

TERRASAR X-BAND INSAR OBSERVATIONS IN URBAN AREAS

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SAR (Synthetic Aperture Radar) has ability to detect subtle surface movement at the scale of millimeter to centimeter. TerraSAR-X is new radar satellite operated at X-band, multi polarization, and multi beam mode. Compared with C-band or L-band SAR, the X-band system inherently suffers from more temporal decorrelation due to short wavelength (3.1 cm), but is more sensitive to surface deformation monitoring due to short wavelength and high spatial resolution (1m-3m).

Many urban areas are experiencing land subsidence due to water, oil and natural gas withdrawal, underground construction, sediment compaction, and so on [1-3]. Monitoring of surface deformation, especially in urban areas, is valuable for effectively limiting damage areas [4]. In addition high accuracy and spatially dense subsidence map can be achieved by X-band InSAR observation, promoting identification and separation of various subsidence processes and leading to enhanced understanding via mechanical modeling.

The Roi_Pac was utilized for interferometric processing of TerraSAR-X SSG data. Although the Roi_Pac was originally developed and distributed by JPL [5], we modified many steps in order to improve the performance, to make it more robust in very flat area and mountainous area, and to deal with the data with inaccurate orbit such JERS-1 and RADARSAT-1. Fig. 1 shows the flowchart of the modified Roi_Pac, which was used for all steps of radar interferometry using TerraSAR-X data. The most special consideration on the

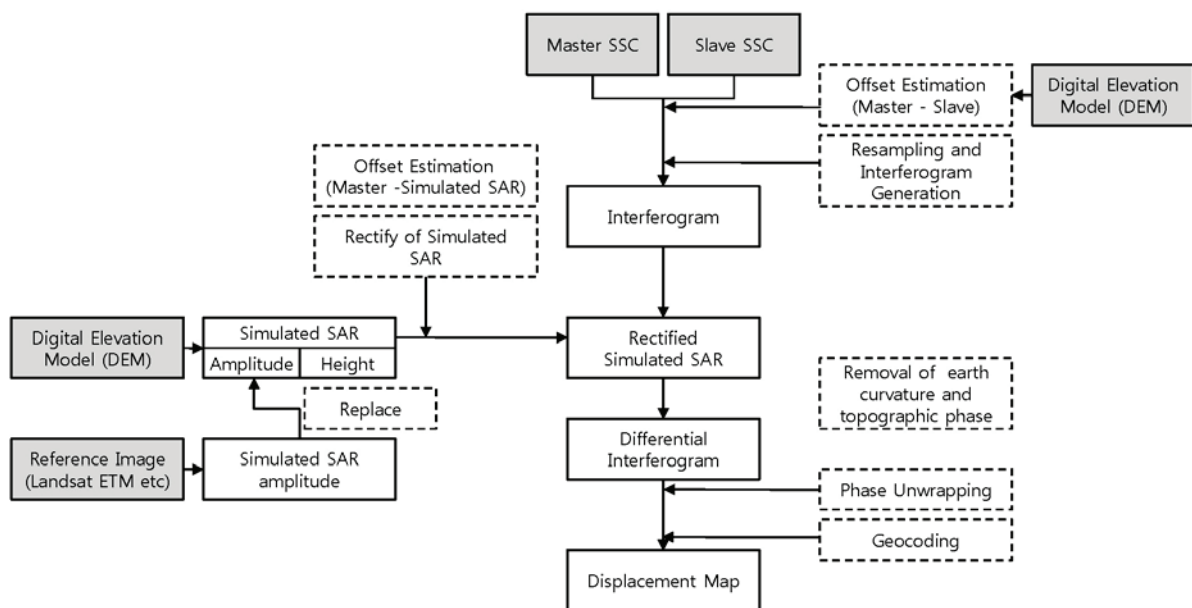


Fig. 1. Flowchart of differential SAR interferometric processing used in this study.

processing of our data set is of offset estimation between master image and simulated SAR image derived from DEM (Digital Elevation Model). In a gently undulating area such as New Orleans, co-registration often failed due to the lack of image contrast of simulated SAR image. Amplitude value of simulated SAR only represents the geometric effect of backscattering factor, which is calculated from input DEM. A reference image such as pre-geocoded SAR image or ortho-photo image can be used as pseudo-simulated image. Here we used Landsat ETM panchromatic ortho-rectified image [6]. The 1-arc NED DEM over New Orleans in USA, provided from the USGS website (<http://seamless.usgs.gov>), was used to subtract topographic phase from interferogram.

Persistent scatterer (PS) technique is also very important tools in X-band satellite system for ground deformation monitoring because phase quality at PS is much more reliable than other distributed scatterers. We will apply the PS technique to TerraSAR-X SAR data acquired at New Orleans in USA. Until now, twelve TerraSAR-X SAR data for PS analysis were acquired at descending track 158 (Table 1 and Fig. 2). In this study we will introduce InSAR and persistent scatterer InSAR results using new TerraSAR-X SAR data for surface deformation monitoring in urban areas. Our analysis will provide useful tests for X-band SAR interferometry technique in urban areas using persistent scatterer, which is also useful for the first Korean X-band SAR satellite, KOMPSAT-5.

Keywords: TerraSAR-X, KOMSAT-5, interferometric SAR (InSAR), persistent scatterer, subsidence, urban area

Table 1. TerraSAR-X data list over New Orleans, USA.

No	Date	Sensor mode	Polarization	Relative orbit	Beam mode
1	2008-02-11	Stripmap	HH	158(D)	strip_005
2	2008-03-15	Stripmap	HH	158(D)	strip_005
3	2008-09-07	Stripmap	HH	158(D)	strip_005
4	2009-02-08	Stripmap	HH	158(D)	strip_005
5	2009-03-13	Stripmap	HH	158(D)	strip_005
6	2009-04-15	Stripmap	HH	158(D)	strip_005
7	2009-05-18	Stripmap	HH	158(D)	strip_005
8	2009-06-20	Stripmap	HH	158(D)	strip_005
9	2009-07-23	Stripmap	HH	158(D)	strip_005
10	2009-08-25	Stripmap	HH	158(D)	strip_005
11	2009-09-27	Stripmap	HH	158(D)	strip_005
12	2009-10-30	Stripmap	HH	158(D)	strip_005



Fig. 2. TerraSAR-X SAR backscatter image of New Orleans.

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