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Geophysical measurements in an abandoned old railway tunnel located in a karst area

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Carbonate aquifers in karst systems are very important water reservoir and are recognized as the most difficult to characterize. The purpose of this article is to present a project aimed to understand the circulation of fluids in carbonate reservoirs through innovative hydrogeophysical methodologies both in the laboratory and in the field. The test site is located in the Castel di Lepre karst system, which is disposed in the Mezo-Cenozoic carbonate substratum of the Monti della Maddalena ridge (Southern Apennines). In the karst area are located several caves, but the presence of an artificial tunnel (disused railway tunnel) could give the opportunity to characterize the whole area and the fluid circulation by multisensors geophysical sensors installed inside the karst aquifer. This natural laboratory permits to define an Applied Geophysics strategy developing several main topics from an engineering to hydrogeological point of view. Firstly, the geophysical investigations conducted, without altering the structure and in a fast manner, obtains important information concerning the construction of the tunnel, and the interaction between the infrastructure and surrounding rock, in that area that we define infrastructural critical zone. The study conducted aims to highlight the potential and any limitations of the use of geophysical techniques applied to infrastructures, emphasizing the emerging role of urban geophysics for the importance and topicality of its contents as well as the important innovations that the use of these techniques they can contribute to the hazardous processes. Secondly, the geophysical methods are used as a tool to characterize the fluid circulation by hydrogeophysical sensors installed inside the karst aquifer. The hydrogeophysics arose as an interdisciplinary field that focuses on the improved understanding of hydrological processes through geophysical observation. These approaches aimed at mitigating the detrimental effects of environmental problems.