

MONITORING THE HEALTH OF WATER AND SEWERAGE NETWORKS

Copernicus Sentinel-1 SAR data were used to detect and monitor ground displacements near Milan's public sewerage network in Italy, to discover damage to the actual water infrastructure.

The challenge

The public sewer network of Milan runs for approximately 1500 km. MM SpA is the engineering company 100% owned by the Municipality of Milan, which manages the Integrated Water and Wastewater Services of the City of Milan, located in the Lombardy region, Italy. MM had been searching for a method to better understand the scenario of ground surface movements caused by the structural defect of its collector that could affect the area above the primary network and adjacent areas. The purpose was to prevent damage to surface structures (roads, buildings, etc.) by detecting the movements underway whose effects are not yet visible. For an assessment of the subsidence trend, a time series of past movements was required to build a past and future trend scenario. MM also aimed for a cost-effective solution that did not require the installation of instruments or their maintenance, and which was suitable for low budget and time-restricted surveys.

The space based solution

Today, satellite surveys allow: measuring millimetric surface deformations; studying the evolution of displacements in time and processing periodic trends, based on a series of acquired data, to identify non-linear movements; determining the horizontal and vertical displacement speed of points; performing multi-scale analyses; and integrating other data sources.

Satellite radar interferometry resulted in being the most accurate and affordable survey method to prevent and detect potential sewerage failures, even in relation to the high traffic volume of metropolitan cities like Milan. 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 on Sentinel-1 radar data. The Rheticus® Displacement service owned by Planetek Italia was able to process satellite data over the area and to provide thematic maps, dynamic geo-analytics and pre-set reports to MM. This service is currently used by several Integrated Water and Wastewater management companies in Italy and other EU countries, with clients like Hera, ACEA, Iren, ABC Napoli, Aquafin and MPWIK.

Benefits to Citizens

Rheticus® Displacement simplifies the detection, monitoring and analysis of subsidence phenomena from various open data sources into an interactive and comprehensive dashboard, to achieve insightful and purpose-built contents from many different perspectives. Users gain immediate and reliable geo-information, including weekly and summary information over wide areas, based on continual satellite monitoring, overcoming the difficulties and costs of field measurement campaigns. Rheticus® Displacement generates reports, thematic maps and geo-analytics based on Sentinel-1 data, meeting local to national content requirements in



Subsidence in urban area induced by water network leakage.
Credits: meadowsaffron on flickr

Thematic Area



TRANSPORTS,
CIVIL
INFRASTRUCTURE
AND SAFETY

Region of Application



LOMBARDY

Sentinel mission used



S1

Copernicus Service used



-

Usage Maturity Level



5

the field of land, buildings or infrastructures monitoring to prevent potential damage to people and properties.

Operators of water and sewage networks spend a lot of money maintaining their network and fighting against water leakages or structural problems. Based on Copernicus data, Rheticus® delivers an automated information service to municipal bodies, helping them pinpoint where leaks are most likely and prioritize their response teams.



Milan, Italy. Screenshot of Rheticus® Displacement interface pinpointing where leaks are most likely and showing ground movements' velocity acceleration and trends.

Credit: Contains modified Copernicus Sentinel data [2014-2018]

“We found satellite radar interferometry the most accurate and affordable survey method to prevent and detect potential sewer and water network failures.”

Andrea Aliscioni, MM SpA

Outlook to the future

The monitoring of environmental resources is taking advantage of the increased availability of satellite data from the Copernicus Programme. New satellite missions planned by ESA and the European Commission in the near future will provide further unique data sources for timely operational services.

Machine learning and deep learning are the methodologies, which will be integrated in future developments of Rheticus® services. These methodologies will allow the integration of heterogeneous data within the processing chain, collected from remote sensing, the user, the Web and social networks to improve forecast accuracy. The output will feed the decision support system of the end-user that will be able to take a decision based on accurate and predicted information.

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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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