

Ensembling satellite monitoring and numerical cartography towards the safety assessment of infrastructures

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Abstract

This paper explores new technologies that can advance the state-of-the-practice in safety assessment and health monitoring of existing infrastructures. In this context, Multi-Temporal interferometric Synthetic Aperture Radar techniques combined with the use of digital models of infrastructures represent a powerful integration to conventional approaches in the monitoring and assessment of structural safety of infrastructures. Although the interferometric method is widely used for ground deformation investigations, using displacement data from satellite observation in structural monitoring is less investigated. The joint use of multi-frequency satellite radar data provided by the European Space Agency Copernicus project and Italian Space Agency will be explored. The paper introduces the workflow implemented for processing satellite radar data from the X-band COSMO-SkyMed constellation by the Italian Space Agency over the municipality of Modena (Italy). An open-source workflow based on Multi-Temporal Interferometric technique and Persistent Scatterers Interferometry is adopted, enabling the detection of displacements of stable targets and the generation of corresponding time series. Radar data products, derived from the processing of both COSMO-SkyMed and Sentinel-1 data, are analyzed in a Geographic Information System alongside the available geospatial dataset of infrastructures. This approach enables the extraction of displacement components related to the ground and infrastructures. The method’s potential for characterizing infrastructures behaviour is assessed through the analysis of selected case studies. The results aim to establish the foundations for a method capable of assessing infrastructure safety.

Keywords: Persistent Scatterer Interferometry, Numerical cartography, Infrastructure safety assessment

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