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Fully exploitation of SBAS-DInSAR deformation time series for assessing structural damage: the case study of Rome, Italy

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Remote sensing techniques have demonstrated to be effective tools to support natural and man-made risk mitigation activities. Among these, the Differential Synthetic Aperture Radar (SAR) Interferometry (DInSAR) technology is largely exploited in geoscience, oil and gas extraction, and landslide fields. Recently, thanks to the large availability of high resolution SAR systems (10 m or less), as well as to the development of advanced data processing techniques, DInSAR products have also started to be effectively used for applications in urban areas to detect localized displacements affecting single buildings and infrastructures.
The advanced DInSAR technique referred to as Small Baseline Subset (SBAS) (Lanari et al., 2004) allows us to generate very long deformation time series, by exploiting large SAR datasets spanning up to 20 years (Bonano et al., 2012). Thanks to its capability to investigate wide areas, the SBAS-DInSAR technique is particularly suitable to remotely analyse the structural conditions of buildings located in densely urbanized zones.
In this work, we fully exploit the results achieved over the city of Rome, Italy, through the well-established SBAS-DInSAR approach, aimed at performing a quantitative assessment of structural damage in urban areas affected by ground deformation (Arangio et al., 2013). More in details, we present an innovative methodology that integrates the SBAS-DInSAR measurements within an existing model, in order to assess the damage, and possibly estimate the future structural conditions, of single buildings affected by significant foundation settlements. In particular, a semi-empirical approach, based on a laminated beam model (Finno et al., 2005), is applied to investigate the damage of buildings located in the southern part of the city.
The obtained results are in substantial agreement with in situ surveys, proving that the presented approach is an effective tool for the preliminary evaluation of the structural conditions in those situations where a quick analysis of a large number of buildings is needed.
Finally, such an integrated method is valuable to carry out accurate back-analyses on the conditions of the investigated buildings over time and, in some cases, also predictive studies to estimate their future structural conditions.

References

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