

## **Anthropogenic sinkholes in the town of Naples**

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The importance of sinkhole as a natural hazard is often underrated when compared with landslides, floods, volcanic eruptions and earthquakes in Italy. Sinkholes are rarely included in risk analysis despite their frequent occurrence in several parts of Italy, especially in karst lands or in those sectors of the country where artificial cavities have been realized underground by man for different purposes. Among the most affected Italian regions, Campania (southern Italy) stands out for several reasons, with particular regard to the town of Naples, highly affected by anthropogenic sinkholes. These latter have caused serious damage to society, and above all to people in terms of deaths, missing persons, and injured people, due to the high urbanization of the city, developed above a complex and extensive network of cavities, excavated during the 2000 years of history of the town. Among the different typologies of artificial cavities, it is worth mentioning the high number of ancient quarry used to extract the building materials for the town construction.

The Institute of Research for the Hydrological Protection (IRPI) of the National Research Council of Italy (CNR) has been working in the last years at populating a specific chronological database on sinkholes in the whole Italian country. On the base of the collected data, Naples appears to have been affected by not less than 250 events from the beginning of the century to nowadays. The IRPI database includes only sinkholes for which a temporal reference on their time of occurrence is known. Particular attention was given on this information, since the catalogue idea is to make a starting point for a complete sinkhole hazard analysis. At this aim, knowledge of the time of occurrence is mandatory. Day, month and year of the event are known for about 70% of sinkholes that took place in Naples, but the hour of occurrence is known for just 6% of the data. Information about site of occurrence are, on the other hand, highly precise in the town of Naples. This is related, beside the several studies performed, to the fact that in many cases sinkholes caused damage to buildings or infrastructures, which have been in some ways documented.

An hazard analysis is mandatory in a town highly prone to sinkhole occurrence. In addition to the collection of information and documentation about past events, a detailed map of the underground cavities below the town could for sure represent a very important source of information for any action dedicated to the sinkhole risk mitigation.