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Risk analysis for local management from hydro-geomorphologic disaster databases

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ABSTRACT

This article describes the applications of a hydro-geomorphologic disaster database allowing a more appropriate local risk management.

Two databases of loss and damage with different criteria, using Central Portugal occurrences, were constructed upon national and regional newspapers: one included all the disaster occurrences regardless of the level of loss and damage reported and the other only the major disasters for which casualties and other human losses were reported.

Risk matrices, exploring likelihood and consequence, were analysed along with data regarding urban and demographic dynamics over time and risk profiles by municipality were obtained.

The results show that the database which only included major disasters produced a risk matrix with lower levels of risk in comparison to the one produced from the more inclusive database.

The most densely urbanised municipalities represent a greater number of disaster occurrences, but when considering only major losses, other peripheral municipalities emerge as high risk. Changes in territorial forcers are shaping the impact patterns in the region. Along with an increase in the housing density, an increase in disasters is observed, although the decrease of inhabitants.

Impacts and territorial forcers cluster analysis and risk matrices' results conduced to municipal risk profiles supporting management. Those profiles conduce to different frames of action from specific emergency planning, warning and alert, multi-hazard planning, or prevention measures involving land use planning or insurance and mutualisation solutions.

Disaster databases that allow differentiating local patterns of impacts–and their respective contexts - contribute to define locally adequate risk management policies.

1. Introduction

The technological development and economic growth that took place during the 20th century was not accompanied by a reduction in the number of natural disasters and their associated damage, leading to a new conceptualization of risk management (Smith and Tombs, 2000). Approximately 9000 natural disasters occurred throughout the world in the period 1900–2003, 80% of which have occurred since 1974

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(Guha-Sapir et al., 2004). In the 21st century, this trend continues. Between 2000 and 2012 the worldwide total damage caused by natural disasters amounted to 1.7 trillion USD, with 2.9 billion people affected and 1.2 million casualties (UNISDR, 2013a). The pressure that is being brought to bear on the planet's resources, with effects on land use and climate change and driven by exponential population growth, is contributing significantly to these figures (UNISDR, 2013b). Nevertheless, if a change in the frequency and magnitude of events is occurring (Field et al., 2012), it cannot be dissociated from changes in exposed elements and vulnerability. Furthermore, not all types of natural disasters may be experiencing the same patterns – for example, normalised flood damage data in the USA for the period 1934–1999 shows a tenuous downward trend (Loucks and Stedinger, 2007), while Europe seems to face the opposite scenario which leads to consider that ''changes in climate cannot be understood as the main reason for increasing flood damage in Europe'' (Barredo, 2007). Finally, disaster databases are susceptible to distinct classifications of the process that caused the damage – storm, flood, hurricane, etc. (Kron et al., 2012).

The importance of adequately registering the historic record of impacts associated with natural disasters is therefore highlighted. Distinct entities and perspectives call upon different data sources, and data collection and organisation still lacks standardisation which can lead to biased and unintended assessment inaccuracies (IFRCRCS, 2005). As a result, an understanding of the databases' level of uncertainty is required (White, 1994; Guha-Sapir and Below, 2002; Smith, 2013). Hydro-geomorphologic related disasters – generally including flooding and slope mass movements – are amongst the more frequent and hazardous disasters worldwide, as can be seen from the several national disaster databases available at the Global Risk Information Platform at www.gripweb.org (GRIP, 2013).

The importance of loss and damage analysis in the risk assessment phase of any flood risk management process has been emphasised elsewhere (Jha et al., 2012; Merz et al., 2011), confirming that the best understanding of impacts is the basis for estimating expected losses from future flood events. Regarding direct physical damage, the authors point out the advantages of using asset databases and stage damage functions.

Several disaster databases exist worldwide, differentiated by the inclusion criteria they adopt. Some of the best known and most widely used are the Emergency Events Database from the Centre of Research on Epidemiology of Disasters (EM-DAT, 2013), the NatCatSERVICE created and managed by Munich RE (Munich Re, 2011) and the DesInventar databases (La Red, 2009). Other national databases referring specifically to flood and slope mass movements related disasters can also be cited, such as the Italian SICI information system containing several disaster databases of which AVI, maintained since 1990, is the most comprehensive (Guzzetti et al., 1994; Guzzetti and Tonelli, 2004), the Spanish Catalonia flood damage database (Barnolas and Llasat, 2007), the Ontario Canadian province floods database (Shrubsole et al., 1993) and the United States flood damage database for the period 1926–2000 from the National Weather Service (Pielke et al., 2002). The scale on which the disaster databases are designed is significant, since estimating the severity of events and their relative level of disturbance in a given area are crucial aspects of risk management (Fischer, 2003).

Several sources can be used to construct a hydro-geomorphologic disaster database: official reports and announcements; data collected during NGO search, rescue and humanitarian operations; data collected as part of research activities by academic institutions, although this often focuses more on the event than its impact; media reports of different types, but especially newspapers (La Red, 2013; Guzzetti et al., 1994; NWS, 2007). The arguments in favour of including newspaper reports as disaster database sources stress the fact that (a) newspapers cover more events and occurrences on a local scale than other sources, (b) the same event and occurrence is frequently reported in different newspapers, thus allowing for comparison and sifting of facts, (c) newspapers are usually better at maintaining and providing access to their archives, (d) newspaper information covers a wider time period than other media sources, such as television and the internet (La Red, 2013).

Loss and damage databases are useful not only in risk management but also in regional and local management in general. The information they provide on severity and probability offers vital support for well-informed disaster risk reduction policies. Risk matrices constructed from probabilistic loss and damage analyses are one of the possible outputs of disaster databases. They offer good potential for territorial differentiation and, despite doubts about their effective contribution towards improving risk information (Cox, 2008), constitute a risk classification tool widely used by risk and emergency practitioners.

The impacts of hazardous events, regardless of their nature, are increasingly forming part of holistic risk governance processes (Dieperink et al., 2013; Tavares and Santos, 2013) which foster consensus and interaction between public and private stakeholders at different power, geographical and decision-making levels (Kasperson et al., 2001). This is even more important given that – apart from the geographical framework – unequal power relations (Collins, 2009) and political ecology (Pelling, 1999) are important factors in the ''hazardscape''. Specifically regarding hydro-geomorphologic risk, attention has focussed recently on the integrated implementation of structural and, in particular, non-structural best practices, ranging from transnational to household level – see Sayers et al. (2013) for flooding, Anderson and Holcombe (2013) for slope mass movements, Holub et al. (2012) and Holub and Fuchs (2009) for hydro-geomorphologic processes in mountain areas.

Embedded in the spirit of the Hyogo Framework for Action, Portuguese policies reflect in planning instruments that emphasise a permanent, multidisciplinary and multisectoral management of risk. The National Programme for the Spatial Planning Policy (Law 58/2007) clearly assumes risk management as one of five backbone vectors in land use policies. This means that the development strategy at any administrative level is obliged to consider risk reduction, prevention and mitigation in the planning process. The downscale implementation occurs through the several Regional Plans for Spatial Planning, from which local strategies for municipal master plans and emergency plans are defined. Funding is a key factor in policy implementation. At the European Union level, such an holistic policy approach is also promoted – framed in the Civil Protection

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