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Persistent Scatterer InSAR monitoring of Bratislava urban area

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The main purpose of this research is to monitor the ground stability of Bratislava urban area by application of the satellite radar interferometry. Bratislava, the capital city of Slovakia, is situated in its south-west on the borders with Austria and Hungary and only 62 kilometers from the border with Czech Republic. With an exclusive location and good infrastructure, the city attracts foreign investors and developers, what has resulted in unprecedented boom in construction in recent years. Another thing is that Danube River in the last five hundred years caused a hundred of devastating floods, so therefore flood occurs every five years, on average. From geological point of view, the Little Carpathians covers the main part of study area and are geologically and tectonically interesting. The current state of relief and spatial distribution of individual geological forms is the result of vertical geodynamic movements of tectonic blocks, e.g., subsiding parts of Vienna Basin and Danubian Basin or uplifting mountains. The Little Carpathians horst and the area of Vienna Basin contains a number of tectonic faults, where ground motions as a result of geodynamic processes are mostly expected. It is assumed that all the phenomena stated above has an impact on the spatial composition of the Earth's surface in Bratislava urban area. As nowadays surface of the Little Carpathians is heavily eroded and morphology smoothed, question of this impact cannot be answered only by interpreting geological tectonic maps. Furthermore, expected changes have never been revealed by any geodetic measurements which would offer advantages of satellite radar interferometry concerning temporal coverage, spatial resolution and accuracy. Thus the generation of ground deformation maps using satellite radar interferometry could gather valuable information. The work aims to perform a series of differential interferograms and PSInSAR (Persistent Scatterer Interferometric Synthetic Aperture Radar) technique, covering the target area with 57 Envisat ASAR images from Ascending Track No. 229 (32) and Descending Track No. 265 (25) captured between years 2002 and 2010. Processing involves Sarproz (Copyright (c) 2009 Daniele Perissin) a powerful software solution for obtaining differential interferograms and performing PSInSAR methodology. The area of interest to investigate the deformation phenomena is covering approximately 16 by 16 kilometers (256 sqkm). For evaluation of PSInSAR potential to detect and monitor ground displacements, PS derived time series of deformation signal were compared to the field GNSS data from three GNSS stations coded PIL1, BRAT and GKU4. By the detailed look on the deformation maps the investigated urban area of Bratislava is relatively stable with the deformation rates within the few ($\pm$5) millimeters. The comparison of PSInSAR derived time series with GNSS data indicates good correlation and confirms achievable precision and applicability of InSAR measurements for ground stability monitoring purposes.

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