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Corner reflector deployment for X-band SAR interferometry to monitor the landslide of Carlantino, Daunia Region (Italy)

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Space-borne SAR Differential Interferometry (DInSAR) techniques are attractive for landslide investigations because of their capability to provide regional scale coverage and, under favourable conditions, spatially dense information on small ground surface deformations. In particular, advanced multi-temporal InSAR techniques such as Persistent Scatterer Interferometry (PSI) allow detecting and monitoring, with millimetre precision, displacements occurring on selected radar targets (PS) exhibiting coherent radar backscattering properties. PS targets correspond mainly to man-made structures or to rock outcrops, and their spatial density depends on the ground coverage, and it is maximum over urban areas.
The application of multi-temporal InSAR analysis to slope instability monitoring poses challenges related to the complex kinematics of the phenomenon, as well as to the unfavourable settings of the area affected by landslides, often occurring on sites of limited extension, characterized by steep topography and variable vegetation cover. This is the case of the Daunia region, located in the Southern Italian Apennine Mountains, which is characterised by scarce urbanisation (mainly small hill-top towns) and dense vegetation cover.
The SPINUA (Stable Point INterferometry over Un-urbanised Areas) PSI multi-temporal processing technique was used in the past years to detect and measure ground displacements over this region. Both C-band medium resolution SAR data from ERS-1/2 and ENVISAT ESA satellites, and X-band high resolution SAR data from the TerraSAR-X (TSX) satellite were used. Results indicate that PSI can be profitably used to investigate slope instability, mainly over the urban and peri-urban areas, and that, on these sites, TSX data result very promising for monitoring areas where ERS/ENVISAT PS density is too low. Nevertheless, the application of PSI for slope instability monitoring still remain problematic or impossible in rural and mountainous areas.
This is the case, for instance, of the Municipality of Carlantino, where PS targets detected by both C- and X-band data correspond to urban structures or peri-urban walls and guard rails, while a large landslide, extending for about 2 km from the hilltop down to the valley, is lacking stable coherent 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. The Corner Reflectors (CR) were designed for TerraSAR-X stripmap acquisitions, and consist of three triangular metal panels welded perpendicular to each others to form a trihedral shape which ensures that the radar signal is scattered back to the sensor. A small size is preferred to minimize the curvature of the side panels, the effect of wind, the exposition to vandalism, and to allow easier transportation and deployment in the harsh terrain setting. To design the 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.
The work discusses the problematic aspects of designing and deployment of the CR network and presents preliminary results.