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Surface deformation of the city of Rome (Italy), investigated with the SBAS-DInSAR technique

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Abstract

We have investigated the surface deformation affecting the city of Rome (Italy) during the 1995-2000 time period by analyzing a data set of 43 ERS-1/2 SAR images with the differential SAR interferometry (DInSAR) technique referred to as Small BAseline Subset (SBAS) approach [1,2]. In particular, we benefited of the SBAS technique capability to investigate surface deformation at two distinct spatial scales: a low resolution, large scale, and a fine resolution, local scale.

At the large scale, the technique exploits multi-look interferograms and allows us to generate mean deformation velocity maps and associated time series for areas extending for some thousands of square kilometres (up to 100 x 100 km), with a ground resolution of the order of 100 x 100 m. The obtained products are particularly suited for regional scale displacement analysis and they can be conveniently used to identify different sites affected by ground deformation.

At the local scale the SBAS approach exploits the SAR images at full spatial resolution (typically of the order of 5 x 20 m along azimuth and range directions, respectively) to detect and analyze localized deformation phenomena at the scale of single buildings or man-made structures.

As key result of the large scale data analysis we show that several subsiding phenomena affecting the urban area of Rome and its surrounding have been detected; in particular, the subsiding areas occur in correspondence of the Aniene river and, above all, of the Tevere river and its minor branches. By integrating these DInSAR results with the geological information of the area we could conclude that the compression of the alluvial deposits, mostly enforced by the buildings overload, represents the most important contribution to the detected displacements.

For what concerns the exploitations of the full resolution DInSAR data, a detailed analysis has been carried out on the Grotta Perfetta valley of the Tevere river; in this case we investigated several deformation phenomena at the scale of single buildings. As key result we show that intra-building displacements of few mm/year, affecting single man-made structures of building complexes, have been detected. Accordingly, we have identified several sites that may be potentially involved in critical situations.

References

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