



RÉPUBLIQUE
FRANÇAISE

*Liberté
Égalité
Fraternité*

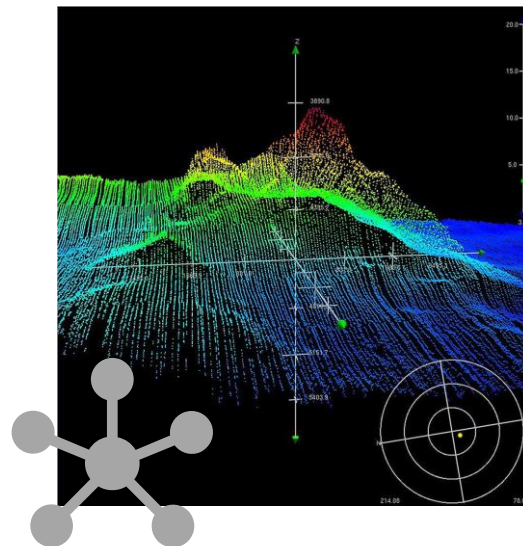


L'océan en référence

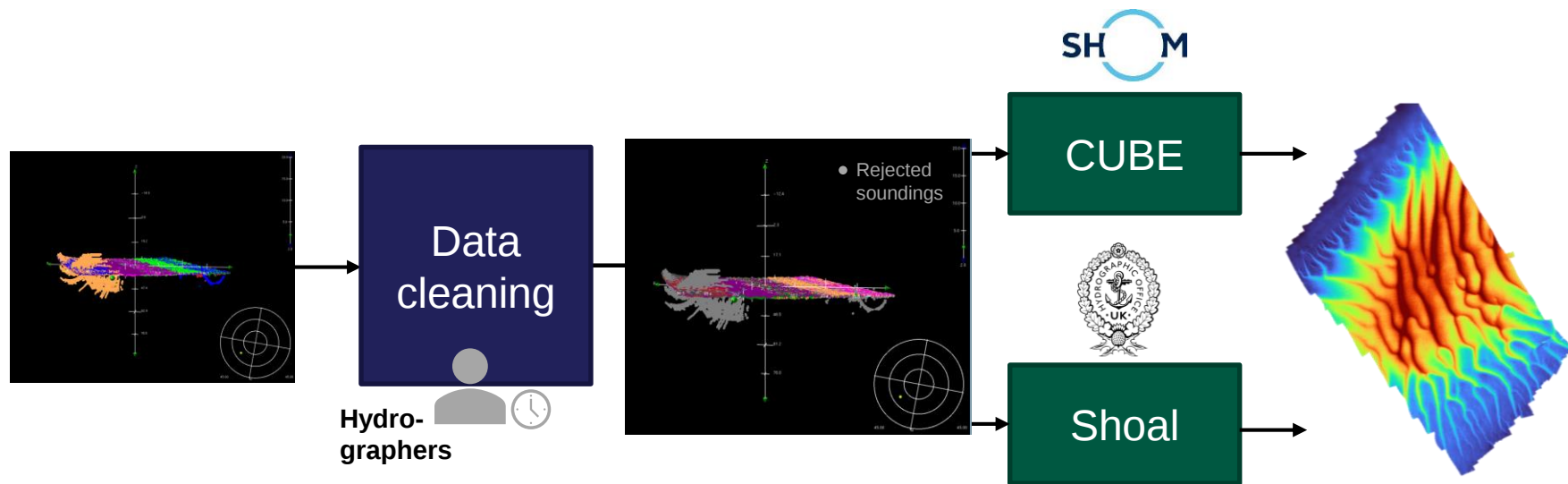


UK Hydrographic
Office

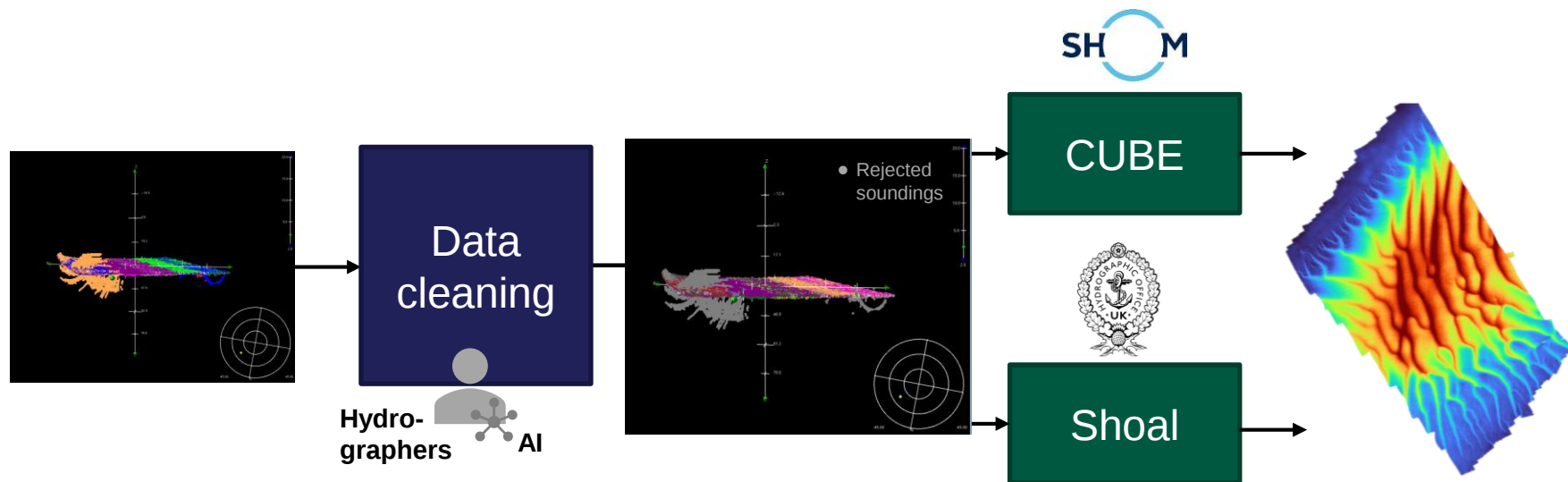
SHOM-UKHO PARTNERSHIP FOR AI-DRIVEN MBES BATHYMETRIC PROCESSING EVALUATION



SHOM and UKHO processing strategies

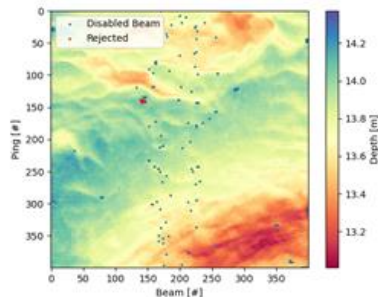


SHOM and UKHO processing strategies



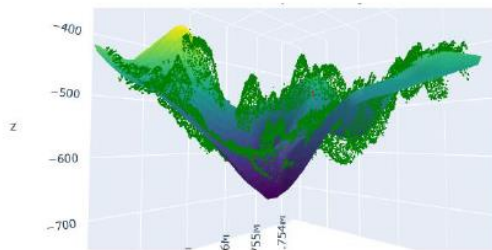
Models

Temporal-based



BathIA2D [1]

Surface-based



GAM [2]



DL2D

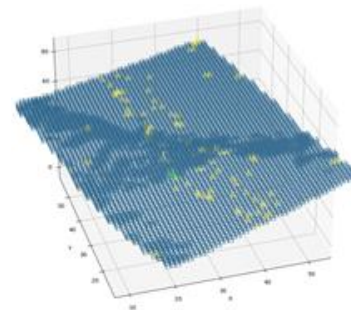


Ensemble



DL3D [3]

Voxel-based

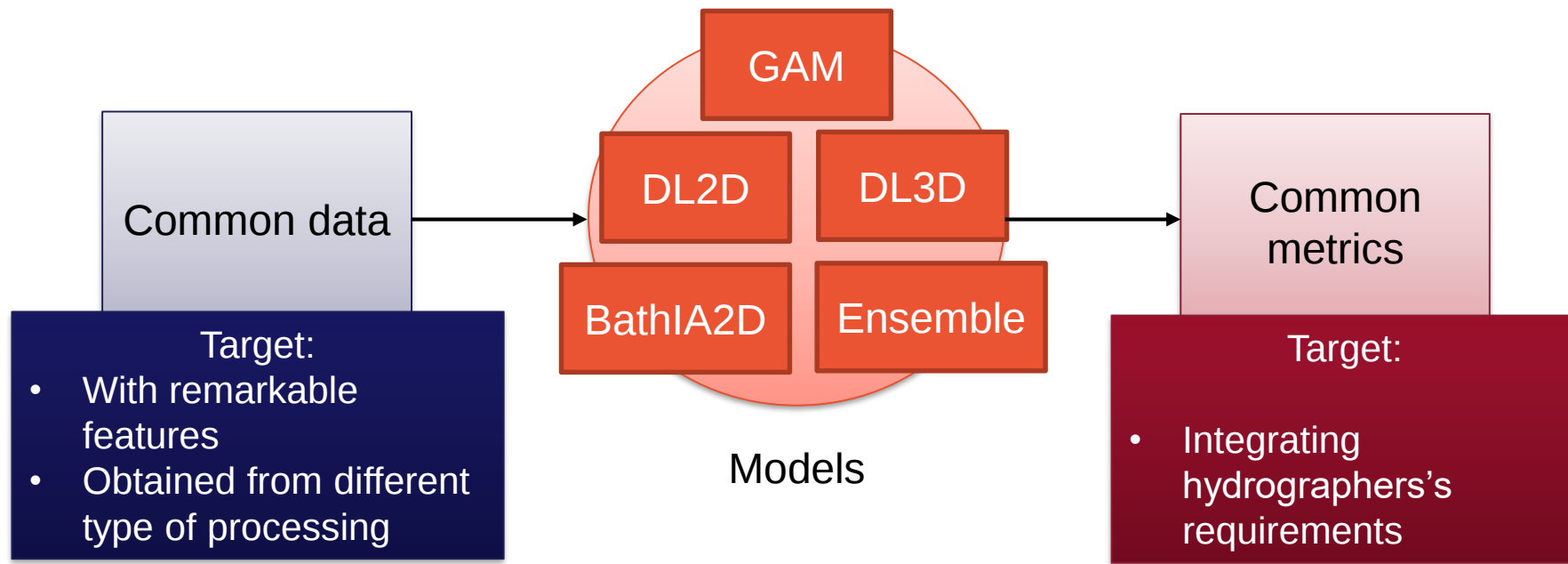


[1] M. Michel, C. Delblond, J. Le Deunf, C. Phung, T. Schmitt, et E. Vallee, « Enhancing Bathymetric Data Processing with Artificial Intelligence: A 2D U-Net Approach for Hydrographic Applications », in *OCEANS 2025 Brest*, juin 2025

[2] <https://www.teledynecaris.com/en/products/whats-new/hips-and-sips/>

[3] D. Stephens, A. Smith, T. Redfern, A. Talbot, A. Lessnoff, et K. Dempsey, « Using three dimensional convolutional neural networks for denoising echosounder point cloud data », *Applied Computing and Geosciences*, vol. 5, p. 100016, mars 2020

Evaluation framework



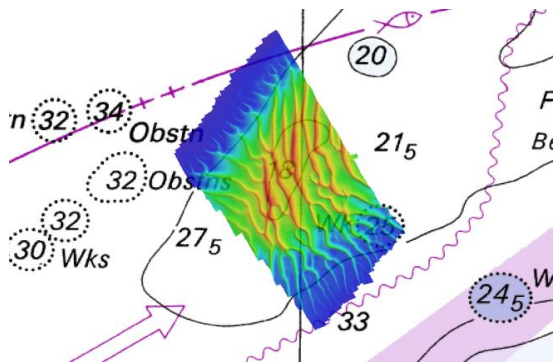
Common data

SHOM DUNKIRK SURVEY (Jun. 2025)

Number of soundings: 49,839,641

Content: sand ripples, wreck

Other: Kongsberg EM 710, CATZOC B, rough sea

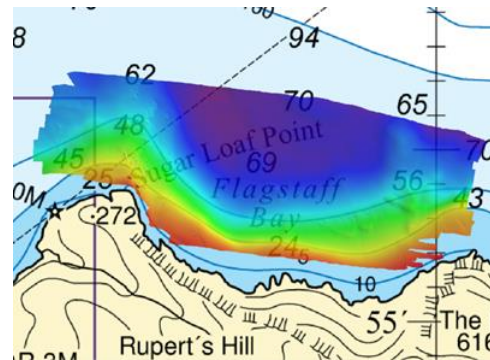


ST HELENA SURVEY (Nov.-Dec. 2018)

Number of soundings: 162,463,971

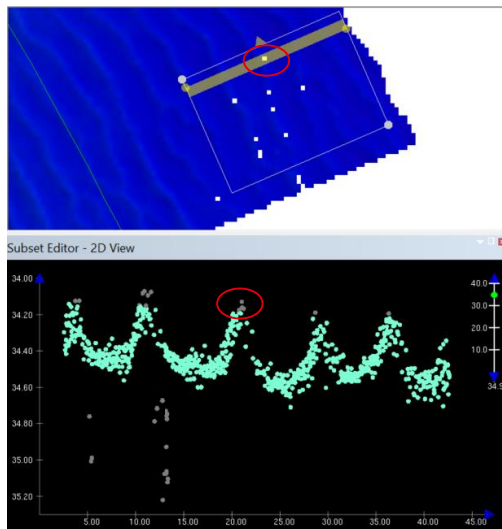
Content: flat seabed, isolated rocky areas

Other: Kongsberg EM2040, CATZOC A1

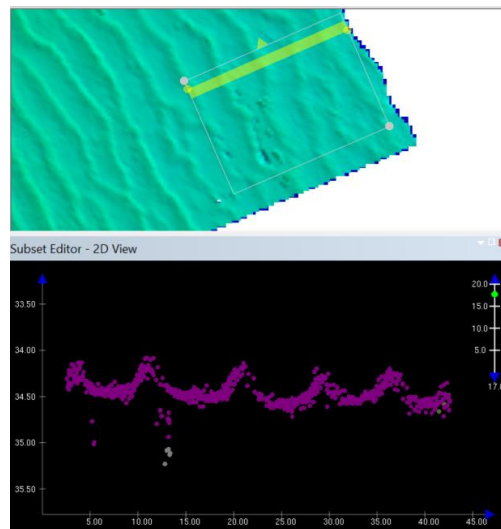


Common metrics

Over-cleaning



Under-cleaning



Machine Learning metrics

recall, precision, F1-score

Sounding metrics

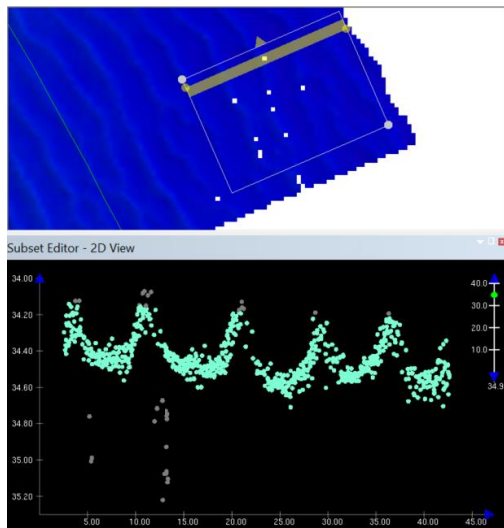
dispersion, density

Surface metrics

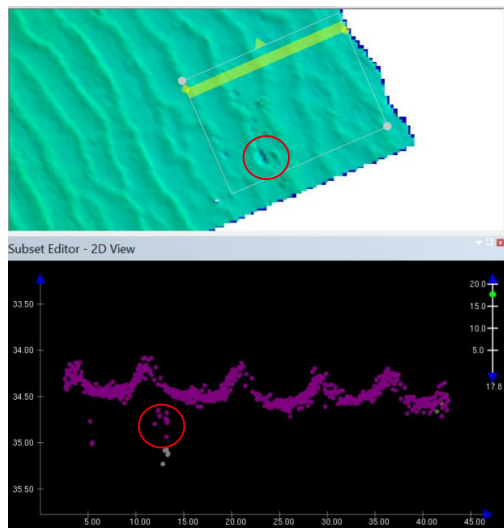
- NRMSE (mean and shoal)
- holes ↗ (and antiholes ↘)
- spikes (over ↗ and under-cleaned ↘)

Common metrics

Over-cleaning



Under-cleaning



Machine Learning metrics

recall, precision, F1-score

Sounding metrics

dispersion, density

Surface metrics

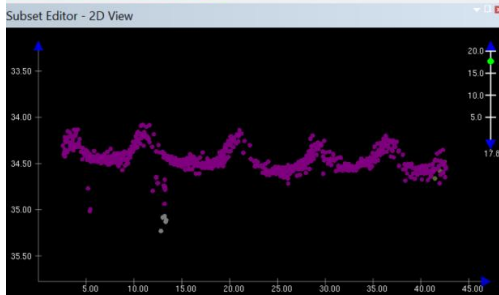
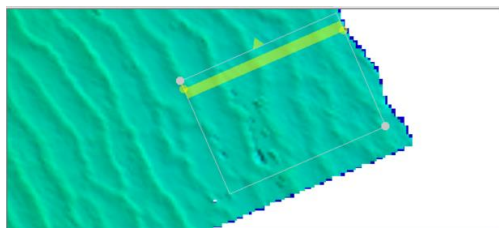
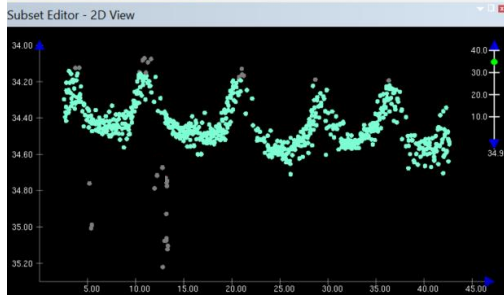
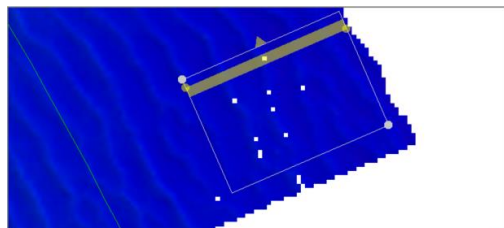
- NRMSE (mean and shoal)
- holes ↘ (and antiholes ↗)
- spikes (over ↘ and under-cleaned ↗)

Common metrics

Over-cleaning



Under-cleaning



Machine Learning metrics
recall, precision, F1-score

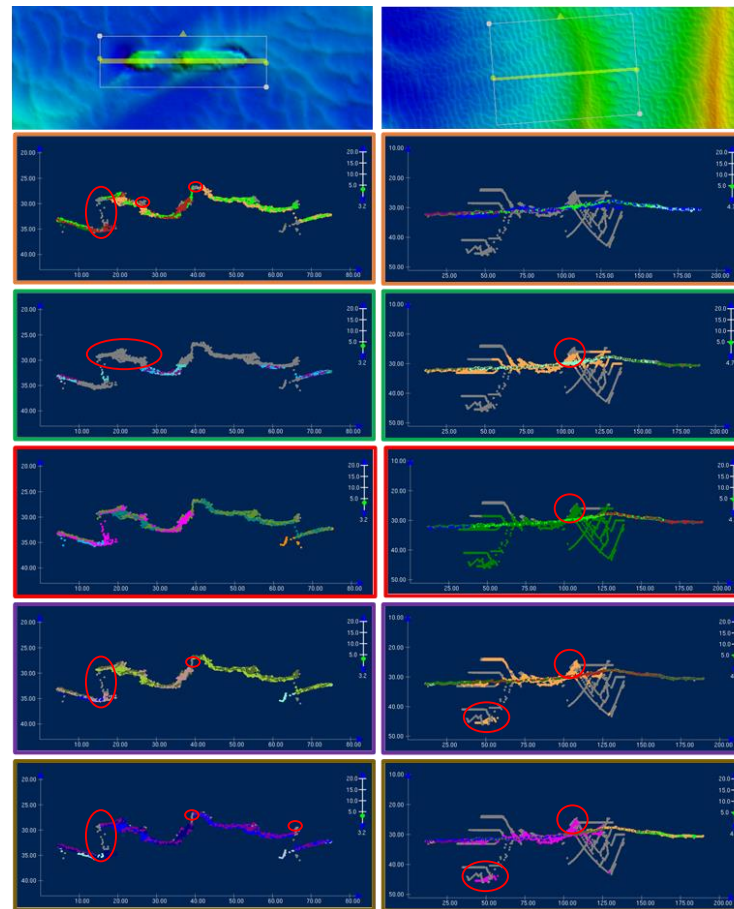
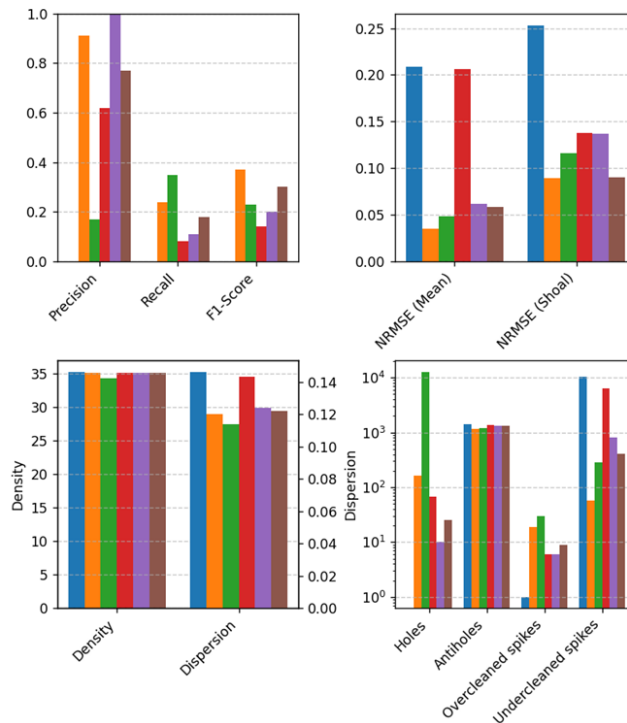
Sounding metrics
dispersion, density

Surface metrics

- ↘ NRMSE (mean and shoal)
- ↘ holes (and antiholes)
- ↘ spikes (over and under-cleaned)

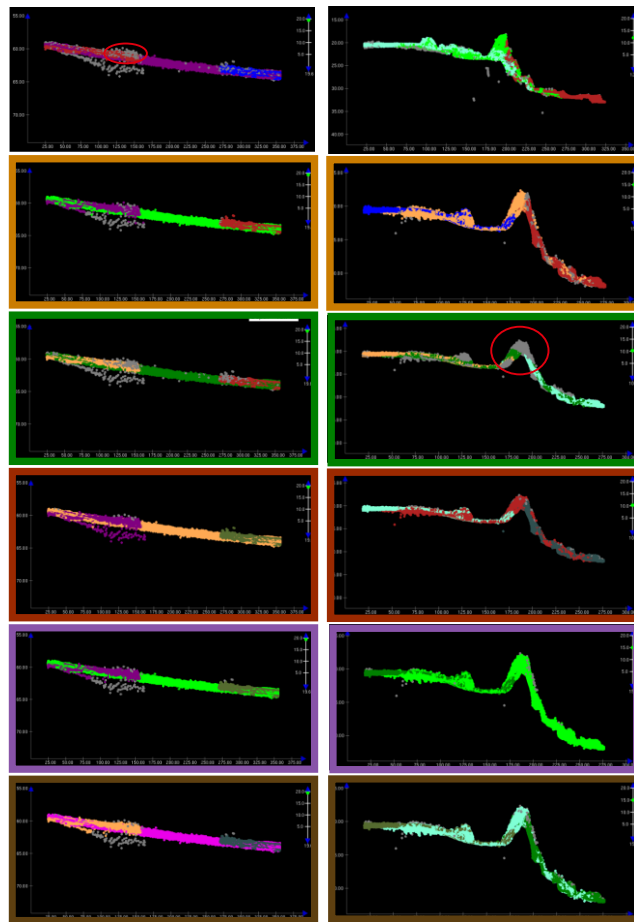
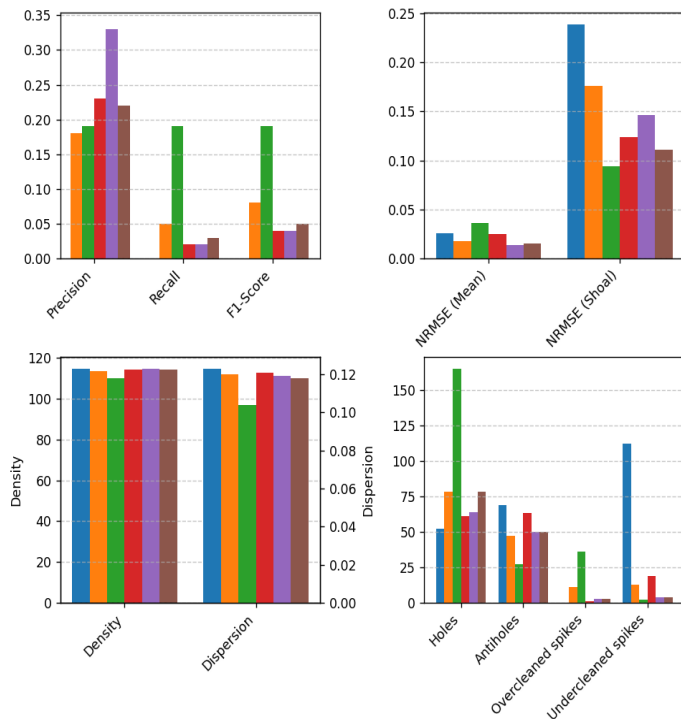
Results: Dunkirk survey

■ Raw
■ BathIA2D
■ GAM
■ DL2D
■ DL3D
■ Ensemble



Results: St Helena survey

- Raw
- BathIA2D
- GAM
- DL2D
- DL3D
- Ensemble



Conclusion

Comparison of models

Model	GAM		BathIA2D		DL2D		DL3D / Ensemble	
Seabed	Nois	Flat	Nois	Flat	Nois	Flat	Nois	Flat
Preserving local features								
Creating artificial features								
Precision								
Recall								
F1-score								

Evaluation framework

- Common data: takes into account different configurations (CATZOC, sensors, depth range, type of seabed, noise level, ...)
- Common metrics: based on ML and hydrographic requirements
- Qualitative analysis: check model behaviour without ground truth bias
- Prospects: wider collaboration to improve data diversity and specify new metrics

Thank you !!!



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