DEFORMATION MONITORING BY LONG TERM D-INSAR ANALYSIS IN THREE GORGES AREA, CHINA

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ABSTRACT

Three Gorges Dam, in Hubei province, China is considered the largest dam in the world. The dam began to work in 2003; as a consequence, the water level of the Yangtze River in Three Gorges area raised more than 100 meters. Then, the largest man-made reservoir (600 kilometers long) was formed in the upriver part of the dam. Although lots of benefits come from the power generation and flood control functions of the project, the raising of the water changed the natural terrain and flooded the basements of the mountains. Moreover, due to the weight of the reservoir on the riverbed, the area becomes instable. The regional assessment of landslide impact in the project upriver areas has been reported in preview studies [1]. In order to get direct evidence about the impact of the project on the ground motion, it’s necessary to measure and analyze the deformation in this area not only in recent years but also before the dam was built. Temporal Differential Interferometric Synthetic Aperture Radar (D-InSAR) analysis is the most suitable tool for getting measurements in such case [2, 3].

It is well known that the geometrical and temporal de-correlation are the main limitations of D-InSAR application with repeat-pass satellite mode [4]. Even though the coherence of two radar signals is high enough, the atmospheric phase screen (APS) difference between master and slave images still reduces the accuracy of the final results [5]. Aiming at the above restrictions, Ferretti et al. presented the Permanent Scatterers Technique (PS) [6]. Instead of extracting information from the whole SAR images, PS InSAR firstly identify certain natural point-like stable reflectors i.e. PSs from long temporal series of interferometric SAR images. The coherence on PS is good enough to obtain sub-meter accuracy DEM and millimetric terrain motion [7]. The applications of PS InSAR technology have been successfully achieved especially in urban areas [8]. In order to measure the crustal deformation in non-urban areas, A. Hooper developed a new Stanford Method for Persistent Scatterer (StaMPS) [9].

For the problem at hand, the objective of this paper is to present the preliminary results of deformation monitoring in Three Gorges area by long term D-InSAR analysis. The data are acquired from ERS and Envisat satellites in the time span from 1993 to 2007. More than 70 scenes of SAR images in two tracks of Badong test site are processed by StaMPS software. The results from ERS data i.e. before the Dam was built and Envisat i.e. after the dam was built are compared. Classical Permanent Scatterers Technique analysis is also carried out with the same data set. Two aspects are considered in this paper.

1) The results from StaMPS and classical Permanent Scatterer Technique are compared using the same focused and co-registered data set. The results from these two techniques are analyzed in this non-urban test site.

2) From the average reflectivity and spatial coherence maps of ERS and Envisat data, the urban changes due to the population migration can be seen. Since the number of ERS images is much fewer than the images from Envisat, a reliable deformation trend comparison is rather difficult. By now, only preliminary results are shown.

REFERENCES


