



Combination of INSAR and GPS to measure ground motions and atmospheric signals

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The combination of different techniques such as InSAR and GPS is characterized by the added value of taking advantage of their complementary strengths and of minimizing their respective weaknesses, thus allowing for the full exploitation of the complementary aspects by overcoming the limitations inherent in the use of each technique alone. Another important aspect of the GPS/InSAR integration regards the fact that today's application of interferometric SAR techniques is limited by the knowledge of the wet tropospheric path delay in microwave observations. GPS-based estimates of tropospheric delays may help in obtaining better corrections which will enhance the coherence and will allow the application of InSAR in a wider range of applications.

The area selected for the InSAR/GPS comparison/integration is in northeastern Italy and includes the town of Bologna, and two nearby sites Medicina (agricultural area) and Loiano (a small city on the Apennines) where a small network of permanent GPS stations is operated by the University of Bologna. The InSAR data used are the COSMO-SkyMed (CSK) images made available by the Italian Space Agency (ASI) in the framework of the research contract AO-1140.

The Permanent Scatterers (PS) technique will be applied to a number of repeated CSK strip map SAR images acquired over a 40x40 square km area encompassing the towns mentioned above. Ultimately this work will contribute demonstrating the CSK capabilities to operate in a repeated interferometric survey mode for measuring ground deformation with millimeter accuracy in different environments. A PS is a target whose radar signature is stable with time. Such targets can be identified by means of multiple SAR observations and they can be exploited for jointly estimating their relative motion and the atmospheric artifacts on a grid that can be quite dense in space but not in time (depending on the SAR revisiting time interval). On the contrary the GPS can provide very frequent time measurements in correspondence of a few measuring points. Elevation, ground deformation and atmospheric artifacts estimated in correspondence of the identified PS will be compared with independent measurements carried out at the same acquisition time by permanent GPS stations in the area of Bologna, Medicina and Loiano. The comparison of these independent measurements is itself a cross-validation of the obtained results. The value of cross-validation of different and compatible techniques is to provide reliable vertical crustal motion determinations in space and time. Urban areas such as that of Bologna will be examined to evaluate CSK capabilities to measure extended subsidence (or up-swelling) and single building deformation.