SAR interferometry analyses and experiments with COSMO-SkyMed

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Abstract

The new X-band SAR missions provide SAR images characterized by a much higher resolution, opening new possibilities for SAR interferometry. Thanks to the high resolution it is expected to find a larger number of coherent points or persistent scatterers per unit area, resulting in more detailed and accurate measurements by means of SAR differential interferometry techniques.

Among the other characteristics, COSMO-SkyMed, the new Italian X-band SAR mission, is characterized by a very short revisit time (4 days with the same look angle when the 4 satellites will be completely deployed), which makes possible to reduce the interval between two observations, with a great advantage for ground displacement monitoring. In addition, COSMO-SkyMed has the capability to perform operationally both left and right looking observations, which can allow discriminating vertical and horizontal terrain displacements measured by SAR interferometry.

Two of the COSMO-SkyMed satellites are currently located in the so-called tandem-like configuration (one day apart), which make possible to observe fast changing phenomena and, in some conditions, to realize digital elevation models (DEMs). In the future two of the satellites can also put in the tandem configuration (few seconds apart), which will make possible to realize high quality DEMs.

In this work, the potentials of SAR interferometry with Cosmo-SkyMed are discussed. Analyses and experiments with both spotlight and stripmap COSMO-SkyMed data are shown. A comparison between the previous medium resolution SAR system and the COSMO-SkyMed data are also reported in order to evaluate the differences and the improvements brought by the Italian constellation. Finally, new and/or improved methodologies (like wide-band interferometry) that allow better exploiting the characteristics of the new high resolution data are discussed.

The obtained results show that Cosmo-SkyMed is a very effective system for SAR interferometry. In particular, the higher spatial resolution and the shorter revisit time largely compensate the possible drawbacks on coherence, atmospheric effects, measurable terrain velocity that could be caused by the shorter wavelength (X-band) with respect to C-band systems.