



GB-InSAR 3D maps for deformation monitoring: the importance of the digital surface models in data georeferencing and interpretation

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Terrestrial Laser Scanner (TLS) and Ground-Based Interferometric Synthetic Aperture Radar (GB-InSAR) play an important role for the study of unstable slopes. TLS and GB-InSAR allow the acquisition of data on an observed surface, with high spatial sampling rate, to generate detailed Digital Terrain Models (DTMs) and displacement maps of the phenomena. Both techniques are used to study the phenomena evolution for civil protection purposes, especially when urban areas and infrastructures are involved: data can be made immediately available to the authorities as a decision support, even if their post-processing could improve their accuracy.

GB-InSAR is increasingly used for a continuous monitoring of landslides by gathering images, at adjustable time rates and from the same viewing position to analyse the spatial distribution of surface deformation in near-real time. In order to obtain 3D displacement maps of the overall area of interest, thus identifying sectors affected by instability conditions, it could be useful to combine GB-InSAR maps with an appropriate DTM (or DSM) by means of a geo-referencing procedure. In this regard, TLS technique is increasingly used because, thanks to the acquisition from a similar point of view, it represents one of the most reliable ways for re-projecting GB-InSAR maps.

Georeferencing TLS derived DTM remains an issue to be addressed in order to compare these results with others obtained with different DTMs. In fact, it is also possible to use digital models derived from airborne laser scanning or satellite techniques, such as stereographic or radar images. Clearly, the use of different DTMs entails different accuracy when re-projecting the displacement maps and in the results interpretation, due mainly to the cell resolution and the acquisition methods and times.

The main purpose of this paper is trying to define a methodological approach for the acquisition of GB-InSAR data in a civil protection perspective, focusing on problems encountered in re-projecting GB-InSAR maps on DTM/DSMs with different resolutions and describing how data interpretation can vary changing cell dimensions and surface models. Three different kind of DTM/DSMs with different resolutions are considered: DTMs with a resolution of about 90 m derived from Shuttle Radar Topography Mission (SRTM), ALS derived DTMs with metric resolution and TLS derived DTMs with centimetric resolution.

Different case studies located in the Tuscan-Emilian Apennines but with different characteristics and behaviours will be presented. The problem of the GB-InSAR data geo-referencing and interpretation in relationship with the use of DTM/DSMs will be also analysed regarding to the morphological features and the vegetation cover that the unstable slopes present. Due to their line of sight, both airborne and satellite systems can effectively describe horizontal surfaces, but can not do the same for vertical rock walls for which TLS could be more efficient; both the vegetation cover and the presence of endangering buildings are others key problems that need to be thoroughly studied, along with the way to generate the DTM/DSMs.