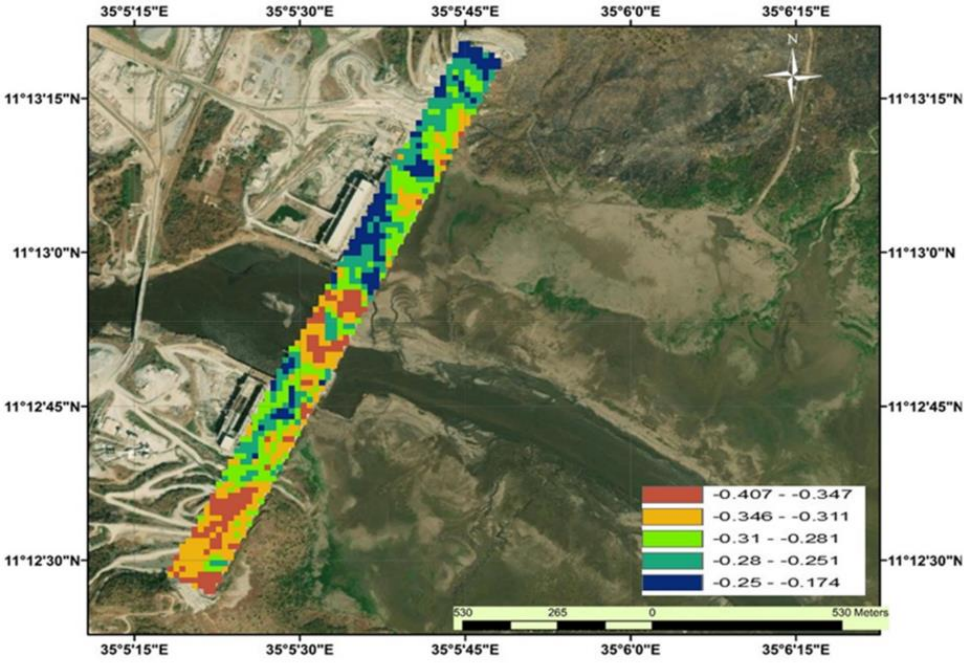
EO-FIN

Dams' Safety



Accumulated vertical displacement from January 2017 till July 2021 over The Grand Ethiopian Renaissance Dam in Ethiopia using Sentinel-1. (Source: El-Askary, H., Fawzy, A., Thomas, R., Li, W., LaHaye, N., Linstead, E., Piechota, T., Struppa, D. and Sayed, M.A., 2021. Assessing the vertical displacement of the grand Ethiopian renaissance dam during its filling using DInSAR technology and its potential acute consequences on the downstream countries. Remote Sensing, 13(21), p.4287.).

Product Category

☐ Land Use	☐ Natural Disaster	☐ Coast Management	■ Earth's Surface Motion
☐ Land Cover	☐ Climate Change	☐ Marine	

Financial Domain(s)

☐ **Investment management** ■ **Risk analysis** ☐ **Insurance management** ☐ **Green finance**

User requirements

UN37: Projection of risk to portfolio assets into future

Description

Dams are significant infrastructure investments, which involve substantial financial commitments. Ensuring dam stability is crucial to safeguard these investments and prevent potential financial losses due to failure or costly repairs. Radar-based remote sensing like SAR can detect and monitor land subsidence near dam sites. SAR-related technologies like InSAR and DInSAR can identify and measure ground deformations over time (vertical and horizontal), enabling the identification of potential subsidence that may affect dam safety. Continuous monitoring of subsidence can help assess the stability of the surrounding area and detect any subsidence-related risks that could impact the dam's integrity.

Spatial Coverage Target

Dams' Surrounding Area

Data Throughput

Rapid tasking	☐ High	■ Low
Data availability	■ High	☐ Low

Product specifications	
Main processing steps	Time series SAR data covers the dam, and its surrounding area can be obtained from different sources such as Copernicus Sentinel-1 or commercial providers such as TerraSAR-X with the selection based on factors like cost, spatial and temporal resolutions required for the application. Then, SAR data should be pre-processed to correct for various artifacts and errors. This step includes calibration, atmospheric corrections, and removing noise caused by factors like topography and vegetation. By comparing the phase components of at least two SAR images captured in different times by using different DIn-SAR or PSI techniques, it is possible to calculate deformations which had occurred between sensing periods.
Input data sources	Optical: N.A Radar: Sentinel-1, VHR images from different sources like ICEYE, Capella space, Umbra, and TerraSAR-X Supporting data: N.A
Accessibility	Sentinel-1: freely and publicly available from ESA. VHR imagery: commercially available on demand from EO service providers.
Spatial resolution	Sentinel-1: 20 m SAR VHR: ≤ 3 m
Frequency (Temporal resolution)	Sentinel-1: 6 days SAR VHR: Daily
Latency	≤ 1 day
Geographical scale coverage	Globally
Delivery/ output format	Data type: Raster File format: GeoTIFF
Accuracies	Thematic accuracy: 1 to 5 mm Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ SAR signal coherence can be reduced in vegetated areas, making it challenging to monitor dam stability in regions with dense vegetation. ■ Changes in the dam environment, such as construction activity or vegetation growth can cause temporal decorrelation, reducing the coherence needed for accurate deformation measurement. ■ SAR data might not capture localized deformation patterns if the area of interest is smaller than the SAR pixel size.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Ample Knowledge: Ample