GROUNDSFOR INVESTMENT

A NEW SERVICE USES SATELLITE REMOTE SENSING IMAGERY AND BIG DATA PROCESSING TO ENABLE UTILITY COMPANIES TO PREDICT WHERE PIPES MIGHT BURST. **ANTONIO BUONAVOGLIA** REPORTS

The management of underground pipelines is a complex and expensive task for utility companies. Generally, pipes are made with long-lasting materials, but often, they are stressed and damaged by ground movements over time. Ground movements are common phenomena across Europe and worldwide. Sometimes, they can be quite severe, causing displacement of up to 1m over a few years, but movements of only a few centimetres can cause damage around buried pipes.

The risks are greatest where the ground is moving faster, putting pipelines under heavy stress and, eventually, causing leaks. These leaks can then accelerate the erosion around the problem area, disrupting services and possibly creating larger problems, damage to surface facilities, properties and/or infrastructures, or exposing people to risks.

Utilities spend considerable sums of money maintaining their networks and fighting against leakages and structural problems. Right now, companies' maintenance policies are strictly oriented to recovery their assets in case of disrupting service due to major problems. A great number of utility companies put in place activities for pipe replacement only in areas where severe subsidence phenomena reveal leaks in the pipes.

Identifying ground movements before they become critical is a challenge. Satellite radar technology can give a good predictive indicator for where this may be occurring by measuring where the ground is subsiding around the pipelines. Radar data, when pushed through interferometric synthetic aperture radar (InSAR) analysis, can provide changes in the ground level with millimetre accuracy. The European Space Agency's Copernicus programme includes SAR data from the Sentinel-1 constellation, which can be used to identify with high precision where the ground starts subsiding, allowing for maintenance strategies focused on areas at high risk and before structural problems occur.
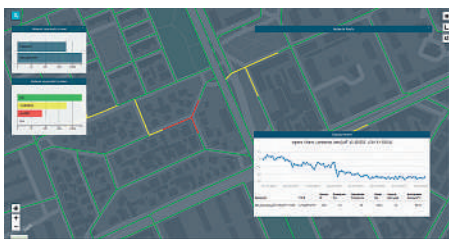
A new model

The Sentinel open data, together with the power of cloud infrastructures, provide players in the EO sector with the unprecedented opportunity to design operational Earth
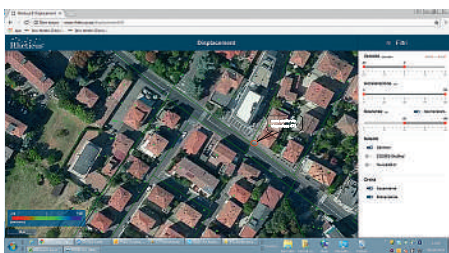
Ground displacement can be a serious problem in Modena, Italy

A Rheticus Network Alert map

A Rheticus Network Alert map using a satellite image

A Rheticus Network report of ground displacement in Modena

monitoring services. Shifting from the provision of data to the provision of continuous monitoring services is the key point in addressing users' needs in this new era of Big Data. Moreover, shifting from monitoring services on request to long-term information services available on subscription is the real disruptive innovation in the field of EO: end-users pay for the information not for the processing.

Rheticus is a cloud-based hub that processes satellite imagery and geospatial data automatically, and delivers geoinformation services ready for end users. Designed and developed by Planetek

Italia, Rheticus moves beyond mapping visualisation, thanks to a broad range of advanced geoanalytics. It allows end-users to gain insight into patterns not easily identified with traditional approaches, to better understand the whole story that lives within data related to their assets. Actionable information is provided through thematic maps, geoanalytics, pre-set reports and alerts. Content is dynamically displayed through a web dashboard, available 24/7 on any device, or in machine-to-machine (M2M) mode directly within users' systems.

By integrating contents generated by Rheticus with Hexagon Geospatial's Smart M.App technology, Planetek Italia has succeeded in creating several monitoring services that provide timely solutions to address users' needs in various industries and vertical markets: Rheticus Network Alert, Rheticus Bridge Alert, Rheticus Railways Alert and Rheticus Infrastructure Alert, all designed around Rheticus Displacement.

The impact of a satellite-based service

Rheticus Network Alert is a turnkey web service that helps utility companies in the management of inspections and maintenance activities with their integrated water and sewerage networks. By using satellite radar data to identify ground instabilities, Rheticus Network Alert provides operators with an always updated log of hotspots within their network that can reveal leaking pipes. The service provides all the information by means of geoanalytics, maps and reports, released every monthly.

Instead of replacing pipes and connectors after major leakage evidence, utility companies can replace those pipes classified as possibly at risk, before larger problems

occur. This enables them to better manage their financial resources and reduce service disruptions and/or threats for people.

Among Rheticus' active users are some of the largest European utility companies, which generally face costs per repair ranging between €2,500-5,000/km. Benefits are even larger in areas exposed to landslides, subsidence and earthquakes.

Hera, the second largest water utility company in Italy, has always looked with enthusiasm towards innovation, the development of new technologies and their testing. For this reason, in 2016, it was the first company in Italy to adopt a system to search for water via satellite to address the problem of hidden leaks from water networks.

Subsequently, Hera decided to test Rheticus, with the aim of providing an automatic system to exploit satellite data to perform complex analyses and simplify inspection planning.

Hera first subscribed to the Rheticus Displacement service for the Province of Modena. In 2018, it adopted Rheticus Network Alert and extended the area of interest to include the Province of Bologna, reaching more than 6,200km of pipelines monitored from space over an area of about 3,500sq km.

Furthermore, Here Group incorporates sophisticated equipment, such as smart meters and traffic-monitoring systems, together with information from citizens into its management processes, collecting a great amount of data related to its assets. It is unfeasible to exploit all that data through traditional approaches.

UTILITY COMPANIES CAN REPLACE THOSE PIPES CLASSIFIED AS POSSIBLY AT RISK, BEFORE LARGER PROBLEMS OCCUR

Artificial intelligence is the only reasonable way to exploit them. Machine learning algorithms integrated in Rheticus Network Alert will enable the better exploitation of historical and real-time data, thus supporting decision-making about all relevant aspects of Hera assets, from demand-forecasting to workforce capacity management, emergency planning, predictive maintenance, optimised scheduling, more accurate travel times, seasonal service patterns, and so forth. Since Hera is in charge of a wide network covering a broad area that requires great management effort, following a proposal from Hera, Rheticus Network Alert will be increased with a specific add-on functionality: the ingestion of various information layers to achieve a predictive operational level alongside the current support on daily inspection planning and mid-term network management.

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