Geophysical Research Abstracts
Vol. 14, EGU2012-2463, 2012
EGU General Assembly 2012

Observing crustal deformation and atmospheric signals from COSMO-SKYMED and GPS data

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The combined use of InSAR and GPS allows for the full exploitation of the complementary aspects of the two techniques by overcoming the limitations inherent in the use of each technique alone. Additionally, GPS-based estimates of tropospheric delays may contribute in obtaining better corrections of the wet tropospheric path delay in InSAR signals. This will enhance the coherence and will allow the application of InSAR in a wider range of applications.
We have compared the InSAR and GPS data at Bologna (urbanized area) and Medicina (agricultural area), in northeastern Italy, where two permanent GPS stations of the University of Bologna are operational since mid 1999 and 1996 respectively. 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 was applied to a number of repeated CSK strip map SAR images acquired over a 40x40 square km area encompassing the two towns mentioned above. The results of this work demonstrate on the one hand the CSK capabilities to operate in a repeated interferometric survey mode for measuring ground deformation with millimeter accuracy in different environments. On the other, the comparison of the differential height between the two stations derived with the GPS and the InSAR data, using both acquisition geometries, is satisfactory.
Elevation, ground deformation and atmospheric artifacts were estimated in correspondence of the identified PS and compared with the GPS measurements carried out at the same acquisition time by the permanent stations at Bologna and Medicina. The comparison of the differential height between the two stations shows the sensitivity of the GPS height solution to the length of the observation interval. The vertical dispersion achieved by GPS is higher than that achieved by PS InSAR, as expected; however, a similar linear trend appears in the results of both techniques.
The comparison of differential tropospheric delays has been carried out. Two GPS solutions derived with different session length and data acquisition rate were considered. The InSAR results were those relevant to two PS located at a very close distance from the GPS stations. These are representative of the majority of PSs identified around the two stations. A similar behavior is present in the results achieved by both GPS and PS-InSAR techniques, despite of expected differences due to the almost instantaneous nature of the PS-InSAR estimates compared to the GPS 5-min averaged results.