Overview of Applications of Persistant Scatterer InSAR in Taiwan

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Abstract

Geodetic tools such as leveling, Global Positioning System (GPS), and Differential Interferometry (DInSAR) have, in the past decade, become very important source of data to uncover the surface deformation and tectonic activities. Researchers have been deploying these tools to obtain average converging velocity between the Eurasian plate and Philippine Sea plate, surface deformation related to seismic event, subsidence related to groundwater withdrawal, …etc. Among these tools, leveling and GPS have high precision while continuous GPS has good precision as well as very high temporal sampling rate. DInSAR, on the other hand, has very high spatial sampling rate, regular recurring acquisition of radar images, theoretical cemtimeter-scale precision, which is very attractive in studying local surface deformation and sudden events.

However, along with other geodetic tools, DInSAR suffers from various sources of errors such as atmospheric phase delay (APS), DEM residual, spatial and temporal decorrelation and make the technique difficult to apply in many regions. These error sources would cause two radar images to decorrelate and generate noises rather than signals. In addition, APS could mask the deformation signals and create uncertainties in the interferograms. In order to reduce the errors and decorrelation in radar signals, the use of persistant scatterer was proposed. The concept behind this is to use radar signals from points that are coherent throughout the entire database. Using the selected persistant scatterer and discard signals from areas that change constantly would vastly improve the quality of the raw signals. Combining these raw signals, information about the orbital normal baseline, and some assumption about the atomspheric phase delay, it is possible to jointly evaluate the effect of APS and DEM residual in the raw signals. By removing these errors from the raw signals, deformation signals can be extracted.

Currently, we are dividing our works in two areas, first is to deploy man-made persistant scatterer, corner reflectors, across the Tatun volcano group in northern Taiwan. Signals from natural and artificial permanent scatterers will be extracted in

order to derive the surface deformation signals in the highly vegetated area. Since some of these corner reflectors will be collocated with GPS, signals from corner reflectors and GPS can be directly compared to each other for validation.

Furthermore, we use a test site in Yunlin County to test out our own algorithm for retrieving signals from persistant scatterers. Since current researches in PSInSAR use their own algorithms that may not extract persistant scatters effectively in highly vegetated area such as Taiwan, we set out to develop the algorithm from the ground up. Our preliminary results indicated that different algorithm extract different persistant scatterers from the radar images and would ultimately affect the results. Algorithms concerning unwrapping of radar signals and removal of APS and DEM residual could also effect the results. Our final results will be compared to the geodetic data (GPS and leveling) already deployed from the study area for further validation and improving our knowledge on styles and amount of the surface deformation in this area.