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Combination of multiple remote sensing data for the study of the complex landslide of Agnone (southern Italy)

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The complex landslide of Agnone, located in Molise Region (southern Italy), is a large deep-seated roto-translational slide, involving terrigenous flysch sequences and evolving in the lower portion, in an earth flow. First evidences of landslide activities date back to early 1900s and keep on moving in several time spans up to nowadays.
This work illustrates the contribution of multiple optical and radar remote sensing data to landslide investigation approximately across a century as well as to mapping and monitoring ground displacements at the catchment scale.
In particular, we firstly revised information from scientific literature and technical reports, compiling monitoring data acquired through inclinometers and geo-morphological surveys in preceding studies to characterize the geological setting of the area. Additionally, we used GPS data acquired from 2010 to 2015 to monitor ground surface motions on some benchmarks of the area. Then, we exploited remotely-sensed data in order to in-depth investigate the spatial and temporal evolution of the landslide-affected catchment.
The use of historical air-photos enabled the generation of 3D models by means of the Structure for Motion (SfM) technique to detect, map and monitor unique geomorphological landscapes across several decades. Historical and recent sets of optical photographs from 1945 to 2003 were used in the study area to perform 3D reconstructions and analyze the geomorphological enlargement of the Agnone landslide over 60 years.
Radar satellite images acquired by ERS1/2 and ENVISAT constellations at medium spatial resolution, in the spanning time 1992-2010, and by COSMO-SkyMed at high resolution, covering the period 2012-2015, were processed through Persistent Scatterer Interferometry (PSI) techniques. The derived PSI data provided yearly velocities and time series of ground deformation with millimetric accuracy and were exploited for back-monitoring slow surface displacements and for better tracing the boundaries of the mass movement.
All data were discussed and used to increase the knowledge about the ground motions affecting the whole Agnone landslide and the surrounding territory. Remotely-sensed data were also compared through in situ field checks to evaluate landslide-induced damage on structures and infrastructures within and close to the landslide body. Outcomes of these analyses demonstrated the operative usefulness of the combination of multi-temporal and multi-technique conventional and remote sensing data for the assessment of spatial and temporal evolution of landslides at basin scale. Moreover, the collected data allowed to plan countermeasures and mitigation actions on the Agnone area according to the distribution and intensity of the detected landslide hazard.