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A comparison of Multi Temporal Interferometry techniques for landslide monitoring

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In this work, Multi Temporal Interferometry techniques (MTI) consistent of advanced synthetic aperture radar differential interferometry (A-DInSAR) for the monitoring of deformation phenomena in slow kinematics have been investigated.
A-DInSAR methodologies include both Coherence-based type, as well as Small Baseline Subset (SBAS) (Berardino et al., 2002, Lanari et al., 2004) that Persistent/Permanent Scatterers (PS), (Ferretti et al., 2001).
These techniques are capable to provide wide-area coverage (thousands of km2) and precise (mm–cm resolution), spatially dense information (from hundreds to thousands of measurement points/km2) on ground surface deformations. New MTI application opportunities are emerging thanks to:
1.greater data availability from radar satellites;
2.improved capabilities of the new space radar sensors (C-band Sentinel-1) in terms of resolution (from 20 to 5 m) and revisit time (about 12 days for C-band acquisitions).
This implies greater quantity and quality information about ground surface displacements and hence improved monitoring capabilities of slow kinematic movements.
These techniques A-DInSAR have been applied to the town of Stigliano (MT) in Basilicata Region (Southern Italy), where the social center has been destroyed after the reactivation of a known landslide.
A direct comparison of the results has been shown that PS and SBAS techniques are comparable in terms of obtained coherent areas and displacement patterns, with highlight slightly different velocity values for individual points. In particular, PS furnished a range of velocity between -5 /-25 mm/year, while for SBAS we found values around -5/-15 mm/year.
These differences in term of number and spatial distribution of the measurable targets depend on the scattering characteristics of the ground surface (e.g. Lauknes et al., 2010). This could be occurring because PS is optimized for resolution cells dominated by a single scatterer, while SBAS focuses on distributed scatterers (without any dominant element within the resolution cell), which are more sensible to both temporal and volume decorrelations than PS.
Furthermore, on the crown of the landslide body, a Robotics Explorer Total Monitoring Station (Leica Nova TM50) that measures distance values with 0.6 mm of resolution has been installed. In particular, 20 different points corresponding to that identified through satellite techniques have been chosen, and a sampling time of 15 minutes has been fixed.
The displacement values obtained are in agreement with the results of the MTI analysis, showing as these techniques could be a useful tool in the case of early – warning situations.