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Flood risk assessment in an urban area: Vila Nova de Gaia

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ABSTRACT: This paper proposes a methodology for flood risk assessment in a non fluvial urban flood. Two hazard classifications were considered; one with water depth and flow velocity classes and other with the product of water depth and flow velocity. The vulnerability assessment resulted in five classes obtained by cluster and principal components analysis. Flood risk maps were achieved by hazard and vulnerability classes' crossover. The methodology is applied to a case study in the city of Vila Nova de Gaia. DTM with one meter resolution; HEC-HMS and HEC-RAS was applied to an urban catchment with one hour temporal scale; the 2001 statistical census tracts provide the demographic and social information. This methodology can be considered a straightforward and successful way to assess flood risk maps. However, the differences attained by the two hazard methods point out the need of further developments in the assessment of flood risk in stepped urban areas.

1 INTRODUCTION

Floods are among the main types of natural disaster. Invariably, the occurrence of flooding occurs throughout in numerous regions of the Earth, being enhanced by environmental change in urban and rural areas.

Urban growth, when it occurs in areas of high flood hazard, and if occupied by lower income populations, has contributed enormously to human and material losses. Over the past decades flood peaks and their propagation velocities become higher and increase the flood hazard.

Risk assessment has to be carried out in an integrated manner, identifying all the possible hazards and how they are likely to develop in the future and according to the Directive 2007/60/EC (EC, 2007) all member states shall establish flood risk management plans to be completed by 22 December 2013.

The floodplain management process is important and helps the society understand that risk can be managed with vulnerability reduction.

The flood risk management process includes:

- Flood plain mapping;
- Quantification of flood risk;

- Implementation of measures to reduce the number of buildings and/or population affected.

There are different approaches for flood risk mapping in terms of content, scale and purpose and use presenting a large heterogeneity of flood mapping in Europe.

In Portugal, there are no agreed practices for flood risk mapping. The few methodologies that have been applied are based in past flood records and in land use.

The flood risk is function of the flood hazard, the exposed values and their recovery capacity. It is widely agreed that risk is the product of a hazard event and its consequences. Where there are no people or values that can be affected by a natural phenomenon, there is no risk as illustrated in the risk triangle proposed by Crichton (2001). A risk assessment should incorporate the interaction between the nature of the event (subject) and the characteristics of the population or area at risk (objects) (Green *et al.*, 2000). Two components interact: the physical (hydrologic and hydraulic) and the socioeconomic.

According to the United Nations International Strategy for Disaster Reduction the risk is the probability of harmful consequences, or expected