Stability analysis of Masjed-Soleyman earth-fill dam using high-resolution satellite radar images

L. Emadali[1], M. Motagh[2]

1- Department of Surveying and Geomatics Engineering, University of Tehran, Tehran, Iran

2. GFZ German Research Center for Geosciences, Department of Geodesy and Remote Sensing, Potsdam, Germany

A dam is a barrier that impounds surface water or underground streams. The reservoirs created by dams not only suppress floods but also provide water for various needs including agricultural irrigation, human consumption, industrial use, aquaculture, navigability and power generation. Earth-fill dams are constructed as a simple embankment of well compacted earth. A zoned-earth dam has distinct parts or zones of dissimilar material, typically a locally plentiful shell with a watertight clay core.

Deformation is unavoidable for any dam and thus, Monitoring is an essential component of dam after construction and during operation. In general, conventional methods for evaluating dam deformation are able to acquire high-precision measurements in discrete points; however, high financial and labor costs and time consuming are unavoidable. On the other hand, Interferometric Synthetic Aperture Radar (InSAR) helps us to derive surface deformation over a wide area by analyzing phase difference between two or more SAR images.

In this research, we present preliminary results of deformation analysis at Masjed-Soleyman earth-fill dam on Karoon River in southwest of Iran using high-resolution SAR images acquired by TerraSAR-X satellite. Masjed-Soleyman dam is a large earth-fill dam with a large size central clay core that has been constructed in 2000. Dam has a vertical clay core and its height is 177 m. 13 SAR images in a descending orbit and 6 SAR images in an ascending orbit were used to assess dam stability. All images were acquired in spotlight mode and were processed by the Small BAseline Subset (SBAS) technique using high-resolution TanDEM-X Digital Elevation Model (DEM) to derive deformation maps. The results are compared to independent measurements obtained from classical geodetic surveys for quality assessment.