

Future of UXO Geophysics.

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SAGEEP

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Detection

Classification

Localization

(DCL)

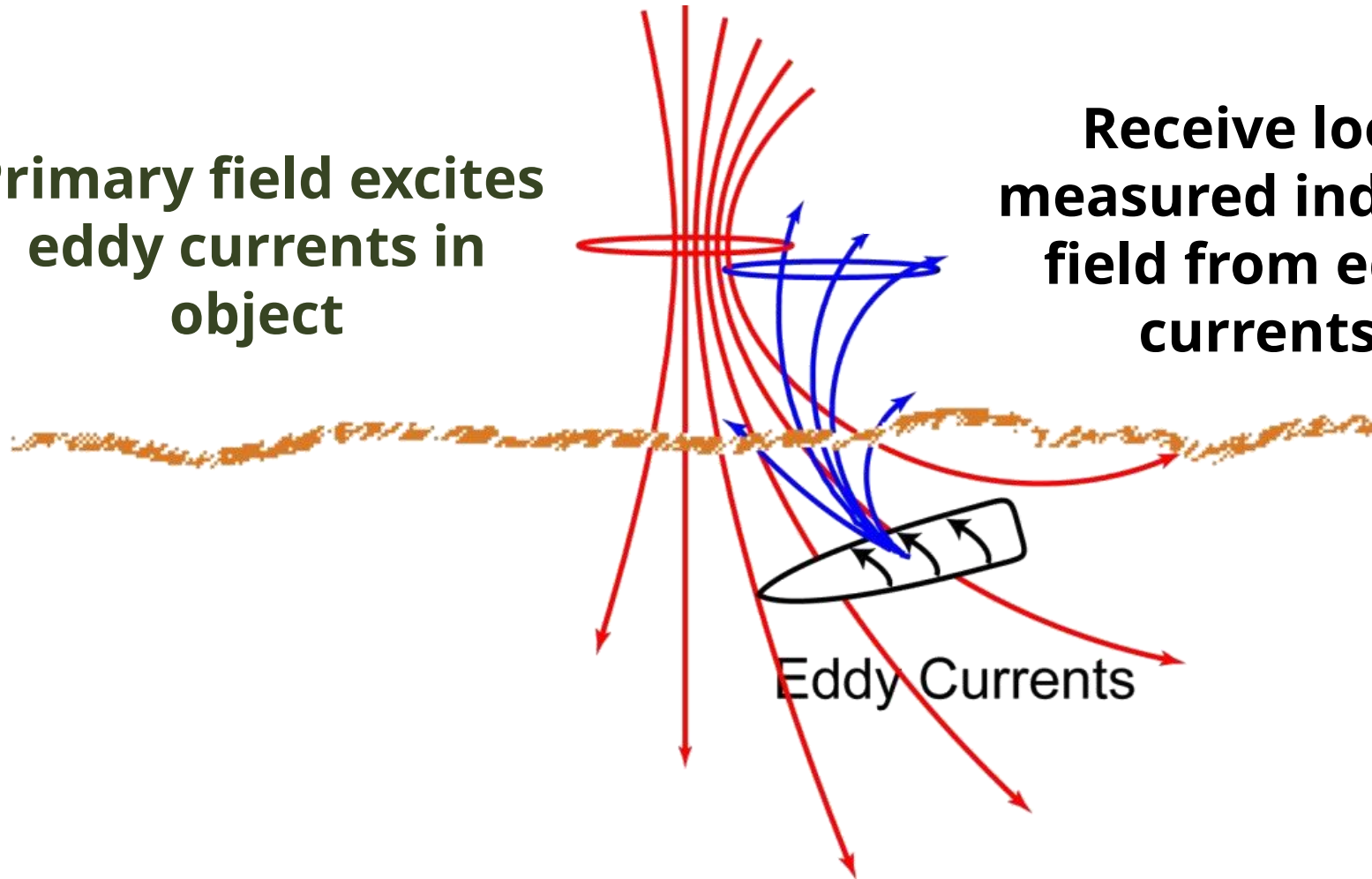
| Not focussing on marine sensing



Electromagnetic Induction

Primary field excites eddy currents in object

Receive loop measured induced field from eddy currents



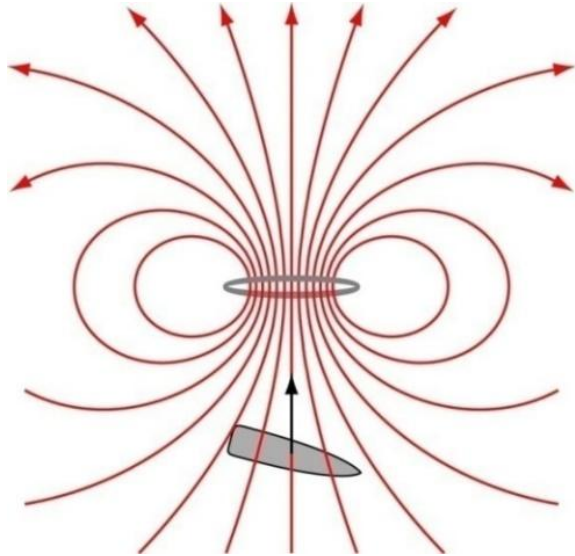
Typical
System
2001



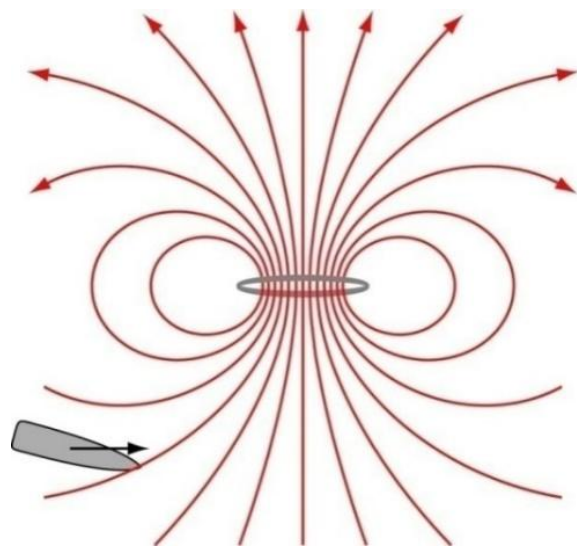


Detection Classification Localization

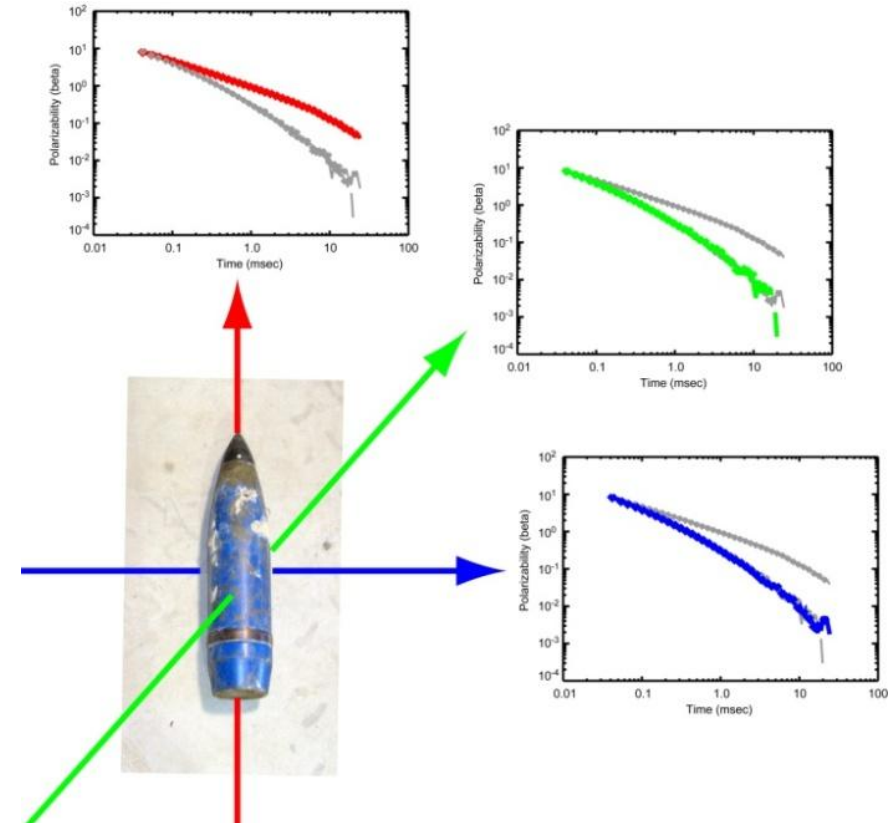
Polarizabilities



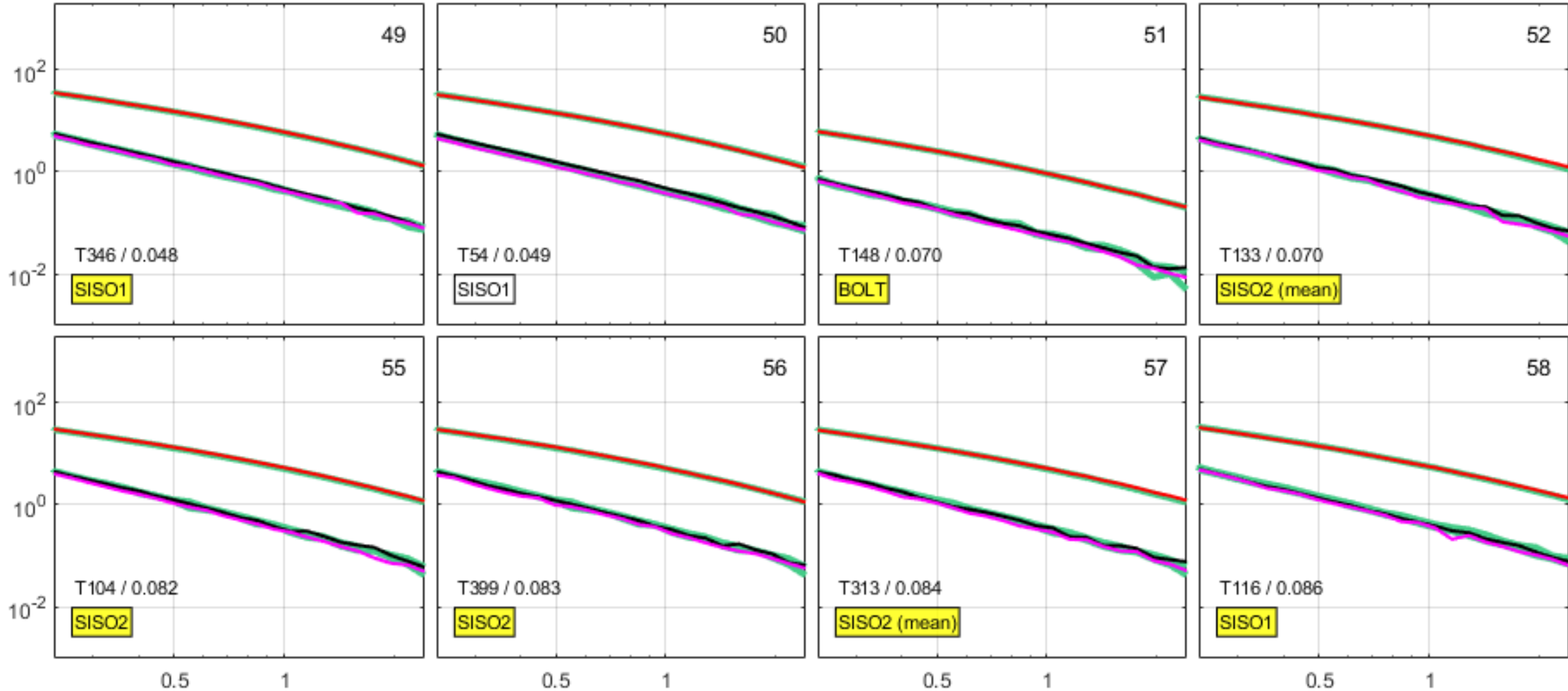
Directly on-top



Offset



Advanced Geophysical Classification (AGC)



Change over time

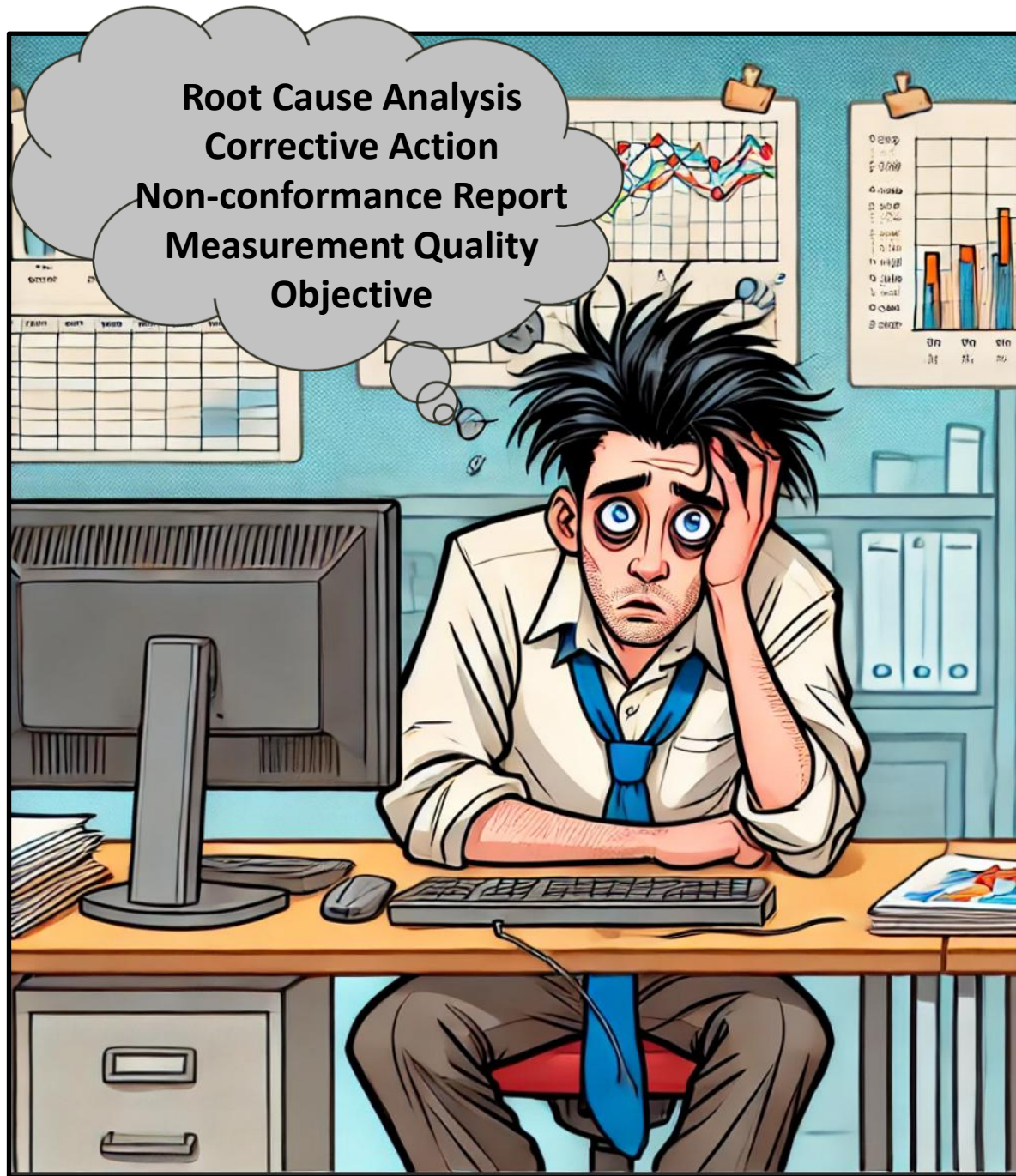


DCL specific
Smaller faster
electronics
Better algorithms
Computational
resources
Improved auxiliary
sensors



**AGC works and is used extensively on
US MMRP projects**

**Is any further technical development
required?**



**Is this the future of
UXO Geophysics?**

Remaining Challenges

Survey efficiency

Magnetic soils

Processing efficiency

Complex sites

Processing complexity

Detect deeper ordnance



Germany

Kuwait

Afghanistan

Japan

**Solomon
Islands**

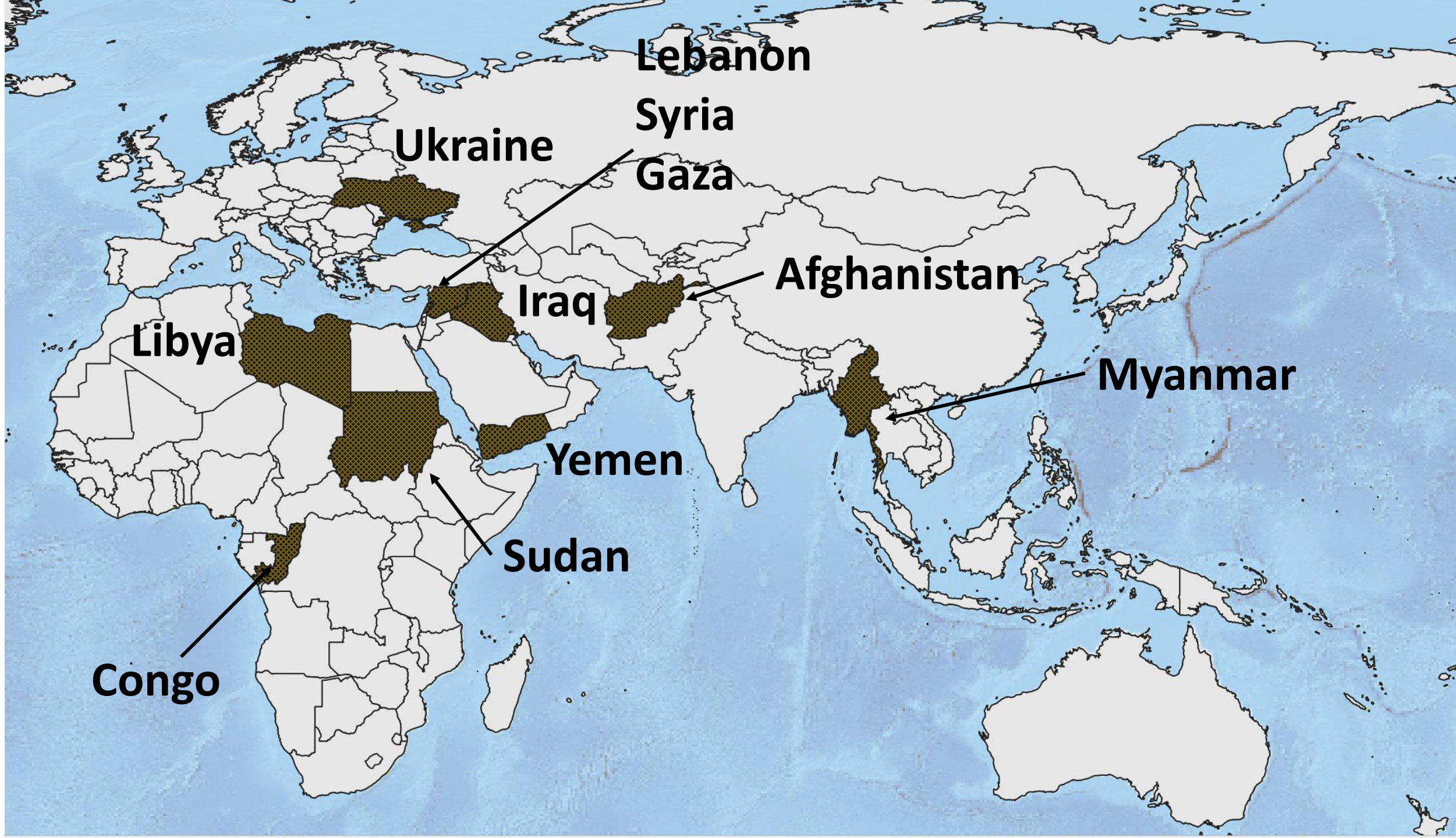
Vietnam

Laos

Cambodia

Angola

Mozambique



Lebanon

Syria

Gaza

Ukraine

Iraq

Afghanistan

Myanmar

Yemen

Sudan

Libya

Congo

UXO

A world-wide problem

**29% of Ukrainian
territory potentially
contaminated**

That's 43 million acres!

**Current AGC survey rates:
0.5 to 10 acres per day**



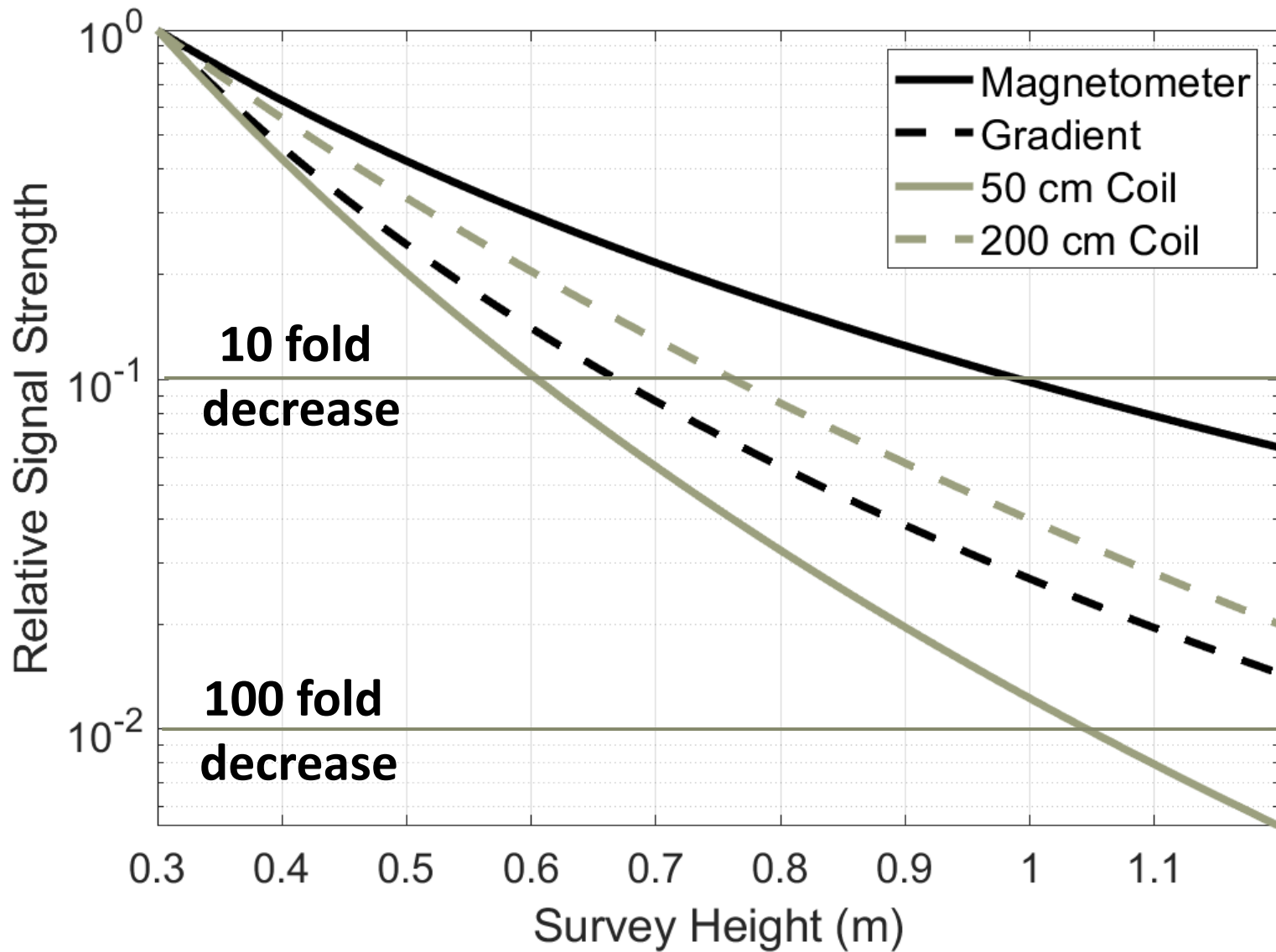
Drones

The solution to the efficiency problem?



Detection

30 cm burial depth



Ground-based Unmanned ground vehicle



| **Ground-based**
Future form factors?

**What about other potential
autonomous form factors?**

Ground-based Future form factors?



Complexity **Machine learning for DCL?**

AGC is complex

Requires skilled geophysicists

**Are there enough skilled personnel in
countries around the world?**

Machine learning **Challenges**

Environmental variability

Diverse types of UXO

Unexpected novelties

Regulatory acceptance

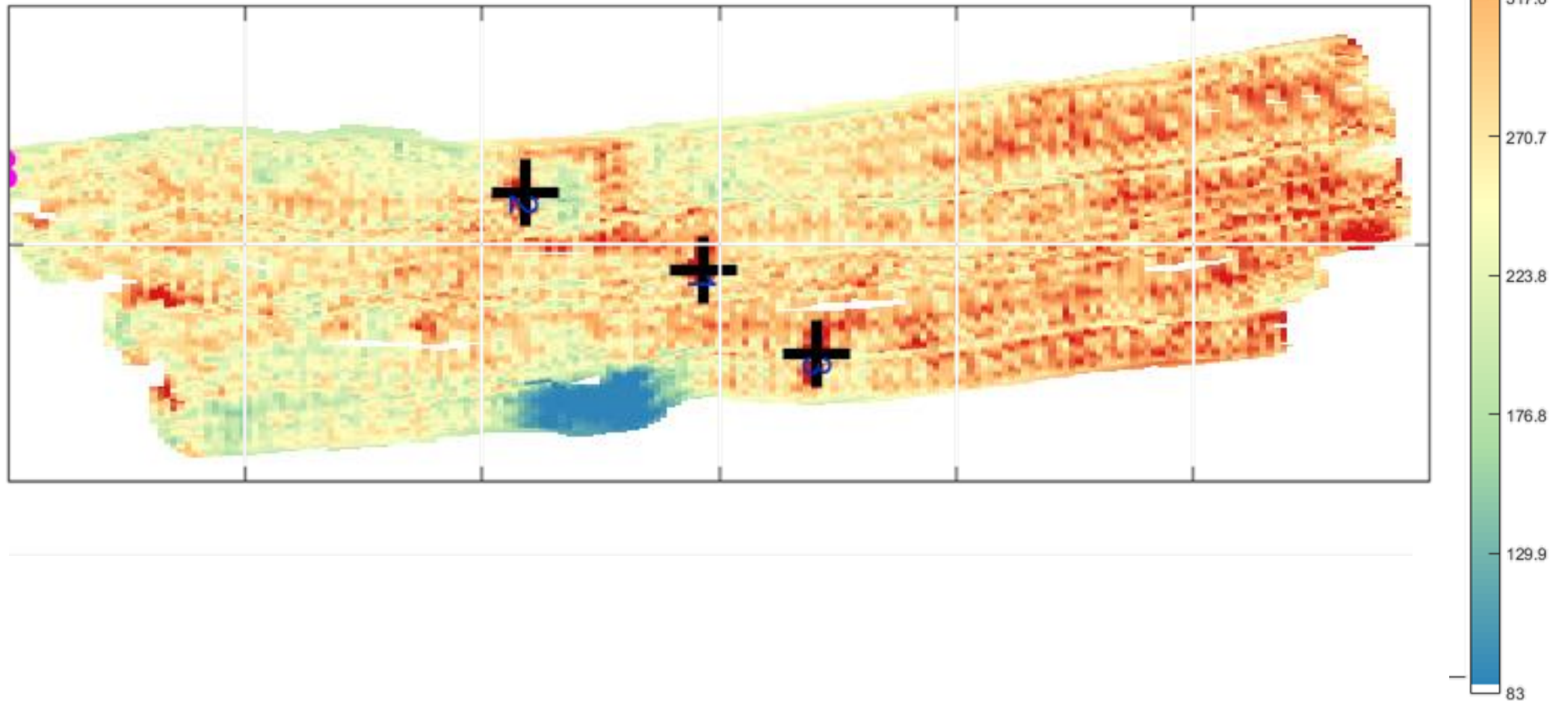
Why sit at the computer and interact when you can prompt?

Observe directory X and when a file appears **uncompress** it and **import** all survey events in BTField project Y under Site Z. **Process** the data using workflow P1. **Check** FT and IVS surveys and **update** QC report document A. **Export** production data to QGIS project B and **update** the coverage history and maps for site C. **Email** a summary of results to me

Magnetic geology

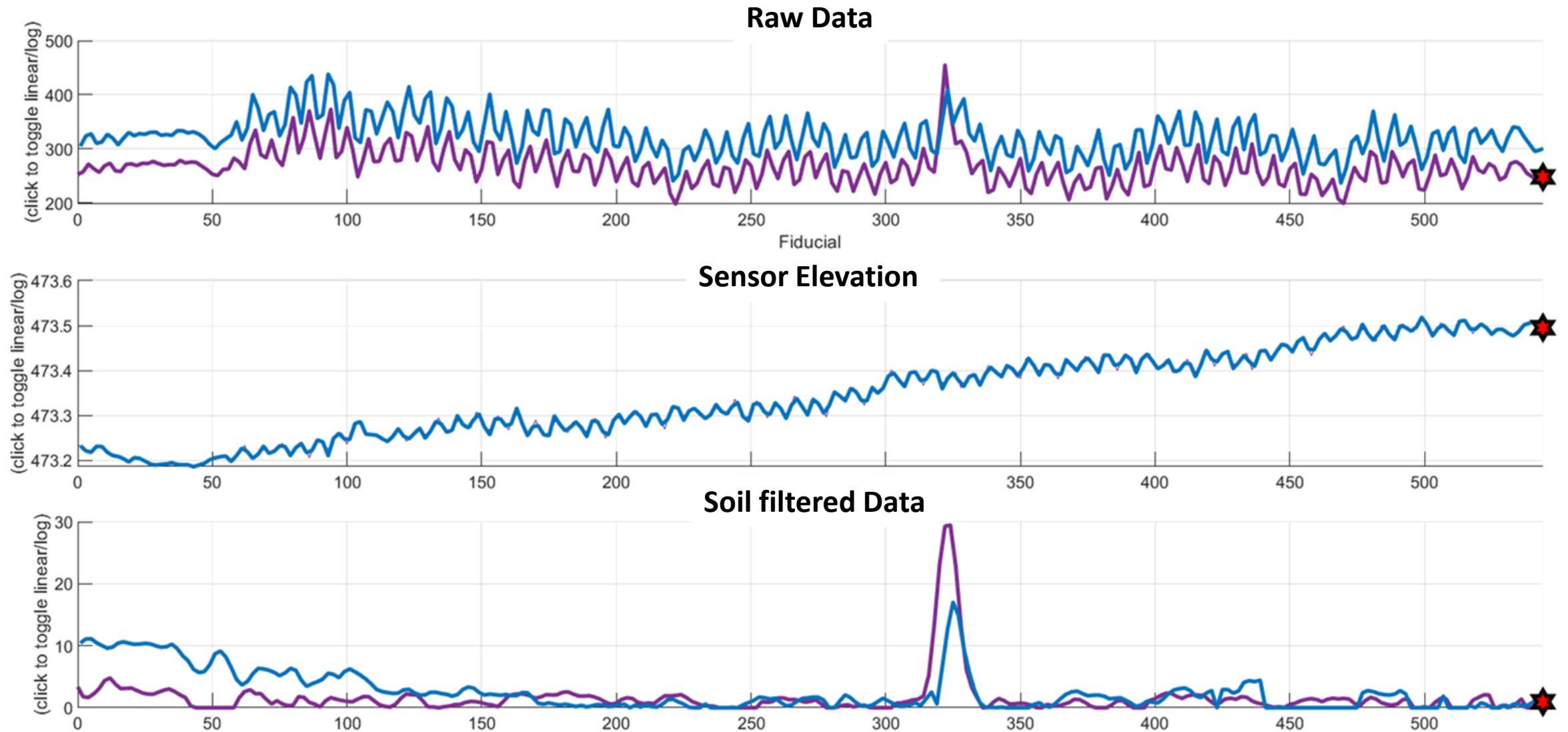
Still a challenging problem

Three small ISOs

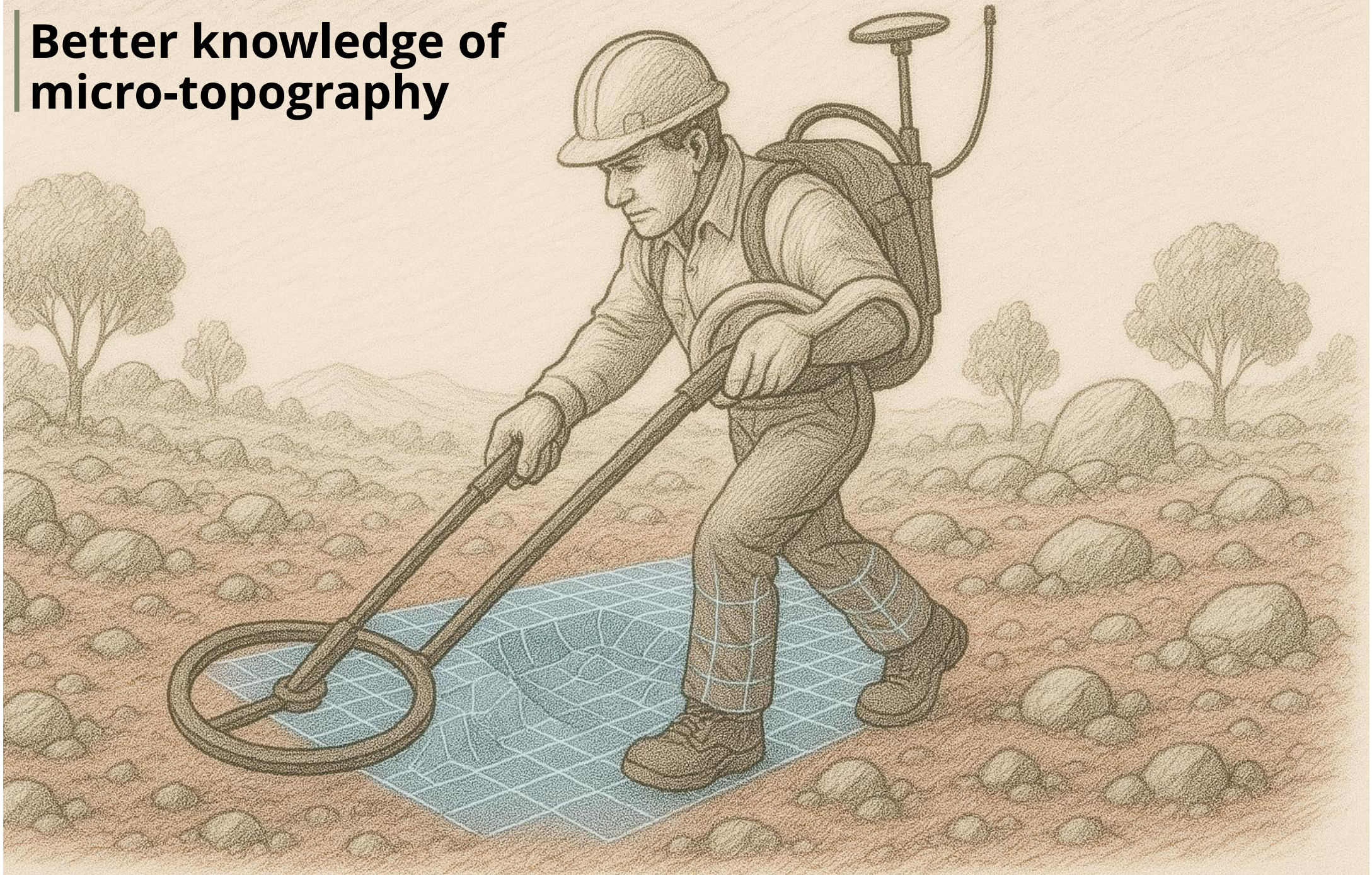


Magnetic geology

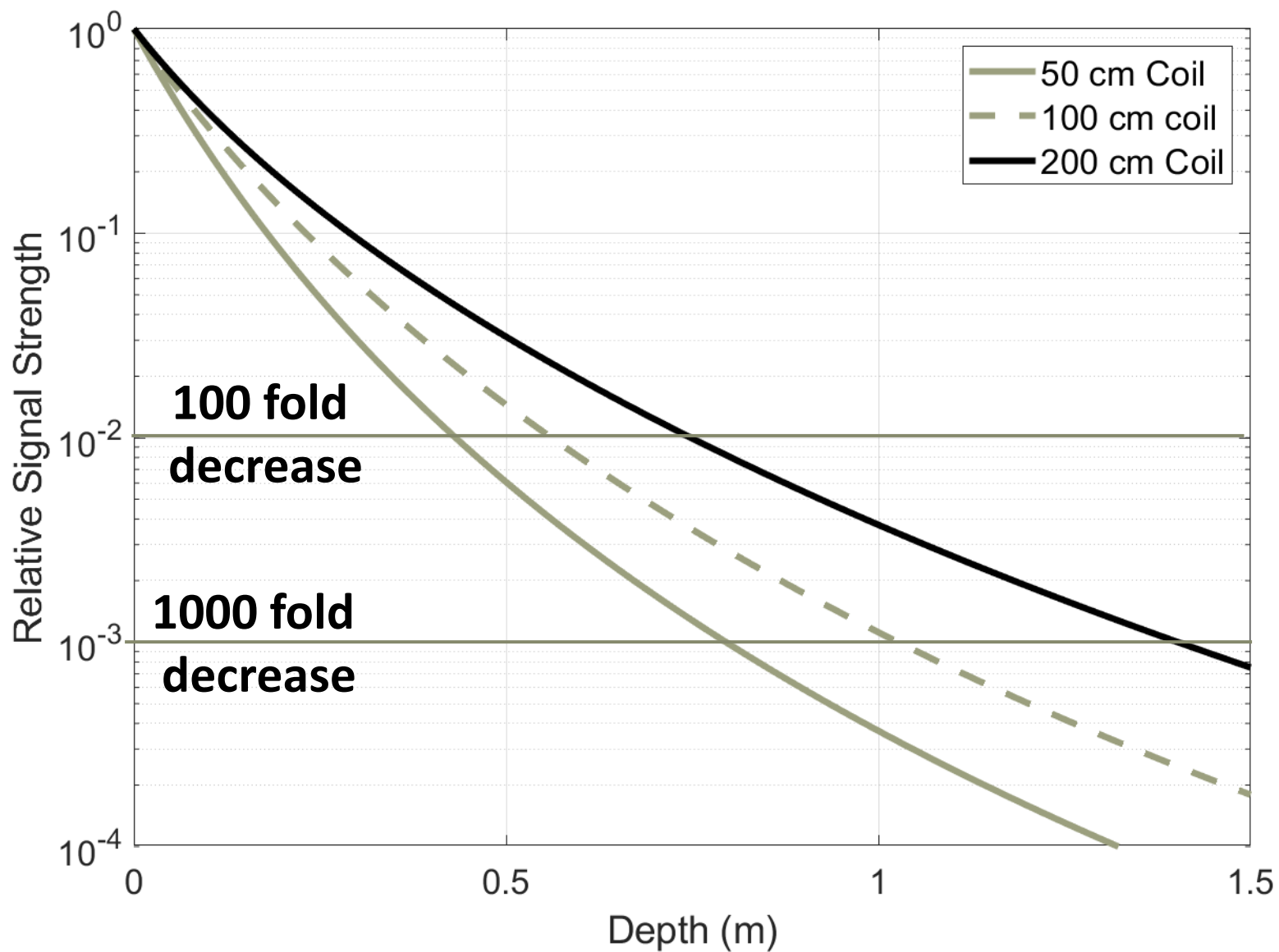
Still a challenging problem

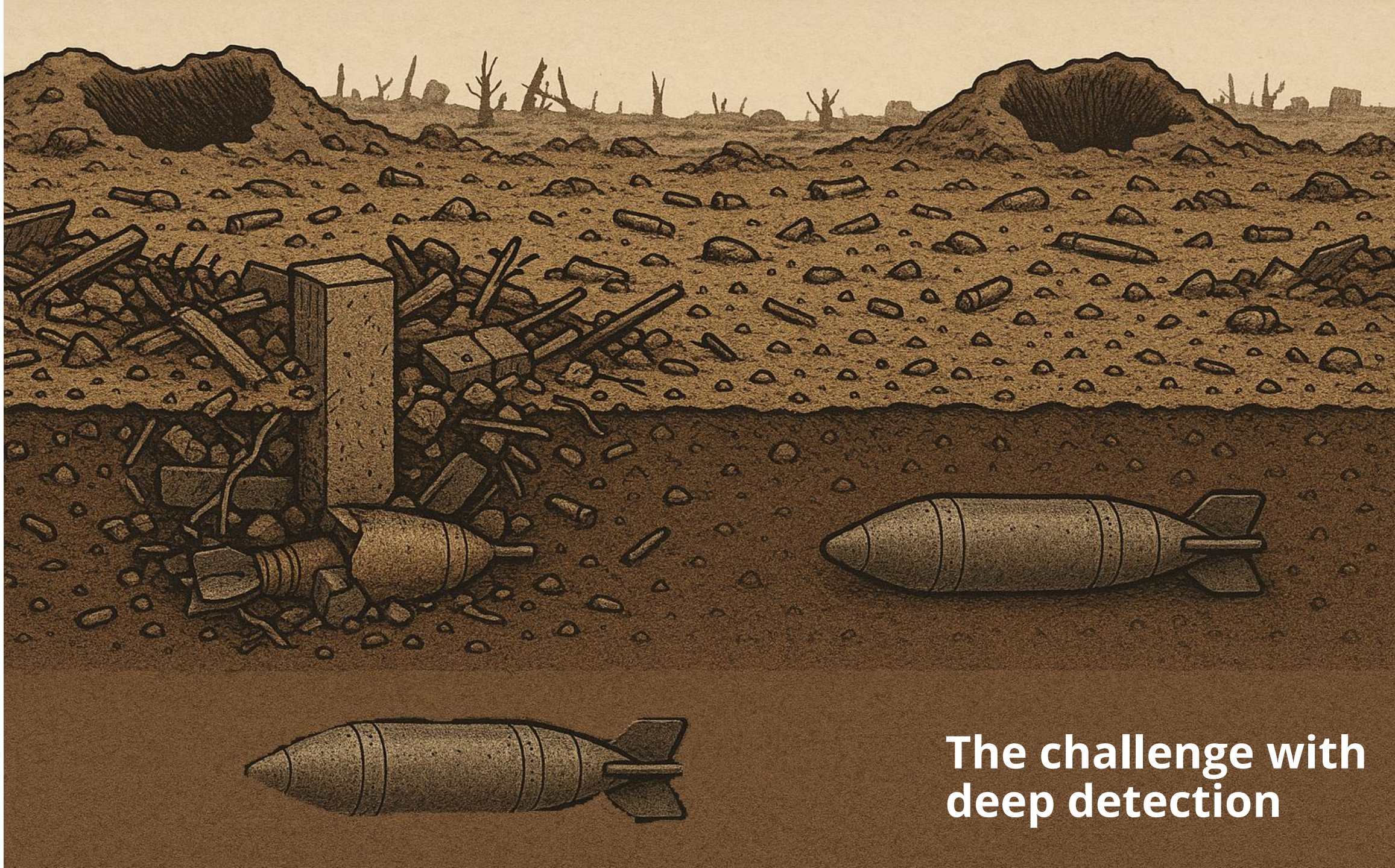


Better knowledge of micro-topography



Detection Depth challenge





**The challenge with
deep detection**



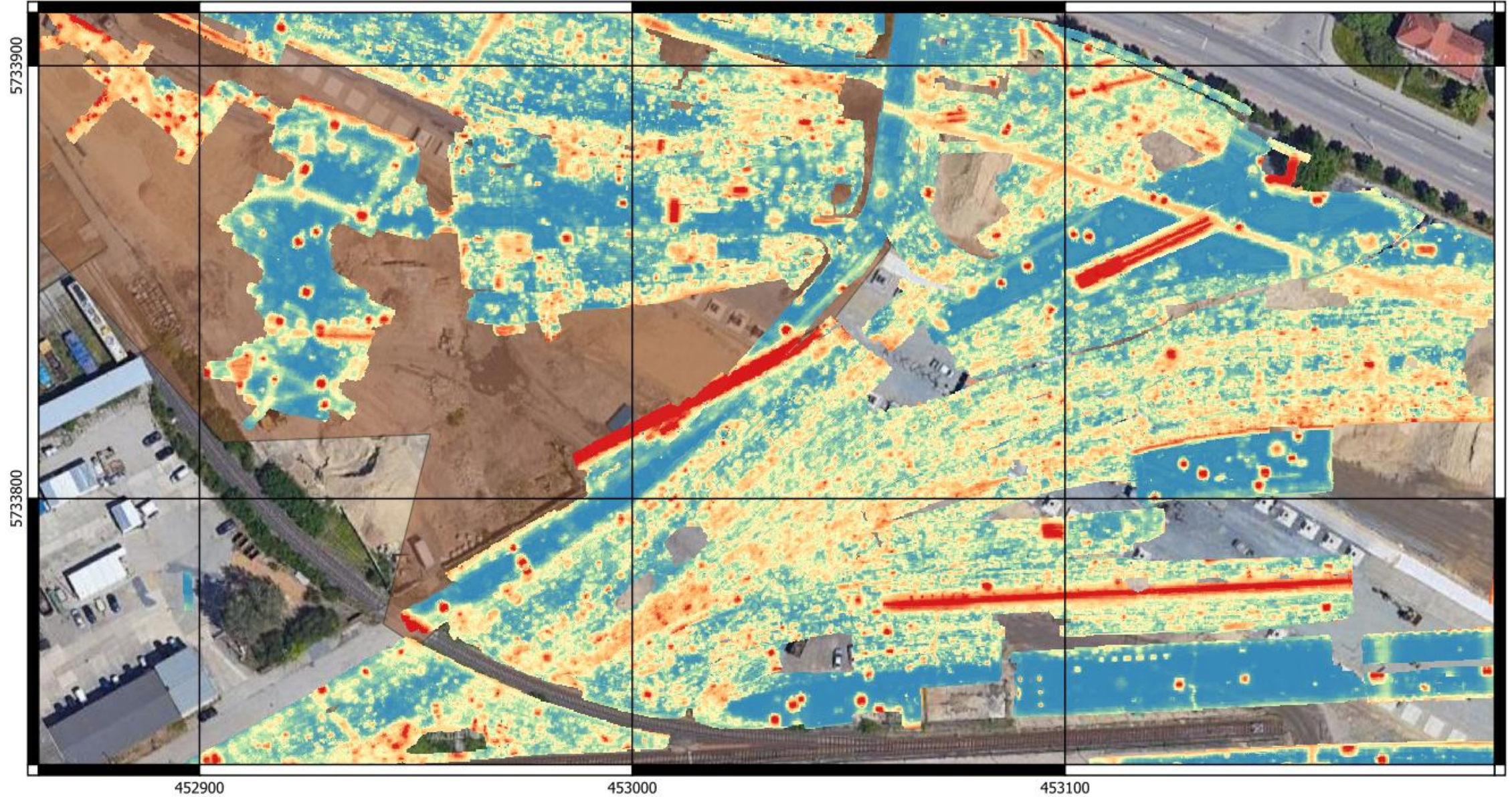
Complex sites

Significant clutter challenge



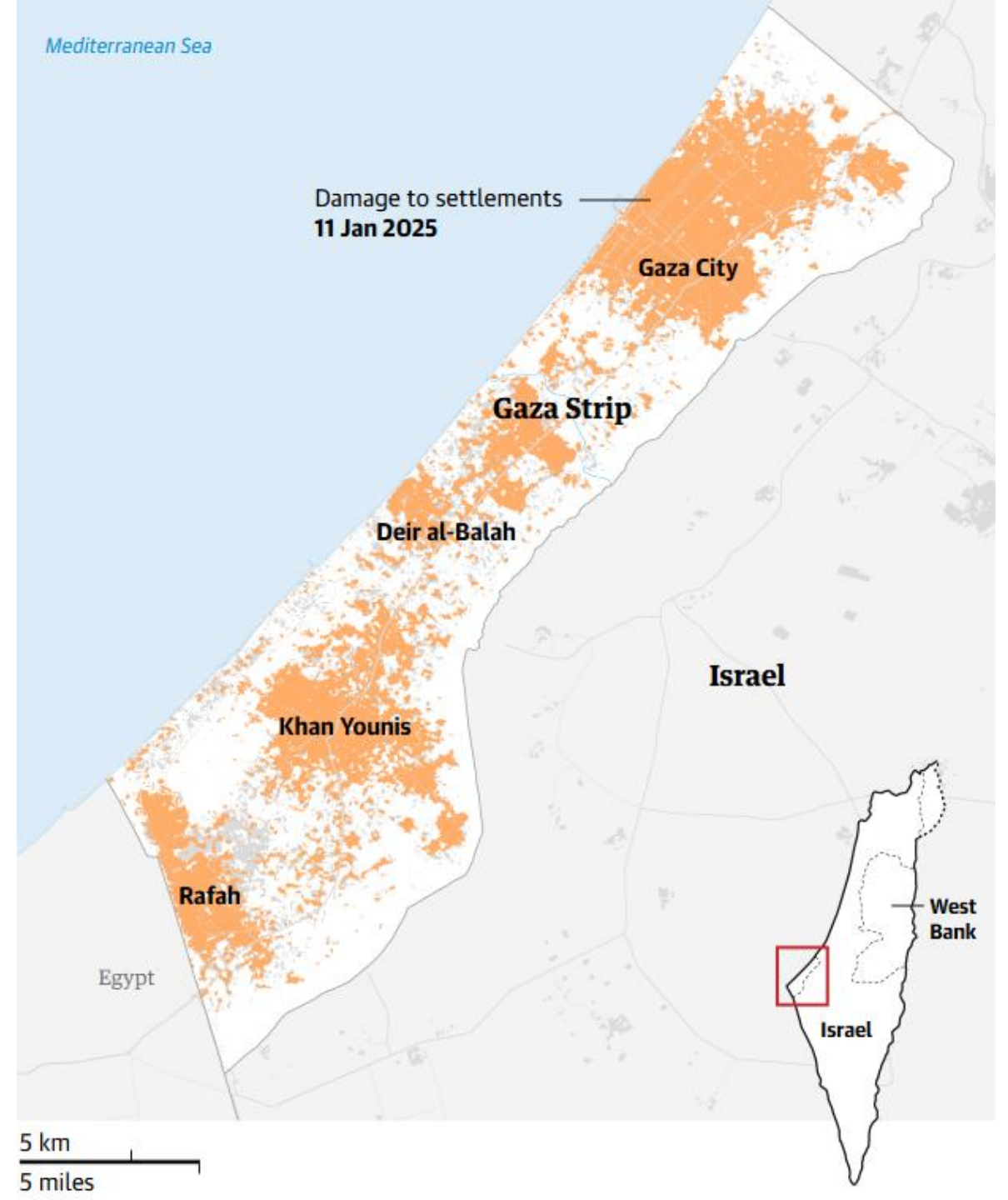
Complex sites

Significant clutter challenge



Complex sites How can geophysics help?

**In Gaza 60% of
buildings destroyed or
damaged**



Complex sites

What role for geophysics?



Future Improvements

Computer resources

Autonomous survey

Auxiliary sensors

AI aided decisions

AI aided processing

Improved algorithms