Quantification of vulnerability for elements at risk exposed to torrent processes in Mediterranean regions

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1. INTRODUCTION

Due to the European Flood Directive there is a need for the establishing of flood risk maps in European countries until 2013.

In order to achieve this goal, risk analyses have to be undertaken on a catchment scale.

With respect to torrent hazards in Mediterranean countries, the assessment of processes has been subject to extensive research during the last decades. The focus was mainly on flash floods which represent a major threat due to periods of intense rainfall events. However, studies of the vulnerability of elements at risk evolved only recently, and related quantitative information is hardly available so far due to an overall lack of systematic data collection.

In the area of natural hazards, risk is defined as a function of the probability of a scenario, the exposed object and the vulnerability of the object.

$$R_{i,j} = f(p_{Si}, A_{Oj}, v_{OjSi}, p_{OjSi})$$

$R_{i,j}$ = risk

p_{si} = probability of scenario i

A_{Oj} = value of object j

v_{OjSi} = vulnerability of object j, dependent on scenario i

p_{OjSi} = probability of exposure of object j to scenario i

2. FLOOD EVENTS IN GREECE

An organized flood record is not available in Greece, for this reason a database has been created based on data from newspapers, previous studies and a digital record, as well as from the Civil Protection Authority and the Greek Observatory of Athens.

A total of 284 flood events has been identified in Greece for the period 1887 - 2010.

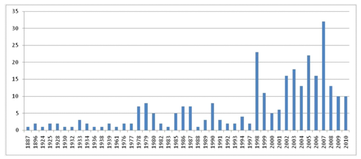

Fig. 2.1 Annual distribution of flood events for the period 1887 - 2010

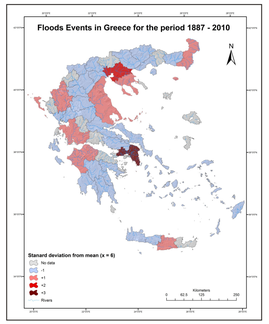

Fig. 2.2 Distribution of flood events in Greece

3.TEST SITE

The test site of "Rafina" was chosen to study the challenges of the implementation of the European Flood Directive. The test site is located in the district of Attica. The catchment size is 129km^2 and reaches from 0 to 915m a.s.l. The Rafina region suffered from severe flood events during recent years, i.e. in 1989, 1997 and 2004 and is characterized by a variety of elements at risk.

Fig. 3.1 Topographic map of the Rafina watershed

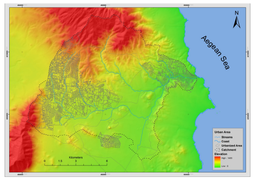

Fig. 3.2 Urbanized area of the Rafina watershed

Fig. 3.3 Rafina watershed

4. VULNERABILITY ASSESSMENT

Based on the box (1), a need for the development of a vulnerability function has been deduced, consisting of

- The selection of test sites and damaging events in areas with accessible event documentation.
- The modeling of the events and the exposed values at risk.
- The assessment of modeling results with respect to damage data.
- The calculation of vulnerability values based on the developed vulnerability functions and
- A sensitivity analysis based on data of different test sites.

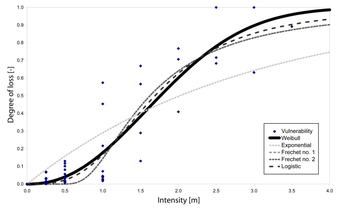

Fig. 4.1 Vulnerability functions (Totschnig et al., online first)

5. ELEMENTS AT RISK

Elements at risk are defined as those persons, infrastructures and buildings which are located on the individual risk areas.

As a result, a database is developed containing information on the indicative number of inhabitants potentially affected, on the type of economic activity of the area and on the infrastructures affected.

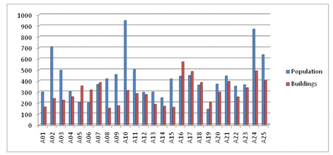

Fig. 5.1 Population and buildings in the municipality of Rafina

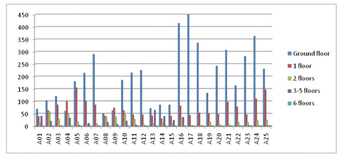

Fig. 5.2 Number of floors for buildings in the municipality of Rafina

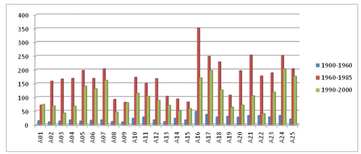

Fig. 5.3 Year of construction for buildings in the municipality of Rafina

6. CONCLUSIONS

In Greece, a general strategy in determining vulnerability of elements at risk to specific events is still missing.

The objective of this study is to close this gap by establishing a spatially explicit vulnerability model for flood processes including fluvial sediment transport which is applicable in Mediterranean regions of Greece.

This model is based on a method combining spatially explicit loss data, data on the value of exposed elements at risk, and data on flood intensities in order to develop vulnerability functions.

This model is needed for a broader understanding of the concept of vulnerability in order to reduce losses resulting from hazard events.

As a result, risk management strategies can be implemented and recommendations will be provided for an area - wide application of the vulnerability functions.

The overarching aim is to show possible implementations of flood risk management emerging from the requirements laid down in the European Flood Risk Directive.

Further Informations

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