



Assessment of sinkhole susceptibility in the Salento Peninsula (Southern Italy) by means of a multi-criteria decision analysis method

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The Salento peninsula (Apulia, southern Italy) is a karst region particularly prone to sinkhole events, as repeatedly shown by the numerous cases occurred during recent years. Man-made changes that have altered the natural setting of the karst environment are often at the origin of the frequent seasonal flooding of plains and flat landforms, and of several subsidence problems as well. The objective of this study is to produce a sinkhole susceptibility map of the Salento peninsula to better understand the factors that cause geomorphological hazard and to assist in future development planning. The study is part of a larger project led by the Basin Authority of Apulia, aimed at providing a better understanding of the spatial distribution of karst features in the region. The preliminary sinkhole susceptibility map is being produced integrating Geographical Information System (GIS) with Multi-Criteria Decision Analysis (MCDA). The analysis used geospatial techniques to determine the relationships between sinkhole distribution and some major controlling factors: lithology, proximity to faults, proximity to surface streams, land use, morphology and depth of aquifer. Once stored all the data in ArcView 3.1, and generated the criterion values, that are seen as map layers, the related maps are converted into grids, and the mathematical processes applied to the criteria with MapCalclater, whilst Pairwise Comparison Method (PCM) is used to calculate the weights from input preferences. According to the guidelines of the “Plan of Management of the Hydrogeological Setting“ of Apulia Region, the study for the preliminary evaluation of the susceptibility to sinkholes has been articulated in the following phases: (1) Realization of the inventory karst map of the study area;

(2) Identification of the physical parameters (criterion) correlated with the sinkholes; (3) Preparation of thematic map (criterion map) for the physical parameters of the territory, directly or indirectly correlated with the sinkholes; (4) Assessment of the contribution of every parameter to the instability; (5) Zonation of the study area in sectors at different degree of susceptibility to sinkholes. The analysis has been performed by using the data available at the Apulia Basin Authority. Reliability of the data is not consistent, but strongly dependent upon the single source: to provide an example, faults were extracted by the official geological map of Italy, and therefore grossly underestimated, since only very few tectonic lineaments are shown in these maps, which have been produced several decades ago. The surficial stream network is another critical factor, due to widespread reclamation works that strongly changed the original hydrogeological setting in Salento during the last one hundred and fifty years, and created a mostly anthropogenic network of channels. Notwithstanding these limitations, the analysis here proposed allows some preliminary considerations on the zonation of Salento in areas differently susceptible to sinkholes, and in some ways the results may help, in turn, to highlighting the need to produce more updated and detailed maps of the relevant hydrological, geological and morphological factors of this karst region. Further work is necessary to validate this preliminary map, and particularly to produce a more reliable multi-thematic database to be used as input.