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Updating landslide inventory maps using Persistent Scatterers Interferometry (PSI) in the Biferno River Basin (Central Italy)

Gaia Righini, Valeria Pancioli, and Nicola Casagli
University of Firenze, Department of Earth Sciences, Firenze, Italy (gaia.righini@unifi.it)

This work illustrates the contribution of Persistent Scatterers Interferometry (PSI) from radar satellites ERS and ENVISAT for the updating of a pre-existing landslide inventory map: the main purpose is to change or confirm the landslide state of activity and geometry and to identify new landslides. PSI results are integrated with optical images and ancillary data in a 1320 km2 wide river basin (Biferno Basin) located in the central-eastern part of Italy: in particular a new contribution to the interpretation of persistent scatterers information is presented. The geological setting of the area, characterised by clay and alternated clayey, silty and sandy formation, that are affected by slow landslides, fits very well with the use of radar data.
The analysis is performed on results from the PSInSAR(™) (Permanent Scatterers SAR Interferometry) technique provided by TeleRilevamento Europa. The updating is obtained through the integration of conventional photo-interpretation and the radar-interpretation chain; the information coming from radar-interpretation is the basis of the proposed method to evaluate the state of activity and the intensity of slow landslides. The interferometric data provide estimates of the mean yearly velocity referred to two distinct time intervals: historic ERS (1992-2001) and recent ENVISAT (2002-2007). The integration of the photo-interpretation gives a fundamental contribution to landslide mapping in particular in hilly and mountainous environments where there is a low density of radar benchmarks.
In field validation confirmed the results and the capabilities of multi-interferometric InSAR data, integrated and coupled with conventional techniques, to support landslides investigation at regional scale thanks to the available archive of repeated satellite data which provide measurements of ground displacements with a millimeter scale accuracy.
In the study area about 9% of the pre-existing landslide inventory has been modified by means of PS information, 15% of which have changed the state of activity from dormant to active and 95 new landslides were detected. Almost all the landslides where the state of activity is changed to “active” involve urban areas and the road network where the reliability of PSI is higher and the photo-interpretation is strongly limited by anthropic activity. The ENVISAT datasets have allowed us to detect many of the landslides that have been reactivated during the 2003 exceptional and prolonged rainfalls and, possibly, after the 2002 earthquake.
The methodology is tailored upon the user needs to identify landslides prone areas; in this case the user involved was the Italian National Civil Protection Department who gave a fundamental contribution in terms of requirements and validation. We consider that this methodology and procedure is portable and suitable for different geological and geomorphological environments.
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