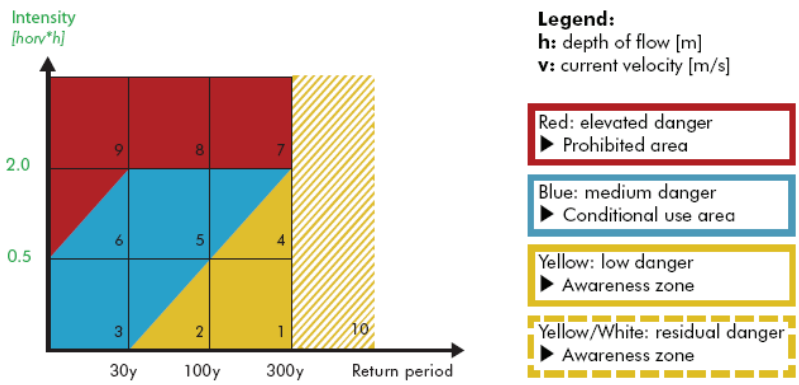

Fig.2 Matrix of the determination of danger level (Swiss Method)

CONCLUSION AND DISCUSSION

The aim of the paper is to introduce the philosophy of flood risk directive implementation in Greece and to present the way in which the general requirements have been met. Moreover, this study will provide guidelines of how to implement the steps of the European Flood Risk directive (flood hazard and danger maps) - the basis for spatial planning, for local assessment, for emergency planning and for planning technical protection measures -, and to show challenges and limitations resulting from the availability of hazard information and land use data.

Keywords: directive 2007/60EU, hazard assessment, flash floods, hazard and danger maps