



A-MINDS

ANALYSIS AND MITIGATION OF INDUCED SEISMICITY

A scientifically advanced solution for the analysis and mitigation of potential risks derived from induced seismicity phenomena in subsurface industrial activities.

MAIN FEATURES

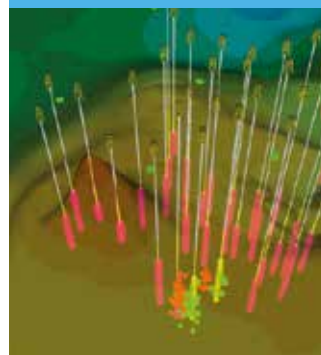
- Combination of leading subsurface engineering and cutting-edge earthquake science.
- Enhanced real-time monitoring of subsurface operation through microseismic networks and analyses.
- Sophisticated statistical-mechanics-type theoretical framework for the analysis of induced seismicity.
- Alert systems based on sound scientific understanding.
- Comprehensive adaptive methodology tailored-made for optimal performance.

WHY?

Induced seismicity from subsurface industrial activities is a **growing concern** and in an increasingly safety-aware environment, industry is required to provide answers. Understanding the processes that generate seismic activity is currently at the frontier of knowledge and needs to be addressed **to develop robust decision support tools that will help optimize operation processes.**

Building on its fifty year's of experience in underground operations, Geostock has set up **a task force of scientists and engineers** and has developed a robust and comprehensive solution.

KEY BENEFITS



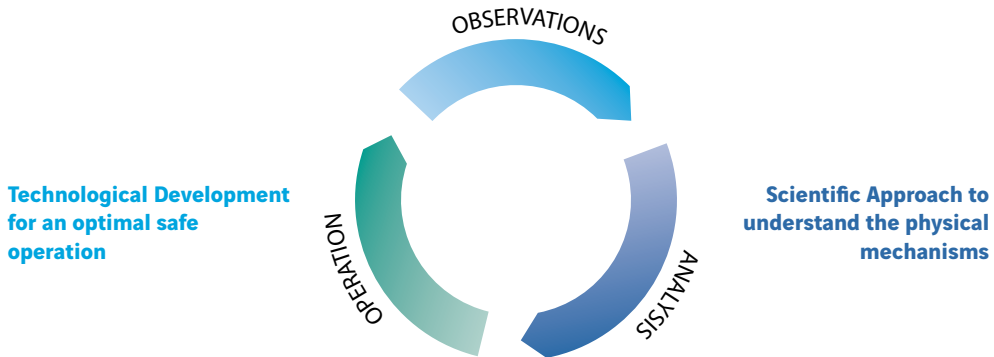
- Robust identification of the presence or absence of induced seismicity.
- Improved understanding of potential risks.
- Optimized design and safety of subsurface operation.
- Improved environmental and safety information.
- Scientifically robust answers to the public and administrations.

WHAT IS A-MINDS?

A-MINDS is a new sophisticated solution for the analysis and mitigation of induced seismicity that entails:

- The combination of a wide range of geophysical, geological, rock mechanics and reservoir engineering observations and measurements.
- The design and deployment of high-resolution observation networks.
- Sophisticated cutting-edge earthquake science analyses: earthquake catalogue declustering, earthquake interaction analyses (nucleation and coalescence), rank ordering statistics, discrete scale invariance, continuum-discrete modeling approach (single-fault rate and state dynamics in poro-elastic media).

A-MINDS is run in a feedback loop between a scientific approach and technological developments to assist in the safe operation of subsurface facilities.



A COMPREHENSIVE TAILORED OFFER

A-MINDS is a global method with a modular approach that progressively adapts to the evolving requirements of each case. Following a tailored initial assessment, scientifically informed decisions guide the evolution of the approach that can include microseismic monitoring, geo-engineering and advanced scientific analyses.

- ▶ **Characterize accurately** if industrial activity produces induced seismicity
- ▶ **Show** should this happen that induced seismicity poses no threat and **operations can continue safely**

<p>INITIAL ASSESSMENT</p> <p>Compile existing data</p> <ul style="list-style-type: none"> ■ Earthquake catalogues ■ Geo-tectonic assessment <p>Initial analyses</p> <ul style="list-style-type: none"> ■ Statistic and mechanistic ■ Seismic hazard analysis 	<p>MICROSEISMIC NETWORK</p> <ul style="list-style-type: none"> ■ Real-time monitoring ■ Good quality catalogue ■ Source mechanisms 	<p>GEO-ENGINEERING</p> <ul style="list-style-type: none"> ■ Hydrogeology ■ Rock mechanics ■ Structural geology ■ Reservoir engineering 	<p>SCIENTIFIC ANALYSIS</p> <ul style="list-style-type: none"> ■ Stochastic time series analysis ■ Hydro-mechanical continuum-discrete modeling approach ■ Robust early-warning system
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SCIENTIFICALLY-INFORMED DECISIONS
ROBUST DECISION SUPPORT TOOLS TO OPTIMIZE OPERATION PROCESSES

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