

## MONITORING LANDSLIDE RISKS IN URBAN AREAS

*Copernicus Sentinel-1 SAR data were used to detect and monitor landslides in the urban area of Niscemi, Sicily, Italy.*

### The challenge

The Municipality of Niscemi, Italy, is a historic village, located in a hilly area in Sicily, affected by landslides. Amongst its institutional activities, on the theme of civil protection in case of landslides and/or subsidence phenomena, the municipality is in charge of the implementation of forecasting activities and risk prevention measures. There was a need to establish an early warning information service to support authorities in the prevention of possible risks to citizens and infrastructures and to find a cost-effective solution that does not require the installation of instruments or their maintenance which was suitable for low budget and time-restricted surveys.

Planetek Italia, with the agreement of the Municipality of Niscemi, activated the Rheticus® Displacement monitoring service over the Municipality area, to exploit Copernicus Sentinel-1 SAR data and Persistent Scatterers (PS) techniques for monitoring landslide risks in urban areas.

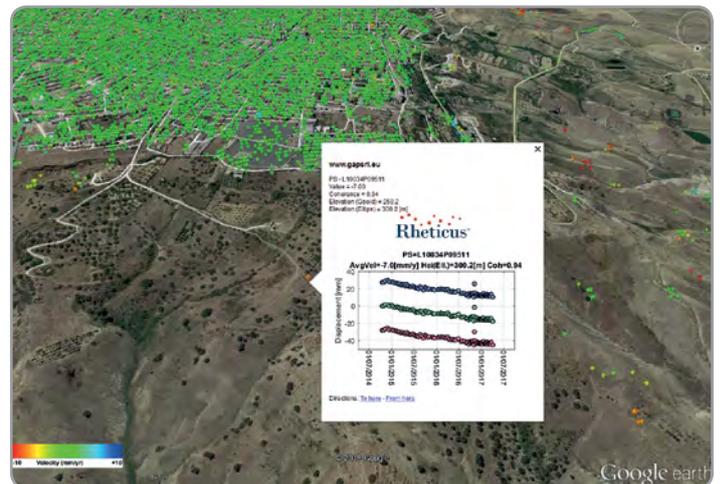
### The space based solution

Today, satellite surveys allow: the measurement of millimetric surface deformations; the study of the evolution of displacements in time; the processing of periodic trends, based on a series of acquired data, to identify non-linear movements; the determination of horizontal and vertical displacement speed of points; the performance of multi-scale analyses; and the integration of other data sources. The Rheticus® Displacement service was able to process satellite data over the area and to provide thematic maps, dynamic geo-analytics and pre-set reports to the Municipality of Niscemi. For the assessment of the landslide trend over the Municipality, a time series of past movements was required to build a past and future trend scenario. Displacement was assessed

over the subscribed area of interest by means of measurements of velocity, acceleration and coherence of Persistent Scatterers (PS). PS were identified and their velocity/acceleration measured through the extensively tested SPINUA® algorithm applied using Sentinel-1 radar data.

Satellite monitoring based on Sentinel-1 data also allowed the creation of a “Warning” service, i.e. an early warning, to alert authorities about the accumulation of instability factors in the areas of interest and thus to concentrate on these areas precise diagnostic actions and any other interventions intended to prevent or mitigate possible damage.

The “Warning Maps” allow a more immediate understanding of the phenomena and of the potential criticalities. In fact, whilst the “Displacement maps” include all the PS obtained in the area of interest, the Warning Maps extrapolate only those that meet some established criteria of risk.



Niscemi, Sicily, Italy. Trends of the displacements identified over the municipality area.

Thematic Area



CIVIL PROTECTION

Region of Application



SICILY

Sentinel mission used



S1

Copernicus Service used



-

Usage Maturity Level



4

## Benefits to Citizens

Monitoring is essential for assessing and predicting landslides or ground structural weaknesses, which could affect buildings, infrastructures and citizens safety.

Using Copernicus Sentinel-1 images and PS techniques, the Rheticus® Displacement service complements traditional survey methods, providing a long-term solution to ground instability monitoring and fresh accurate information all over the world.

By subscribing to the Rheticus® Displacement service, users can log in to the Web platform and access an intuitive dashboard, gaining an immediate overview and reliable geo-information, including reports, thematic maps, indicators and geo-analytics, and a weekly update. This is possible thanks to the continuous Copernicus Sentinel monitoring information that helps to meet local and national requirements in the field of land monitoring and ground surface displacement detection.

Rheticus® Displacement guarantees the best quality-price ratio available on the market, thanks to the use of open data, automatic processing procedures and its cloud-based architecture, overcoming difficulties and costs of field measurement campaigns.



Niscemi, Sicily, Italy. Rheticus® Displacement user interface showing ground movements' velocity acceleration and trends over data retrieved from Sentinel-1.

“This service gives us the opportunity to monitor in real-time the dynamics of ground movements and identify the most critical points.”

*Concetta Meli, Head of Environment and Public Works Dept., Municipality of Niscemi, Sicily, Italy*

## Outlook to the future

The service will include a new advanced and interactive analysis system, based on the correlation between the different PS, in order to highlight homogeneous areas in terms of displacement kinematics.

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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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