



## 3-D Ground Displacement Monitoring of very fast-moving Landslides in Emergency Scenario

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On December 3rd, 2013, a large and fast-moving landslide phenomena, which occurred in South-West of Montescaglioso town (southern Italy) after some days of intense raining, caused ground displacements on the order of several meters. The mass wasting involved an important freeway connection disrupting more than 500 meters of the route and some isolated buildings.

In this work we present a case study of application of SAR remote sensing techniques for retrieving ground displacement field in a landslide emergency scenario. To this aim, thanks to the availability of ascending and descending COSMO-SkyMed (CSK) satellite acquisitions, we first applied the DInSAR technique (Massonnet et al., 1993) to both datasets, for generating differential interferograms across the investigated event. In particular, two data pairs (one ascending and one descending) involving pre- and post-event epochs and approximately spanning the same time interval were identified. Unfortunately, the DInSAR analysis produced unsatisfactory results, because of the excessive phase noise within the area of interest, mainly related to the fast-moving deformation pattern (several meters) and also to the presence of vegetation.

To overcome the above mentioned limitations, the amplitude-based Pixel Offset (PO) technique (Fialko and Simons, 2001) was applied to the previous identified CSK data pairs. In this case, the PO technique allowed us to retrieve the projection of the surface displacements across and along the satellite's track (range and azimuth, respectively) for both the ascending and descending orbits. Then, by properly combining these 2-D maps of the measured surface movements, we also retrieved the 3-D ground deformation pattern, i.e. the North, East and Vertical displacement components. The ground displacements have a main SSE component, with values exceeding 10 meters. Moreover, large subsidence values were identified in those areas experiencing the largest damages, as well as a clear uplift (up to 5 meters) close to the region where landslide materials accumulated.

Our results show that the PO technique applied on high resolution SAR data can be strategic for monitoring and mapping fast-moving surface displacements in complex landslide scenarios, providing important information on the magnitude of the occurred phenomena that can be valuable in emergency contexts.

### References

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- Fialko, Y. and Simons, M. (2001), The complete (3-D) surface displacement field in the epicentral area of the 1999 Mw 7.1 Hector Mine earthquake California from space geodetic observations, *Geophys. Res. Lett.*, vol. 28, no. 16, pp. 3063–3066.