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Coupling of satellite radar data and Volunteered Geographic Information (VGI) in an innovative approach aimed at supporting landslide inventories development

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After major geo-hydrological disasters, the rapid detection of both location and extension of the areas struck by floods and landslides is essential to manage recovery operations. In these cases, one of the most important tools required by decision-makers is a georeferenced map showing the affected areas. Preliminary maps reporting the potential location of landslides, for example, may also represents a starting point for field Geologists engaged in the production of detailed event landslides inventories, allowing optimize time and efforts. Optical and radar satellite images are experiencing an increasing use in the emergency operations due to improved revisiting times and spatial resolution. However, optical scenes are often useless for long times because of a permanent cloud cover or shadow effects hiding the collapsed mountain slopes. For this reason, the landslide research community is dedicating more efforts to implement new approaches based on satellite radar data, which typically are not affected by these types of disturbance. Even if the development of landslide inventories from radar images is still a challenge, such data represent a valuable support to generate archives of information acquired systematically, forming therefore clusters of “Big data” that can be useful in the context of susceptibility, hazard, and landslide risk analysis.
In the innovative approach presented in this contribution, we faced many of the issues related to the use of satellite radar data for supporting the production of event landslides inventories. The research activities have been carried out in the framework of the STRESS (Strategies, Tools and new data for REsilient Smart Societies) project, devoted to design, implement and test a prototype of a Spatial Data Infrastructure (SDI) to support decision makers in the geo-hydrological risk management. Specifically, our group have implemented an automatic processing chain that, starting from the downloading of Sentinel-1 satellite images, produces a georeferenced map highlighting the likely location of landslides. The procedure exploits multi-temporal variations of the radar backscattered signal induced by significant land cover changes, which can be associated to the occurrence of rapid-moving landslides. This map is sent to local scientists and citizens by means of a Smart App developed to collect, store and analyze Volunteered Geographic Information (VGI), to ease and improve results obtained from satellites. The STRESS project is also aimed at promoting and exploiting VGI freely provided by citizens involved as “human sensors” in the production of landslide inventories, providing direct information if no evidences are available from remote sensing. Outcomes resulting from both remote sensing and VGI activities should thereby support the updating of existing landslides susceptibility models and hazard assessment. The test site of the project is located in the Central Alps (Italy), where the steep slopes are very prone to landslides and debris flow processes. However, a preliminary application of the automatic processing chain has been successfully performed for a wide area of the Papua New Guinea affected by dozens of landslides in 2018, as well as the implementation of the VGI Smart App has been completed and verified.