

# Satellite-Based Subsurface Soil Moisture Mapping: Rail Monitoring in France

## Background

ASTERRA has developed a unique technology for subsurface soil moisture mapping known as "EarthWorks." Using technology originally purposed to search for water on other planets, ASTERRA Earthworks analyzes satellite imagery to detect water leakage and seepage from pipes, earthen dams, levees, railroads, and more. The result? Infrastructure monitoring that covers thousands of square kilometers at once, without any sensors or devices on the ground.

The project in question concerns the concessionaire of a high-speed rail-line in Southwestern France.

## Summary

Subsidence was observed on an embankment on a stretch of the rail line. The origin of these disorders was not yet identified. The concessionaire decided to initiate investigations to understand the phenomenon and decide on possible corrective actions. Measures that were decided by the concessionaire included: implementation of monthly topographic surveys since 2017, restriction of the traffic speed to 170km / h, and deployment of an automatic monitoring system allowing the measurement of the track geometry several times per day.



## ASTERRA EarthWorks Key Benefits

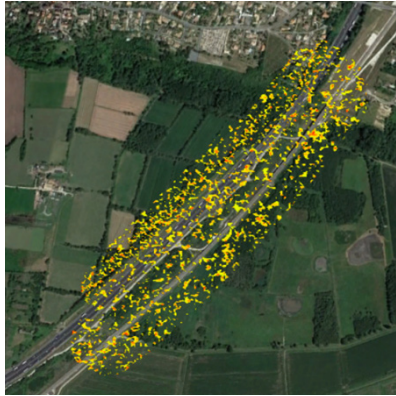
- No preparations or set-up required.
- No sensor deployment or maintenance necessary.
- Scanning for saturated ground below the surface may identify problems at a very early stage, thus making repairs less costly.
- Ability to repeat scanning of specific sections as needed; Either to verify repairs or to track changes in sensitive locations.



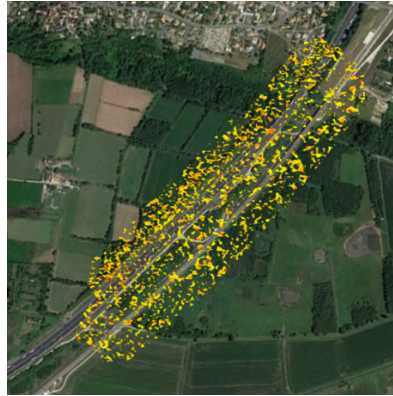
**Area of Interest:** The blue line shows the area of subsidence provided by the concessionaire. The yellow line is the area analyzed by ASTERRA.

## Solution Applied

ASTERRA acquired two satellite images, one from 2017 and one recent one, to remotely inspect the relevant track sections. By default, 100 meters are scanned on each side of the train tracks. The deliverables include:



**Soil moisture map of the area within the yellow polygon based on the 2017 image.**



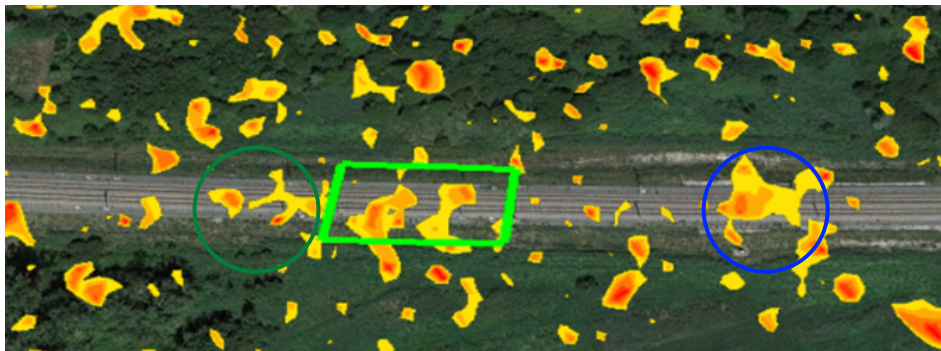
**Soil moisture map of the area within the yellow polygon based on recently acquired image.**



**Spatial and temporal change/difference highlighted, highlight, between 2017 image and the recent satellite image.**

## Conclusions

ASTERRA's data helped confirm the following hypothesis: The problem is likely probably associated with the embankment construction materials, not the foundation. If the problem originated from a break in the foundation, the observed movement would have been more severe, which is not the case.



In 2019, in the marked green area, movements were detected that correlates well with ASTERRA's soil moisture data. In the blue circle, the concessionaire believes the results to be of note because they have not noticed any sign of movement there yet. A visual and localized inspection in the field is thus required to check the embankment and track bed.