

Aswan High Dam structural stability analysed by Persistent Scatterer Interferometry from 2004 until 2010.

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Detection of Sinkhole Activity in Central Florida with High Spatial-Resolution InSAR Time Series Observations

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Central Florida's thick carbonate deposits and hydrological conditions make the area prone to sinkhole development. Sinkhole collapse is a major geologic hazard, threatening human life and causing substantial damage to property. Detecting sinkhole deformation before a collapse is a difficult task, due to small and typically unnoticeable surface changes. Most techniques used to map sinkholes, such as ground penetrating radar, require ground contact and are practical for localized (typically 2D, tens to hundreds of meters) surveys but not for broad study areas.

In this study we use Persistent Scatterer (PS) time series analysis of Interferometric Synthetic Aperture Radar (InSAR), which is a very useful technique for detecting localized deformation while covering vast areas. We acquired SAR images over four locations in central Florida in order to detect possible pre-collapse or slow subsidence surface movements. Our data consists of TerraSAR-X and COSMO-SkyMed images with pixel resolutions ranging between 25cm and 1m. To date, we have obtained four datasets, each covering a period from March of 2015 to June of 2016 over a total of roughly 2200 km². We generate PS time series for each of the four datasets using DORIS and StaMPS software packages. Preliminary results indicate localized deformation in the range of 5mm/yr in some houses and commercial and apartment buildings in two of the sites. Deforming areas vary in size from approximately 10m x 20m of a single house to 60m x 60m for a commercial building. Future work will include the expansion of the PS time series beyond June 2016 and ground truth surveys with ground penetrating radar for verifying the space-based sinkhole activity detection.

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The Aswan High Dam, Egypt, was built in the 1970s and is one of the biggest dams in the world. It stopped the seasonal flood of Nile river, allowing the urban expansion of cities/villages, full year cultivation and produces \$10 milliard KWH annually. The dam is located in an area where several earthquakes (< ML 6) occurred from 1981 to 2007.

Here we want to identify any potential damage that could be caused to the dam, and assess its overall structural stability using Persistent Scatterer Interferometry (PSI). We used Envisat data, from a descending orbit and acquired between 2004 and 2010.

Preliminary results show that small rates (maximum around 3mm/year in the satellite Line-Of-Sight) of deformation can be identified, which implications must be further investigated. In addition, the results indicate that the Aswan High Dam presents two different behaviors. The western part shows differential subsidence relative to a reference point selected outside the dam, while the eastern part, corresponding to the electrical power plant, shows a slight up-lift. Both phenomena need further investigation to assess if the detected movements correspond to the expected vertical behavior for this kind of mega-structures.