Plinius Conference Abstracts
Vol. 15, Plinius15-12, 2016
15th Plinius Conference on Mediterranean Risks

A Gis-Based, Rapid And Holistic Flash Flood Risk Assessment For Emergency Management Services

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An ideal, risk assessment should be holistic, thus, it should take into account all the components of the vulnerability (e.g. physical, social, economic, environmental). In order to perform such analysis, a large amount of time is needed, as well as reliable data. If a rapid risk assessment is performed (e.g. for emergency management purposes), a rapid but reliable procedure should be adopted.
The aim of this work is to present a GIS-based, rapid and holistic flash flood risk assessment that was developed for the Copernicus Emergency Management (EMS) Service -Risk and Recovery Mapping- and applied so far for the activations EMS018 (Azores), EMS020 (Madeira) and EMS021 (Austria). The method was developed with the aim to obtain a robust and quick procedure for the assessment of the risk in areas with complex orography mainly affected by flash floods, such as the Mediterranean coast.
The hazard was defined according to the methodology proposed by Manfreda et al. 2014, that is based upon the definition of a "Flood Susceptibility Index" that accounts for upstream drainage area and local slope along the drainage network, allowing for a qualitative hazard level definition. Five hazard levels from very low to very high are defined.
The vulnerability was estimated by taking into account different indicators representative of different vulnerability typologies: physical (building density, number of floors), social (population density, percentage of specific categories at risk, i.e. children and elders), environmental (land cover). A normalized (0-1) vulnerability level was then assigned to each indicator. Finally, a total holistic vulnerability level was obtained as weighted mean of the previous vulnerability levels. In order to orient the scope of the analysis toward civil protection purposes, vulnerability classes and weights were defined to emphasise the vulnerability of the population to suffer direct and indirect damages (e.g. higher weights to urban areas with high population and building density). The holistic vulnerability value was classified in five classes consistently with the hazard level.
Finally, the risk was calculated by intersecting hazard and vulnerability according to a specific risk lookup table.

The proposed approach is particularly suitable for risk and recovery mapping to be done in short time because it is based on reliable information that can be rapidly and easily available during an activation: DEMs, census data and land cover layers. Furthermore, it produces a risk map that is oriented toward civil protection purposes. Particular attention should be paid in the definition of the vulnerability classes and weights, therefore the experience and the judgment of the operator is an essential requirement.