

Brest, XX August 2016

N° XX SHOM/DOPS/MIP/BATHY/NP

SERVICE HYDROGRAPHIQUE ET  
Océanographique de la Marine

DIRECTION DES OPERATIONS, DE LA PRODUCTION  
ET DES SERVICES

Division "maîtrise de l'information et  
produits mixtes"

Département "bathymétrie"

Dossier suivi par

Dossier suivi par  
ISC Thierry SCHMITT

## FICHE

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Object : Crowdsourced data collected by the French INSU ships.

Reference(s) : see in fine

Attachment : two annexes

### 1. INTRODUCTION

This paper is describing treatment and evaluation of a crowd-sourced singlebeam navigation echosounder dataset coming from the French institute INSU. These data have been collected on the Atlantic and Channel area, and are used for updating bathymetric Digital Elevation Models.

The Mediterranean data are not taken in account as they are less interesting in regards of the actual knowledge.

### 2. GENERAL OVERVIEW

#### 2.1. Context.

The Technical Division of the INSU – CNRS provide to the scientist a fleet of coastal ships used for the oceanographic campaigns. (Reference d/) Scientists have basically 900 days at sea with these ships. The INSU fleet is also used for the teaching, in collaboration with university.

Some of the data providing from this fleet is available via a link <ftp://daufin.dt.insu.cnrs.fr/>.

These data seems to be interesting for the production of bathymetric DEM in areas where there is a lack of data like the Bay of Biscay or the Channel Islands.

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Destinataire(s) : MIP/BATHY – MIP/HYDRO

Copie(s) extérieure(s):

Copies intérieures : DOPS – HOM - MIP – DMI/PL - Archives (cote rubrique de classement).

## 2.2. System overview.

### 2.2.1. *The INSU fleet*

Vessel	Type	Data downloaded
Neomysis	Coastal ship - scientific station	2009-2012
Albert Lucas	Coastal ship - scientific station	2011
Côte d'Aquitaine	Coastal ship – ocean frontage	2003-2009
Côtes de la Manche	Coastal ship – ocean frontage	2001-2014

Table 1 : INSU's different ships used in this study

#### - Côtes de la Manche :

The coastal ship Côtes de la Manche, built in 1997, is a 24.9 m length and 230t weight oceanographic ship with a 3.6m draught. It is equipped with two Furuno sounders, FCV 1200 L bi frequencies 15 / 200 kHz and FCV 1100 L bi frequencies 28 / 200 kHz (<http://www.dt.insu.cnrs.fr/flottille/cotemanche.php>) and with 2 GPS Trimble.



#### - Côte d'Aquitaine :

The coastal ship Côte d'Aquitaine is a 19 m length and 88t weight oceanographic ship. It has been built in 1980 and stopped his work in 2009. It was equipped with two sounders Simrad EK 400, 12 KHz 0-4000m and ES701 (<http://www.dt.insu.cnrs.fr/flottille/coteaquitaine.php>) associated with a GPS Trimble. The 2.4m draught allowed this ship to work in low water areas like estuaries (Seine and Gironde).



#### - Albert Lucas :

Oceanographic vessel Albert Lucas is the IUEM station research vessel. It has been built in 2009 and it is 11.5m length with a draught of 1.4m. It is equipped with a sounder Furuno FCV 1150 bi frequencies 28 / 200 kHz ([http://www.dt.insu.cnrs.fr/flottille/albert\\_lucas.php](http://www.dt.insu.cnrs.fr/flottille/albert_lucas.php)) and a GPS Trimble.



- **Neomysis :**

Neomysis is the oceanographic research vessel from the biological station of Roscoff. It has been built in 2008 and it is 11.9m length with a draught of 2.1m. It is equipped with a sounder Furuno FCV 1100 L bi frequencies 50 / 200 kHz (<http://www.dt.insu.cnrs.fr/flottille/neomysis.php>) and a GPS Trimble.



### 2.2.2. *Data disponibilities*

The system Daufin (Dispositif d'Acquisition Unifié pour la Flotte de l'INSU)) is used by the INSU fleet for the acquisition, the storage and the distribution of the data coming from all the sensors installed on the ships. Data files are transmitted through Cofin and are accessible on an ftp server.

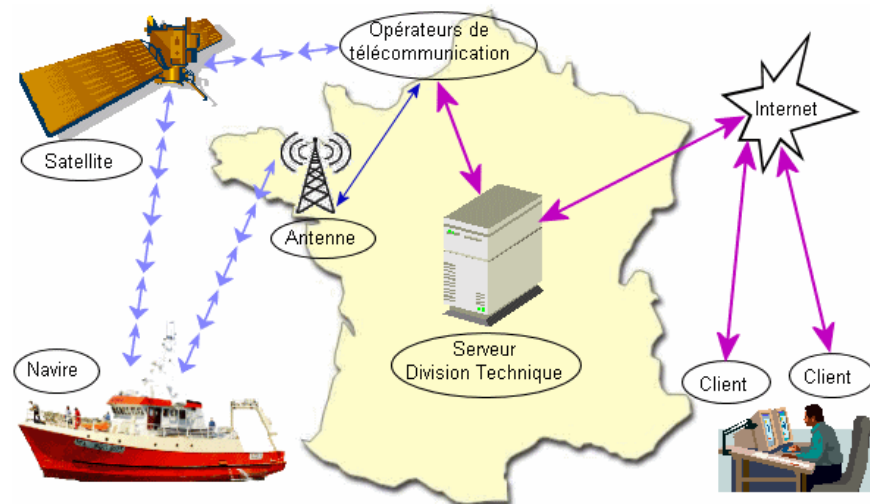


Figure 1 : System DAUFIN diagram

Downloaded data are daily ASCII files, and contain all the data providing from the ship's sensors (GPS, sounder, weather, and physical parameters of the water). There are described in reference a/.

As these data are available, they can be considerate as opportunity data.

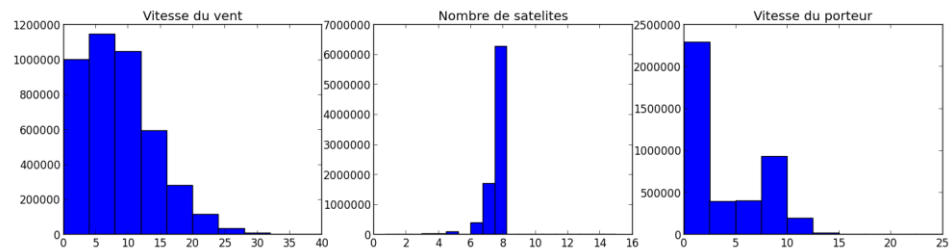
## 2.3. **Treatment processing.**

### 2.3.1. *Automatics treatment*

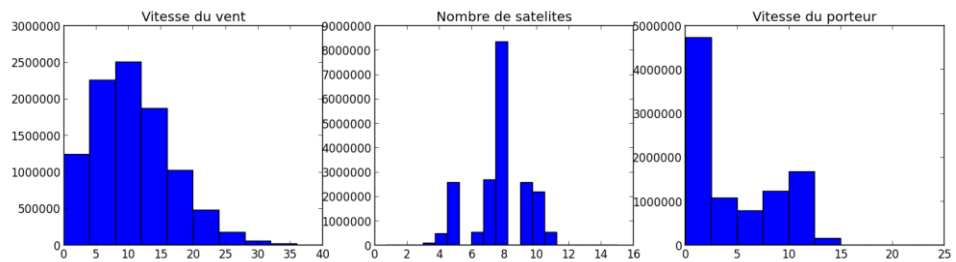
Files have been downloaded until the end of the year 2014. The Python script is used for export them in ASCII files, by years and by platform type.

Data are filtered thanks to other sensors parameters. It permits us to conserve only the most relevant values:

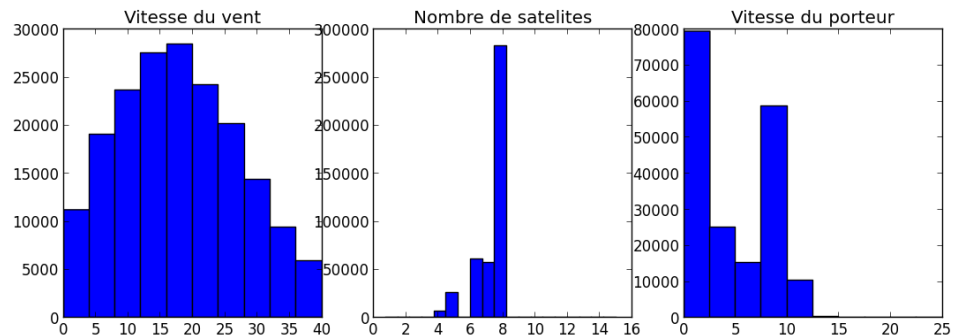
- Filtering the position to conserve the values situated in the Channel and in the Atlantic 8°W – 3°E – 42°N – 53°N ;
- Remove the outliers 9999 and 0 ;
- Filtering the ground speed of the vessel to conserve the values acquired between 2 and 15 knots ; This filter permit us to remove the sounding acquired during an anchorage or during a fast transit between two harbours, etc. ;
- Filtering the number of GPS satellites to conserve the positions acquired with at least 4 satellites ;
- Filtering the wind speed to remove the sounding acquired with more than 25 knots of real speed wind.



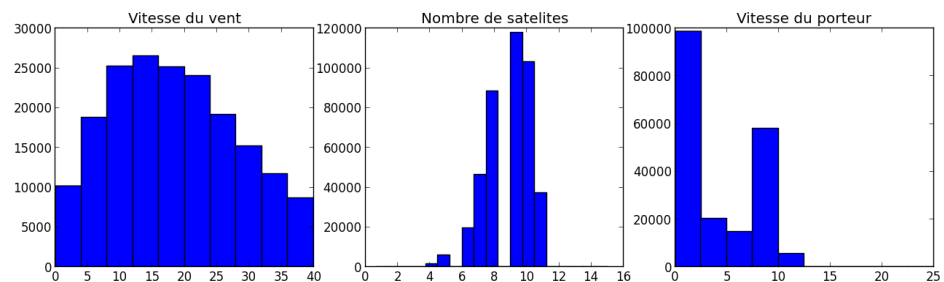
*Côte d'Aquitaine: Distribution histogram of additional settings*



*Côtes de la Manche : Distribution histogram of additional settings*



*Albert Lucas: Distribution histogram of additional settings*



*Néomysis: Distribution histogram of additional settings*

As data from the vessel Côtes de la Manche acquired before September 2004 and data from the vessel Côte d'Aquitaine before 2005 are referenced to the ED50 ellipsoid, it is

necessary to convert them in WGS84 to obtain a consistent positioning. These conversions are made thanks to the IGN software *Circé 4.2*.

### 2.3.2. *Reducing the sounding*

All the sounding has been reduced from a predicted tide, calculated with the tide model *cstFRANCE*, version of the 24/06/2009 (reference c/) with the help of the tide reduction software *masg2* (reference b/).

The predicted tide calculated is applied directly with the Python script and all the sounding are referenced to the Lower Astronomical Tide (LAT).

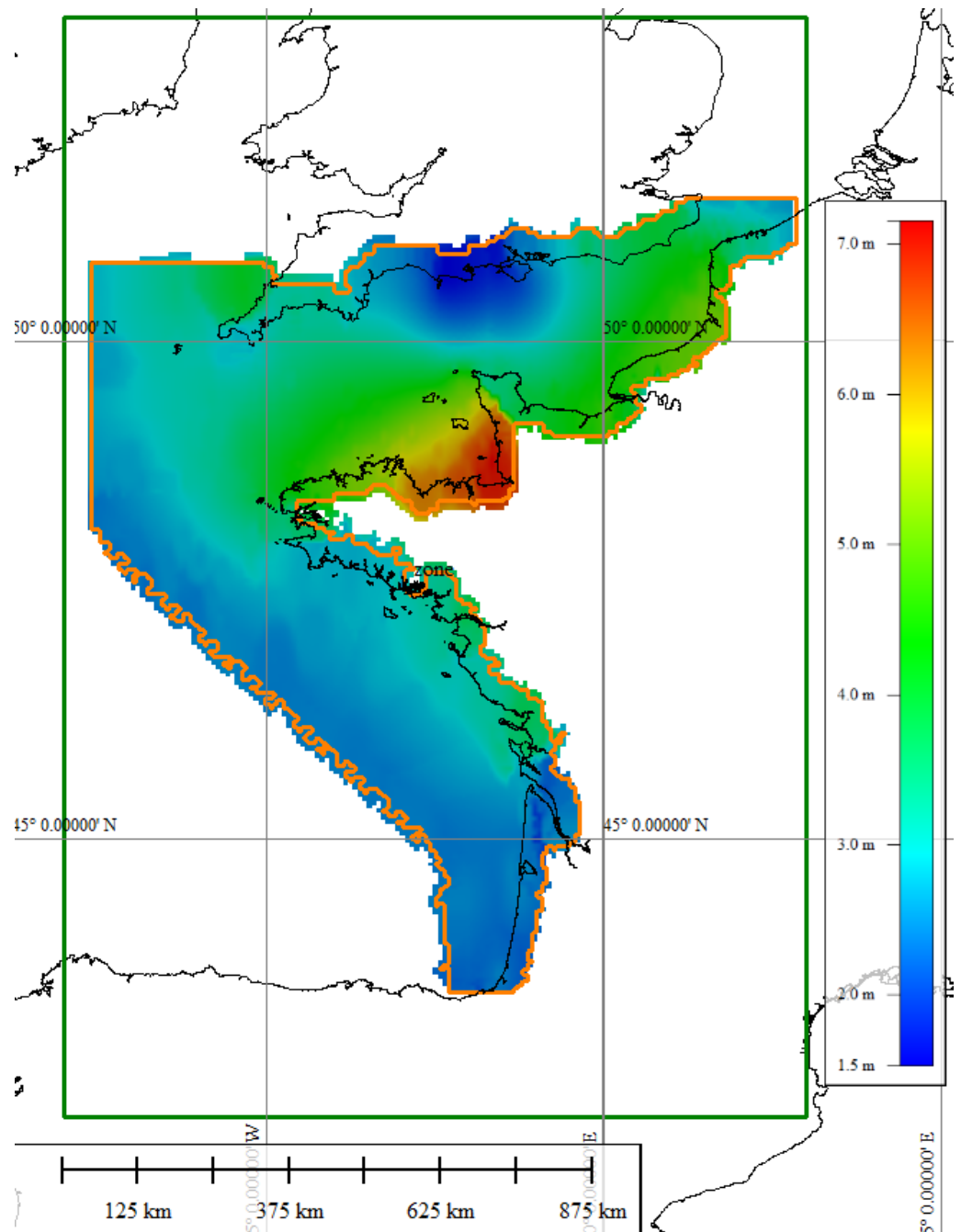


Figure 2 : Sounding used boundary (green), tide model boundary (orange) and model maximal half-marnage

### 2.3.3. *Results of the automatic treatments*

Only 20% of the 30 million sounding available at the beginning are preserved after the automatic treatment. Results are shown in the table 2.

	<i>Number of initial sounding</i>	<i>Number of sounding exclude</i>						<i>% of sounding preserved</i>
		<i>aberrant depth</i>	<i>Ship speed</i>	<i>Number of satellites</i>	<i>Wind speed</i>	<i>Outside of area</i>	<i>Outside of the tidal model</i>	
Côtes de la Manche	20 630 819	9 323 169	6 223 192	29 895	162 279	279 316	268 388	21.1
Côte d'Aquitaine	8 938 524	5 008 621	2 185 837	6850	17 738	2125	63 436	18.5
Albert Lucas	457 829	267 449	72 920	82	36 980	0	48 166	7.0
Mysis	377 394	177 619	94 396	4	52 781	0	0	13.9
<b>Total</b>	<b>30 404 566</b>	<b>14 776 858</b>	<b>8 576 345</b>	<b>36 831</b>	<b>269 778</b>	<b>281 441</b>	<b>379 990</b>	<b>20.0</b>

Table 2 : Exclusion statistics of the sounding according to different parameters defined in the section 2.3.1.

### 2.3.4. *Manual treatments*

In spite of the automatic treatment, some files have plenty of outliers. We decided to exclude some of this years. The years we worked with are list below, in the table 3.

<b>Ships</b>	<b>Years exploited</b>
Neomysis	2012
Albert Lucas	-
Côte d'Aquitaine	2003-2009
Côtes de la Manche	2001-2011

Table 3 : Years kept for the manual treatment.

Number of sounding after the automatic treatment: 5 066 398

Number of invalided sounding: 71 865, or 1.4%

Number of valid sounding: 4 994 533

Valid data:

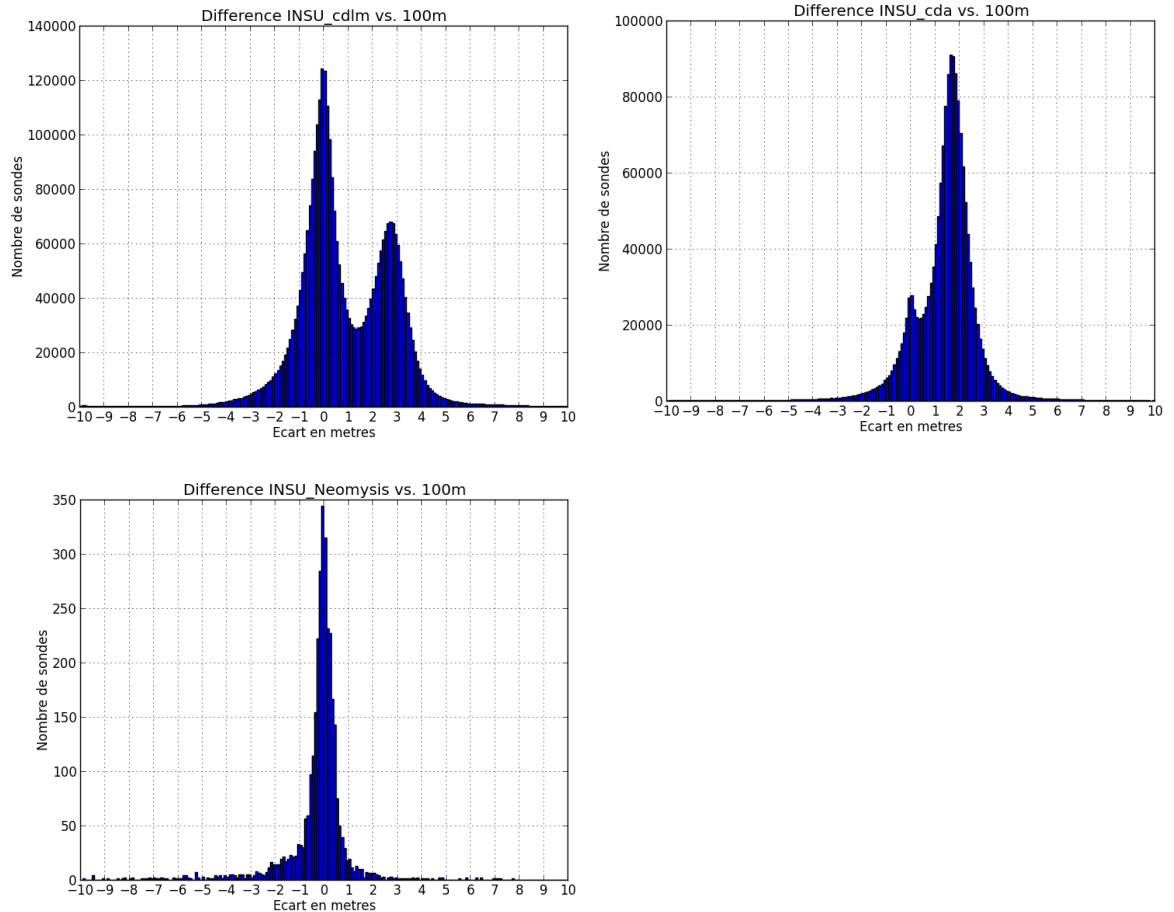
- Minimal depth : -7.4 m
- Maximal depth : 2951.8 m
- Mean depth : 49.9 m

## 2.4. **Data evaluation.**

### 2.4.1. *Difference between the dataset and the DEM 100m HOMONIM v2*

The comparison between the data coming from the INSU singlebeam echosounder and the DEM 100m HOMONIM v2 from February 2014 (referenced to the PBMA) does not permit us to qualify these data. Hence, the main objective of the comparison is to verify the general coherence of the data, the vertical reference and the well reduction of the sounding.





*Difference between INSU dataset and HOMONIM 100m DEM*

It clearly appears that there is a bias observed in some of the data, represented by one or more peak not centered on 0. These biases are depending on the ships and are associated to the echosounder depth installation. (*Table 4*)

In the INSU case, the navigation echosounder can be set of two different sorts: The data reference can be either the water surface, giving the real depth, or the head of the sounder, giving water depth under the ship. Contrary to the first case, used by the scientists, the last case is used by the ship crew to obtain the water depth under the ship, without taking in account the ship draft. (*Annex 2*).

Ship	Mounting depth vs. waterline
Côtes de la Manche	2.9 m
Côte d'Aquitaine	1.8 m
Neomysis	0.3 m

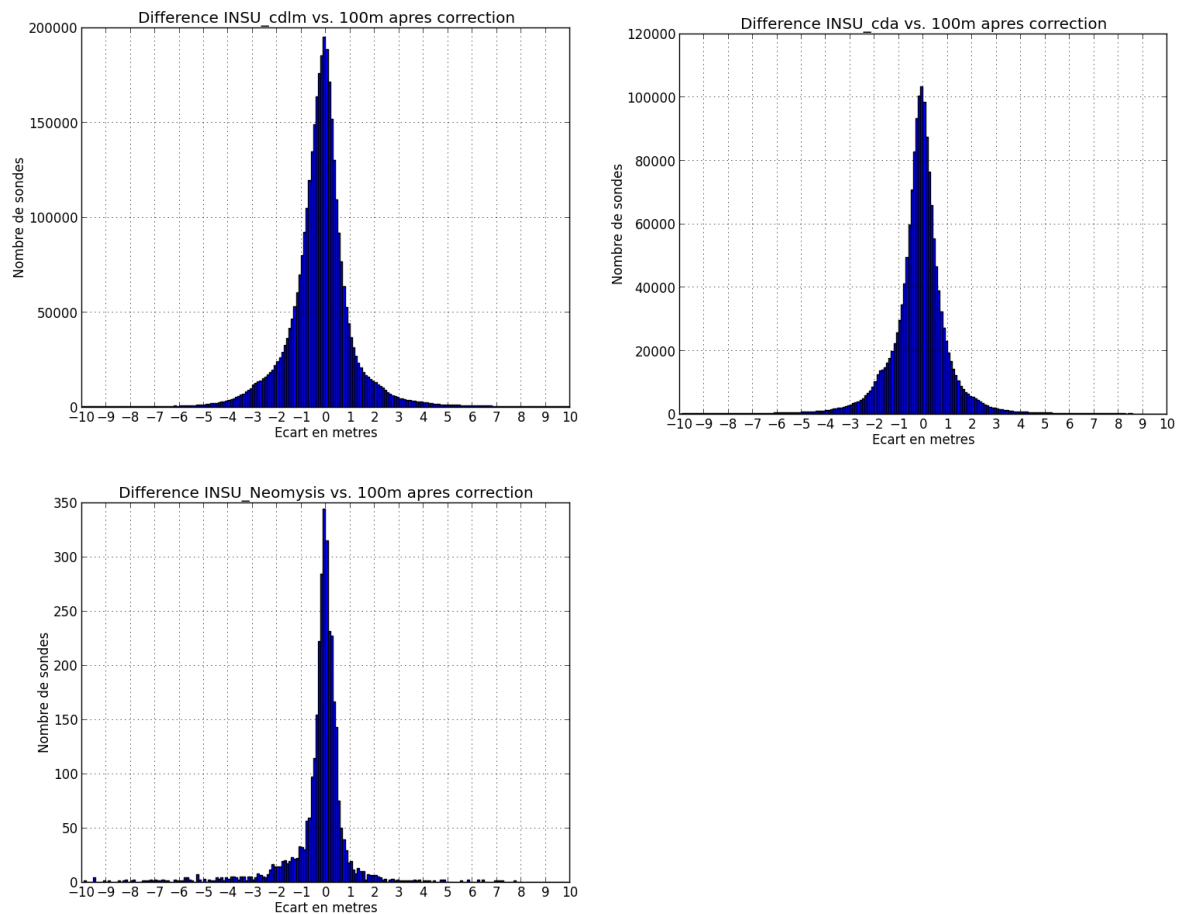
*Table 4 : echosounder installation depths on the INSU ships.*

Data are then corrected from this sounder installation depth through a *Python* script

This script is based on the difference between the INSU dataset and the DEM 100m HOMONIM. It allows us to correct the sounding from each different ship, profile by profile on a global way. However, as this is a global way to correct the sounding, some of the profiles are corrected while they seemed initially good. That can create incoherence in some areas. (*Section 2.4.3*).

**The script improves the file in general, without carry out an individual data correction of required data. Conversely, data which should not be corrected can be wrongly corrected.**

We obtain the following difference histograms, ship by ship:



*Difference between INSU dataset and HOMONIM 100m DEM after correction*

Statistic from the difference after correction:

- INSU dataset mean depth : 48.94 m ;
- Mean difference : -0.096 m (min : -476.3m, max : 2194.14 m) ;
- Mean difference between 0 and 200m depth: -0.29m (min : -92.03m, max : 1839.12 m) ;
- Standard deviation : 9.84 m ;
- Standard deviation between 0 and 200m depth: 2.04 m.

#### 2.4.2. *Qualitative evaluation*

We have realized a DEM 3s resolution of the INSU dataset to study the qualitative evaluation. As the data are mainly coming from transit between two harbors, there is a lack in the seabed description.

However, in the areas with a high density of transits, INSU dataset could be interesting to map the sedimentary structures. The area between Boulogne/mer and Dieppe is a great example (*Figure 3*).



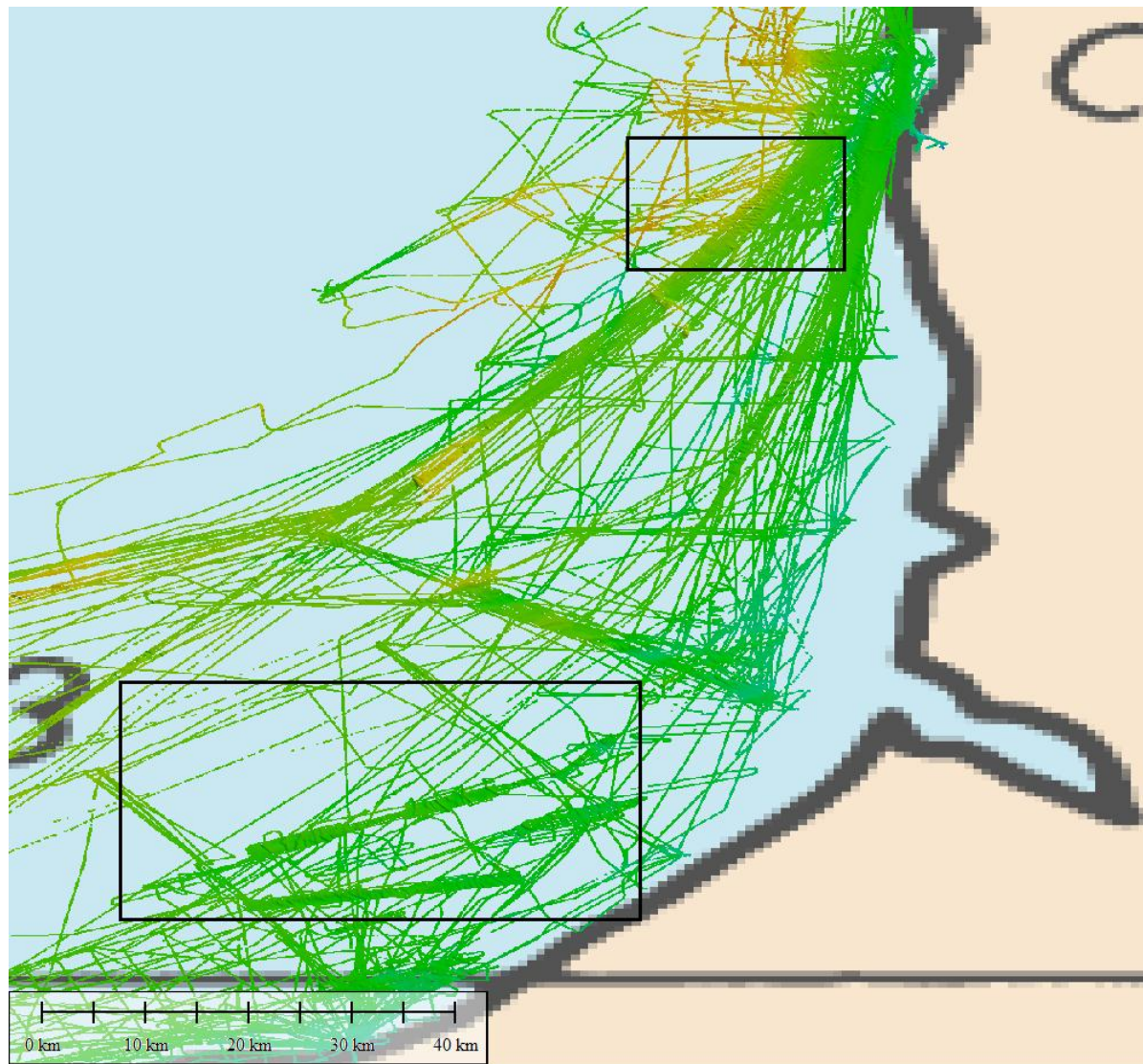
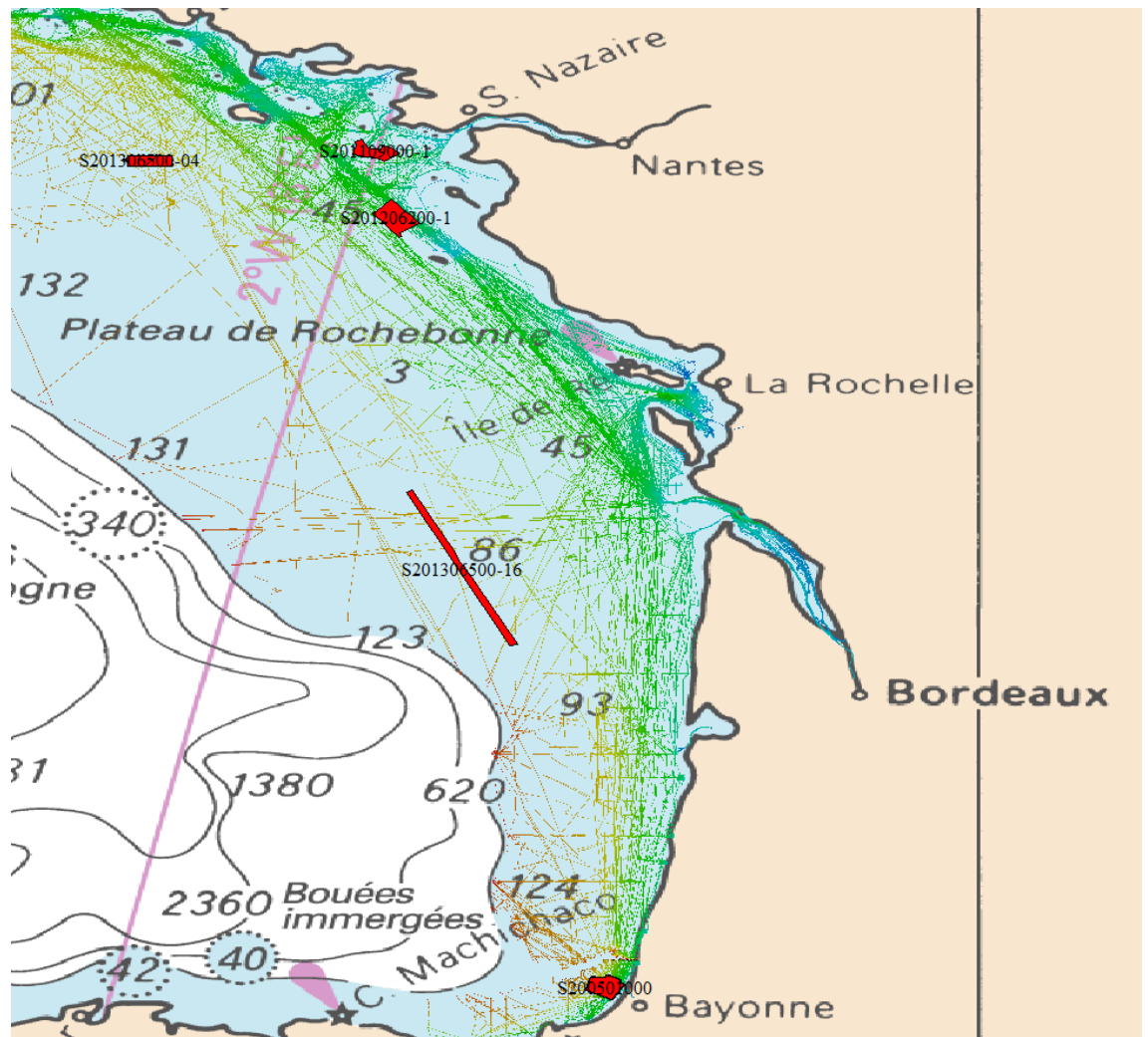


Figure 3 : Sedimentary structures between Boulogne/mer and Dieppe –INSU 100m DEM

#### 2.4.3. Comparison to the SHOM's Bathymetric DataBase (BDBS)

INSU dataset is compared with some multibeam echosounder surveys from the BDBS. Recent surveys realized by the SHOM are used to cover different depth and different places. They are either CUBE surfaces or data decimated by the *Choixsonde* tool, s44 option with the better resolution (Figure 4).

A



B

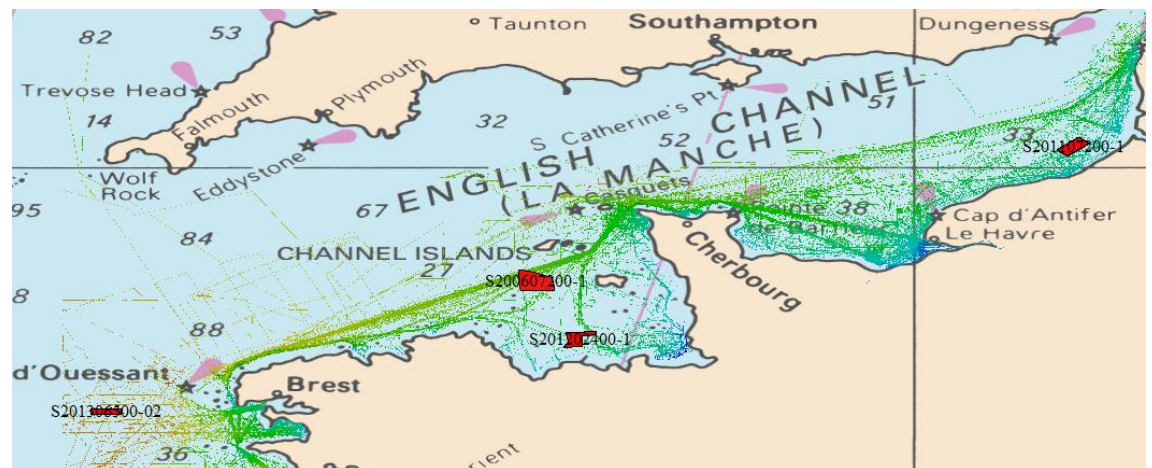


Figure 4 : Localisation of the SHOM's surveys used and INSU dataset DEM (A: Bay of Biscay B: Channel)

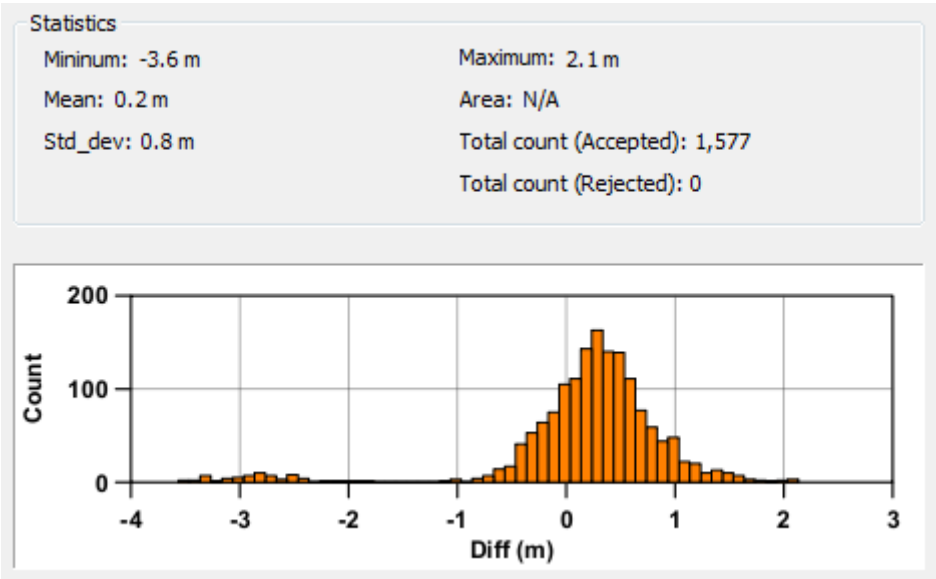
Survey	Statistics from the difference between INSU dataset and SHOM's bathymetric surveys								
<p>S201206200 Lot 1</p>	<p>Multibeam survey EM1002 of the Yeu-Noirmoutier area, CUBE surface, resolution 2,5 m</p> <p>Depths of the survey : mean = 28 m / minimum = 15 m / maximum = 41 m</p> <div data-bbox="539 344 1453 566"> <p>Statistics</p> <table> <tr> <td>Minimum: -3.8 m</td> <td>Maximum: 3.5 m</td> </tr> <tr> <td>Mean: -0.2 m</td> <td>Area: N/A</td> </tr> <tr> <td>Std_dev: 0.6 m</td> <td>Total count (Accepted): 14,990</td> </tr> <tr> <td></td> <td>Total count (Rejected): 0</td> </tr> </table> </div> <div data-bbox="539 602 1453 909"> </div> <p>(Mean+2Std_dev=1.4m that is to say 5% Mean depth)</p> <div data-bbox="523 1014 1581 1615"> </div> <p>Survey S201206200-1, difference between INSU dataset – SHOM's bathymetric survey. Extract from Marine Chart 6990</p>	Minimum: -3.8 m	Maximum: 3.5 m	Mean: -0.2 m	Area: N/A	Std_dev: 0.6 m	Total count (Accepted): 14,990		Total count (Rejected): 0
Minimum: -3.8 m	Maximum: 3.5 m								
Mean: -0.2 m	Area: N/A								
Std_dev: 0.6 m	Total count (Accepted): 14,990								
	Total count (Rejected): 0								
<p>S201202400 Lot 1</p>	<p>Multibeam survey EM1002 of the LRB area, near the Fréhel cape, CUBE surface, resolution 3 m.</p> <p>Depths of the survey : mean = 33 m / minimum = 22 m / maximum = 39 m</p>								





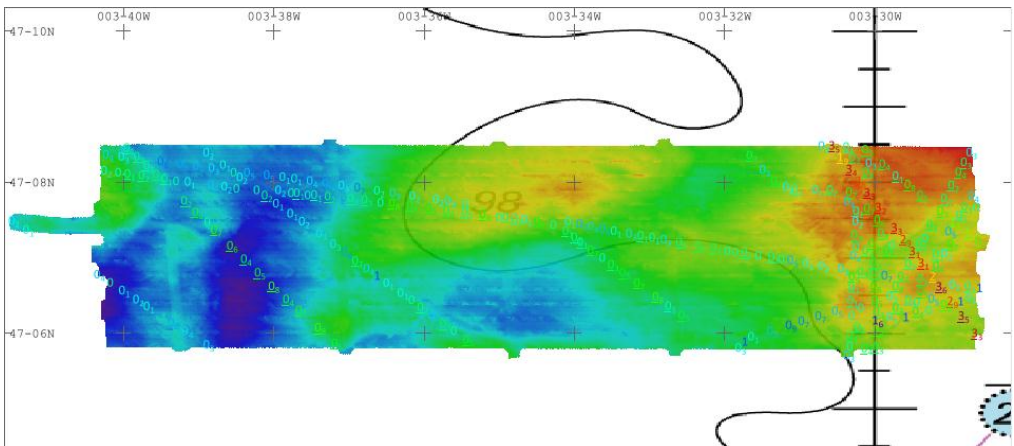
S201306500  
Lot 4 and 5

Multibeam survey EM1002, continental shelf of Bay of Biscay, resolution 10 m  
Depths of the survey : mean = 102 m / minimum = 95 m / maximum = 108 m



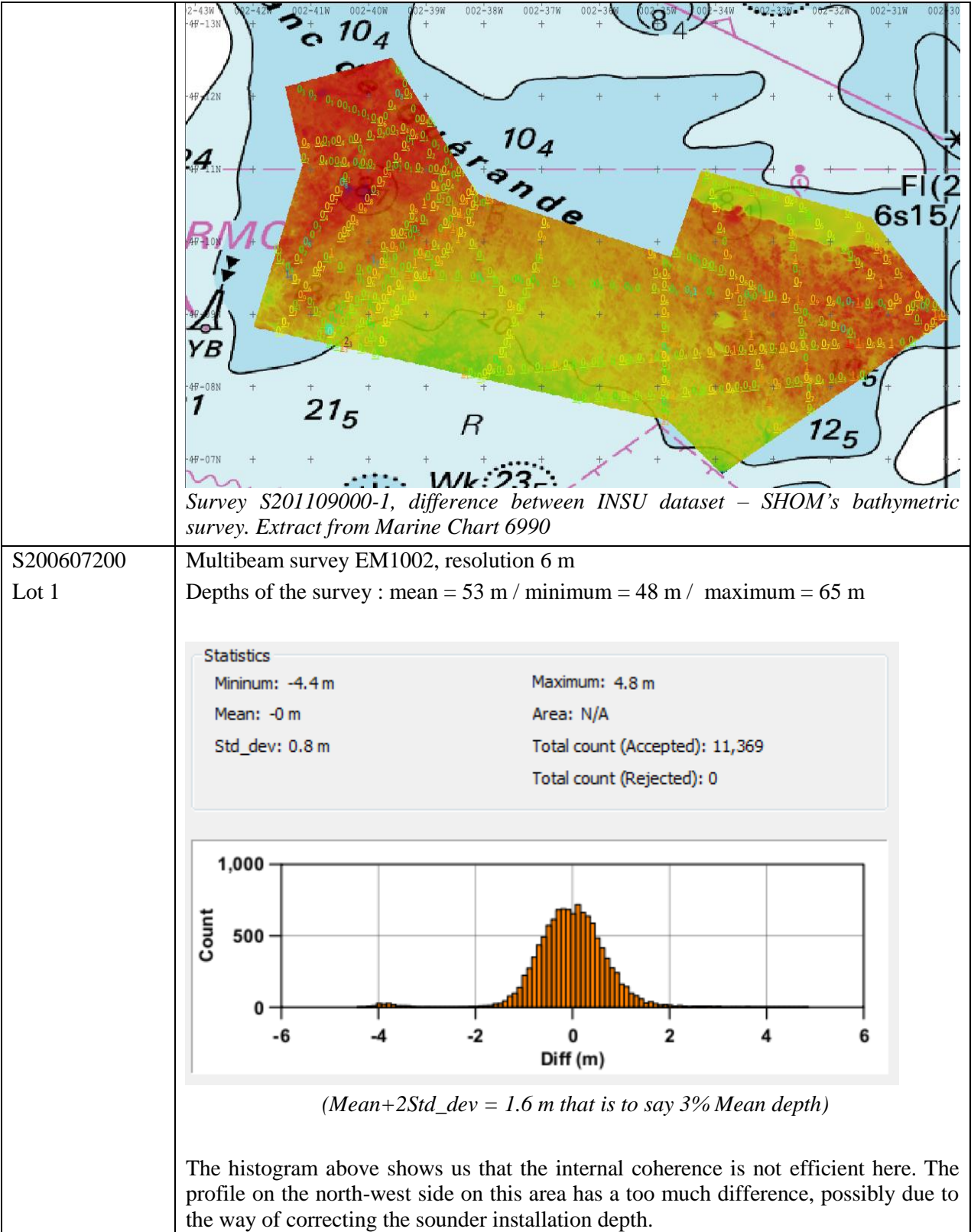
(Mean+2Std\_dev = 1.8 m that is to say 1.8% Mean depth)

The histogram above shows us that the internal coherence is not efficient here. The profile on the east side on this area has a too much difference, possibly due to the way of correcting the sounder installation depth.

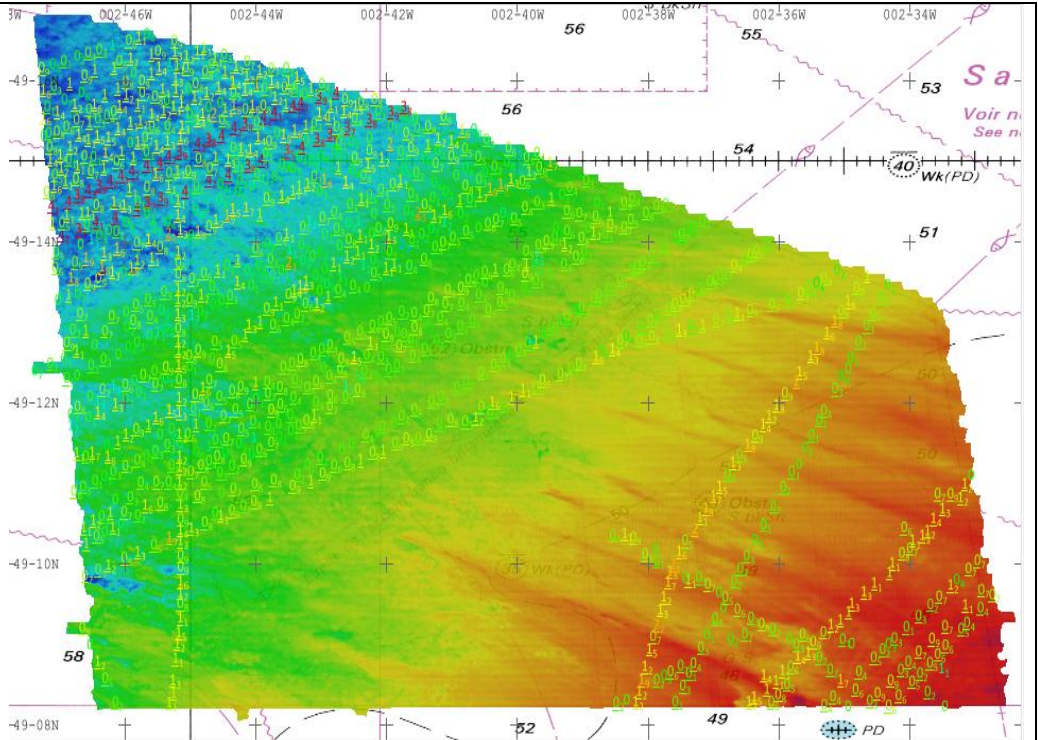
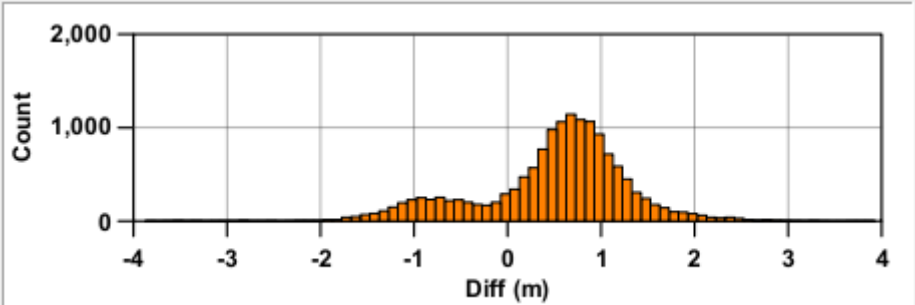


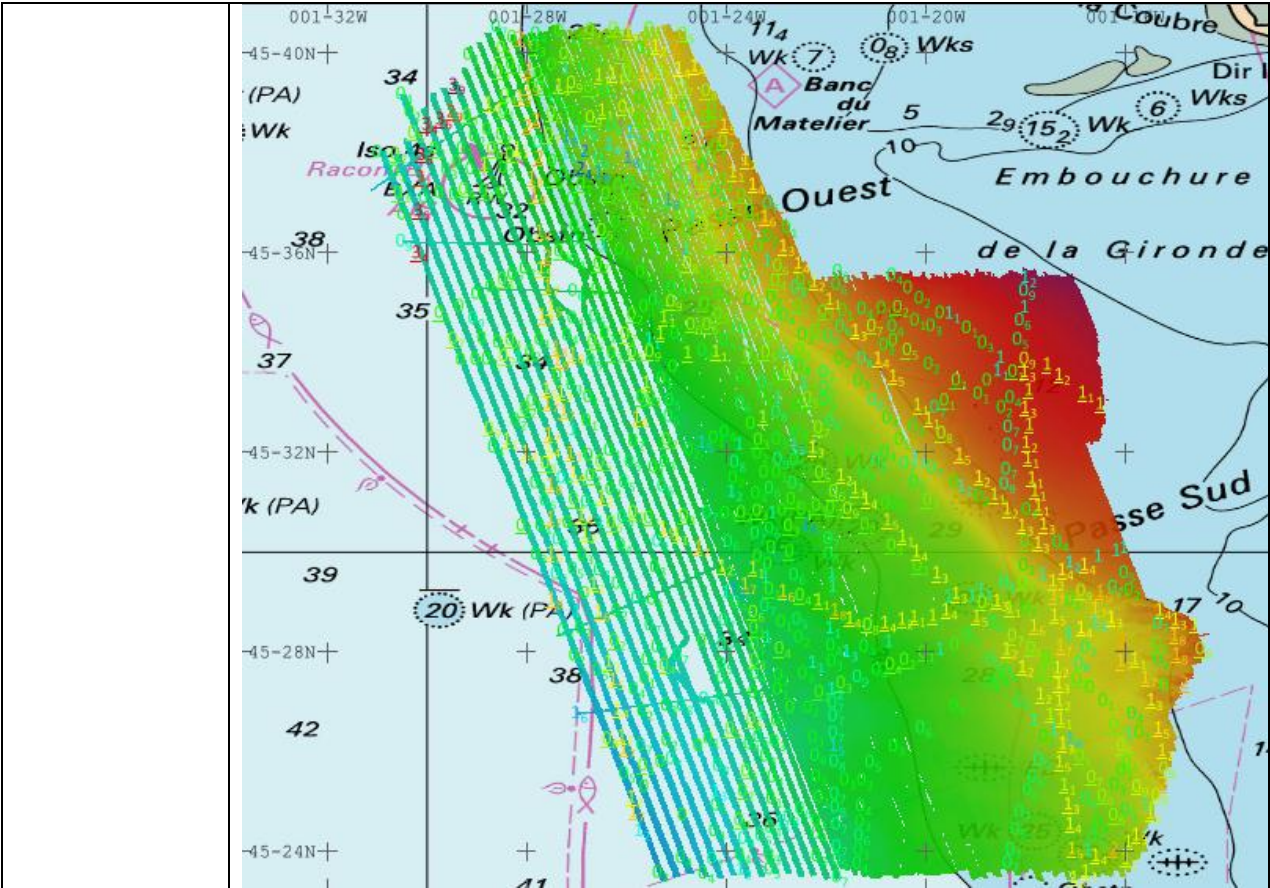
Surveys S201306500-4 and 5, difference between INSU dataset – SHOM's bathymetric survey. Extract from Marine Chart 6990

S201306500 Lot 16	<p>Multibeam survey EM1002 Bay of Biscay transit, resolution 10 m.</p> <p>Depths of the survey : mean = 106 m / minimum = 94 m / maximum = 112 m</p> <div data-bbox="539 271 1449 483"> <p>Statistics</p> <table> <tr> <td>Minimum: -1.8 m</td><td>Maximum: 2.1 m</td></tr> <tr> <td>Mean: 0.5 m</td><td>Area: N/A</td></tr> <tr> <td>Std_dev: 0.5 m</td><td>Total count (Accepted): 255</td></tr> <tr> <td></td><td>Total count (Rejected): 0</td></tr> </table> </div> <div data-bbox="539 528 1449 831"> </div> <p><i>(Mean+2Std_dev = 1.5 m that is to say 1.4% Mean depth)</i></p>	Minimum: -1.8 m	Maximum: 2.1 m	Mean: 0.5 m	Area: N/A	Std_dev: 0.5 m	Total count (Accepted): 255		Total count (Rejected): 0
Minimum: -1.8 m	Maximum: 2.1 m								
Mean: 0.5 m	Area: N/A								
Std_dev: 0.5 m	Total count (Accepted): 255								
	Total count (Rejected): 0								
S201109000 Lot 1	<p>Multibeam survey EM1002 of the area near the Croisic, resolution 3 m</p> <p>Depths of the survey : mean = 18 m / minimum = 9 m / maximum = 44 m</p> <div data-bbox="539 1021 1449 1234"> <p>Statistics</p> <table> <tr> <td>Minimum: -2.2 m</td><td>Maximum: 2.6 m</td></tr> <tr> <td>Mean: 0.1 m</td><td>Area: N/A</td></tr> <tr> <td>Std_dev: 0.5 m</td><td>Total count (Accepted): 2,440</td></tr> <tr> <td></td><td>Total count (Rejected): 0</td></tr> </table> </div> <div data-bbox="539 1279 1449 1581"> </div> <p><i>(Mean+2Std_dev = 1.1m that is to say 6% Mean depth)</i></p>	Minimum: -2.2 m	Maximum: 2.6 m	Mean: 0.1 m	Area: N/A	Std_dev: 0.5 m	Total count (Accepted): 2,440		Total count (Rejected): 0
Minimum: -2.2 m	Maximum: 2.6 m								
Mean: 0.1 m	Area: N/A								
Std_dev: 0.5 m	Total count (Accepted): 2,440								
	Total count (Rejected): 0								

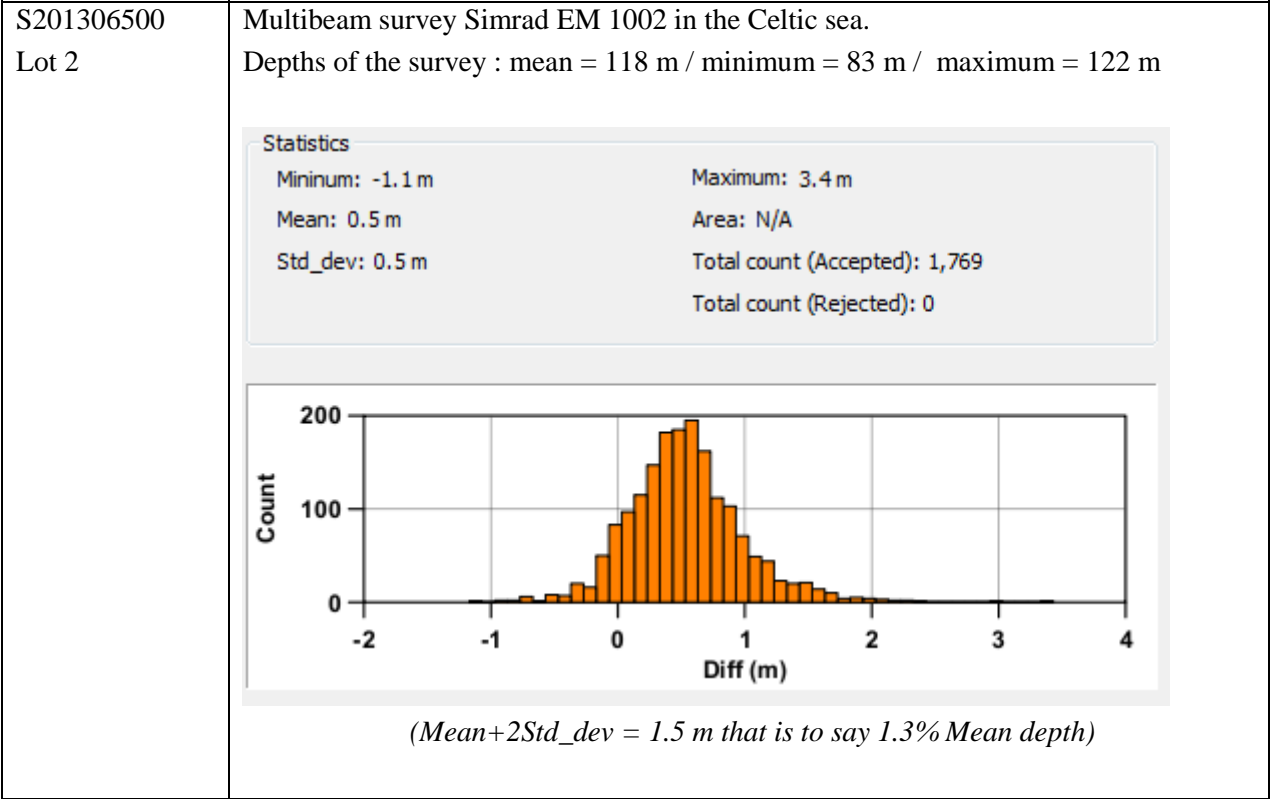


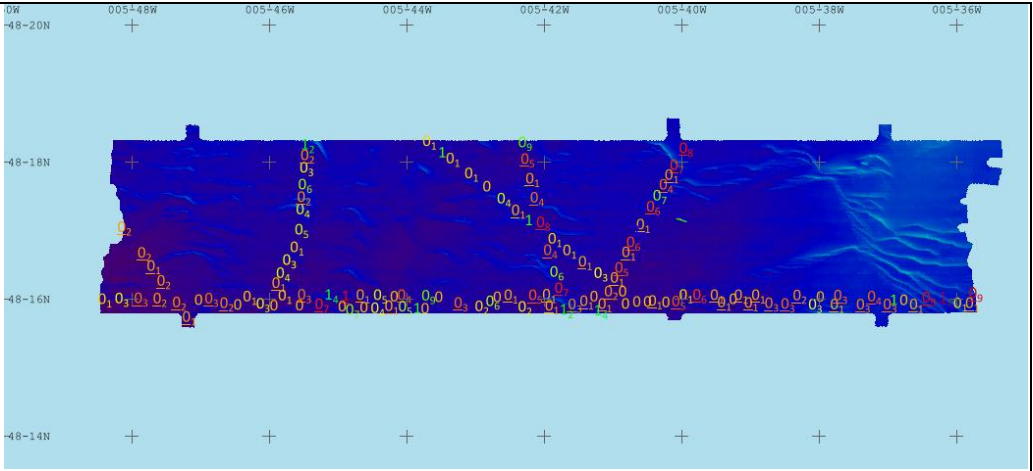
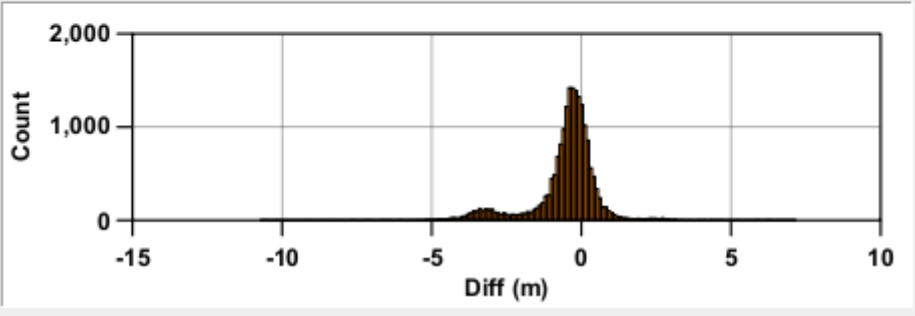


	<div><p>Survey S200607200-1, difference between INSU dataset – SHOM's bathymetric survey. Extract from Marine Chart 6966</p></div>								
S201407600	<div><p>Multibeam echosounder EM710 in the Gironde estuary, CUBE surface, resolution 2 m.</p><p>Depths of the survey : mean = 27 m / minimum = 10 m / maximum = 50 m</p><div><div><p>Statistics</p><table><tbody><tr><td>Minimum: -3.9 m</td><td>Maximum: 3.9 m</td></tr><tr><td>Mean: 0.5 m</td><td>Area: N/A</td></tr><tr><td>Std_dev: 0.8 m</td><td>Total count (Accepted): 14,766</td></tr><tr><td></td><td>Total count (Rejected): 0</td></tr></tbody></table></div><div></div><p>(Mean+2Std_dev = 2.1 m that is to say 7.8% Mean depth)</p><p>The histogram above shows us that the internal coherence is not efficient here. Several profiles have a difference around 1m, possibly due to the way of correcting the sounder installation depth.</p></div></div>	Minimum: -3.9 m	Maximum: 3.9 m	Mean: 0.5 m	Area: N/A	Std_dev: 0.8 m	Total count (Accepted): 14,766		Total count (Rejected): 0
Minimum: -3.9 m	Maximum: 3.9 m								
Mean: 0.5 m	Area: N/A								
Std_dev: 0.8 m	Total count (Accepted): 14,766								
	Total count (Rejected): 0								

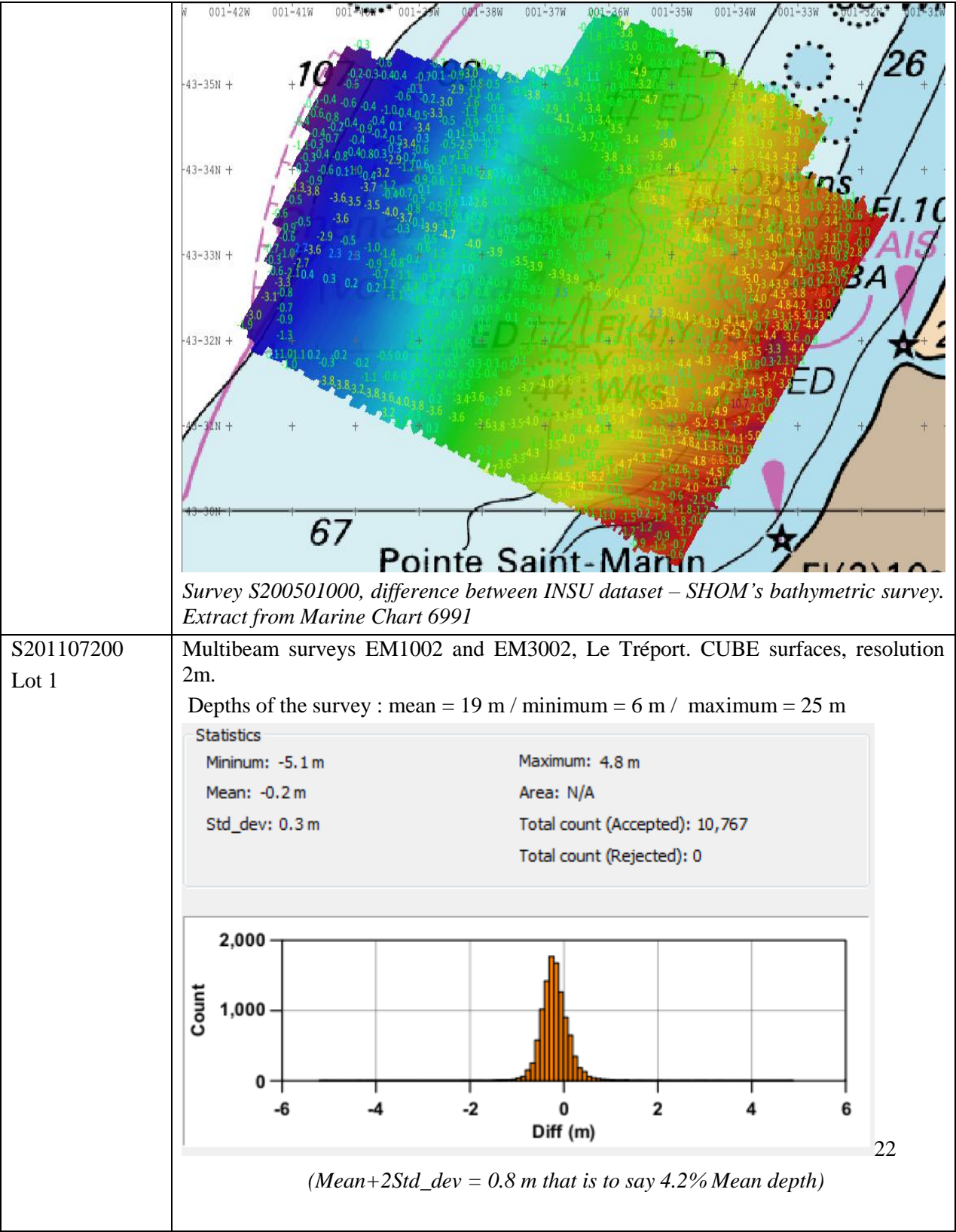


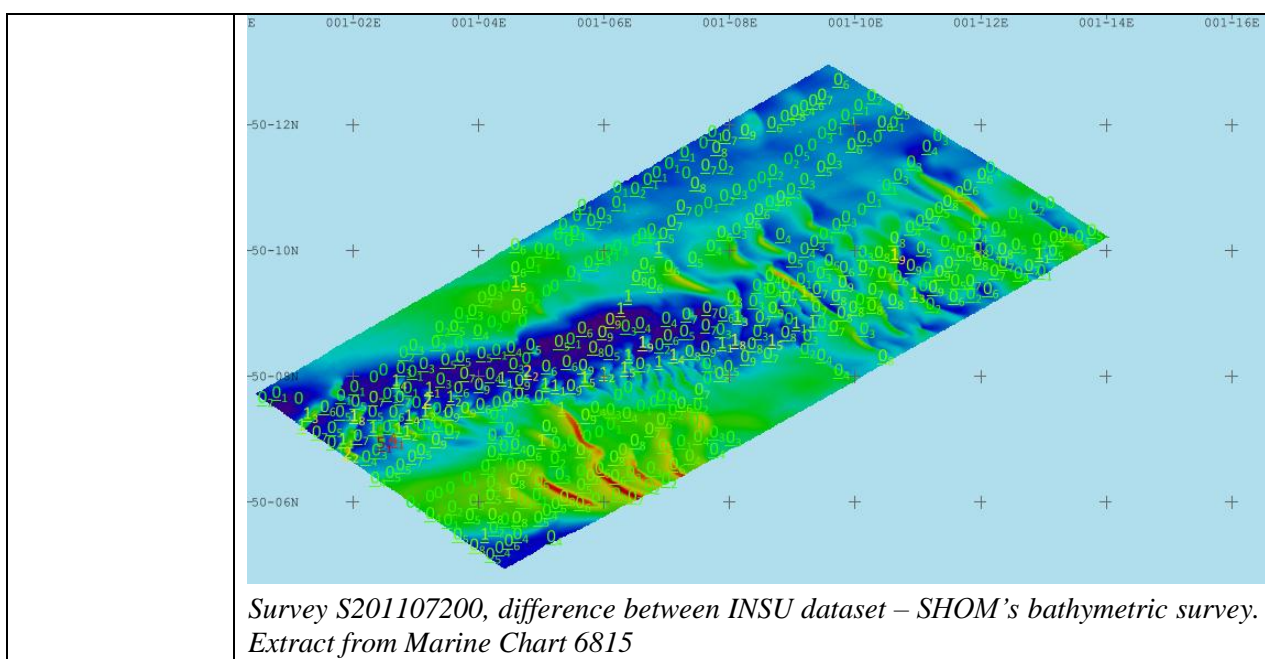
Survey S201407600, difference between INSU dataset – SHOM's bathymetric survey.  
Extract from Marine Chart 6991



	<div></div> <p>Survey S201306500, lot 1, difference between INSU dataset – SHOM's bathymetric survey. Extract from Marine Chart 6815</p>								
S200501000 Lots 1 et 2	<p>Multibeam survey EM1002 around Bayonne.</p> <p>Depths of the survey : mean = 60 m / minimum = 12 m / maximum = 109 m</p> <div><p>Statistics</p><table><tbody><tr><td>Minimum: -10.6 m</td><td>Maximum: 7.1 m</td></tr><tr><td>Mean: -0.5 m</td><td>Area: N/A</td></tr><tr><td>Std_dev: 1.1 m</td><td>Total count (Accepted): 19,016</td></tr><tr><td></td><td>Total count (Rejected): 0</td></tr></tbody></table></div> <div></div> <p>(Mean+2Std_dev = 2.7 m soit 4.5% Mean depth)</p> <p>The histogram above shows us that the internal coherence is not efficient here. Several profiles have an important difference, possibly due to the way of correcting the sounder installation depth.</p>	Minimum: -10.6 m	Maximum: 7.1 m	Mean: -0.5 m	Area: N/A	Std_dev: 1.1 m	Total count (Accepted): 19,016		Total count (Rejected): 0
Minimum: -10.6 m	Maximum: 7.1 m								
Mean: -0.5 m	Area: N/A								
Std_dev: 1.1 m	Total count (Accepted): 19,016								
	Total count (Rejected): 0								







#### 2.4.4. *Internal coherence at the crossing points*

Distance between each sounding is generally important and so it is not possible to defined crossing points statistics without interpolation. It is only possible to study the standard deviation in a specific area to obtain an idea of the coherence between the sounding. Indeed, a high density of sounding with a low standard deviation will be typical of a good internal coherence.

Nine squares of 100m, which permit to gather at least four sounds, are arbitrarily chosen to correspond to the different depth range of the INSU dataset., Each square contain profiles from different ships or different dates. (*Table 5*).

Areas	Mean depth (m)	Standard-deviation	Number of sounding
Area 1	30	0.2	8
Area 2	30.7	0.5	4
Area 3	35.9	1.2	16
Area 4	26.2	0.8	12
Area 5	109.7	0.5	7
Area 6	22	0.9	12
Area 7	604.5	5.7	4
Area 8	67.5	0.5	8
Area 9	46	1.4	52

*Table 5 : Internal coherence for a square of 100 m*

The important standard deviation in the area n°7 is due to the position of the soundings, situated in the continental shelf border and so, in the limit for these sounder's type. Moreover, the important number of sounding in the area n°9 is due to the position of this area, in the Brest's harbor entrance, with a high rate of transit in a low geographical space.

If we exclude the area n°7, we observe an important variation of the standard-deviation (especially in areas n°3 and n°9). These variations attest that the internal coherence is not efficient in all the dataset. This is due to the global way of correct the file, its size, and also to the bathymetry variability in the squares.

#### 2.4.5. Qualification results

As the profiles are corrected on a global way without taken in account the internal coherence, some profiles may have bias due to the correction or not of the sounder depth installation. The OHI order 2 vertical precision is nearly reached for all the depth range of the INSU dataset (Figure 5).

INSU dataset precision is considered as better than  $1.7m + 1.7\% \times D$  in the range  $0m < D < 160m$ .

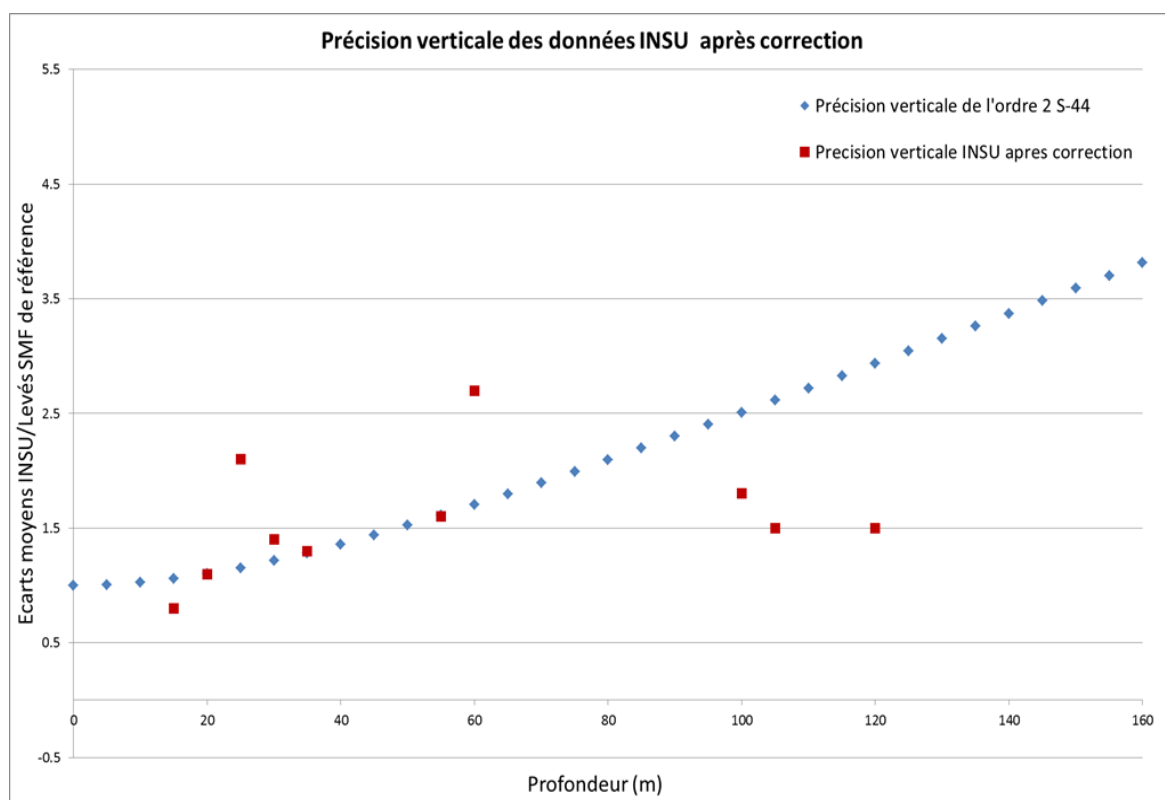


Figure 5 : Comparisons results between SHOM's survey and INSU dataset – compared with OHI S-44 Order 2

Mean difference with SHOM's surveys are small, under 0.5 meter. The better use for those data could be the construction of DEMs with resolution upper than 100m.

#### 2.5. Conclusion.

The general results are conform to the other crowdsourced data studies and show the benefic of those data in regards of the sea bed knowledge. The qualification of those data has been more exhaustive than in the other studies. However, the results after correction are relatively good compared with the actual standards. Even if the ship draft correction is not applied precisely, this methodology allows a good improvement of the dataset. It remains some errors due to the processes and to the acquisition system (celerity) and some individual values could be wrong, due to the correction or not of the dataset.

Considering the evaluation in this study, data are usable for the bathymetric DEM production, 30-40 meters depth, mixed with other bathymetric sources.

INSU dataset helps us to highlight the different maritime roads between the different harbours in the Atlantic and Channel.

Those data could also be used in case of a lack of other data in specific areas. The low quantity of sounding beyond 250m, with a higher uncertainty may be rejected.

Finally, those data could help to map the sedimentary structures in the Channel, and defined new areas for sedimentological work.

ISC Thierry Schmitt



## ANNEXE 1

**Sujet:** Levés Côtes de la Manche 1/2

**Date:** Thu, 26 Jan 2006 14:18:41 +0100

**De:** BAILLY-DU-BOIS Pascal <[pascal.bailly-du-bois@irsn.fr](mailto:pascal.bailly-du-bois@irsn.fr)>

**A:** "Jehan, Raymond" <[jehan@shom.fr](mailto:jehan@shom.fr)>

Bonjour,

Après réduction et vérification, voici les levés bathymétriques du Côtes de la Manche de 2001 à 2005, soit 1 628 515 mesures.

Les vérifications que j'ai pu faire concernant la cohérence des mesures et la comparaison aux données dont je dispose déjà, elles n'excluent pas d'autres erreurs.

Comme j'ai automatisé la plupart des tâches, on pourra une mise à jour dans un an avec les données de 2006.

En ce qui concerne la réduction au nord du Cap de La Hague, la marée est mal représentée par le modèle cst-France, j'essayerai d'améliorer cela si j'ai le temps avec le données marégraphes et modèles dont je dispose.

Cordialement,

Pascal Bailly du Bois

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**ANNEXE 2****Sujet:** traitement des données monofaisceau bathymétriques INSU**Date:** 09 May 2016 11:51**De:** HEYNDRICKX Céline <[celine.heyndrickxs@cnrs.fr](mailto:celine.heyndrickxs@cnrs.fr)>**A:** TRIVIDIC Gwenaël <[gwenael.trividic@shom.fr](mailto:gwenael.trividic@shom.fr)>

Bonjour,

j'ai essayé de trouver des éléments de réponses pour votre recherche. Voici ce qu'il en ressort:

- tout d'abord il faut savoir qu'un sondeur peut être réglé dans son logiciel de 2 manières: soit on lui donne comme base de mesure la surface de l'eau (ce que demandent souvent les scientifiques), soit la position de la tête du sondeur sous la coque (ce que préfèrent les marins car ils savent ainsi la marge qu'ils ont sans tenir compte du tirant d'eau).

Le changement de ce réglage explique facilement les différences que vous observez selon les moments, quand elles sont stables et oscillent entre 0m et la profondeur de la base.

- voici les infos que j'ai trouvé pour chaque navire:

Côtes de La Manche :

prof d'installation du sondeur = 2.9 m

modèle = FURUNO FCV 1200 (15-200 kHz) et FURUNO FCV 1100 (28-200 kHz)

Néomysis:

prof d'installation du sondeur = 0.3 m

modèle = FURUNO FCV 1100 (28-200 kHz)

Albert Lucas:

prof d'installation du sondeur = 0.5 m

modèle = FURUNO FCV 1150 (28-200 kHz)

Côtes d'Aquitaine:

prof d'installation du sondeur = 1.8 m

Modèle : je devrais l'avoir demain... mais assez vieux.

Les précisions de ces appareils sont en dessous du mètre.

Les données du CDLM disponibles sur le site proviennent uniquement d'un sondeur: il y en a deux au cas où il y ait une panne (obligation légale) mais je ne peux pas trouver d'information concernant d'éventuels changements de sondeur. Normalement les données viennent toujours du même. De même, ils n'ont pas besoin d'être recalibrés. Enfin, je dois encore consulter certains capitaines pour connaître les vitesses de propagation du son qu'ils entrent dans leur sondeur. Sur le Téthys on utilise 1500m/s par défaut, mais sur les autres navires je ne sais pas encore...

Bonne journée,

Céline H

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