



Monitoring urban landslides in Iasi city (Romania) using Differential SAR Interferometry

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Recent advances of space-borne Synthetic Aperture Radar (SAR) sensors and the development of techniques in this domain made the interferometric approaches a very suitable and convenient way to analyze and monitor landslide behavior, especially for slow moving landslides. The open access to image archives of past missions (e.g. ERS-1/2 and ENVISAT) and the free availability of data acquired by active satellites (e.g. Sentinel-1), the reduced costs and the relatively short time necessary to perform the processing, make Differential SAR Interferometry (DInSAR) techniques an important tool that increase the possibilities to identify, characterize and monitor mass movements. In the case of urban areas, the use of DInSAR represents an extremely convenient and effective method to detect landslides induced displacements affecting buildings and infrastructure, allowing the authorities to intervene in the stabilization of critical areas and, in this way, to reduce the economic losses and the negative impact to the community.

The study area considered in this work, the Municipality of Iași, is located in the north-eastern part of Romania and is characterized by slow-moving landslides with frequent reactivations, the most recent one of which took place in May 2017. These reactivations produced damage to infrastructure and destruction of houses, and specific visible marks such as wall cracks, tilted trees, stabilizing infrastructure affected by bulging or cracking can be seen in the field as a consequence of mass movements. For this reason, this case study represents a good asset for the use of multi-temporal interferometry as a tool to prevent further damage in the area. The DInSAR technique used is the Persistent Scatterers Interferometry (PSI), which relies on persistent reflectors and hence is a suitable method for the monitoring of urbanized areas. Three different C-band SAR datasets, acquired in both ascending and descending orbits by the ERS-1/2, ENVISAT and Sentinel-1A/B satellites and covering a period of 25 years (1992-2017), were processed through the SARscape software. The results, obtained in terms of velocity maps, showed the main areas affected by slope instability with displacement rates ranging from 10-15 mm/year to 20-25 mm/year. The analysis of the time series revealed almost linear trends of deformation, in accordance with the data obtained from the GPS surveys carried out in the area.

The monitoring activity carried out in this study using the PSI DInSAR technique and supported by the GPS in-situ observations, helped in better understanding the landslide activity occurring in the Municipality of Iași, and permitted the production of a large database containing information of deformation velocities of the entire study area from which it was possible to precisely delineate the extent of the areas affected by slope deformations.