

A VILLAGE STRICKEN BY TERRAIN MOVEMENTS

The Sentinel-1 radar satellites capacities in detecting and measuring small ground surface movements allow the provision of quantified expertise to decision makers.

The challenge

Lochwiller, an Alsatian village in the Grand Est region, Northeastern France, is affected by severe land elevation movement because of the swelling of a geological layer reaching an underground water table, during a sub-surface geothermal drilling activity. Houses are cracking and families are obliged to leave their homes.

The State services need to monitor the evolution of the phenomenon that the technical services cannot stop and, with insurance companies, promote a policy of compensation for those affected. The municipality is trying to establish a plan both to prevent the growth of abandoned housing and to decide on its future urbanisation policy around the disaster area. Therefore, decision makers are seeking relevant indicators to support a strategy that will directly depend on the evolution, in space and time, of the surface instability phenomenon.

The space based solution

The EUGENIUS H2020 project combines in a common catalogue of services the expertise of several remote sensing operators for the benefit of their region. SERTIT (Service Régional de Traitement d'Image et de Télédétection, a technical platform of the ICube laboratory of Strasbourg University), associated with the Italian company, Planetek, has thus proposed to the deconcentrated service of the French Ministry of Environment, in the Grand Est region, a pilot project based on the exploitation of interferometric data, acquired by the Sentinel-1 radar satellites, which allow the detection of millimetric ground displacements. With the use of Persistent Scatter Interferometry technique, regular monitoring of the behaviour of permanent reflectors over time, has been set up and performed. The height variations measured with the use

of more than twenty satellite acquisitions during the first year (Sentinel-1A data), and more than fifty observations during the second year (Sentinel-1A and Sentinel-1B data), made it possible to detect the lifting of the surface related to the swelling of the anhydrite layer pierced by drilling, and also, to map and measure the extent of the phenomenon. Compared to observations and field surveys, measurements derived from spatial data were also calibrated. Maximum vertical displacement measures could reach 140 mm/year around the drilling.

The approach having been validated, the State services asked for the monitoring of the affected sector to be continued and also to apply it on another Alsatian village where a similar phenomenon has started.



Houses affected by terrain movements in the village of Lochwiller (Alsace- France)

Thematic Area



TRANSPORTS,
CIVIL
INFRASTRUCTURE
AND SAFETY

Region of Application



BAS-RHIN

Sentinel mission used



S1

Copernicus Service used



-

Usage Maturity Level



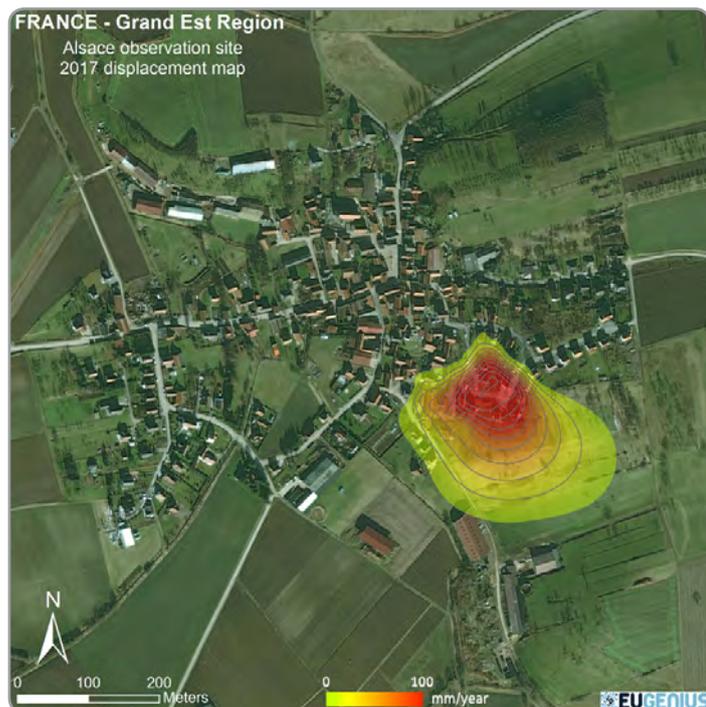
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Benefits to Citizens

The approach presented here benefits citizen on several levels. Allowing for the monitoring and quantifying of a phenomenon causing property damage, even human ones, it contributes to the risk assessment mission of the state services, and to the drawing up of the request for compensation which is paid by the insurance guarantee fund.

Risk prevention and mitigation are major societal challenges, such as the sustainable management of resources and territories.

Therefore the EUGENIUS Association is federating skills and interoperable tools from different European partners in order to respond in the most effective way to these issues.



Spatial representation of the swelling phenomenon in the Lochwiller most affected area (Alsace-France)

“This remote sensed technique has transformed the way we are monitoring this particular problem for which a long-term survey will be necessary.”

Frank Pouvreau, Direction départementale des territoires du Bas-Rhin, French Ministry of Ecological and Solidarity Transition

Outlook to the future

With these swelling phenomena having a continuous evolution, and upon user request, the monitoring of the two villages will be pursued after the H2020 project.

Through its regular observation frequency capacity, the Copernicus programme space infrastructure offers new possibilities for the monitoring of vast territories and the measurement of spatialised indicators previously inaccessible by ground-based observation means. The interferometric techniques presented here can also be applied to subsidence problems, such as the ones occurring in the mining sectors, related to karst environments or underground activities.

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ABOUT COPERNICUS4REGIONS

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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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