

## DriX

### MULTIBEAM SURVEY IN HARSH CONDITIONS

DEC-20



#### ***Document N°***

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# 1. DRIX FEATURES

## 1.1. EQUIPMENT SETUP





Positioning		
positioning system Septentrio Asterx-U Marine	<ul style="list-style-type: none"> <li>• RTK correction</li> <li>• Horizontal accuracy: <math>\pm(0.02 \text{ m})</math> RMS</li> <li>• Vertical accuracy: <math>\pm(0.03 \text{ m})</math> RMS</li> </ul>	
Inertial system		
Inertial sensor iXblue, PHINS C7	<ul style="list-style-type: none"> <li>• Fiber-optic gyroscope technology</li> <li>• Heave: <math>\pm 2.5 \text{ cm}</math> or 2.5% RMS</li> <li>• Roll and pitch: <math>\pm 0.01^\circ</math> RMS</li> <li>• Heading: <math>\pm 0.01^\circ \text{ sec. lat}</math> RMS</li> <li>• GPS jump correction with inertial mode</li> <li>• Sampling rate: 0.1 to 200 Hz</li> </ul>	
Multibeam echosounder		
MBES EM2040C	<ul style="list-style-type: none"> <li>• Resolution: 0,8 mm</li> <li>• Frequency: 300 kHz</li> <li>• Beam steering</li> <li>• Beam resolution: <math>1 \times 1^\circ</math></li> <li>• Dual swath capability</li> <li>• ROLL and PITCH stabilisation</li> </ul>	
Sound velocity measurement on DRIX		
Sound velocity sensor (On Gondola frame) Valeport Mini SVs	<ul style="list-style-type: none"> <li>• Range: 1375 à 1900 m/s</li> <li>• Accuracy: <math>\pm 0.02 \text{ m/s}</math></li> <li>• Resolution: <math>\pm 0.001 \text{ m/s}</math></li> </ul>	

Table 1: DRIX equipment

## 1.2. SOFTWARE USED





Software		
Positioning	<ul style="list-style-type: none"> <li>Inertial data post processing: iXBlue APPS</li> </ul>	
Bathymetry online	<ul style="list-style-type: none"> <li>Acquisition software: QPS QINSy</li> <li>Acquisition software Kongsberg SIS</li> </ul>	  <b>KONGSBERG</b>
Bathymetry processing	<ul style="list-style-type: none"> <li>Post processing software: QPS QIMERA</li> </ul>	

Table 2 : DRIX software

## 2. WEATHER CONDITIONS

### 2.1. FORECAST

Weather forecast checked during the morning for the bay of La Ciotat predicted 1.9 to 2m significant wave height (Sea State 4) , with around 25 knots of wind (Beaufort 6) with gust up to 33knts.



Figure 1 : Weather forecast

## 2.2. WAVE BUOY MEASUREMENTS

### 2.2.1. Wave buoy location

The permanent wave buoy used is located close to the Island Planier, approximately 20km from La Ciotat.



Figure 2 : Wave buoy and survey area locations

### 2.2.2. Buoy Measurements

Numerical data of the buoy is displayed below with:

Date	H1/3	HMax	T1/3	Dir to pic	Spreading	Temperature
------	------	------	------	------------	-----------	-------------



21/10/2020 20:00	1.9	3.1	6.5	141	34	18.6
21/10/2020 19:30	2.2	3.3	6.7	148	38	18.6
21/10/2020 19:00	2.2	3.8	6.7	151	31	18.5
21/10/2020 18:30	2.2	4.3	6.6	145	35	18.6
21/10/2020 18:00	2.3	3.4	6.4	151	32	18.5
21/10/2020 17:30	2.4	3.7	6.5	144	29	18.5
21/10/2020 17:00	2.5	3.9	6.8	150	29	18.5
21/10/2020 16:30	2.4	4.5	6.1	133	23	18.6
21/10/2020 16:00	2.4	4.7	6.3	144	30	18.6
21/10/2020 15:30	2.2	3.9	6.3	143	29	18.6
21/10/2020 15:00	2.2	4.0	6.4	143	37	18.5
21/10/2020 14:30	2.2	3.7	6.4	145	35	18.6
21/10/2020 14:00	2.2	3.6	6.2	137	27	18.6
21/10/2020 13:30	2.1	3.9	6.3	154	31	18.6
21/10/2020 13:00	2.2	3.7	6.3	123	21	18.6
21/10/2020 12:30	2.1	4.3	6.3	141	40	18.6
21/10/2020 12:00	2.2	4.0	6.2	129	24	18.6
21/10/2020 11:30	2.2	3.9	6.1	148	39	18.5
21/10/2020 11:00	2.2	3.6	6.6	145	34	18.5
21/10/2020 10:30	2.0	3.4	6.4	133	28	18.6
21/10/2020 10:00	1.9	3.6	6.0	144	34	18.7

Table 3 : Wave measurements table

Access to data following the link :

<http://candhis.cetmef.developpementdurable.gouv.fr/campagne/?idcampagne=26657d5ff9020d2abefe558796b99584>

The data from the buoy is displayed below, with a particular highlight on the time the survey was performed.

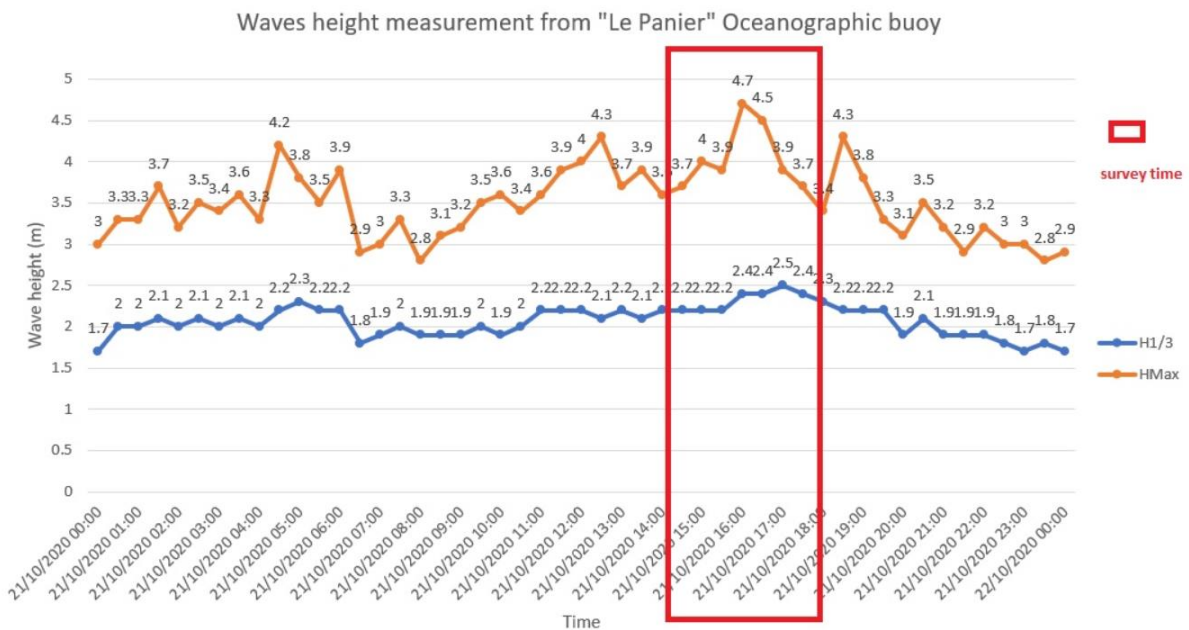


Figure 3 : Wave buoy graph

### 3. SURVEY AREA AND PARAMETERS

The survey area is located in the bay of La Ciotat, with ranging depth from 25 to 49m. Lines were drawn parallel to the isobath, which gives a line orientation of 80° and 260°. The area was chosen to be fully exposed to the waves.







Figure 4 : Survey area

<b><u>DRiX Configuration</u></b>	
DRiX mode	Autopilot
Trajectory	Line automatic following
DRiX speed for survey	8 to 12 knots
Communication	Wifi / Over The Horizon
Obstacle Avoidance	ON

Table 4 : DRiX configuration

<b><u>Multibeam Echosounder parameters</u></b>	
Frequency used	300Khz
MBES opening angle	130° to 110°
Pulse	Very short CW
Dual swath option	ON
Roll stabilisation	ON
Pitch stabilisation	ON

Table 5 : Multibeam echosounder configuration

## 4. DRiX MOTION DURING SURVEY

### 4.1. ROLL



Figure 5 : DRiX roll curve

### 4.2. PITCH

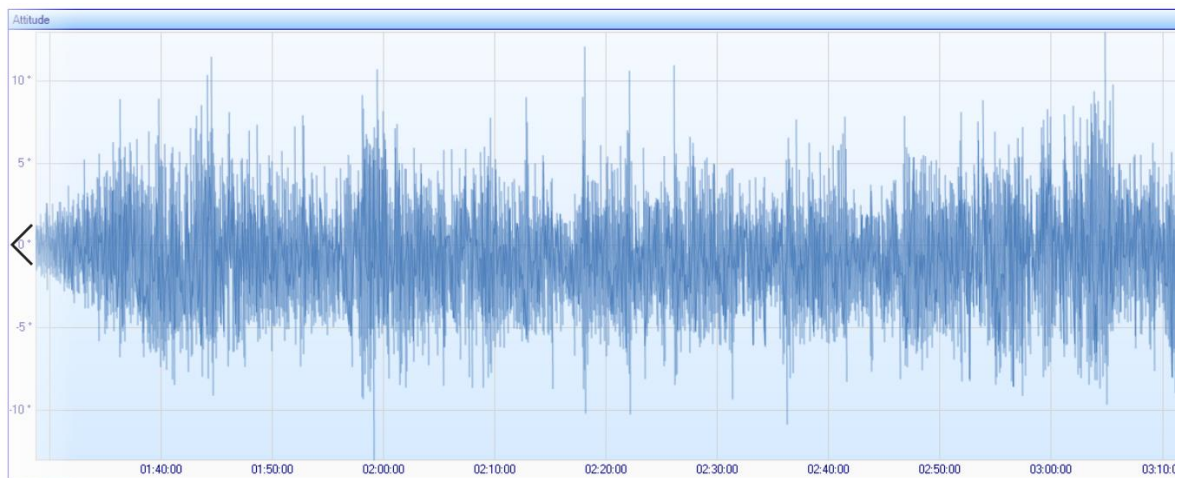
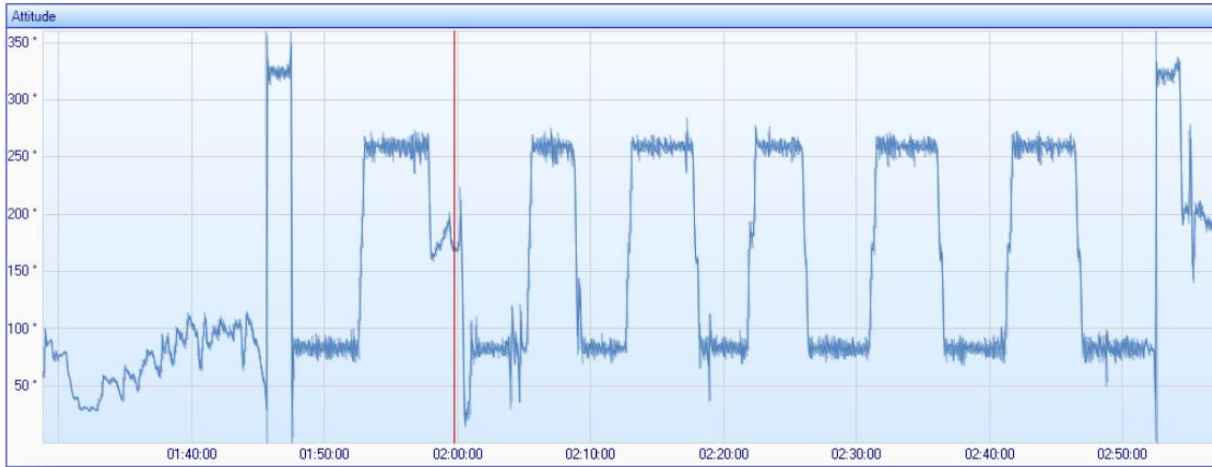


Figure 6 : DRiX Pitch curve

### 4.3. HEADING



### 4.4. HEAVE

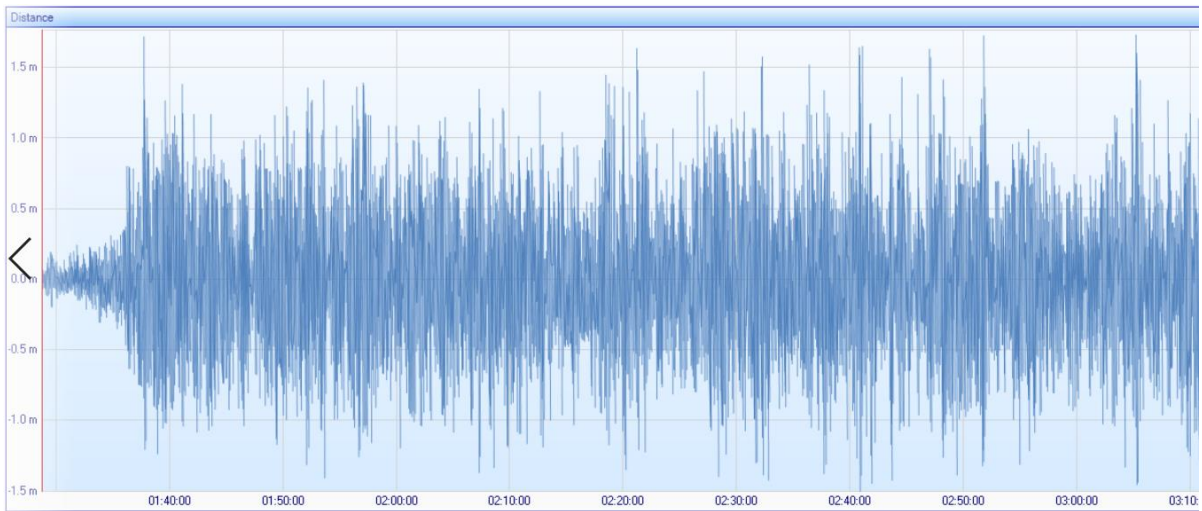


Figure 7 : DRiX Heave curve

## 5. DRIX MULTIBEAM DATA QUALITY

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### 5.1. DRIX BATHYMETRY RESULT

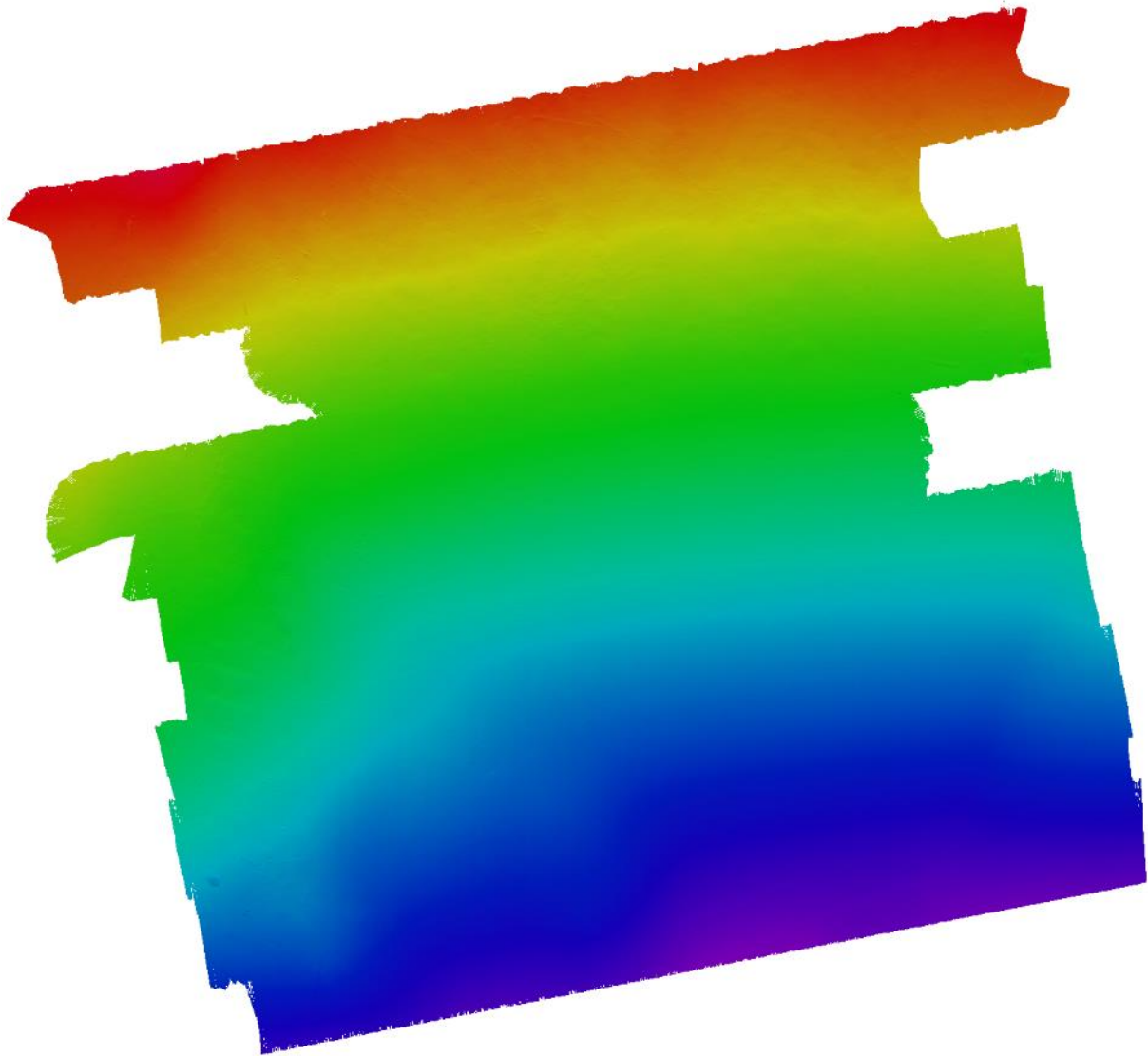


Figure 8 : Bathymetry result

The resulting grid is obtained after 30 minutes of processing, including:

- GNSS and INS processing in APPS
- Bathymetric and SBET data loaded in Qimera
- Creation of a CUBE Surface at 1m cell size / No manual despiking performed

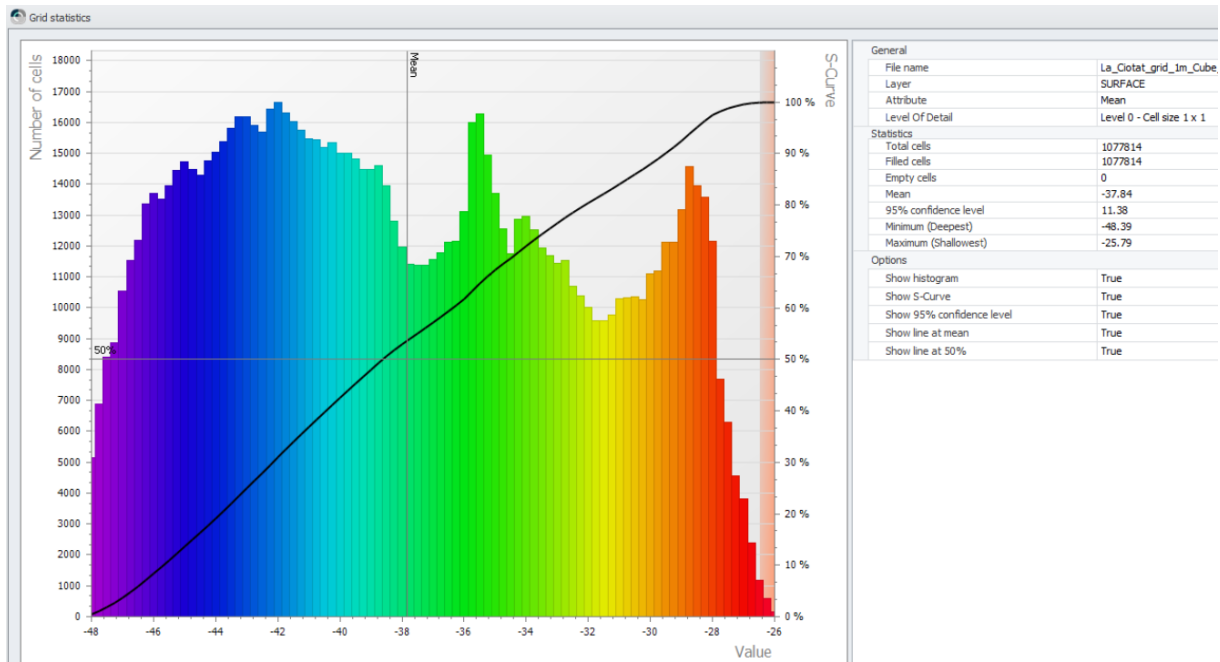


Figure 9 : Depth distribution on the survey area

## 5.2. HIT COUNT

The figure below presents the hit count result obtained for a 1mx1m grid.

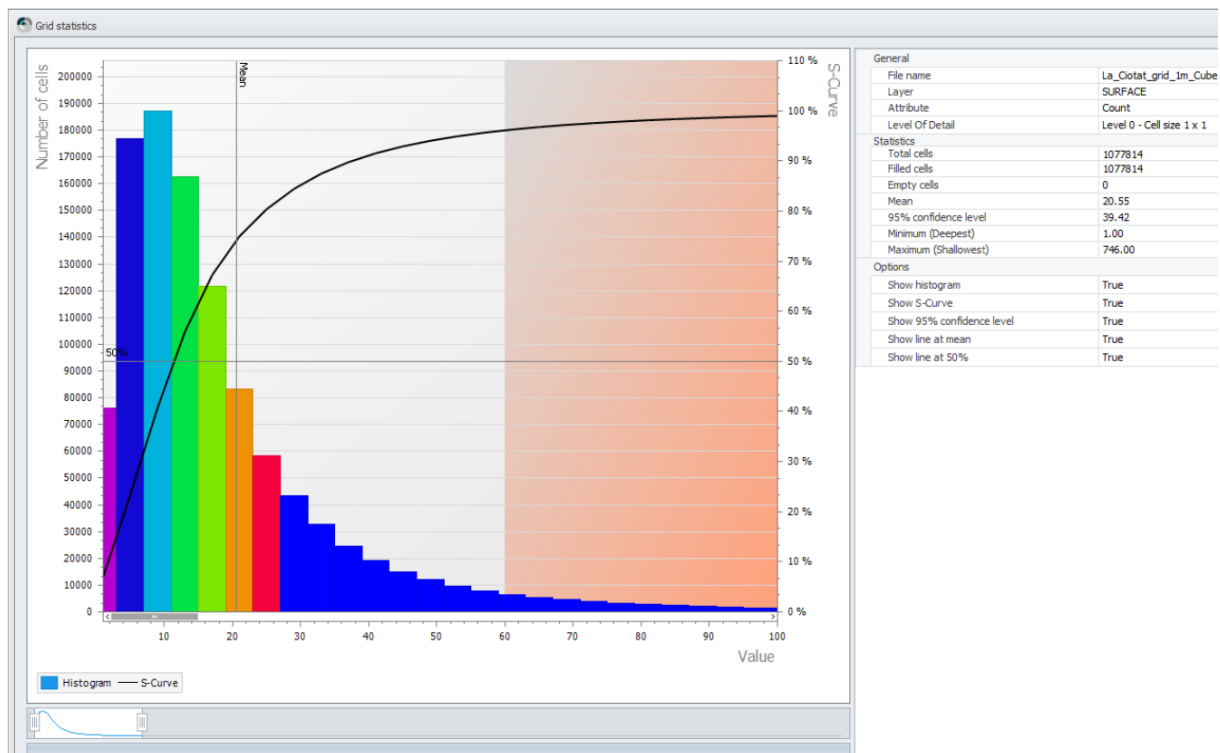


Figure 10 : Hit Count per cell

The mean number of soundings per cell is 21, for a survey performed between 8 and 12 knots.

### 5.3. STANDARD DEVIATION



Figure 11 : survey area standard deviation

The Standard deviation displayed show highest values being on the bottom of the area, with a value of 15cm (depth of 48m). This also corresponds to the lines where the MBES swath was opened to 130°. Max standard deviation being observed on the outer beams.



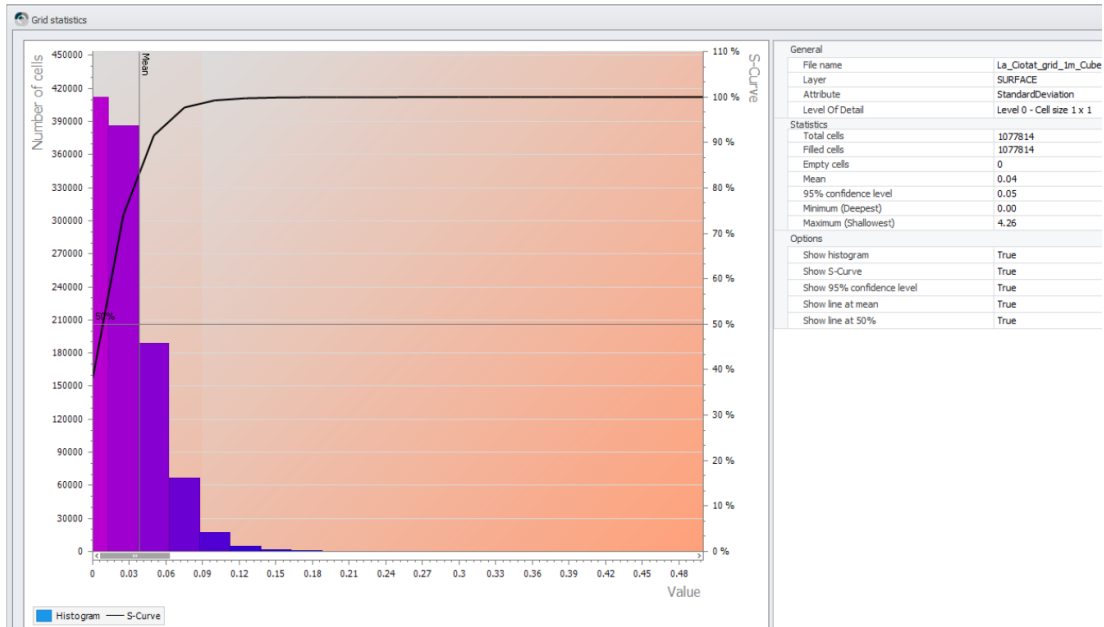
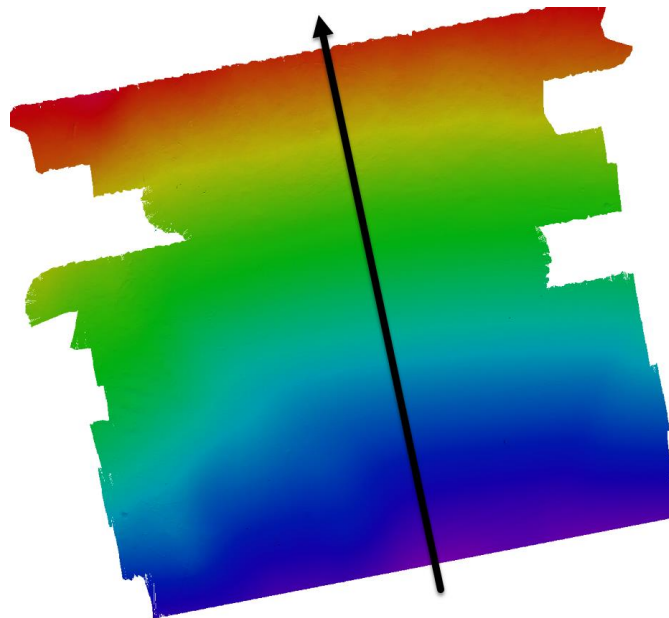


Figure 12 : Standard déviation result

The mean standard deviation obtained on the survey is 4cm.

### 5.4. QUALITY CONTROL

Quality control is done performing a perpendicular line to the survey lines and comparing this line to a referenced model, in our case compared with the digital Terrain model created with the other lines.





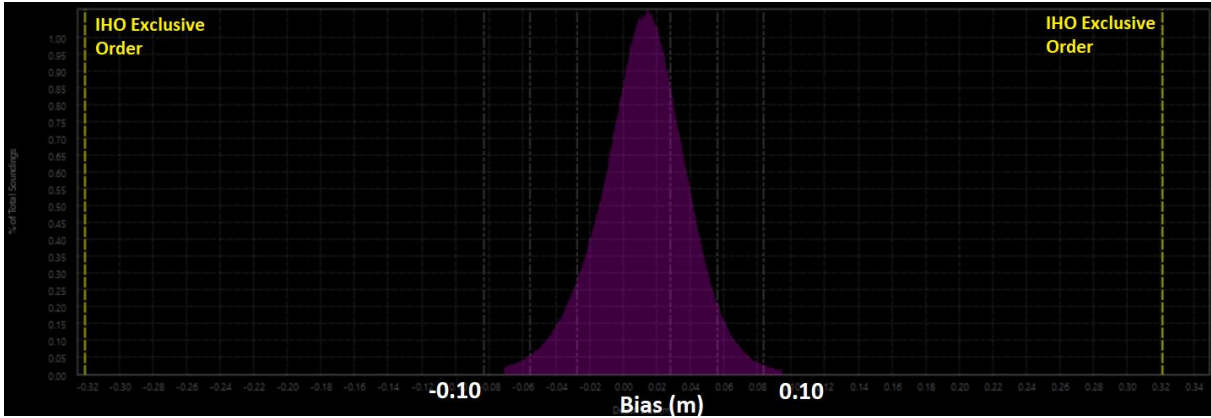


Figure 13 : MBES data distribution histogram

Data distribution histogram is centered on 0 indicating no bias between the cross line and the Digital Terrain Model, with 95% of data distribution contained at +/- 0.08m.

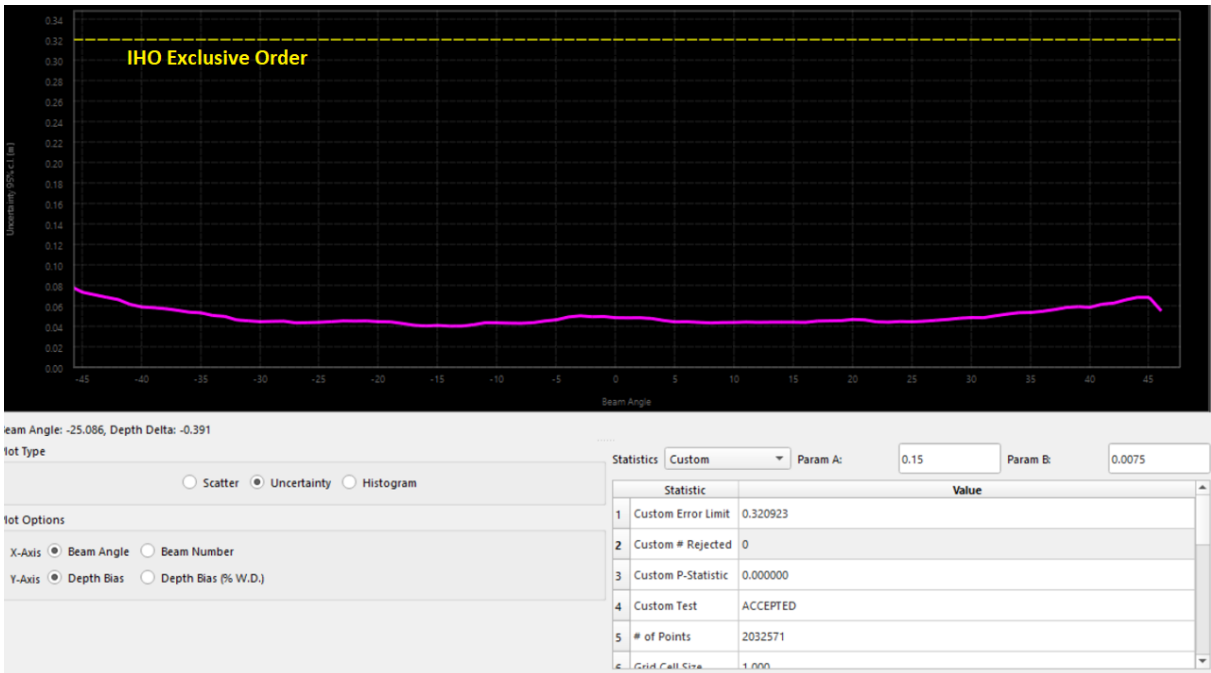


Figure 14 : Swath display with respect to the exclusive order

Result shows, that in term of Total Propagated Vertical Error, DRIX passed with a factor 4 the new IHO standard Exclusive Order, over the complete swath width (100° aperture).