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Integrated mapping method of sinkholes, through an application in the Apulian karst (Southern Italy)

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Karst landscape is a remarkably interesting and complex environment, where the numerous natural processes in act may determine consequences for human assets and changes in the landscape itself.
Understanding the karst processes should proceed through accurate identification of their geomorphological features, and their correct interpretation and representation on maps. In particular, recognition of landforms such as sinkholes allows, besides the actions above recalled, to predict and manage future consequences associated with the evolution of such a hazard.
With this in mind, we propose a multi-disciplinary sinkhole mapping methodology that exploits heuristic (geomorphological) and GIS modeling approach in a workflow that optimize the time consumption and minimize errors in the final results. According to these intentions, we use a study area in the Apulia region (Southeast Italy), characterized by the presence of sinkholes of different typologies, to apply: i) an automatic mapping method, ii) a manual mapping method carried out with digital stereoscopic interpretation, and iii) a final field survey. In order to test the robustness of the automatic method we run it by using as input two DTMs at different resolutions, and we compare the results with a sinkhole map obtained with geomorphological interpretation. The results show the reliability of the automatic mapping method and point out that the accuracy of the features detected is linked to the resolution of the input DTM. However, it was noticed that it tends, in some cases, to overestimate the number of sinkholes by including artifacts or features attributable to other non-karst processes. On the other side, the automatic procedure could be very handy for the analysis of wide areas, and to provide the geomorphologist with a draft map to be cleaned and completed by using digital stereoscopy as well. Hence, we underline the importance of the expert geomorphologist contribution, who must check and integrate the product obtained with the automated mapping.
The integration of these two approaches determines a substantial decrease of errors in the mapping, and a substantial saving of time as well.