



Chronology of sinkhole events in Apulia, Italy

Mario Parise (1) and Antonio Fiore (2)

(1) Institute of Research for Hydrogeological Protection, National Research Council, Bari, Italy (m.parise@ba.irpi.cnr.it, +39 080 592 9611), (2) Basin Authority of Apulia, Bari, Italy (antonello.fiore@adb.puglia.it)

Sinkholes are a subtle hazard which affects karst territories, due to presence of underground voids. Even though the original definition of sinkhole regards specifically natural caves in karst environments, this term is nowadays being used also for phenomena related to man-made cavities, in karst and non-karst areas as well. In this broader sense, the effects produced by sinkholes to the human society and the built-up areas may be significant, with heavy economic losses, if not casualties. In the analysis of sinkholes, as of any other natural or anthropogenic danger, knowledge of the temporal occurrence of the events is crucial to properly define the hazard. Lack of data about the timing of the events determines the impossibility to actually evaluate the hazard, limiting the analysis to the susceptibility assessment.

In the last years, a worrying increase of sinkhole events, related to both natural and anthropogenic cavities, has been registered in Apulia, an almost entirely karst region of southern Italy. Due to the features of the area, Apulia has always been affected by such events, and all the typologies of sinkholes according to the classification by Waltham and co-workers (2005) can be identified in the region. However, starting since the first years of the present century, the frequency of events had a definite increase, which reached a peak during 2009 and 2010. It has to be noted that the recorded events represent only a small part of what is actually occurring, since many others (likely, the majority) are not registered due to lack of information, or to rapid infilling of sinkholes by the land owners.

Historical researches, consisting of the scrutiny of many different sources (scientific publications, newspapers, chronicles, technical reports, interviews with professionals, etc.), allowed to put together a database about sinkhole events in Apulia, that was integrated by direct surveys from the authors in the last years. Overall, the database consists so far in several tens of cases of sinkholes for which a date (even though generic, that is month and year, or only the year) was found. Reliability of the dates is highly variable, depending upon the type of source and the degree and amount of available information. Nevertheless, such database represents a valid starting point for examining in greater detail the temporal occurrence of sinkholes in the region, and perform further, more detailed analysis (for instance, in relation with triggering factors).

Most of the recent sinkholes occurred because of the presence of underground quarries, that is cavities dug by man in the past (generally, in the first decades of the last century), and which memory was later on lost. Abandonment of the quarries generally resulted in degradation of the sites, due to development of weathering processes, and the deriving weakening of the rock mass, thus originating instability phenomena that may propagate upward until reaching the ground surface. In such a context, the urban expansion, together with vibrations due to traffic, and other human activities often are able to trigger sinkholes, and to threaten the human life for those cases located within urban areas or in the proximity of communication routes.