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Development of InSAR processing tools in NIED

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Synthetic aperture radar (SAR) became one of the useful tools for crustal deformation detection. Recently, InSAR processors which can be used freely in scientific research (e.g., ROI_PAC, GMTSAR, and Doris) were released, and enabled anyone to do crustal deformation detection by InSAR. Especially, algorithm of two-pass differential InSAR analysis matured, and it enabled anyone to obtain almost same results. On the other hand, advanced InSAR analysis methods, e.g., time-series analysis, have been recently used to detect precise crustal deformation. However, many issues to improve remains in such analyses. In order to research on improvements for such analysis, we are developing InSAR processor.

In this InSAR processor, general procedure is adopted. (1) Format conversion of SLC and creation of parameter files. (2) Rough co-registration of two SLCs considering parallel shift only. (3) Estimation of affine transformation coefficients using the accurate matching method by Tobita et al. (1999). (4) Resampling of SLC. (5) Generation of the initial interferogram. (6) Simulation of a SAR intensity image and estimation of translation tables between geodetic and radar coordinates based on DEM. (7) Co-registration between simulated and observed SAR intensity images. (8) Correction of translation tables. (9) Simulation of the orbital and the topographic phase components. (10) Generation of differential interferogram. (11) Applying interferogram filter (Goldstein and Werner (1998) or Baran et al. (2003)). (12) Geocodeing.

Test analysis for this processor was carried out using PALSAR data pair about the earthquake which occurred in the south-eastern Iran (Path:559, Frame:550, 2010/9/30 - 2010/12/31). In this analysis, we used SLC images generated from SIGMA-SAR which was developed by Dr. Shimada of JAXA. Analyzing this data pair using SIGMA-SAR and GAMMA processor, results that the orbital and the topographic phase components don't remain were obtained. The result by this processor was almost consistent with them about crustal deformation component for the earthquake. Furthermore, it seems that coherence is almost the same. However, the orbital phase component with phase change of one cycle in the full scene remained.

Some issues which need to improve of algorithm remain in this processor, and improvement of them is next issue. Additionally, we are planning integration of some algorithms which were developed in NIED, the atmospheric delay simulation (Ozawa and Shimizu, 2010), time-series analysis using multi-track interferograms (Ozawa and Ueda, 2011), and so on.