Prospects for innovation at Shom
Remote sensing bathymetry
- Historical background
- SDB

Backscatter
- Calibration
- Processing

AUV
- Use and project

Around Base Editor (CARIS product)
- BDB Emprise
- Et GeoWizard
- SurfRef

Machine learning processing
- Issue
- First result
- Perspectives
<table>
<thead>
<tr>
<th>Topic</th>
<th>Details</th>
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</table>
| Remote sensing bathymetry                          | • Historical background  
|                                                    | • SDB                                      |
| Backscatter                                         | • Calibration  
|                                                    | • Processing                               |
| AUV                                                | • Use and project                          |
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|                                                    | • Perspectives                            |
- Satellite imagery used since 1987 as data sources for nautical chart at Shom.

- On the 1\textsuperscript{st} January 2012, it’s more than hundred “spatiochart” from 87 survey dedicated to this data.

\textit{SHOM 7458 chart on Aratika atoll. The south-eastern part from satellite remote sensing (the northern part comes from conventional hydrographic surveys).}
SATELLITE DERIVED BATHYMETRY → MARINE SPATIOCHART

Image
Pléiades

Specific HRS databases

S-57 product
An innovation partnership

- 3 stages: Research, Development, Industrialization
- 3 consortiums
- Research stage has started for a 1 year period

Objectives

- Assess performances improvements of emerging solutions
- Strengths and assets of the operators
  - Atmospheric corrections
  - Land mask creation
  - Inversion solution (empirical, LUT, analytical modeling)
  - Optimization process with time series from free images
  - Error models
- Make a state of art and define a strategy
- Upgrade Shom’s production line
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BACKSCATTER CALIBRATION
THE ISSUE

3km
Mise en contexte

BACKSCATTER CALIBRATION
THE IFREMER/SHOM SOLUTION

Dots: EK60 calibrated data for 2 frequencies
(Curves: fitting curve – model GSAB)

Offsets between EM2040c and EK60 (BS correction)

EK60 vs EM2040c

4dB
From: Analysis of calibrated seafloor backscatter for habitat classification methodology and case study of 158 spots in the Bay of Biscay and Celtic Sea, Ridha Fezzi, Laurent Berger (Ifremer).
Mise en contexte

From: Backscatter Working Group Software Inter-comparison Project Requesting and Comparing Intermediate Backscatter Processing Results, BSIP
Intermediate processing steps provides insights into differences between software outputs
Differences in level “as read in the datagrams” BL0 a surprise

A variety of processing approaches available
Improved tools needed to understand impact of one choice vs. another

Next steps
Round 2 processing in progress to provide other intermediate steps (corrections)

We need your help !!
Users: To demand that results processed by different software should agree with each other
Software developers: To work together to implement agreed best practices for backscatter processing
BSWG: To provide a platform to facilitate these discussions

From: BSIP, Backscatter Working Group Software Inter-comparison Project Requesting and Comparing Intermediate Backscatter Processing Results, U.S Hydro 2019
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Minerve research

AUV Astérix will be used to find the Minerve submarine. Should be around 2300 meters depth.

NAVIDRO:

Develop an AUV navigation simulator to simulate and improve planning, predict positioning uncertainty during the mission.

Predict when the AUV will no longer meet the required requirements.
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Mise en contexte
AROUND BASE EDITOR
BDB EMPRISE
Mise en contexte

AROUND BASE EDITOR
ET GEOWIZARDS

GeoWizards Client 1.7

Input:
- ASCII

Surface:
- Type: LGZ, GLZ
- Fichier ASCII
- POSACC: 0.00
- RESLOT: 0.00

ET GeoWizards
- SHP Directory
- Tolerance (m): 0.00
- Traitement #1
  - Polygones
  - Lignes
  - Remove holes
  - Avoid loops
- Buffer (m): 0.00

Défaut de zone, ajustement de la distance de la zone (Fichier ASCII)
### Mise en contexte

**AROUND BASE EDITOR**

**SURFREF: SEMI-AUTOMATIC DECONFLICTION ANALYSIS**

#### Image Description:

- **Image 1:** A screenshot showing a spreadsheet titled "BOB Surface Reference 1.2" with columns labeled "OBINAM," "BASE," "SUREND," "CALEVA," and "CALTXT." The spreadsheet contains data for various entries.

- **Image 2:** A screenshot showing a dialog box titled "Edition info" with fields for "OBJNAM," "BASE," "SUREND," and an option to "Annule et remplace les levés antérieurs." A button labeled "OK" is present.

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</table>
Mise en contexte

MACHINE LEARNING

ISSUE

Three outlier’s categories in bathymetric section
MACHINE LEARNING
ISSUE: LIDAR POINT OF VIEW
MACHINE LEARNING

ISSUE: LIDAR POINT OF VIEW
Mise en contexte

1) Study window type:
- Fix window
- Moving window
- Quadtree

2) Point representation:
- Easting
- Northing
- Spatial
- Ping Number
- Beam Number
- Temporal/sequential
3) Type of features compute:

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<tr>
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**BIBLIOGRAPHIE:**

- *Automatic Detection of Outliers in Multibeam Echo Sounding Data*, Tianhang Hou & Larry A. Mayer, University of Hampshire, 2001
- *Using the Median Absolute Deviation to Find Outliers*, Peter Rosenmai, January 2013
- *Outlier Detection Techniques*, H-P Kriegel, P. Kröger & A. Zimek, Columbus, Ohio, 2010
1) Data analysis

- Temporal features
  - Bad Ping Detection
2) ML model

- Features de la sonde
  - Features voisinage spatial
  - Features voisinage temporel

Annotations
Accept / Reject

- 1) Régression Logistique
- 2) Random Forest
- 3) Gradient Boosting

Métrique ?
3) Metrics and results

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Results on area: Northing: [7713100 - 7713400], Easting: [422100 - 4222200], train/test à 70%/30%
➤ We are just at the beginning but we have very promising results

➤ The first results were based on MBES data but we will look at Lidar data very soon

➤ Strong interaction between the university community (engineering school ENSTA Bretagne and IMT Atlantique) and the Shom

➤ We started a Phd on the subject since october 2018
MERCI !