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One year after the Abruzzo 2009 earthquake: pre-, co- and post-seismic surface deformation investigation through advanced InSAR analyses

Riccardo Lanari
IREA, CNR, Napoli, Italy (lanari.r@irea.cnr.it, +39 081 570 5734)

On 6 April 2009, at 01:33 UTC, a magnitude (Mw) 6.3 earthquake struck central Italy, partially destroying L'Aquila, several surrounding villages, and causing hundreds of casualties. Immediately, the Italian Civil Protection and the scientific community started the work to mitigate the effects and analyze the causes of the natural catastrophe. At the same time almost all the existing spaceborne Synthetic Aperture Radar (SAR) systems imaged the L'Aquila area revealing, through InSAR analyses, the undeniable scar produced by the seismic event on the Earth's surface. Moreover, some of these sensors continued to image the area affected by the seismic displacements, including the advanced SAR sensors of the COSMO/Skymed constellation of the Italian Space Agency (ASI).
We present in this study the results achieved by the InSAR group of the IREA-CNR institute, through an extended InSAR-based analysis carried out on the displacements of the area affected by the seismic event.
We show first the results achieved by applying the Differential SAR Interferometry (InSAR) algorithm referred to as Small BAseline Subset (SBAS) technique (Berardino et al., 2002) to analyze the temporal evolution of the detected displacements retrieved through the data acquired, from ascending and descending orbits, by the C-band ENVISAT sensor of the European Space Agency (ESA) starting from 2002. This permitted us to investigate possible long term pre-seismic phenomena and provided several co-seismic deformation maps; the latter have been combined with the homologous co-seismic deformation maps retrieved by processing InSAR data pairs acquired by X-band (COSMO/Skymed and TERRASAR-X) and L-band (ALOS-PALSAR) SAR sensors. These co-seismic displacements have been jointly inverted in order to provide insights on the deformation source.
The final results are focused on the exploitation of COSMO/SkyMed data acquired on both right ascending and descending orbits. The ascending dataset is composed by 32 post-event images while the descending one includes 26 post-event acquisitions. This unique dataset allowed us to carry out a detailed InSAR analysis of the post-seismic signal by benefiting of the short revisit time of the COSMO/SkyMed constellation (8 days, except for the tandem option) and of the high spatial resolution of the retrieved deformation measurements; these results demonstrate the key role that the new generation SAR sensors may play for the investigation of ongoing deformation phenomena.

References

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