

# Radar based Dam Monitoring – Strong Alternative to Terrestrial Surveying

Case Study



## Challenge

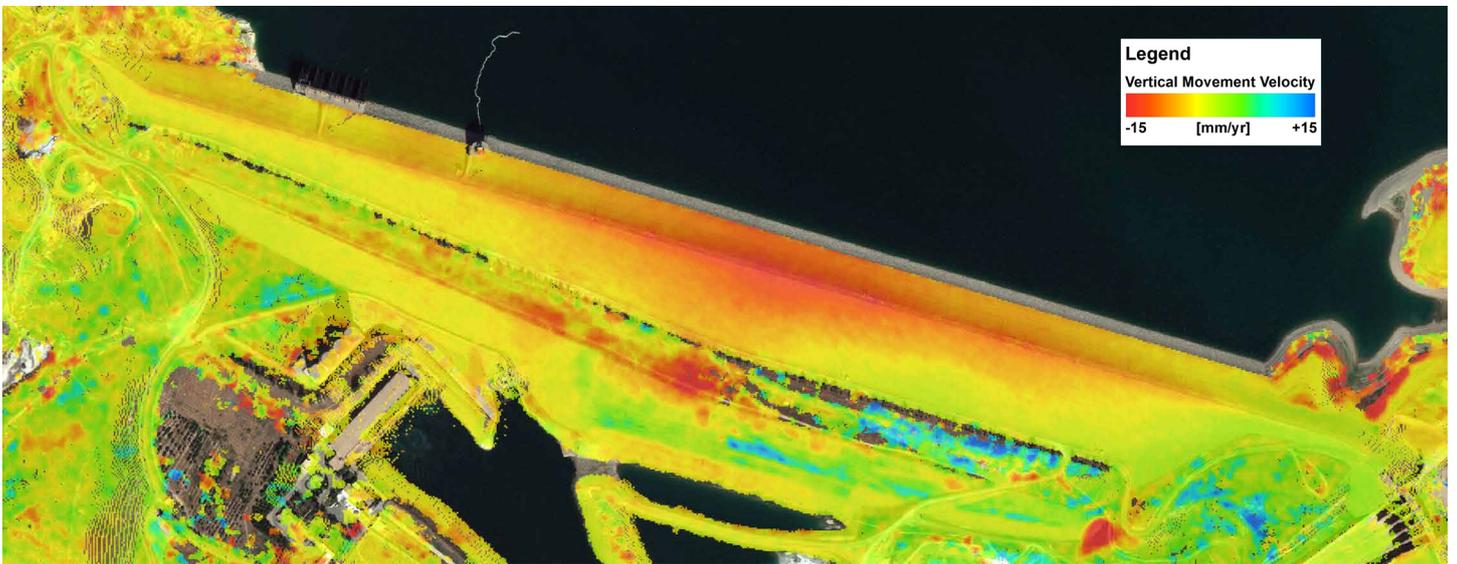
Collection of surface and object stability information in a risky environment.

## Method and Results

Interferometric (InSAR) Data Stack Analysis. Precise object and surface motion information with regular updates.

## Benefits

Achieved results show a number of anomalies with a very high precision – remotely collected without any risk to staff.



## Challenge

The Mosul Dam was built in the early 1980s and is the largest dam in Iraq. It is located on the Tigris river, upstream of the city of Mosul. The purpose of the dam is to generate hydroelectricity and provide water for downstream irrigation. At full capacity, the structure holds around 12.5 million cubic metres of water and provides electricity to the 1.7 million residents of Mosul.

The dam is well known for its instability, as the riverbed is made of unstable soft soil and gypsum, a mineral that dissolves as water runs through it. The structure has to be grouted daily in order to keep water from seeping through.

Concerns over the dam's instability have led to major remediation efforts. Nevertheless, independent and objective risk evaluation needs to be continuously completed in order to support local operators, in case of any irregular surface motion to avoid any serious incidents occurring.

## Solution and Results

Airbus provided a TerraSAR-X based Interferometric (InSAR) Analysis to the client, using >30 TerraSAR-X high-resolution spotlight scenes, covering a one-year time period between April 2015 and April 2016. The data has been processed using a time series interferometric approach. Additionally, the World DEM™ Digital Elevation Model, which is exclusively available from Airbus, was used to introduce accurate dam heights and achieve results of maximum precision.

The results showed a number of surface motion anomalies, which were either visible through pure vertical displacements of the surface (e.g. through underground dissolution) or lateral motion of the dam crown induced by water pressure of the reservoir and/or underground instabilities. Airbus was able to demonstrate the suitability of the space-borne approach by obtaining information about surface motion in the Mosul Dam area. The high precision and reliability of this Radar-based analysis provides a complementary solution for terrestrial surveying of larger objects, especially in environments that carry risk.

## Applicability

Radar-based (TerraSAR-X/PAZ) InSAR Analysis are a sound complement to terrestrial surveying, whenever information on surface or object motion is required. Nevertheless, it is also an alternative in adverse conditions such as remoteness, climate, wilderness or when the social/political environment cause unwarranted risks for operating staff. Furthermore, the space-based solution offers a cost-saving potential due to significantly reduced effort and time for staff mobilization and related safety measures.

## Benefits

- Efficient and precise information about surface instability with millimetric precision, available in near real-time — ideal for guiding countermeasures like concrete injection.
- Health, security and environmental (HSE) aspects are fulfilled due to remote character of measurements. No on-site staff involvement and risk exposure, and no impact on the environment.
- Wide area overview of surface motion also allows detection of non-predicted displacements potentially relevant for risk evaluation.