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Integrated monitoring system for ground deformation hazard assessment in Telese Terme (Benevento province, Italy)

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TeleseTerme plain is characterized by a very articulated stratigraphy (levels of travertine, fluvial-marshy and pyroclastic deposits), that allows the occurrence of underground water circulation with overlapping aquifers. These aquifers are locally in pressure and, because of chemical characteristics and physical properties of the water, they may activate processes of accelerated travertine's corrosion; the consequence is the formation of cavity along the ground water's preferential flow paths, and the activation of subsidence and sinkholes phenomena. In particular test area includes two zones, where in 2002 and 2006 occurred two sinkholes events, classified as "piping sinkholes".
The hazard evaluation was carried out trhought an integrated monitoring system, based on "traditional" techniques conduced "in situ", as geological-geomorphological and geophysical (microgravity) surveys, integrated by the most innovative techniques of Remote sensing interferometry(Advanced DInSAR Interferometry Techniques).
The last allow to evaluate the ground deformation, characterized by a predominantvertical component (typical deformation of sinkholes and subsidence phenomena), and are well suited to operate a continuous and long monitoring ofvery extended areas.
Through an initial analysis of the Permanent Scatterers available in the Telese municipality, we found the envelopes of the areal that contain PS with negative and positive mean velocities; these velocities showed the presence of a possible phenomenon of subsidence detected by ERS and ENVISAT satellites.
Through interferometric processing of ENVISAT images, the soil deformations of 2002-2010 year sare evaluated and compared with the data obtainedby survey took "in situ" during the same period.
The knowledge of the deformation's evolution of the area made it possible to organize a more focused future monitoring through traditional techniques of relief (with the help of geophysical methodologies).
Since the zone affected by sinkhole phenomena is located in urbanized area, microgravity method was preferred to other geophysical methodologies. In fact, seismic, magnetic and electromagnetic techniques are strongly influenced by urban noise and this produces a low value of signal to noise ratio.
The gravity exploration, based on the identification of anomalies in the Earth's gravity field by measuring the gravity acceleration, allows to define any inhomogeneities generated by sources at different densities in the subsurface structure, such as underground voids.
Based on geological informations, geophysical models of the known cavities are made. Establishing the physical and geometrical characteristics of the voids it was possible compute the amplitudes and wavelengths of the expected geophysical signal, in order to establish the procedures of the executive acquisition phase.
If the magnitude of the evolution of the sinkhole phenomenon will be detected by gravity observations, the time-lapse gravity monitoring will be an excellent tool at the base of risk mitigation.