

Monitoring landslides in the Three Gorges Area using TerraSAR-X data

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Abstract

The Three Gorges Dam is the largest construction project on the planet which is due to be completed until 2009. The 2.3km long dam will create a 660km long reservoir, drowning over 100 towns. It is believed that the weight of water will lead to an increasing frequency of landslides. The effects of these landslides should be able to be observed from space in the microwave region of the electromagnetic spectrum. In theory, land slippage prior to landslides should be observable using radar interferometry and possibly using phase correlation. The launch of the German TerraSAR-X, with high resolution (1m) at X-band, offers a unique opportunity to study this region as the dam is being completed.

Our main goal is to monitor land subsidence in the Three Gorges area using TerraSAR-X data using natural targets. We are mapping the displacement associated with landslides along the banks of the Yangtze using both interferometry and sub-pixel correlation methods. Firstly, the ground deformation is being mapped by means of interferometry over the Three Gorges area. TerraSAR-X's resolution is up to 1m and its repetition rate is 11 days. The high resolution should ensure improved accuracy of the results and the high frequency of acquisition should allow longer time series to be obtained over susceptible areas along the riverbank. Using both INSAR phase changes and phase correlation will permit different areas to be monitored. Secondly, the offset associated with land subsidence will also be retrieved using sub-pixel correlation of TerraSAR-X amplitude images. InSAR (Interferometric SAR) only provides one component of the displacement vector which is along the radar look direction. It is a notable merit of sub-pixel correlation method that it can calculate both North-South and East-West components of motion. As the resolution of this method is claimed to be up to 1/100 pixel, its result should be comparable to that of the interferometry. Also, it can provide an effective constraint to the analysis of the landslides along the banks of the Yangtze River.

Key Words: Three Gorges Dam, Landslides, InSAR, Sub-pixel Correlation, TerraSAR-X