

SENTINEL-1 MONITORS GEOHAZARDS TO SECURE CITIZENS' HOMES

Sentinel-1 enables operational monitoring of structures threatened by landslides and subsidence over the large area of the Upper Nitra region, Slovakia. Effectively, precisely and at low cost merit.

The challenge

Slope deformations are the most significant geohazards in Slovakia which cause extensive economic damage on an annual basis, seriously limiting the rational use of land and in some cases also threatening property and the health of residents in the affected areas.

Especially in the region of Upper Nitra, Central Slovakia, notable for its landslide susceptibility over 60% of the territory, which is further impaired by intensive coal mining activity.

Conventional in situ monitoring techniques provide only point-wise information of the landslide's activity, however, they lack efficient and timely updates. To reduce the risks, we need to respond to emergencies faster and more accurately over the entire region.

The space based solution

Monitoring of mass-wasting geohazards like landslides and land subsidence due to under mining has been marked by the new perspective thanks to the Europe's Copernicus programme Sentinel-1 radar satellites. Extended spatial coverage of this EO mission covers the entire Upper Nitra region spanning more than thousand square kilometres in a single image.

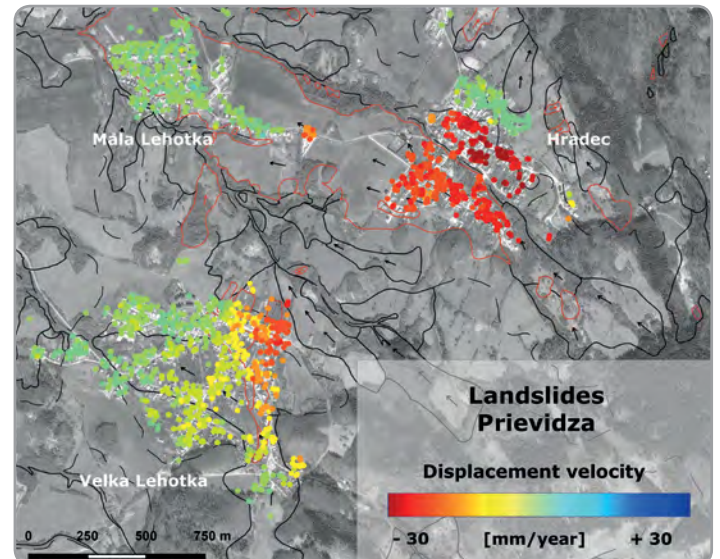
Using advanced radar interferometry technique InSAR and regularly utilising all radar images acquired by the Sentinel-1 pair over the desired area of interest, we can observe recent ground movements. As shown in an example image [above] of several villages in the Upper Nitra region, for every coloured point corresponding to the particular man-made structure or infrastructure, we derive precise displacement time series in millimetres per year, thus forming a "natural GPS network" with measurements going back to the end of 2014.

This way, we can remotely detect and monitor hundreds of objects endangered by landslide activity simultaneously, whilst being independent of cloud coverage or daylight thanks to the radar nature of the Sentinel-1 satellites. Moreover, the satellite's weekly revisit allows for frequent updates, thus empowering the operational capability of the technique.

Benefits to Citizens

Our emerging monitoring service based on Sentinel-1 EO data will provide continually updated information on the stability of individual structures and infrastructure, which can ensure advanced situation awareness during evolving and complex deformation processes like landslides, building collapses, road disruptions or land subsidence as a consequence of active under mining.

In comparison to labourious and costly in situ measurements, it brings unprecedented spatial coverage as well as guaranteed



Landslides detected over three villages in Upper Nitra region. Affected structures shown in red, stable in green.

Credit: Contains modified Copernicus Sentinel data [2018]

Thematic Area



CIVIL PROTECTION

Region of Application



TRENČIANSKY KRAJ

Sentinel mission used



S1

Copernicus Service used



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Usage Maturity Level



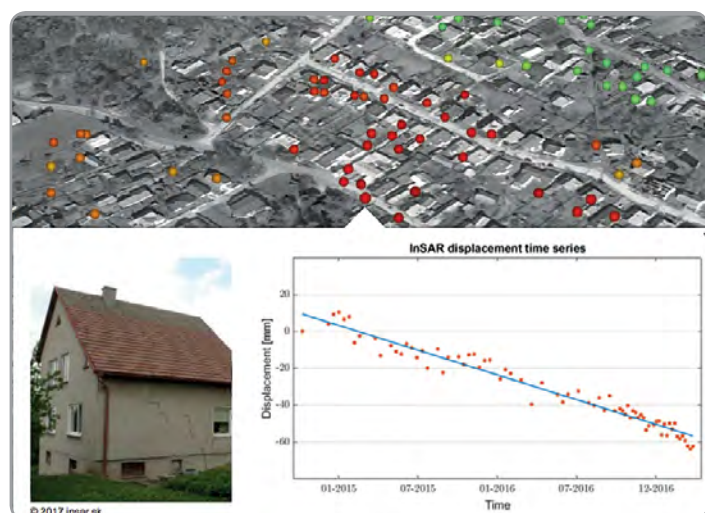
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updates and may, therefore, potentially reduce operating costs by several million euro. More detailed and frequent surveillance means better safety conditions for citizens, and as such can help identify and prioritise buildings requiring field inspection or repair work. All maintained without the prior need for equipment or human presence at the area of interest.

Such operational monitoring can help prevent emergency situations and economic losses due to structural damage, help to assess remediation works of the State Geological Survey, or assist with the responsibilities of the mining companies as well as regional authorities.

Outlook to the future

Sentinel 1 InSAR complements conventional ground-based landslide monitoring techniques. Once the presented service becomes fully operational, it can further extend its regional application capability to monitor cultural heritage (e.g. Bojnice castle), to help assess the complex environmental impact of under mining or become an integral part of the regional urban planning policy.



Detail of village Hradec in first figure: Displacement time series showing 3 cm/year subsidence over building disrupted by landslide. Each dot represents satellite's acquisition.

Credit: Contains modified Copernicus Sentinel data [2018]

“Thanks to Sentinel-1 we can monitor landslides threatening citizens' homes more reliably and with unprecedented detail.”

*Dr. Pavel Liscak,
State Geological Institute*

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ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication “**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**”, 2018, Edited by NEREUS, the European Space Agency and the European Commission.

The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains. The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.

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