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Potentiality of SENTINEL-1 for landslide detection: first results in the Molise Region (Italy)

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A detailed inventory map, including information on landslide activity, is one of the most important input to landslide susceptibility and hazard analyses. The contribution of satellite SAR Interferometry in landslide risk mitigation is well-known within the scientific community. In fact, many encouraging results have been obtained, principally, in areas characterized by high coherence of the images (e.g. due to rock lithology or urban environment setting). In terms of coherence, the expected increased capabilities of Sentinel-1 for landslide mapping and monitoring are connected to both wavelength (55.5 mm) and short temporal baseline (12 days). The latter one is expected to be a key feature for increasing coherence and for defining monitoring and updating plans. With the aim of assessing these potentialities, we processed a set of 14 Sentinel-1 SLC images, acquired during a temporal span of 7 months, over the Molise region (Southern Italy), a critical area geologically susceptible to landslides. Even though Molise is mostly covered by crops and forested areas (63% and 35% respectively), that means a non-optimal coherence condition for SAR interferometry, promising results have been obtained. This has been achieved by integrating differential interferometric SAR techniques (12-days interferograms and time series) with GIS multilayer analysis (optical, geological, geomorphological, etc.). Specifically, analyzing a single burst of a Sentinel-1 frame (approximately 1875 km2), 62 landslides have been detected, thus allowing to improve the pre-existing inventory maps both in terms of landslide boundaries and state of activity. The results of our ongoing research show that Sentinel-1 can give a significant improvement in terms of exploitation of SAR data for landslide mapping and monitoring. As a matter of fact, by analyzing longer periods, it is expected to achieve a better understanding of landslide behavior and its relationship with triggering factors. This will be key to perform hazard analyses. Further research will be focused in finding algorithms to automatically detect and extract patterns and in developing a more reliable methodology. This will be done by integrating the Sentinel-1 data with other types of data and, in particular, with Sentinel-2 imagery.