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# Comparison of COSMO-SkyMed PSP SAR interferometry ground deformation analysis with field measurements and geological studies: the case study of Wuhan city

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Synthetic aperture radar (SAR) interferometry is a powerful technology for measuring ground surface elevation and deformation due to landslides, subsidence, and volcanic or seismic phenomena. Extraction of this information is a complex task. The PSP technique is a proven SAR interferometry technology characterized by the fact of exploiting in the processing only the relative properties between close points (pairs) in order to overcome atmospheric artifacts (which are one of the main problems of SAR interferometry). Validations analyses [Costantini et al. 2015] settled that this technique applied to COSMO-SkyMed Himage data is able to retrieve very dense (except of course on vegetated or cultivated areas) millimetric deformation measurements with sub-metric localization.

In this work, after reminding the qualifying characteristics of the PSP method, we will describe the comparisons between the ground and structure deformation measurements obtained by COSMO-SkyMed PSP SAR interferometry, with field measurements and surveys, and with geological studies over Wuhan (China). While Beijing and Tianjin (China) are well known for subsidence phenomena related to the overexploitation of underground water, Wuhan never suffered from this problem due to the richness of its water resources. However, in recent years, subsidence phenomena have gradually appeared, mostly in areas where urban infrastructures and underground railways are under construction.

In order to evaluate the measurements obtained from the processing of the COSMO-SkyMed SAR images acquired over Wuhan, three different types of data were used: optical leveling data collected along a subway line under construction, photographic evidences obtained by field investigations, and a map of the soft layer thickness obtained by a geological study. The comparison between PSP measurements and optical leveling survey data confirmed the validity of the PSP approach and demonstrated that very accurate ground deformation and building stability measurements can be obtained from COSMO-SkyMed data. The reliability of the PSP measurements was verified also by performing field inspections on three relevant areas where many evidences that confirm the subsidence phenomena identified by the PSP analysis were found. Finally, the soft layer thickness map was used to verify if a relation between the subsidence phenomena and the geological characteristics of the soil exists.

From the comparison between the terrace thickness map and the SAR measurements, it was possible to identify a good correlation between the geological characteristics of the alluvial areas close to the Yangtze River and the PSP measurements. However, there is not perfect correspondence between the terraces and the deformation patterns, and this could mean that there are other geological or structural mechanisms involved in the measured deformations. The accurate and dense deformation measurements obtained by PSP COSMO-SkyMed SAR interferometry can be very useful to identify these mechanisms. We are completing the integration of satellite, geological and structural information, in order to obtain a more detailed and accurate knowledge of the ground deformation phenomena affecting Wuhan area. The result will be shown in the final presentation.