A New Approach to the Use of DInSAR Data in Landslide Studies at Different Scales: the Case Study of National Basin Authority of Liri-Garigliano and Volturno Rivers (Italy)

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In the last decade, remote sensing techniques have proven to be helpful in detecting large areas and in analyzing both the state of activity and the kinematical characteristics of the instability phenomena. In particular, the contribution of the integrated use of remote sensing techniques such as Differential SAR Interferometry has already been dealt with in the scientific literature via a number of case studies. However, standardized procedures for the interpretation and the confident use of DInSAR data, according to landslide zoning developments, have not been fully investigated and validated, although algorithms for image processing have become more and more sophisticated.

Starting from current limits to the applicability to landslide studies, this research introduces innovative procedures for the generation of advanced DInSAR landslide velocity maps (CASCINI et al., 2010) based on the joint use of DInSAR data at both full- and low-resolution (FORNARO et al., 2009a and b), simple geomorphological models and geometric considerations. To this aim, ERS image datasets are processed inside a well documented area, of 489 m^2 within the National Basin Authority of "Liri-Garigliano and Volturno" Rivers (Central-Southern Italy), for which both base and thematic maps are available.

The first step is the generation of the a-priori DInSAR landslide visibility map (described in detail in CASCINI et al., 2009) which allows zoning the areas where remote-sensed data can be available. Then, the use of advanced low-resolution DInSAR landslide velocity maps suggests perspectives of increasingly reliable applications to check/update landslide inventory maps at a scale of 1:25,000 over large areas (CASCINI et al., 2009, 2010). As for the full-resolution DInSAR data, the analyses carried out at a scale of 1:5,000 allow: i) the investigation of likely relationships among evidence of movement/no movement derived from DInSAR data; ii) the updating of the evolution model of the slope affected by landsliding, as well as an insight into the damage survey to buildings located within the unstable areas (CASCINI et al., 2010).

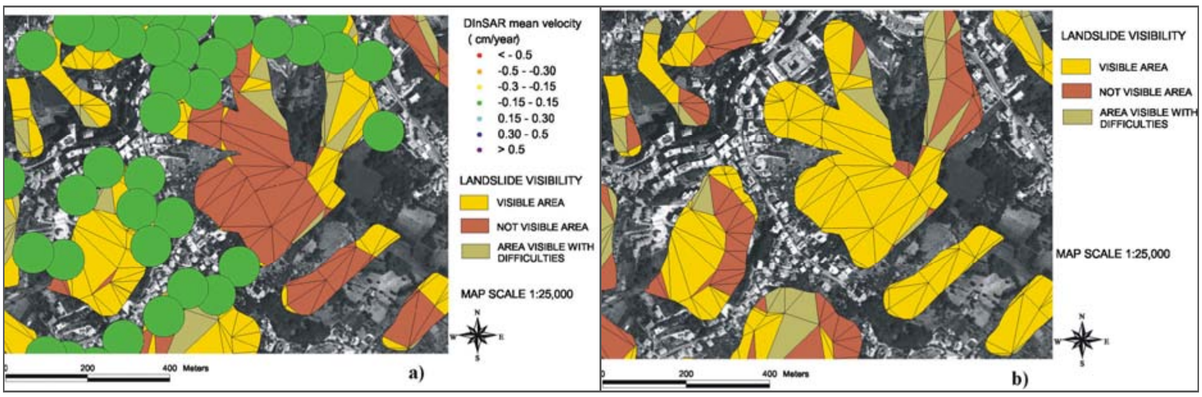

Fig. 1: The "a priori DInSAR landslide visibility map": a) on descending orbits with low-resolution DInSAR coherent pixel distribution; b) on ascending orbits (CASCINI et al., 2009).

The results obtained seem particularly appealing considering the enhanced capabilities of the newest sensor (e.g. TerraSAR_X, COSMO/SKYMED, etc.) which will offer high resolution DEMs also allowing improved spatial resolution, three times higher data acquisition frequency and an increase in the sensitivity to temporal decorrelation via the reduction of the wavelength.

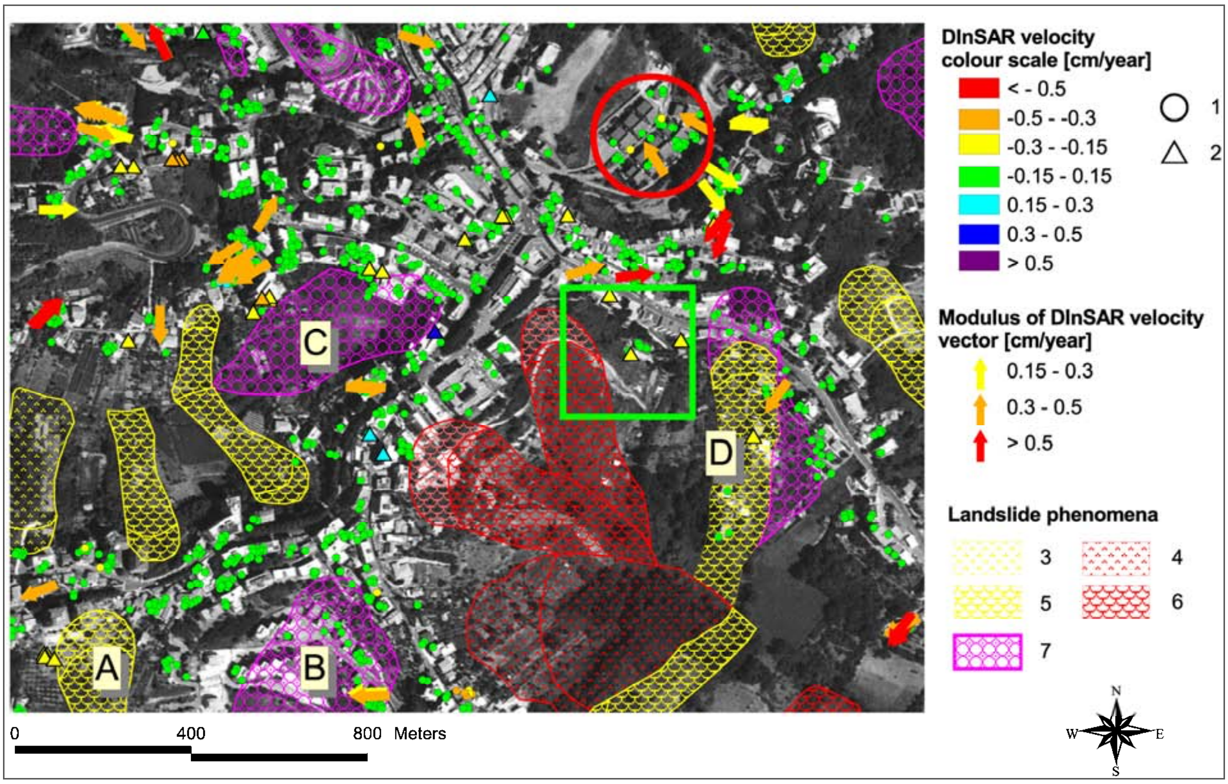

Fig. 2: Example of advanced full-resolution DInSAR landslide velocity map.
1) Not moving DInSAR coherent pixel or on flat areas; 2) not projected translational displacement owing to high condition number; 3) dormant rotational slide; 4) active rotational slide; 5) dormant earth flow; 6) active earth flow; 7) creep phenomenon (CASCINI et al., 2010).

References

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