Applying PSI and Tomographic techniques using Radarsat-2 Spotlight data; a case study for Edmonton area

Valentin Poncos[(1)], John Dehls[(2)], Gianfranco Fornaro[(3)], Diego Reale[(3)]

(1) University of Calgary, Alberta, Canada, viponcos@ucalgary.ca

(2) Alberta Geological Survey, Edmonton, Canada, John.Dehls@ercb.ca

(3) IREA – CNR, Naples, Italy, fornaro.g@irea.cnr.it

Persistent Scatterers Technique (PSI) [1] is a well established tool for the monitoring of urban areas. It has been extensively used for the monitoring of cities with ERS, ENVISAT and Radarsat-1 medium resolution data.

The city centre of Edmonton consists of an agglomeration of high-rise buildings which return a radar signal with a good Signal to Clutter Ratio but also generate extensive layover areas. With the Radarsat-2 Spotlight mode, at a resolution of 1.8 meters in slant range and 0.5 meters in azimuth, the potential of accurate monitoring of very local areas is maximized; in the same time, the layover effects become very extensive and a large number of potential radar targets visible at the Spotlight resolution cannot be actually detected with PSI which is limited by the assumption that only one persistent scatterer per pixel is present in each of the analyzed image pixels.

SAR tomography [2], which was originally developed for the reconstruction of the vertical scattering of layers in forest areas, has been recently proposed as an alternative to PSI techniques for the separation of scatterers affected by layover effects. Experiments on medium resolution (ERS) data has shown, on available medium resolution data, the capability of SAR tomography to detect typical layover effects characterized by a combination of two point targets occurring, for instance from a building and another from the surface in front of the building or from two buildings. Even more the monitoring of interfering targets has been proven to be possible via the use of the Differential SAR tomography technique, which is an extension of the classical SAR tomography [3] [4] technique.

Tomographic techniques are based on the resolve power of an aperture antenna synthesized in the vertical direction from the baseline values of multiple acquisitions. With this regards, Radarsat-2 tends to have a higher baseline spread, thus increasing the resolution of tomography.

n this work results of PSI and Tomographic analysis on the city of Edmonton with Radarsat-2 spotlight data will be shown. In particular, due to the availability of a reduced number of acquisitions, we focus on the aspects related to the target localization in elevation direction, leaving monitoring aspects to future studies.

Also, a comparison of such results with those obtained with Terra-SAR X Spotlight data on the same area will be shown.

References

[1] A. Ferretti, C., Prati, and F. Rocca, “Nonlinear subsidence rate estimation using the permanent scatterers in differential SAR interferometry”. IEEE Trans. Geosci. Remote Sens., vol. 38 (5), pp.2202-2212, 2000

[2] G. Fornaro, F. Serafino, and F. Lombardini, “3D Multipass SAR Focusing: Experiments with Long-Term Spaceborne Data”, IEEE Trans. Geosci. Remote Sens., vol. 43, pp. 702-712, 2005.

[3] F. Lombardini, “Differential Tomography: a New Framework for SAR Interferometry”, IEEE Trans. Geosci. Remote Sens., vol. 43, pp. 37-44, 2005.

[4] G. Fornaro, D. Reale, F. Serafino, Four-Dimensional SAR Imaging for Height Estimation and Monitoring of Single and Double Scatterers, IEEE Trans. Geosci. Remote Sensing, vol. 47, pp: 224 – 237, 2009