Proceedings of the 10 th Workshop "Seabed Acoustics", Presentation P11:

Ultra-high-resolution 2D/3D seismic data for munition detection

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Overview

- BASTA Project
- Equipment
- SBP: Modes Comparison
- Integration with magnetics and MB
- Detection ranges
- 3D Results
- Conclusions and future work

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BASTA

Boost **A**pplied munition detection through **S**mart data in**T**egration and **A**I workflows

Develop more efficient data acquisition and object detection strategies

2D/3D ultra-high-resolution acoustics

Correlation with multibeam and magnetic (gradiometer) data

VLIZ EGEOS G-tec

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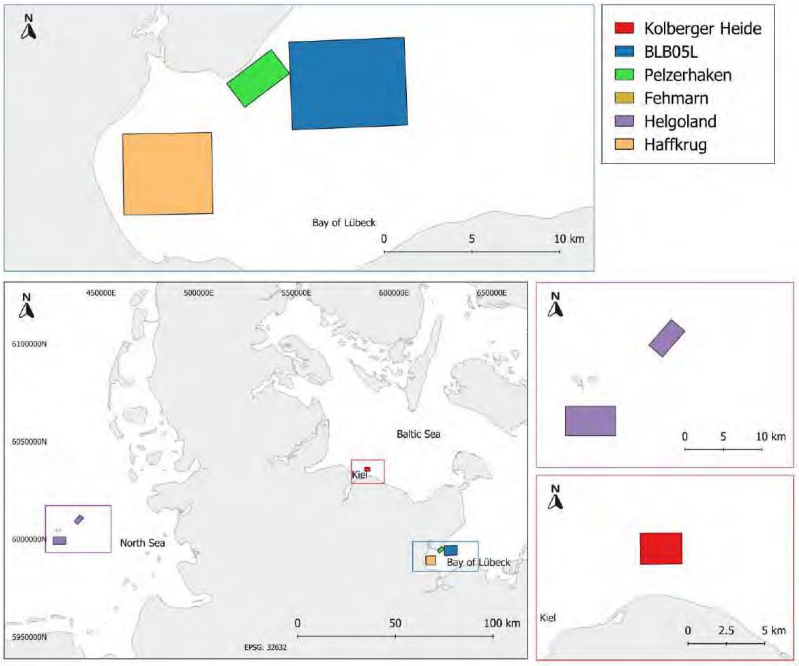
Surveys

2020-2021



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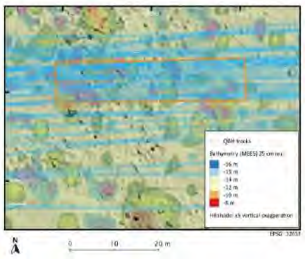
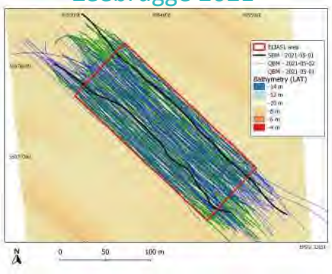
3D Surveys

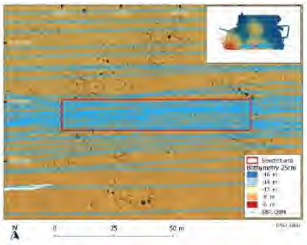
Kolberger Heide 2020



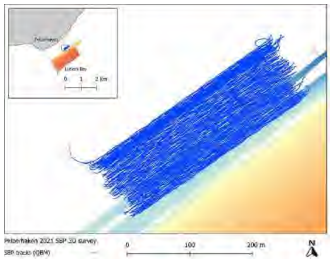
Zeebrugge 2021



Lubeck Bay 2020



Lubeck Bay 2021



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Equipment

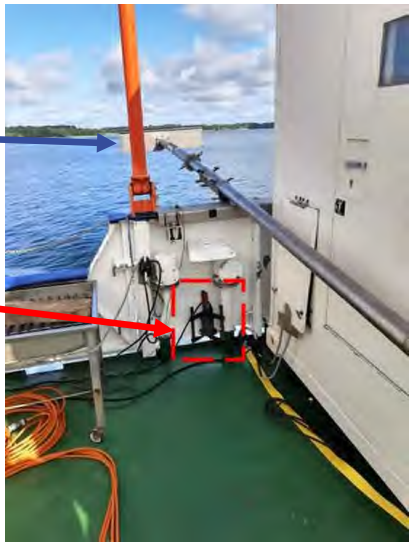
Innomar SES-2000 Quattro

Acquisition unit

Multi-transducer SBP

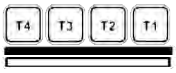
4 Transducers

+ Motion sensor
+ GNSS

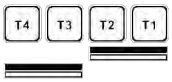


Kolberger Heide, RV Littorina (June 2020)

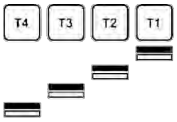
Single Beam Mode



Dual Beam Mode



Quadruple Beam Mode



Transmitting
Receiving

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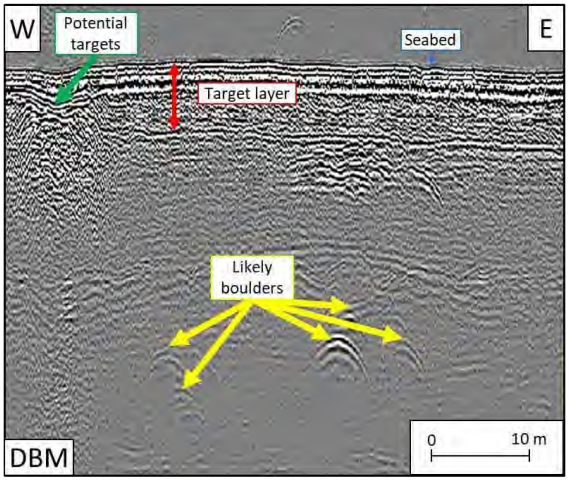
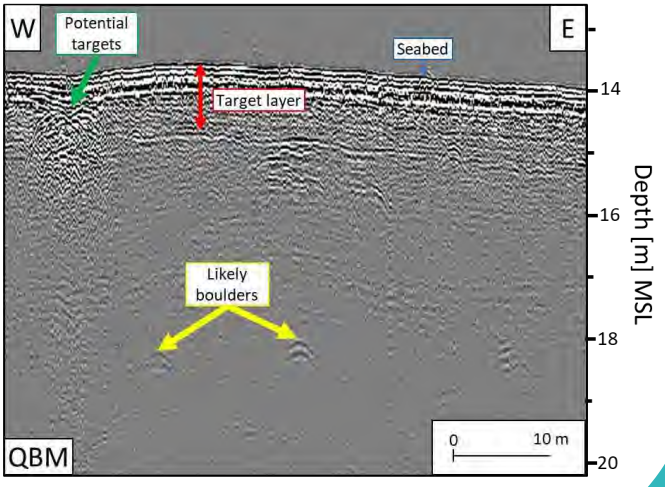
Modes comparison

Dual Beam Mode



Quadruple Beam Mode



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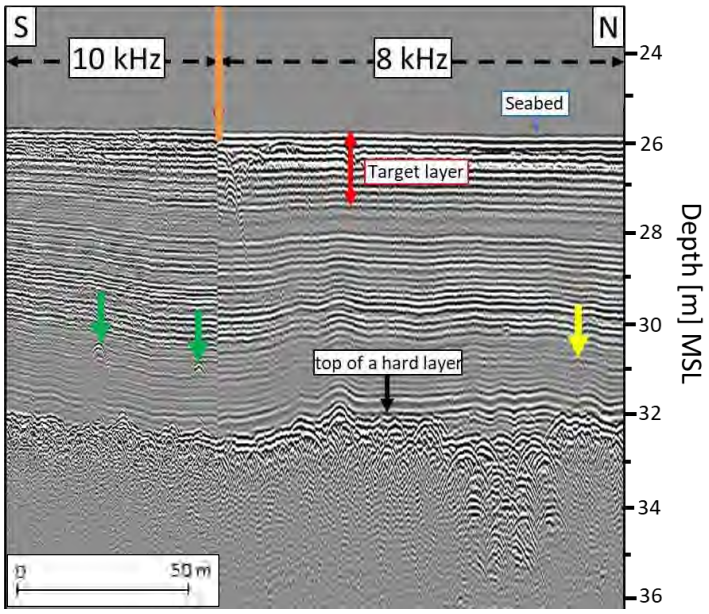
Frequency comparison

Single Beam Mode



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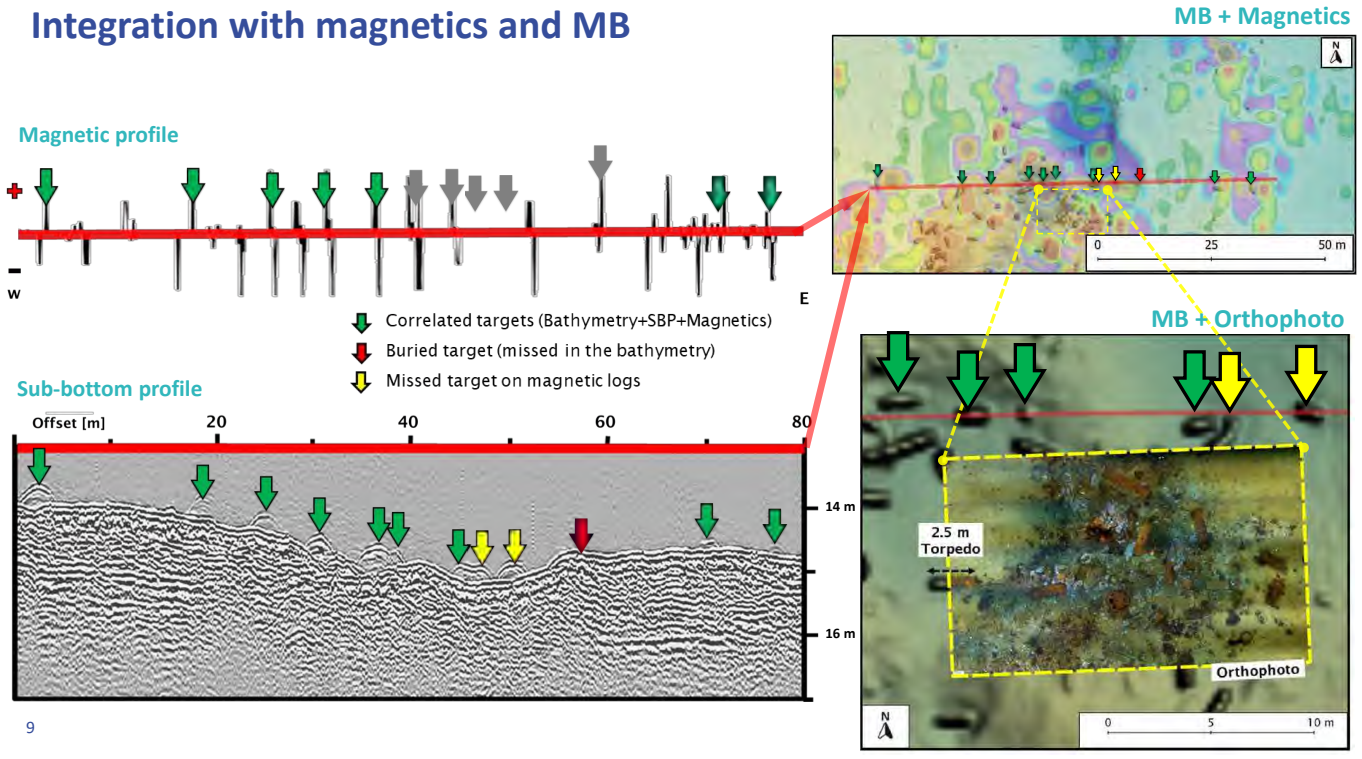
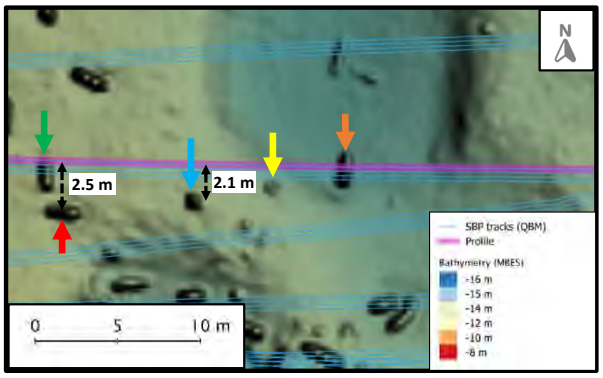
Integration with magnetics and MB

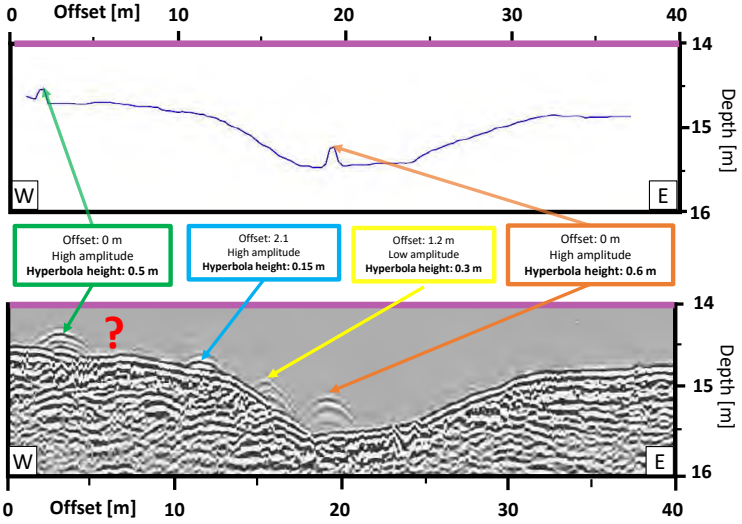


Amplitude and detection ranges

MB mapping



MB Topographic profile



Sub-bottom profile

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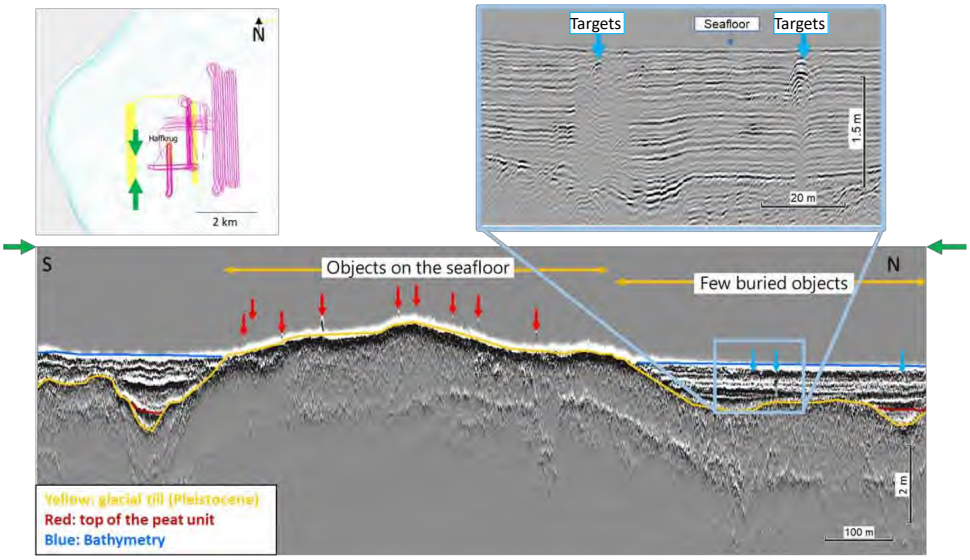
The importance of geology

Lubeck Bay 2021



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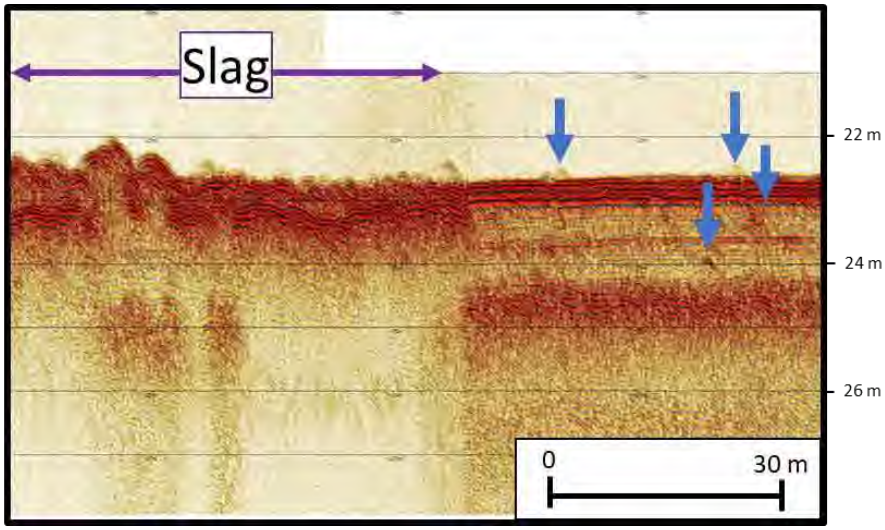
The importance of geology

Lubeck Bay 2021



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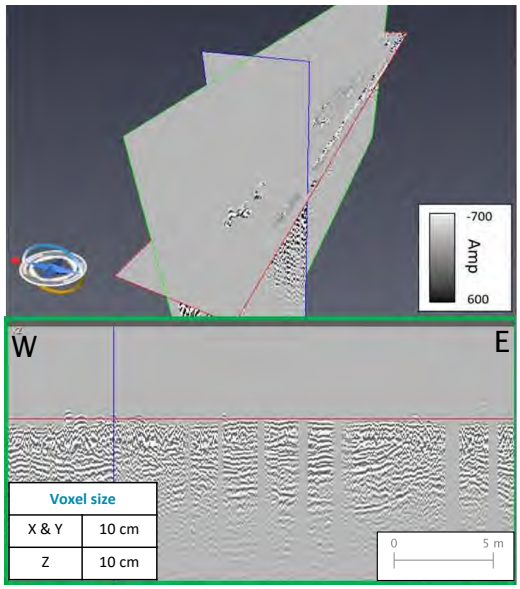
Ultra-high resolution acoustics

3D Results

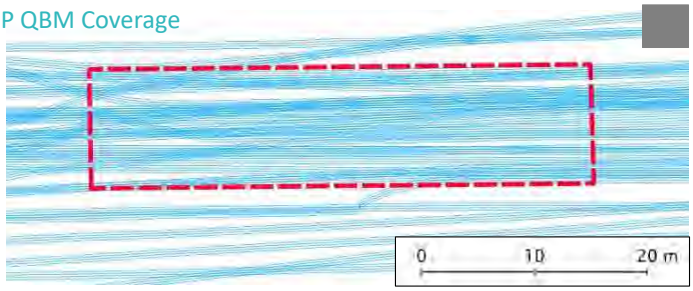
VLIZ

3D Results

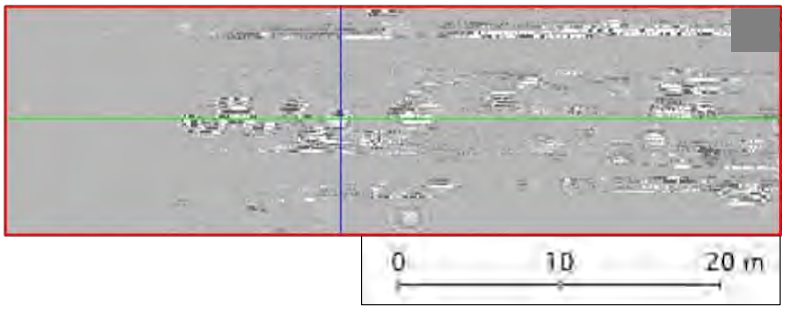
Kolberger Heide



SBP QBM Coverage



Depth slice



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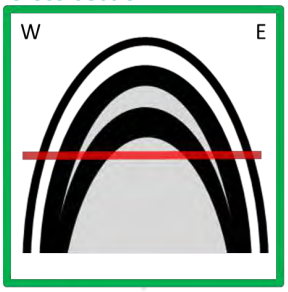
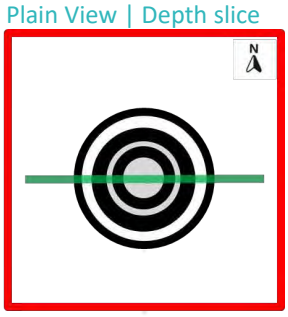
3D Results

Kolberger Heide

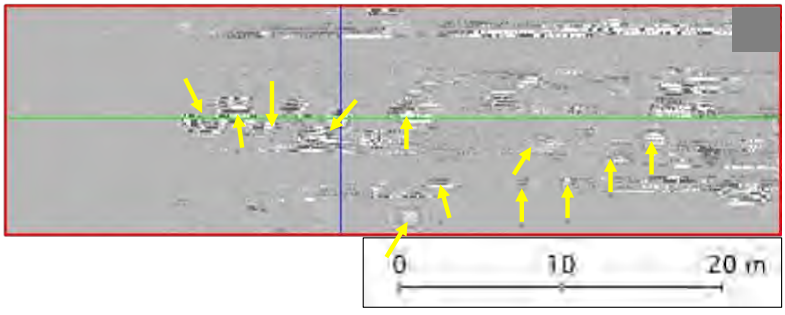
Cross-section



Plain View | Depth slice



Depth slice



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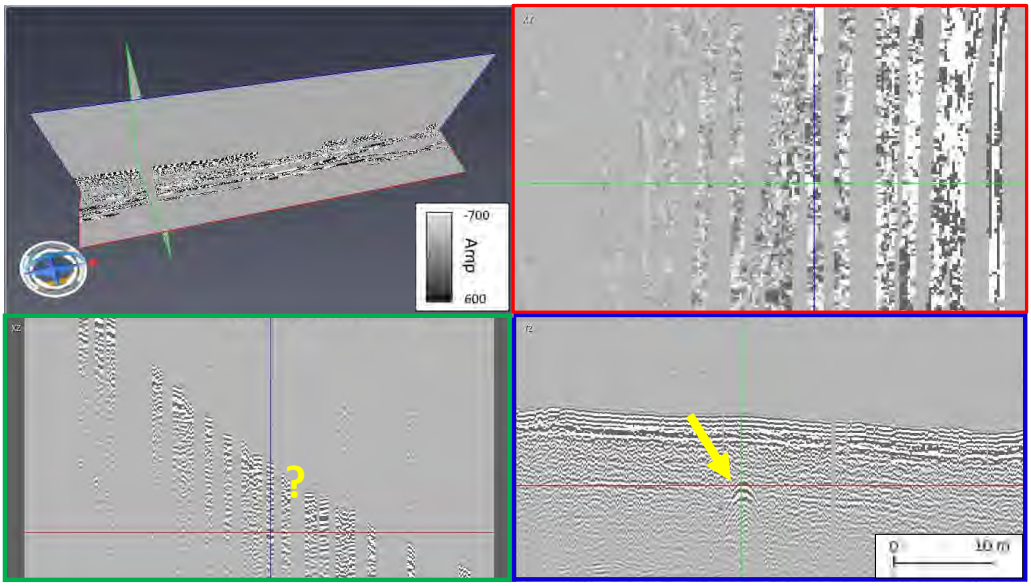
3D Results

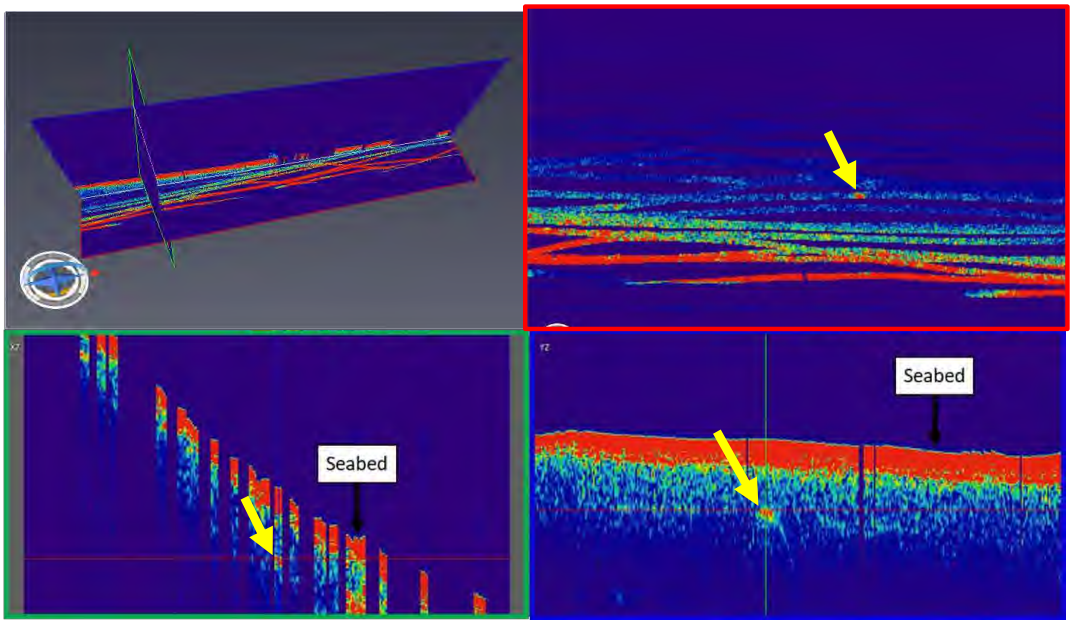
Lubeck Bay #1

Full wave-form 3D volume



VLIZ

3D Results – Lubeck Bay #1



Envelope demodulated 3D volume

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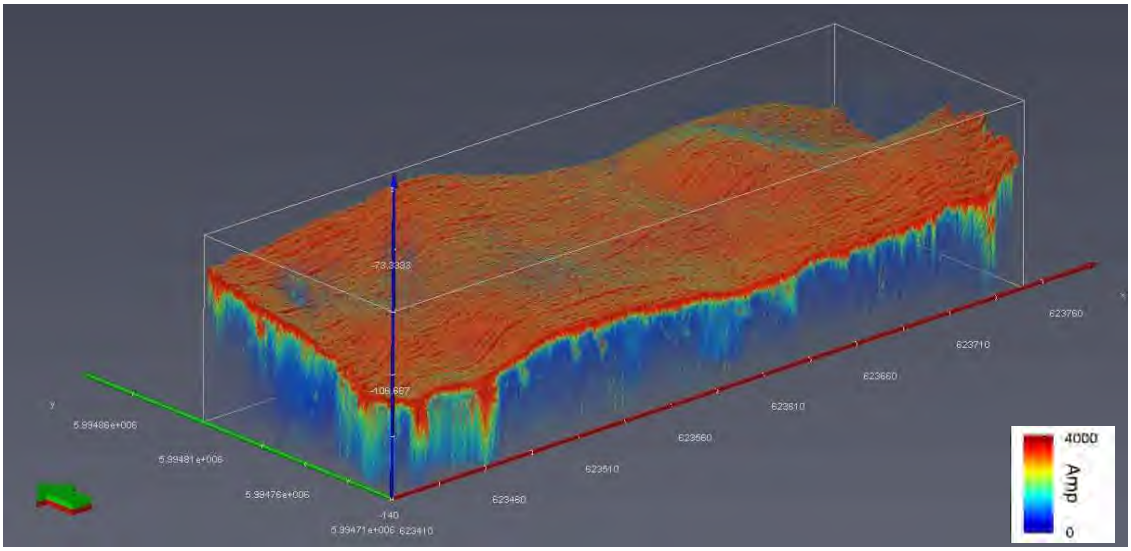
VLIZ

3D Results – Lubeck Bay #2



Envelope demodulated 3D volume

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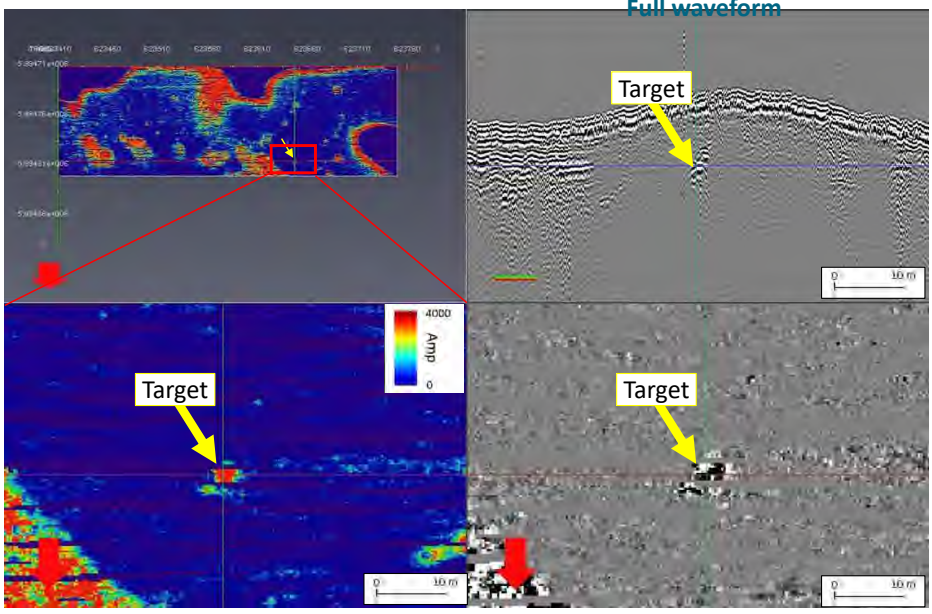
3D Results – Lubeck Bay #2

Envelope demodulated

Full waveform



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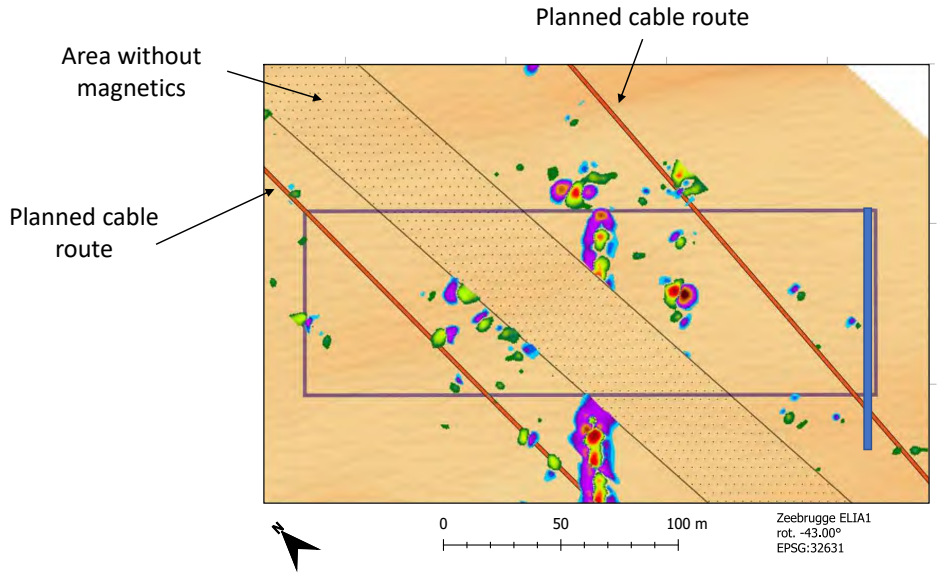
3D Results – Zeebrugge



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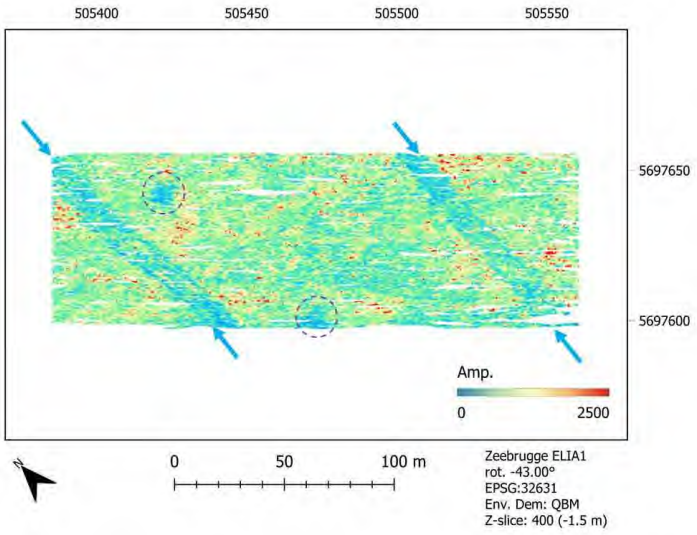
3D Results – Zeebrugge



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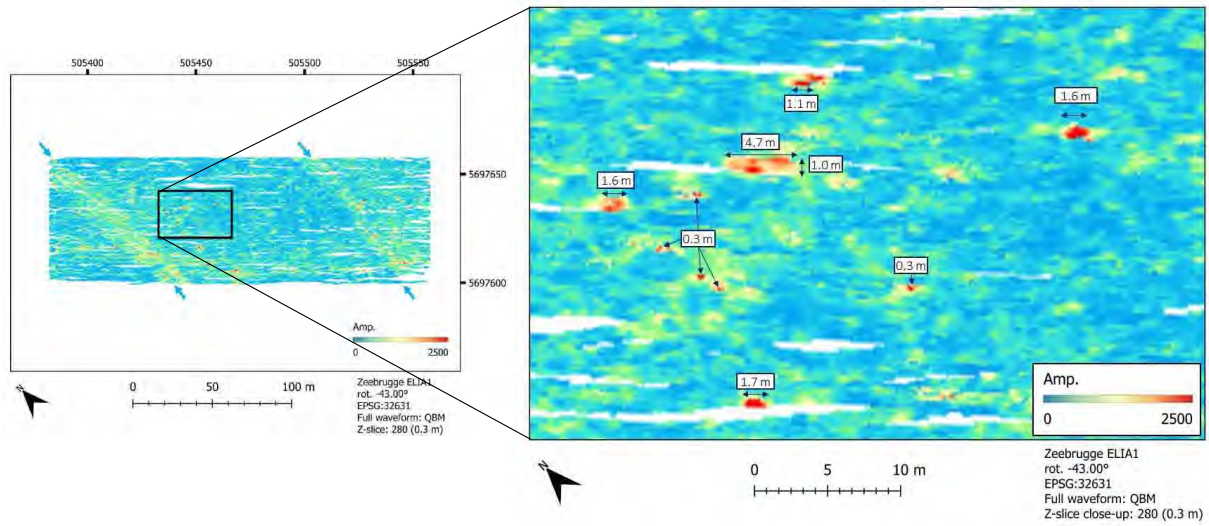
3D Results – Zeebrugge



Some conclusions

What have we learned so far?

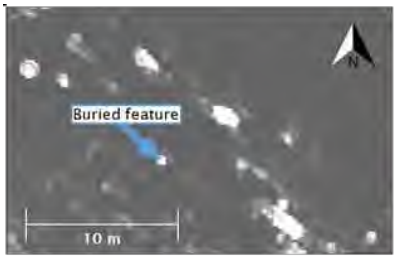
- Different expressions of buried and exposed munition in SBP data
- 2D data allow objects to be 'missed'. Detection range <2 m.
- 3D data require optimal acquisition (coverage, weather, …). However, it is suitable for mid to large feature interpretation (<10 m).
- Identification of small-scale features remains difficult in this data set. Transducer movements are not fully compensated, the only motion correction applied is the heave.
- Integration with MB and magnetic data remains crucial

Future work

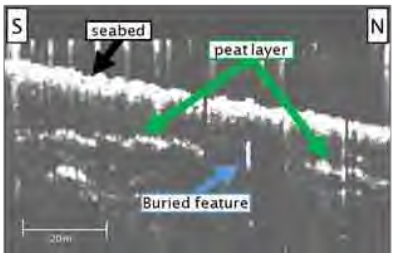
- Post-processing of 3D data to improve 3D data quality – e.g. variance attributes
- Potential of AUV for SBP data – implementation of transducer on VLIZ AUV is considered
- 2D/3D tests in controlled test site in 2023 (La Spezia, La Ciotat)

Post-processing – variance attributes

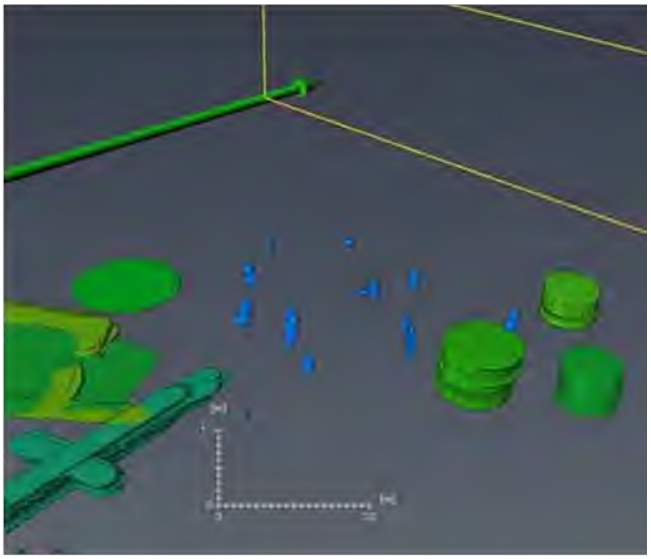
Variance 3D attribute: Depth slice



Variance 3D attribute: cross-section



3D modeling



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