May 2022

# SENTINEL-1 MONITORS GEOHAZARDS TO SECURE CITIZENS HOMES

## A few years later

In the past few years, the solution continued its evolution. At the moment, the solution is being further developed under ESA PECS project SK6-20 Contract 4000137030 - Retrieval of Motions and Potential Deformation Threats using InSAR Geodesy (remotIO) elaborated by insar.sk Ltd. Moreover, a network of corner reflectors (CRs) for monitoring landslides in Slovakia is operated under a cooperation framework with Slovak University of Technology and State Geological Institute of Dionyz Stur.

***Dr. Matus Bakon, insar.sk Ltd***

| | TIER 1: SERVICE PROVIDER | TIER 2 PRIMARY USER | TIER 3 SECONDARY USER | TIER 4 END USER BENEFICIARIES |
|---|---|---|---|---|
| BENEFICIARIES | insar.sk Ltd; Slovak University of Technology | State Geological Institute; Central Slovakia Region | Private house/property owners; Road managers | Society and Citizens |
| SERVICES | Sentinel-1 | Mapping of ground movements affecting specific areas subject to mining; Precise displacement time series in mm/year ("a natural GPS network", dating back to 2014) | Monitoring of mass-wasting geo-hazards due to mining activities; Updated monitoring information on the stability of individual structures and infrastructure | Improved awareness on evolving and complex deformation processes as a consequence of active mining such as landslides, building falls, road disruptions or land subsidence |

Value chain definition following SeBS Methodology - https://earsc.org/sebs

## The space-based solution

This Copernicus-based solution was produced by a scientific entity for a Public Administration. In the past few years, there were significant performance/automation improvements such as the implementation with information deriving from the network of corner reflectors (CRs).

## The Usage Maturity Level

In the past few years, the UML has transitioned to the higher level UML=3. The main reason for this was recognised in the fact that new space-funds were allocated to uptake the space-based solutions into territorial practices, specifically ESA's Plan for European Cooperating States (PECS).

Thematic Area: CIVIL PROTECTION

Region of Application: TRENČIANSKY KRAJS

Sentinel mission used: S1

Copernicus Service used: –

Usage Maturity Level: 3

## Overall benefits

### ECONOMIC

- Reduction of risk has been registered

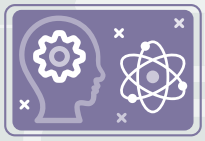
### INNOVATION

- There were positive market externalities

### ENVIRONMENTAL

No noticeable additional modification/impact on the functioning of the public administration nor on the lives of the citizens since 2018.

### SCIENCE



- The solution has enabled some technological advancement
- There was an increase in technical/scientific expertise related to Copernicus/EO within the PA

### REGULATORY

- There were improvements in the policy monitoring capabilities of the PA in charge

### SOCIETAL

- Civil security has improved

Benefits classification following SeBS Methodology - https://earsc.org/sebs

## Interesting facts...

Due to heavy precipitation in Slovakia in summer of 2021, the acceleration of the horizontal movement of more than 10cm has already been recorded for one station using CR technology. Responsible authorities have been duly informed and resilience measures have been implemented. Similar monitoring measurements are also conducted over dams, mining areas and other objects of strategic importance.

## Outlook to the future

In order to provide end-users with an operational deformation monitoring service with regular updates and a reliable warning system, quality control is imperative. For this reason, geodetic-grade quality of InSAR analysis (from the full range of satellite SAR sensors and terrestrial tools) are integrated to be cross-validated with satellite-derived measurements. The long term goal is to establish a robust service ecosystem capable of responding to a variety of precise engineering tasks. The service should be flexible and allow customized set-ups.

## Acknowledgements

Sentinel-1 data are provided by the European Commission and ESA under the free, full and open data policy. The authors would like to thank the State Geological Institute of Dionyz Stur, Hornonitrianske bane Prievidza, a.s. and Vodohospodarska vystavba, s.p.

## Contacts

**Dr. Matus Bakon |** matusbakon@insar.sk