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A two-scale analysis of surface deformation affecting the L'Aquila (Italy) area performed through the advanced SBAS-DInSAR technique

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In this work we investigate the surface deformation scenario of the city of L'Aquila (Italy) and its neighboring in the last decade, by analyzing deformation time series retrieved through SAR data acquired by the ENVISAT and the COSMO-SkyMed satellites. To this aim we focus on the advanced Differential SAR Interferometry (DInSAR) algorithm known as Small BAseline Subset (SBAS) approach (Berardino et al., 2002, Lanari et al., 2004), which allows investigating ground deformation at two distinct spatial scales, referred to as regional and local scale, respectively. At the regional (low resolution) scale the technique exploits average (multi-look) interferograms and permits to generate mean deformation velocity maps and the corresponding time-series relevant to very large areas (about 100 x 100 km), with a ground resolution that is typically of about 100 x 100 m. At the local (full resolution) scale, the technique exploits the single-look interferograms, generated at full spatial resolution (5-10 m), in order to detect and analyze local deformation that may affect single buildings and man-made structures; such a detailed analysis represents the main focus of this work.

We exploit both descending and ascending datasets of ENVISAT and COSMO-SkyMed images, spanning the 2002-2010 time periods and the six months of 2009 following the 6 April 2009 L'Aquila earthquake, respectively. In particular, the ENVISAT results allow us to exclude, within its 35-days revisit time, the presence of pre-seismic displacements related to the Paganica fault involved in the 6 April 2009 earthquake (Lanari et al., 2010). On the other hand, we reveal the evidence of on-going long-term surface deformation due to land motions and local subsidence effects.

Subsequently, the deformation effects on the buildings of the town, due to the earthquake event, are analyzed, followed by the investigation of the post-event displacements. The latter analysis benefits of the improved spatial and temporal resolution of the COSMO-SkyMed data with respect to the ENVISAT ones, leading to an 8-days revisit time. This case study further confirms the relevance of such DInSAR analysis for the investigation of complex scenarios involving surface deformation, with a relevant impact on the definition of risk prevention and post-crisis management strategies.

References

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