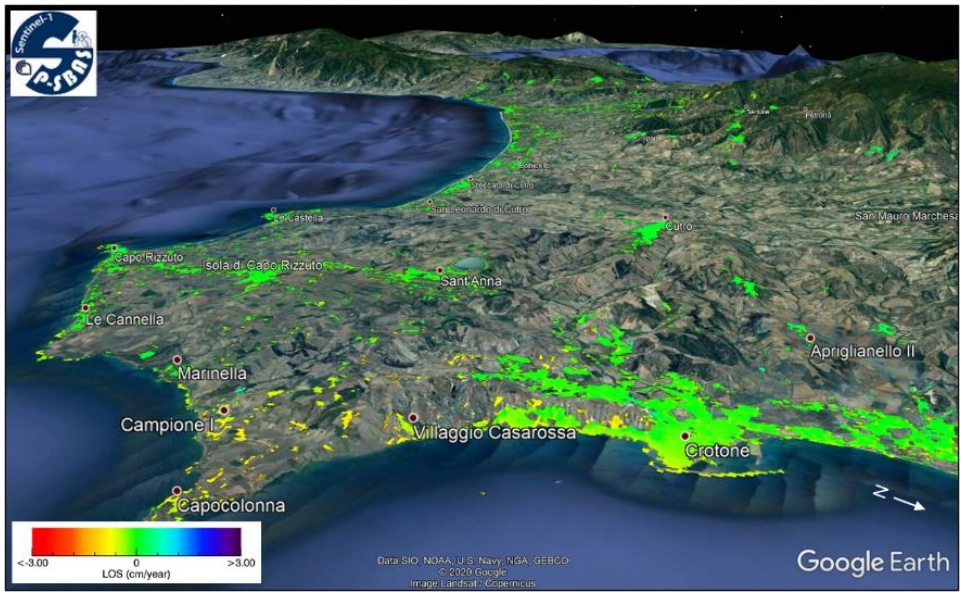
EO-FIN

Monitor Slow-Moving Subsidence



Google Earth output file obtained after P-SBAS InSAR processing of the 2014–2020 Sentinel-1 IW SAR ascending mode stack: detail over the area of Crotone province, southern Italy. (Source: Cigna, F. and Tapete, D., 2021. Sentinel-1 big data processing with P-SBAS InSAR in the geohazards exploitation platform: An experiment on coastal land subsidence and landslides in Italy. Remote Sensing, 13(5), p.885.).

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

Slow-moving subsidence can pose substantial risks to properties and investments. Monitoring enables financial institutions to identify properties at risk, assess potential losses, and make informed decisions about lending, insurance, and investment activities. SAR interferometry, specifically the technique called Interferometric Synthetic Aperture Radar (InSAR), is widely used for subsidence monitoring. InSAR uses multiple SAR images acquired over time to measure small changes in the Earth's surface (vertical and horizontal displacements). It can detect millimetre-scale ground deformation, making it suitable for monitoring slow-moving subsidence. In addition, Differential SAR Interferometry (DInSAR) compares two or more SAR images taken at different times to generate an interferogram, which highlights surface displacement. By subtracting two interferograms, DInSAR can detect and quantify slow subsidence rates, even in areas where ground deformation is challenging to observe visually.

Spatial Coverage Target

Asset level

Data Throughput

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

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Product specifications	
Main processing steps	Time series SAR data covers the extension of the asset 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 spatial and temporal resolutions required for the application. When dealing with known vulnerable locations that can be covered by a few images, VHR SAR imagery is suggested. However, for monitoring large areas, the use of Sentinel-1 data is recommended due to its free availability, larger swath width, and lower spatial resolution compared to commercial SAR imagery. Additionally, after detecting failures using Sentinel-1, utilizing VHR SAR imagery is advised to ensure higher accuracies. 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 PSI techniques (based on the application and area of interest) such as PS-InSAR and SBAS, it is possible to calculate ground 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&2: 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: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ In areas with varied topography and dense vegetation cover, analysing subsidence can be challenging due to the influence of terrain on measurements. ■ Local factors like soil composition, water table fluctuations, and geologic conditions can influence subsidence rates, leading to complexities in interpretation.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Ample Knowledge: Ample
Similar products	European Ground Motion Service from ESA