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Spaceborne InSAR monitoring of terrain instabilities in Apulia, Italy: outcomes of a National project

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We report on the InSAR-related results of the National Research Project (PRIN) entitled "Advanced technologies in the assessment and mitigation of the landslide risk: precursors detection, previsional models and thematic mapping", funded by the Italian Ministry for Scientific Research. In the framework of the project, multi-temporal interferometric techniques were applied to time series of SAR data, from legacy ERS and ENVISAT, as well as high-resolution TerraSAR-X sensors. We report on the final outcomes of the project, which concentrate on two sites of the Apulia Region, representative of terrain instability problems widespread in the area.
The fist one is the coastal area near the Lesina Marina tourist village, at the north of the Region, close to the Gargano promontory, where the excavation of a canal exposed grey micro- and meso-crystalline gypsum which is now showing a high density of cavities and sinkholes due to gravitational collapse processes. A slow but steady uplift phenomenon has been detected by processing through persistent scatterers interferometry (PSI) methodologies ERS and ENVISAT data, acquired in both ascending and descending geometries, and spanning a total time interval from 1995 to 2010. The displacement data were validated by comparison with leveling measurements performed in 2000 and 2010. Derived vertical displacement rates exceed 3-4 mm/y on locations adjacent to the canal, gently decreasing towards the western end of the built up area. These observations, supported by ancillary data and in situ investigations performed in the past, seem compatible with processes such as diapirism or the hydration of the residual anhydrite in the core of the gypsum mass.
The second site is an inland landslide area close to the municipality of Carlantino, in the Daunia mountains. Here, a relatively large landslide affects the slopes spreading from the town outskirts to the banks of the Occhito lake, an artificial basin formed by a dam on the Fortore river. PS targets detected by both C- and X-band data correspond to urban structures or peri-urban walls and guard rails, while the landslide body is almost completely devoid of stable targets, due to the vegetation cover. In order to allow stability monitoring through spaceborne SAR interferometry, a network of passive reflectors was designed and deployed on the area of interest. To design the corner reflector (CR) network, different factors were taken into account: the visibility of the CR by the satellite in terms of geometry and radiometry, the accessibility of the location on the ground, and the relative distance between CR. Results of the comparison of phase data over the CR with that of surrounding objects are presented.
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