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High resolution integrated geological and geophysical surveys for the detection of cavities in coastal karst areas

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Surface or shallow karst constitute a significant problem for many coastal urbanized areas where soluble rocks crop out. This presentation illustrates the advantages of integrating geological and geomorphological methods with geophysical for the detection of cavities in a coastal environment. Direct geological and topographic surveys and indirect with Ground-penetrating radar (GPR), seismic refraction tomography, and electrical resistivity tomography (ERT) surveys have been conducted in the southern Salento peninsula (Italy) in order to map subsurface karstic features. The study was conducted in Santa Maria di Leuca (Lecce) where an important construction (ex Colonia Scarciglia) is located. The carbonatic nature of the rocks means they are affected by karst phenomena, forming such features as sinkholes, collapsed dolines and caverns, as a result of chemical leaching of carbonates by percolating water. Difficulties take the form of the risk of collapse or damage to the construction . By using three geophysical methods and careful processing for the geophysical data, and by modeling these data with geological and topographic information from within the cave, accurate interpretations have been achieved.
The constraints on the interpreted geologic models are better when combining the geological and geophysical methods than when using only one of the methods, despite the general limitations of two-dimensional 2D profiling. ERT and seismic methods can complement GPR for accurately delineating a shallow cave section.
Conversely, GPR method can be complementary in determining and verifying the presence of off-line features and numerous areas of small cavities and fractures, which may be difficult to resolve in ERT and seismic data. Nevertheless the use of more Integrated geophysical methods could be expensive, therefore with the aim to reduce the geophysical methods 3D ERT models have been realized: this technique applied in karstic areas characterized by the presence of conductive rocks is demonstrated to be appropriate and to give results to high resolution.