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Deep Seated Gravitational Slope Deformations triggered by the 2009 L'Aquila earthquake

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We investigated the surface effects of the April 6th, 2009, L'Aquila earthquake (Mw 6.3), using geological investigations and Synthetic Aperture Radar (SAR) data obtained by new High Resolution COSMO-SkyMed SAR2000. The earthquake affected a large area in Central Italy causing strong damage to cities and villages in the epicentral region.
Deep-seated Gravitational Slope Deformation (DGSD) triggered by the earthquake shaking have been detected and quantified in term of their coseismic movement. DGSD are gravity-driven ground movements occurring on large (1-5 km length, 100-500 m depth and width) rock volumes.
We exploited the capabilities of the new High Resolution COSMO-SkyMed SAR2000 instrument, using the Differential SAR Interferometry (DInSAR) technique. We used a right ascending, Stripmap mode (35° incidence angle), coseimic image pair (April 4 – April 12) to measure the surface displacement. We removed the topographic phase contribution using a detailed DEM at 5-m resolution.
Fringe complexities, not directly attributed to the main tectonic pattern, have been detected in local areas. Geomorphological and geological analysis allow us to attribute such fringe patterns to ground displacement occurred along two different DGSD, one close to Roio Piano village, and the other North of the Barisciano village. The first DGSD is interpreted as a sackung induced by the particular structural setting (down dip strata) and the high relief energy, whilst the second one appears to be a lateral spread of carbonatic bedrock.
We unwrapped the interferogram to measure the local movements, and found 4-5 cm of LOS (Line Of Sight) displacement in both areas. The DGSD movement was triggered by the earthquake ground shaking, and, although in this case it did not result in a catastrophic collapse of the rock masses, it certainly indicates the presence of an increased ground shaking hazard in these areas.
The L'Aquila earthquake is the second case study where the seismic triggering of DGSD has been recognized by DInSAR. It is worth noting that a step forward in terms of scale detail has been achieved thanks to the COSMO-SkyMed spatial resolution and frequency band of the COSMO-SkyMed satellite.