



Integration of geological, geomorphological and geophysical methods in the study of sinkholes

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The Salento region of southern Italy has a great number of active sinkholes, related to both natural and anthropogenic cavities. The presence of sinkholes is at the origin of several problems to the built-up environment, due to the increasing population growth and development pressures. In such a context, the detection of cavities, and therefore the assessment of the sinkhole hazard, presents numerous difficulties. At this aim, the present paper illustrates the advantages of integrating geological and geomorphological surveys with surface geophysical techniques such as seismic, geoelectrical and ground penetrating radar methods for the identification of sinkhole-prone areas. Three different types of sinkholes related to natural karst caves are here described. The first is that of Casalabate, a typical Adriatic coastal town affected by a long history of sinkhole phenomena correlated to the presence of marsh deposits overlying a carbonate karstified bedrock. The second is the Palude del Capitano area, along the Ionian coastline, which is characterized by alignments of sinkholes with the main tectonic systems; it is in an advanced stage of evolution, with wide basins connected by submerged passages, only a part of which has been so far explored by scuba divers. The third is the sinkhole system at Nociglia (inland Salento) where the shallow phreatic speleogenesis operates close to the water table level with formation of karst conduits and proto-caves whose evolution occurs through successive roof collapse, formation of wide caverns and sinkhole development at the surface. In all the cases above, the combination of different methods made possible to recognize the sectors more prone to sinkhole development, and to identify the zones of mechanical weakness. Geological and geomorphological analyses provided the basic data necessary to constitute a framework for understanding the mechanism of formation of sinkholes, at the same time guiding the choice of the most suitable geophysical technique and the interpretation of the measurements. The different geophysical methods are eventually discussed in order to point out to their value in locating the main karst conduits and caves. For each technique, both potentialities and drawbacks in the different geological contexts are highlighted, with particular reference to coastal vs inland settings.