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Analysis of slow - moving landslides by means of integration of ground measurements and remote sensing techniques

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Slow-moving landslides are among the most costly geological hazards in Italy, widely affecting properties and infrastructures. The analysis of unstable slopes characterized by slow movements (that is, velocity comprised between few mm/year to few cm/year) requires a regular and continuous monitoring in order to correctly establish the causes of the instability and to prevent the possible catastrophic phase. However, the sustainability for long time intervals of an effective monitoring network based on traditional measurement methods is, in most of the cases, hampered by financial and technical limitations. “Innovative” monitoring techniques, known as remote sensing techniques, may contribute in overcome these problems. This paper focuses on the application of an integrated monitoring system based on ground and satellite techniques to two case studies, Moio della Civitella (Salerno province) and Calitri (Avellino province), located in the Campania Region of Southern Italy.
Detailed geomorphological analysis, carried out through multi-temporal air-photo interpretation and field surveys, resulted in thematic maps (landslides inventory map, landslides activity map, etc) that showed the high density of slope instability phenomena at both the study sites. The main triggering factors are heavy and/or prolonged rainfall, anthropogenic factors and earthquakes (as in the case of the large landslide at Calitri, induced by the 1980 Irpinia earthquake, and which directly involved the historical part of the town).
In addition to the geomorphological approach, both sites are being monitored with inclinometers and topographic measurements. These ground data are being, in turn, integrated with the results obtained by applying remote sensing monitoring, in particular interferometric techniques. Current descending Radarsat-2 Ultra-Fine images have been processed with Standard Differential Interferometry, and ERS-1/ERS-2 images acquired from 1992 - 2001 with Permanent Scatterers technique. This latter is a multi-interferogram InSAR technique that takes advantages from the use of large datasets of SAR images and focuses on phase stable targets, allowing us to measure their motions with high accuracy and to analyse the dynamic of both the observed areas over time.