Geophysical Research Abstracts
Vol. 21, EGU2019-7173, 2019
EGU General Assembly 2019

Urban landslide investigation through A-DInSAR techniques and numerical modeling

Nicușor Necula (1), Mihai Niculita (1), Mario Floris (2), and Rinaldo Genevois (2)

(1) Department of Geography, Faculty of Geography and Geology, Alexandru Ioan Cuza University of Iași, Iași, Romania (nicusor.necula@student.uaic.ro), (2) Department of Geosciences, University of Padova, Padova, Italy (mario.floris@unipd.it)

The presence of landslides in urbanized areas might be, in some cases, one of the biggest challenges that local authorities have to deal with, because it generates a state of insecurity for the inhabitants. To reduce the threat posed by these hazardous phenomena and to prevent some disasters, it is required the investigation of the processes to provide effective landslide mitigation strategies. For this purpose, many sensing techniques, tools and instruments, were developed. Combining the results from multi-temporal Synthetic Aperture Radar Differential Interferometry (DInSAR) and numerical modeling of slope instability allows to build up a suitable tool for the identification, monitoring and analysis of landslide behavior. The first approach exploits the capabilities given by the SAR images and allows the detection of moving areas affected by various geomorphological and geological processes, landslides being of our interest. The second methodology uses mathematical models to solve the mechanical problems by simulating the behavior of materials characterized by certain parameters and under different environmental conditions.
In our case, we applied these techniques to investigate a very slow moving landslide affecting one of the residential neighborhoods of Iași Municipality (East Romania). Our aim is to determine the mechanism of sliding, the slip surface location and geometry, and to understand the material behavior in relationship to the conditioning factors. Based on the results of Multi Temporal Interferometry we identified the affected area that is moving with a rate of about 15 - 20 mm/year in satellite's Line of Sight (LOS) direction. The instability extends over an old landslide event that occurred in 1941 and described in the literature of that time. Since then, because of the improper stabilizing measures implemented by authorities, the moving body have constantly produced damages to road network and human settlements. In this case, a geotechnical approach, supported by numerical modeling of soil mechanics, has to be considered for the implementation of appropriate measures to stabilize the displaced material. However, the lack of geophysical data and the lower quality of in-situ measurements and surveys make the investigation of this case difficult. The geological and geotechnical model of the instability phenomena was created considering the rough information available in few geotechnical boreholes and the geomorphological evidences. Thus, we performed several back-analyses to determine the slip surface and the properties of materials. Further on, we performed two-dimensional Finite Element (FE) modeling in FLAC software to simulate the material behavior in time and to identify the critical stability conditions. Finally, we optimized the model taking into account the long-term displacement series of DInSAR measurements. The results show the importance of numerical modeling and DInSAR outputs for the validation of the proposed geomorphological landslide type and its dynamics. Moreover, they outline the active sectors of landslide body allowing a proper evaluation, management and implementation of effective strategies to mitigate this hazard.