Damaging flood risk in the Portuguese municipalities

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Modeling and understanding the impact of climate change on flooding processes in Mediterranean climate areas, namely in southern Europe, is a complex endeavor, which must also consider exposure and vulnerability patterns. Assuming that vulnerability plays a relevant role in explaining the degree of loss due to natural hazards, the present research compares a flood-susceptibility index with a social-vulnerability index and a historical record of flood losses, both aggregated at the municipal level. The purpose of this research is to define municipal flood risk profiles that would rank the 278 municipalities and contribute to the strategic allocation of resources and flood risk management. A simplified method for assessing flood susceptibility for mainland Portugal was applied considering three inputs, highlighting the relevance of flooding past evidences: distribution of alluvial deposits, Floods Directive mapping and a 100-yr flood hazard map provided by LNEC. Further, the percentage of flood susceptible areas per municipalities was computed in order to obtain the municipal flood susceptibility rank. Social vulnerability at the municipal level was assessed combining the dimensions of criticality and support capability. Criticality refers to the individual and household characteristics that define the expected degree of loss and the ability to recover (e.g. age, education and income). Support capability refers to the territorial context in terms of civil protection, health, education and other infrastructure that contributes to reduce the flood impact and facilitate community's recovery. For each dimension, scores resulting from PCA were multiplied assuming that support capability acts as an attenuating factor of criticality. Historical losses caused by damaging floods were extracted from the DISASTER database, querying only the records related to floods collected for the period 1865-2015 in mainland Portugal that caused fatalities, injured, homeless and evacuated people. This work contributes to the discussion of the spectrum of combinations of flood susceptibility, social vulnerability and past flood disaster events at the municipal level. The highest scores of susceptibility (those above the 90th percentile) are found on the 14 municipalities located along the downstream areas of the Vouga, Mondego and Tagus basins. These municipalities are also those where the highest number of cases and the highest impacts in terms of displaced and evacuated persons were registered in the historical record of flood losses. The municipalities along the Tagus and Sado rivers present high criticality and are among those with large portions of their territory with a high susceptibility index to floods (respectively, 9, 19 and 15%). Regarding support capability, the overlay of low scores with high susceptibility is found along the Tagus and Mondego basins. Considering the final score of social vulnerability, Chamusca and Coruche, in the lower Tagus basin, are the municipalities with simultaneously high scores and high susceptibility. A more thorough cross-analysis is made possible if the principal components of both criticality and support capability are considered. Such outputs, when crossed with flood susceptibility are able to identify the specific drivers of social vulnerability (e.g. mobility), upon which, stakeholders may act in reducing flood impacts.

Keywords: flood susceptibility; social vulnerability; flood losses; municipalities; historical records.

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