



TRE
ALTAMIRA
A CLS Group Company

GROUND MOTION MONITORING FOR **MINING OPERATIONS**



Mine wide deformation mapping with satellite radar data

TRE ALTAMIRA's mine mapping services remotely measure ground movement ranging from millimetres to metres over entire mine sites. All mining assets can be monitored regularly and precisely for deformation without the installation of any in-situ equipment.



Underground Mining

Our services detect and monitor complex subsidence patterns related to underground mining operations, including block caving and longwall mining.

Bulletin Service

Provides an actionable report on trends and changes to the ground surface and is delivered within 12 hours of receiving the latest satellite image.

Long-Term Analysis

This service is used to extract a history of ground displacement ranging from millimetres to metres over all mining assets.

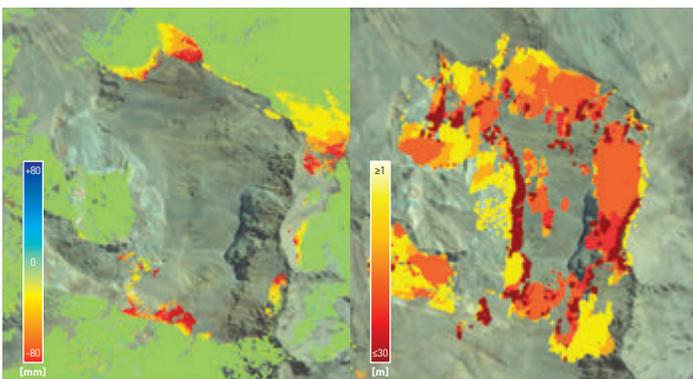
UNDERGROUND MINING

Complex subsidence patterns associated with underground activities are suitably monitored from satellite

Underground activities often lead to surface deformation patterns with strong temporal and spatial variation since face work progress determines the affected area. TRE ALTAMIRA has developed algorithms to analyse the complex subsidence patterns associated with these operations and conducts studies for all ranges of underground mining activities, including unsupported underground mining sites (like block caving and longwall).

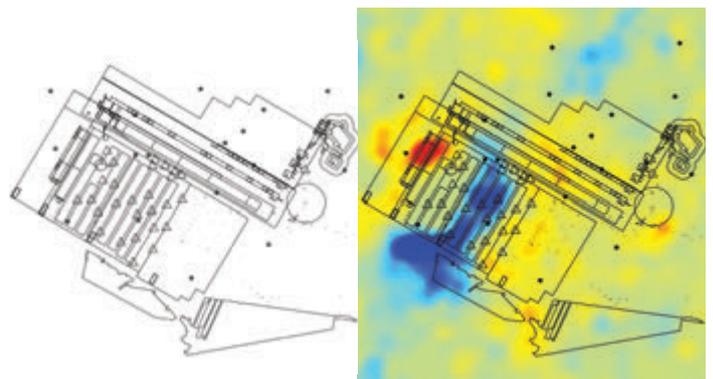
Our technology has also proven to be an efficient tool for providing long-term monitoring of residual subsidence over inactive and abandoned mines.

Block Caving



Monitoring over a block caving mine: the subsidence crater is delimited and different types of motion magnitudes measured, millimetric-centimetric motion on the left, metric motion on the right.

Longwall

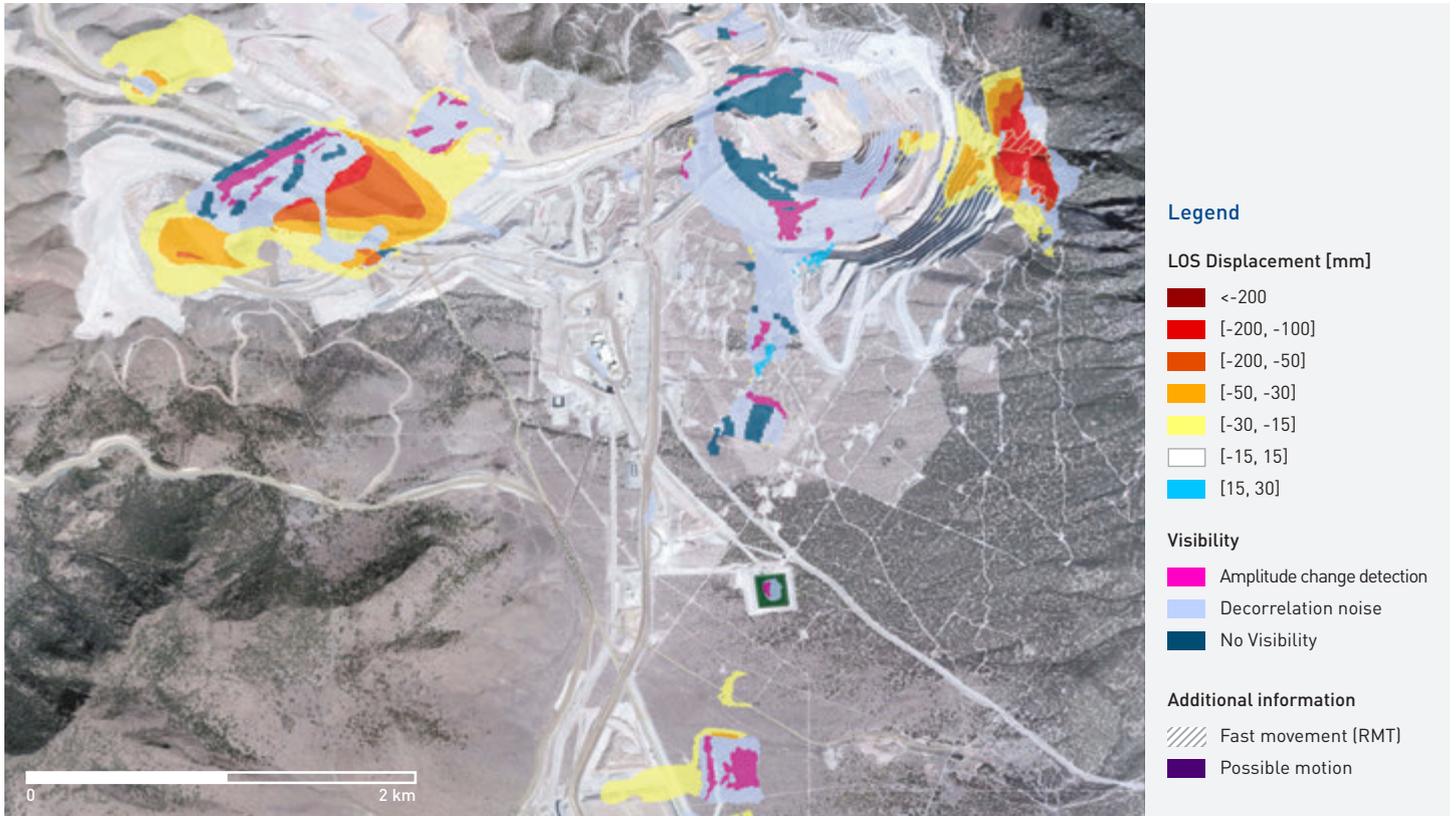


Monitoring over a longwall mined coal seam: an advanced SqueeSAR™ analysis (right image) identifies areas of increasing rates of subsidence (red), as the longwall operations approach, and residual subsidence rates (blue), after the initial longwall operations have passed.

BULLETIN SERVICE

The Bulletin Service is available over any mine site worldwide

This service provides actionable reports on trends and changes to the ground surface within 12 hours of receiving the most recent satellite image.



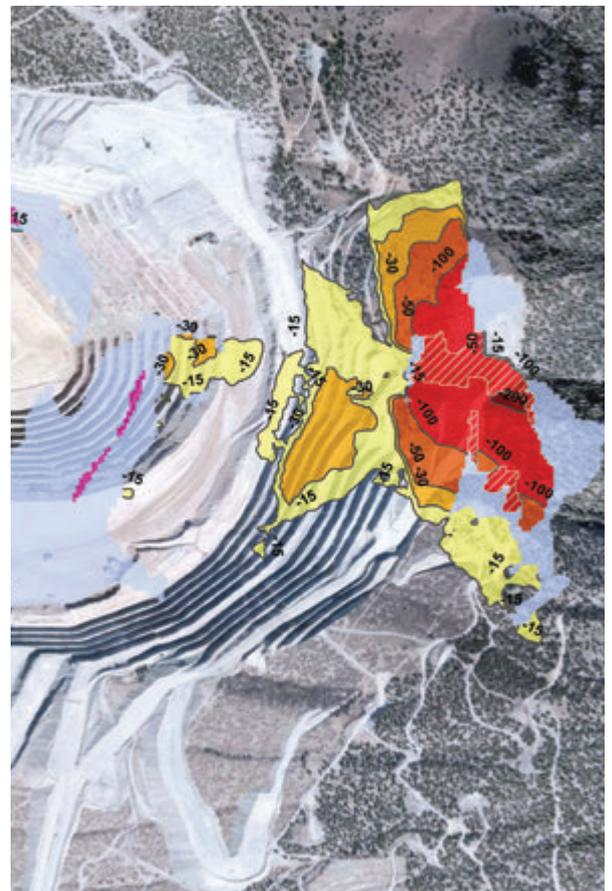
Deformation over the entire mine site is detected without the need for ground instrumentation. A synoptic view from satellite offers a quick visualization of deformation trends over all mine assets.

Intuitive colour-coded deformation maps highlight areas where changes in trend are occurring with respect to previous situations, providing magnitude and area of deformation at a glance.

Weekly updates of deformation within a few hours of the latest satellite acquisition, thanks to a new generation of satellites acquiring every 6/10 days.

Compatibility with the main mine softwares. Maps are delivered in all standard formats, to seamlessly import into your visualization software.

Client support, with a global presence and offices in Europe, North and South America. TRE ALTAMIRA provides support for geotechnicians and decision makers.



LONG-TERM ANALYSIS

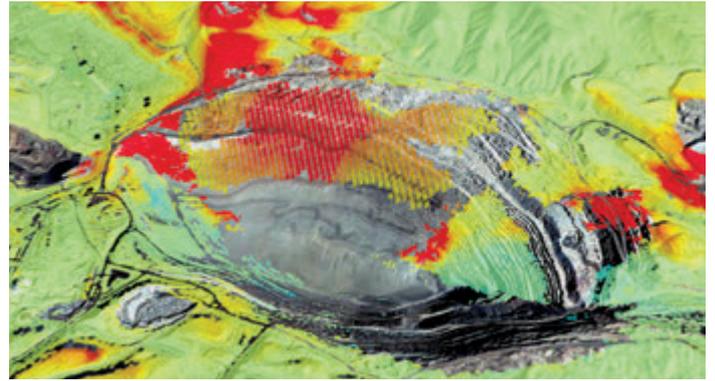
Mine wide deformation mapping with satellite radar data

The history of surface deformation over the entire mine site can be extracted with our advanced multi-temporal satellite radar data analyses.

All mining assets can be monitored regularly for deformation every month, quarter, semi-annually or annually.

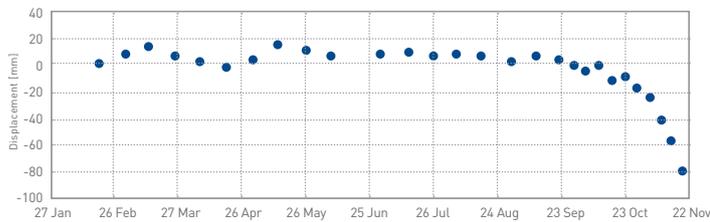
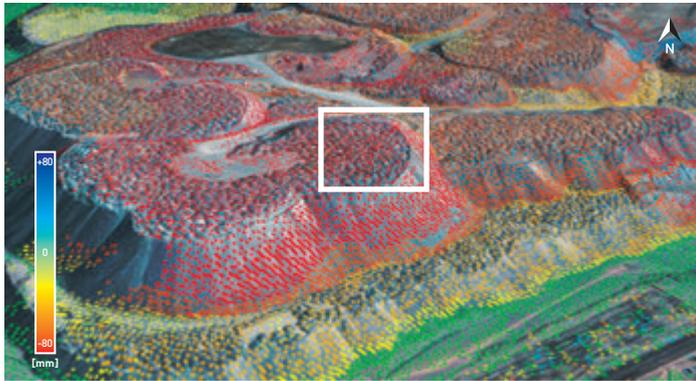
Satellite radar data is an excellent monitoring tool over slopes and surfaces where Health & Safety concerns limit access for conventional surveying techniques.

In-Pit Monitoring



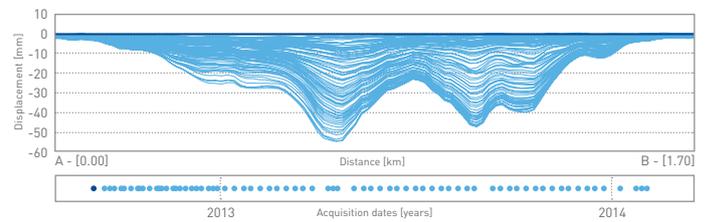
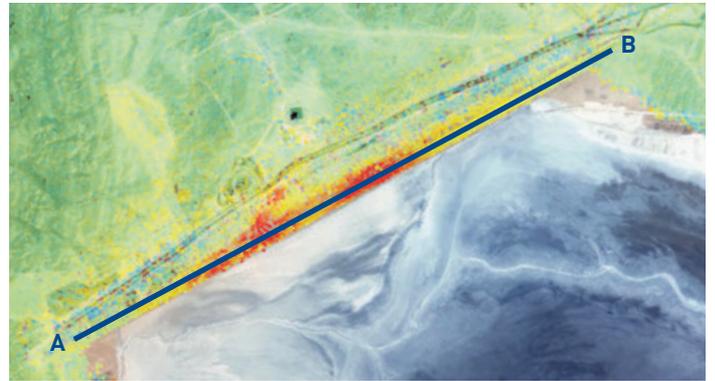
SqueeSAR™ coupled with a Rapid Motion Tracking analysis provides identification of slow and fast motions for improved hazard prevention and management.

Waste Piles



Sample point densities of greater than 10,000 /km² provide more complete coverage than any other monitoring technique.

Tailings Dams



Dam compaction is shown in the cross-section profile. Profile A-B shows non standard settlement of the tailings dam with a maximum rate of 32 mm/year.

TRE ALTAMIRA is globally recognised as the world leader in InSAR. We provide displacement measurements and deformation mapping solutions from satellite radar data that are used in a variety of sectors, including mining, oil & gas and civil engineering. We offer our clients reliable and timely information on how their areas of interest are changing over time, allowing them to mitigate risks, optimise operations and plan future activities.

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