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# Slope instability mapping around L'Aquila (Abruzzo, Italy) with Persistent Scatterers Interferometry from ERS, ENVISAT and RADARSAT datasets

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In the last decade Persistent Scatterers Interferometry (PSI) was used in natural hazards investigations with significant results and it is considered a helpful tool in ground deformations detection and mapping (Berardino et. al., 2003; Colesanti et al., 2003; Colesanti & Wasowski, 2006; Hilley et al., 2004).
In this work results of PSI processing were interpreted after the main seismic shock that affected the Abruzzo region (Central Italy) on 6th of April 2009, in order to carry out a slope instability mapping according to the requirement of National Department of Civil Protection and in the framework of the Landslides thematic services of the EU FP7 project 'SAFER' (Services and Applications For Emergency Response – Grant Agreement n° 218802).
The area of interest was chosen in almost 460 km2 around L'Aquila according the highest probability of reactivations of landslides which depends on the local geological conditions, on the epicenter location and on other seismic parameters (Keefer, 1984).
The radar images datasets were collected in order to provide estimates of the mean yearly velocity referred to two distinct time intervals: historic ERS (1992-2000) and recent ENVISAT (2002-2009), RADARSAT (2003-2009); the ERS and RADARSAT images were processed by Tele-Rilevamento Europa (TRE) using PS-InSAR(TM) technique, while the ENVISAT images were processed by e-GEOS using PSP-DIFSAR technique.
A pre-existing landslide inventory map was updated through the integration of conventional photo interpretation and the radar-interpretation chain, as defined by Farina et al. (2008) and reported in literature (Farina et al. 2006, Meisina et al. 2007, Pancioli et al., 2008; Righini et al., 2008, Casagli et al., 2008, Herrera et al., 2009). The data were analyzed and interpreted in Geographic Information System (GIS) environment.
Main updates of the pre-existing landslides are focusing on the identification of new landslides, modification of boundaries through the spatial radar interpretation and the assessment of the state of activity, intended as defined by Cruden and Varnes (1996). The information coming from the radar interpretation is the basis to evaluate the state of activity and the intensity of slow landslides.
Two main situations can occur: the presence of PS within the already mapped landslides, and the presence of PS outside the previous mapped area resulting often in new landslides.
The analysis of PSI data allowed to map 57 new landslides and gave information on 203 (39%) landslides mapped of the pre-existed PAI while the updated Landslide Inventory Map has 579 landslides totally: thus EO data did not give any additional information on 319 landslides of the pre-existing inventory map. Considering the 203 updated landslides, the modifications concern 155 phenomena while 48 are confirmed: the modifications are related to the boundary and/or the state of activity and the typology. All the new landslides added are considered active.
It is worth noting that almost all the landslides where the state of activity is changed from dormant (or stabilized) to active involve urban areas and the road network where the reliability of radar benchmarks is higher.
Radar satellite data were in particular very useful to map slow superficial movements named as "creep" that are widespread in the slopes around L'Aquila: the typical velocity is few centimeters per year which is perfectly suited to the capability of multi-interferometric techniques for ground deformation detection.

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