H13608

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13608

LOCALITY

State(s):	Ohio
General Locality:	Lake Erie
Sub-locality:	6 NM Northeast of Cleveland

2022

CHIEF OF PARTY
Matthew J. Jaskoski, CDR/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13608**

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State(s):	**Ohio**
General Locality:	**Lake Erie**
Sub-Locality:	**6 NM Northeast of Cleveland**
Scale:	**5000**
Dates of Survey:	**08/08/2022 to 09/16/2022**
Instructions Dated:	**04/19/2022**
Project Number:	**OPR-W386-TJ-22**
Field Unit:	**NOAA Ship *Thomas Jefferson***
Chief of Party:	**Matthew J. Jaskoski, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Low Water Datum IGLD-1985**

Remarks:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in NAD83 UTM 17N, LWD-IGLD 1985. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H13608

Project: OPR-W386-TJ-22

Locality: Lake Erie

Sublocality: 6 NM Northeast of Cleveland

Scale: 1:5000

August 2022 - September 2022

NOAA Ship *Thomas Jefferson*

Chief of Party: Matthew J. Jaskoski, CDR/NOAA

A. Area Surveyed

Survey H13608, located 6 nautical miles (nm) Northeast of Cleveland in Lake Erie, OH, was conducted in accordance with coverage requirements set forth in the Project Instructions (PI) OPR-W386-TJ-22. The survey area is approximately 31.8 square nautical miles (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 39' 56.83" N 81° 42' 56.26" W	41° 31' 35.01" N 81° 31' 58.49" W

Table 1: Survey Limits

Survey data were acquired in accordance with the requirements set forth by the PI and the 2022 Hydrographic Surveys Specifications and Deliverables (HSSD). A deprioritized S-57 CRANES area was provided within the survey limits set forth in the PI. Data were not collected in this area due to operational time constraints (Figure 2).

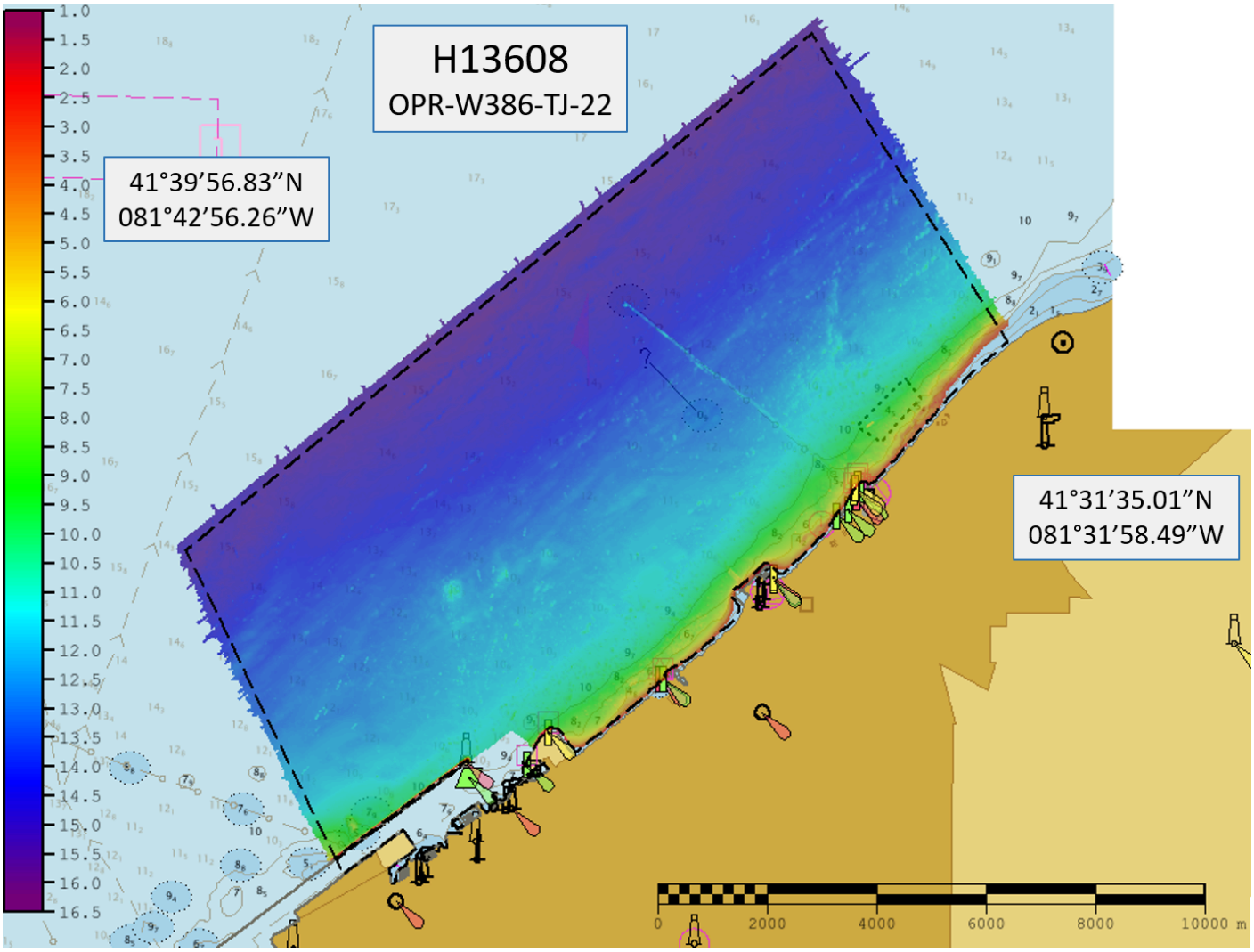


Figure 1: Survey layout for H13608 overlaid on ENC US4OH01M. Black outline represents the survey limits set forth in the Project Instructions.

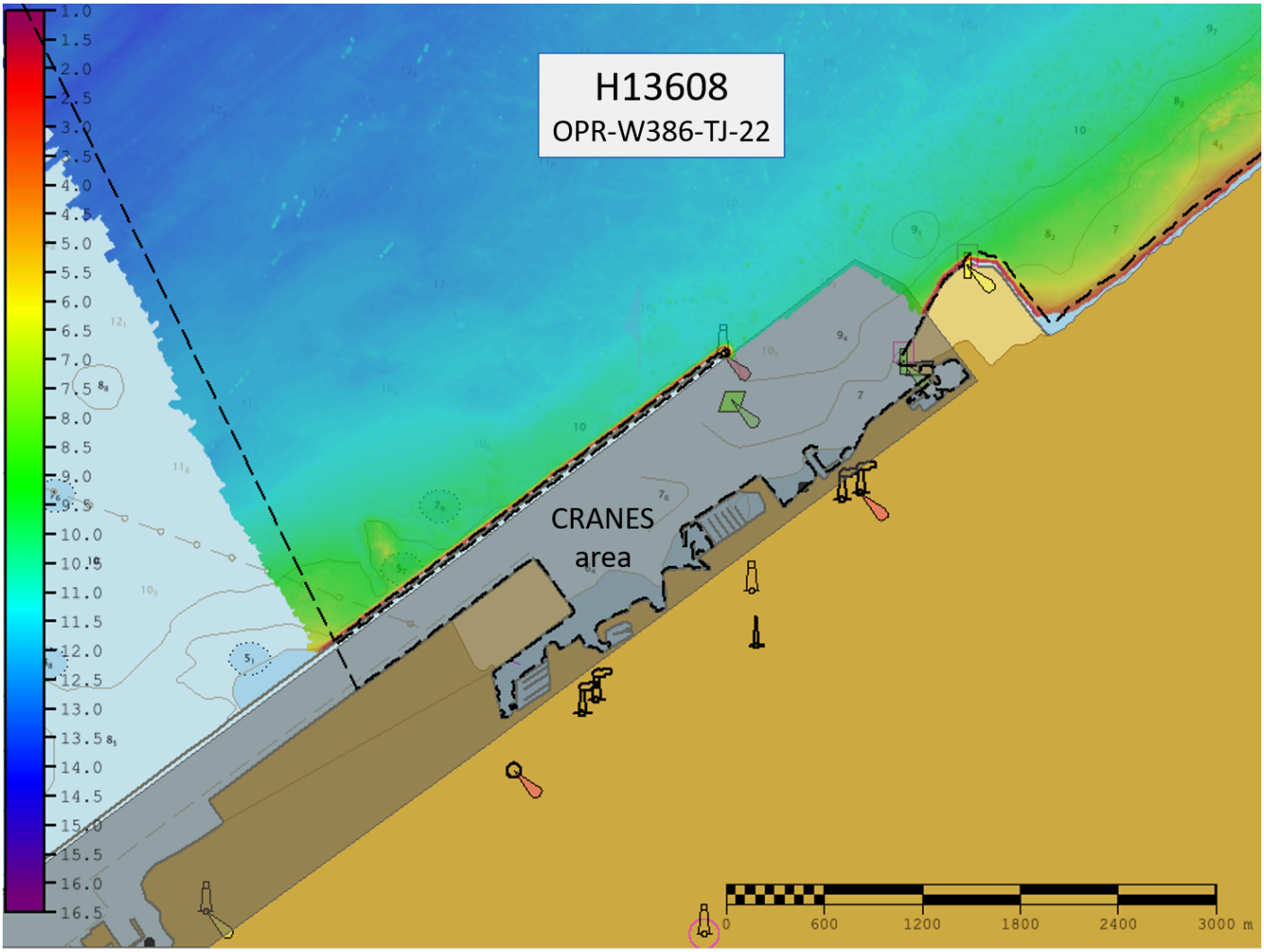


Figure 2: Deprioritized CRANES area in the southwest corner of H13608; sheet limits outlined in black.

A.2 Survey Purpose

The Port of Cleveland is one of the largest ports on the Great Lakes and ranks within the top 50 ports in the United States. Roughly 13 million tons of cargo are transported through Cleveland Harbor each year supporting over 20,000 jobs and $3.5 billion in annual economic activity (1). This project will provide modern bathymetric data for the Cleveland area as well as the vicinity of South Bass Island and Presque Isle. The project area was identified as a statistically significant hot spot within the 2018 hydrographic health model, a risk model that Coast Survey uses for evaluating priorities based upon navigational risks and the necessary quality of data to support modern traffic. Most of this area has not been surveyed since the 1940s, and experiences significant vessel traffic.

Conducting a modern bathymetric survey in this area will identify hazards and changes to the seafloor, provide critical data for updating National Ocean Service (NOS) nautical charting products and improve

maritime safety. Survey data from this project is intended to supersede all prior survey data in the common area.

1 https://www.portofcleveland.com/

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H13608 meet complete coverage requirements as specified by the 2022 HSSD with complete multibeam echo sounder (MBES) coverage (see Section 5.2.2.3, Option A). This includes crosslines (see Section 5.2.4.2), NOAA allowable uncertainty (see Section 5.1.3), and density requirements (see Section 5.2.2.3, Option A).

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3)
All waters in survey area	Acquire backscatter data during all multibeam data acquisition (Refer to 2022 HSSD Section 6.2)

Table 2: Survey Coverage

Survey coverage is in accordance with requirements listed in the 2022 HSSD. Coverage requirements were met with 100% MBES coverage with contacts and features developed to complete coverage specifications.

Coverage was acquired to the inshore limit of hydrography, the Navigable Area Limit Line (NALL). Areas where survey coverage did not reach the 3.5 meter depth contour, nor the assigned sheet limits, were due to the survey vessel reaching the extent of safe navigation. These areas are characterized as being near shore and subject to dangerous wave action or other hazards. Additionally, the survey vessel did not acquire data in the deprioritized area provided in the PI (see Section A.1).

One holiday, centrally located at 41°35'19.02"N/081°34'01.08"W, exists in the coverage achieved for H13608. This holiday marks the location of a detached breakwater that can be seen in Google satellite imagery (Figure 3).

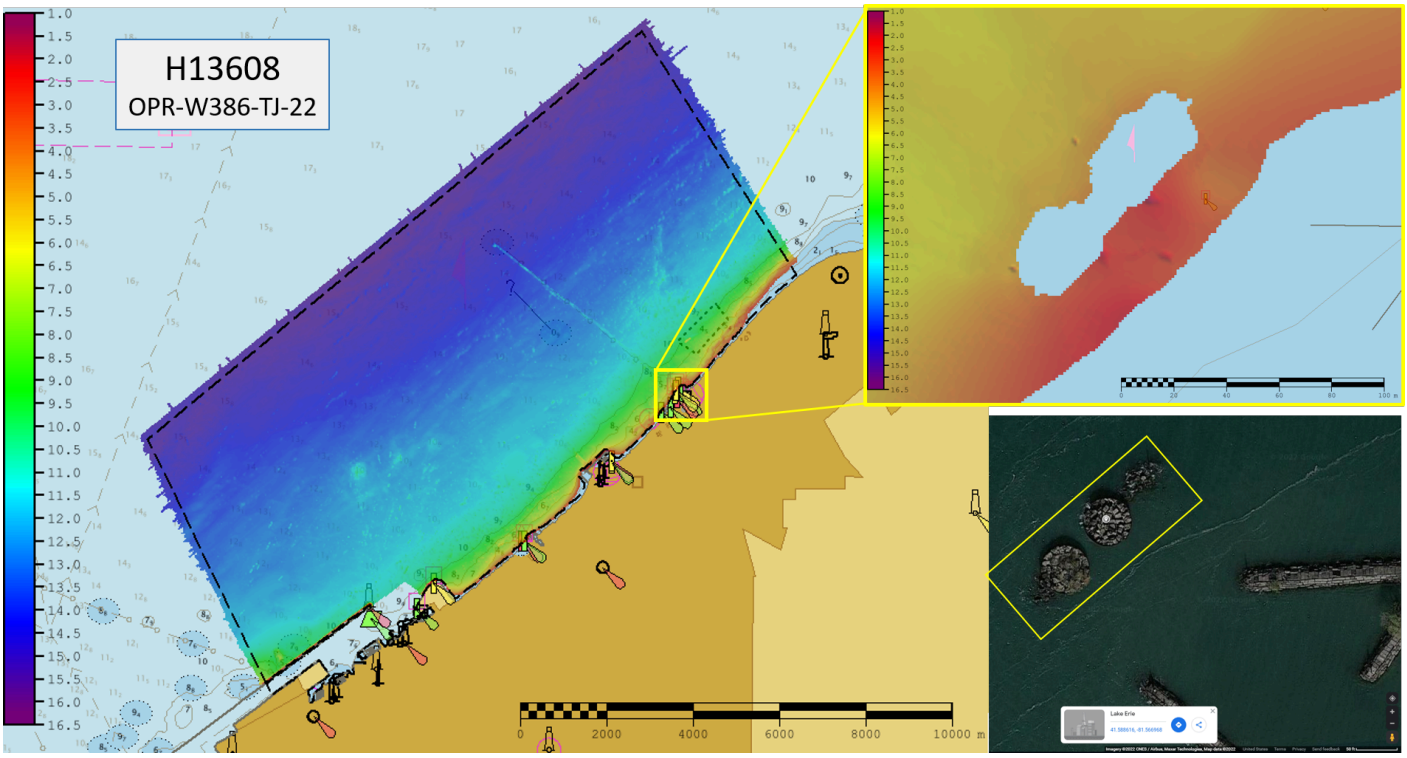


Figure 3: Holiday in coverage at 41°35'19.02"N/081°34'01.08"W.

A.6 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	*S222*	*2903*	*2904*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0
	MBES Mainscheme	799.9	600.0	369.7	1769.6
	Lidar Mainscheme	0.0	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/MBES Crosslines	33.6	42.4	0.0	76.0
	Lidar Crosslines	0.0	0.0	0.0	0.0
Number of Bottom Samples					12
Number Maritime Boundary Points Investigated					0
Number of DPs					0
Number of Items Investigated by Dive Ops					0
Total SNM					31.8

Table 3: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates	Day of the Year
08/08/2022	220
08/09/2022	221

Survey Dates	Day of the Year
08/17/2022	229
08/18/2022	230
08/19/2022	231
08/20/2022	232
08/21/2022	233
08/22/2022	234
08/24/2022	236
08/27/2022	239
08/29/2022	241
09/01/2022	244
09/02/2022	245
09/03/2022	246
09/04/2022	247
09/05/2022	248
09/07/2022	250
09/08/2022	251
09/12/2022	255
09/13/2022	256
09/15/2022	258
09/16/2022	259

Table 4: Dates of Hydrography

MBES data acquisition started on 08/08/2022 and ended on 09/16/2022.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	***S222***	***2903***	***2904***
LOA	63.4 meters	8.5 meters	8.5 meters
Draft	4.6 meters	1.2 meters	1.2 meters

Table 5: Vessels Used

Figure 4: NOAA Ship Thomas Jefferson (S222)

Figure 5: Thomas Jefferson Launch 2903

Figure 6: Thomas Jefferson Launch 2904

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040	MBES
Kongsberg Maritime	EM 2040	MBES Backscatter
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
AML Oceanographic	MVP-X	Conductivity, Temperature, and Depth Sensor
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor
Valeport	Thru-Hull SVS	Sound Speed System
Teledyne RESON	SVP 70	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System

Table 6: Major Systems Used

Vessel configurations, equipment operations, data acquisition, and processing were consistent with specifications described in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

Hydrographic survey vessels S222, 2903, and 2904 collected 76.0 linear nautical miles of crosslines, or 4.3% of mainscheme MBES data. The crosslines acquired represent good spatial and depth diversity for this survey area (Figure 7). A 1m gridded Combined Uncertainty and Bathymetry Estimator (CUBE) surface of mainscheme data and a 1m gridded CUBE surface of crossline data were differenced; the resulting mean was 0.01m with a standard deviation of 0.05m (Figure 8). Over 99.5% of nodes are compliant with fraction of allowable error standards (Figure 9). Visual inspection of the differenced surfaces indicated no systematic issues.

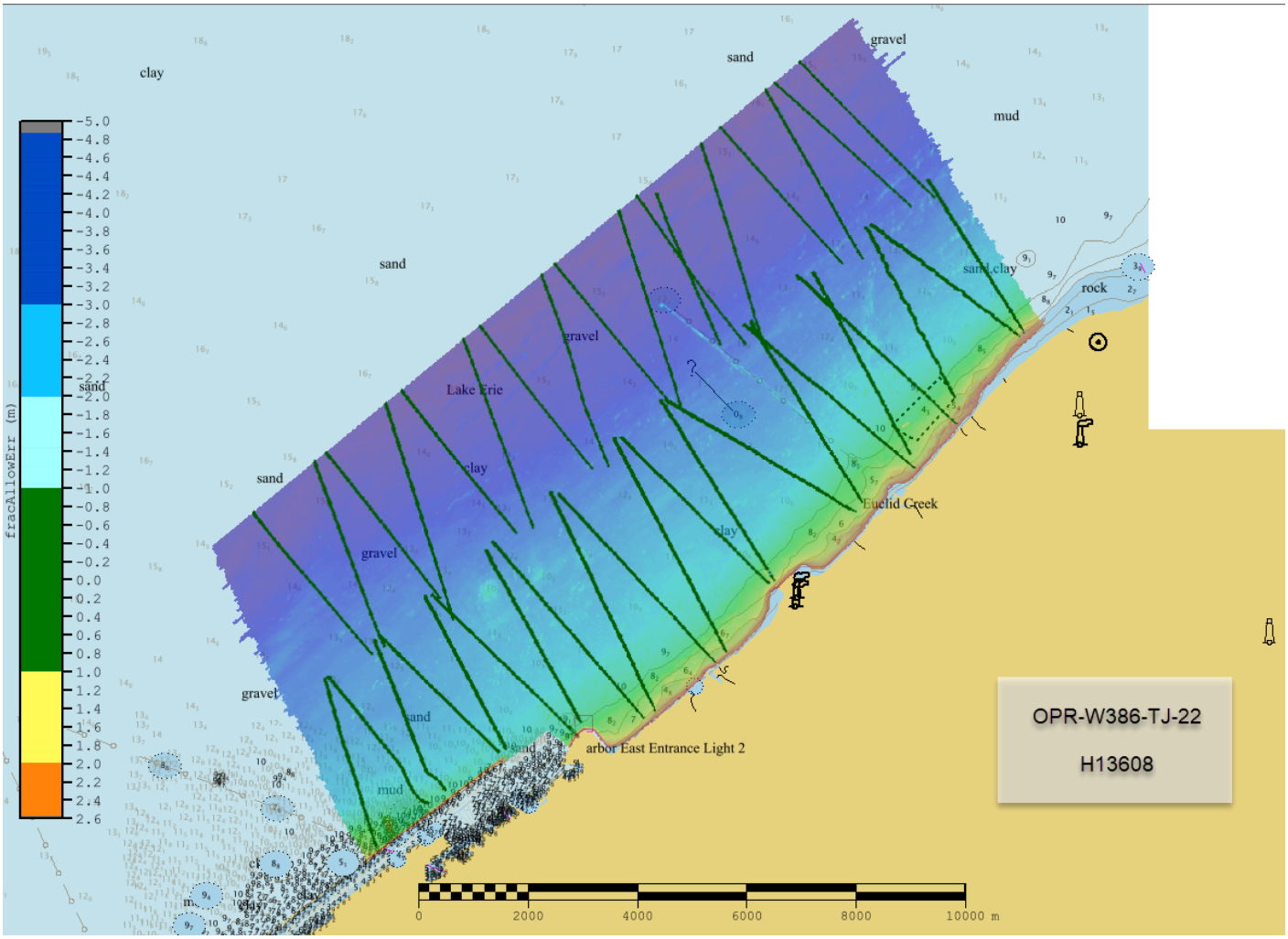
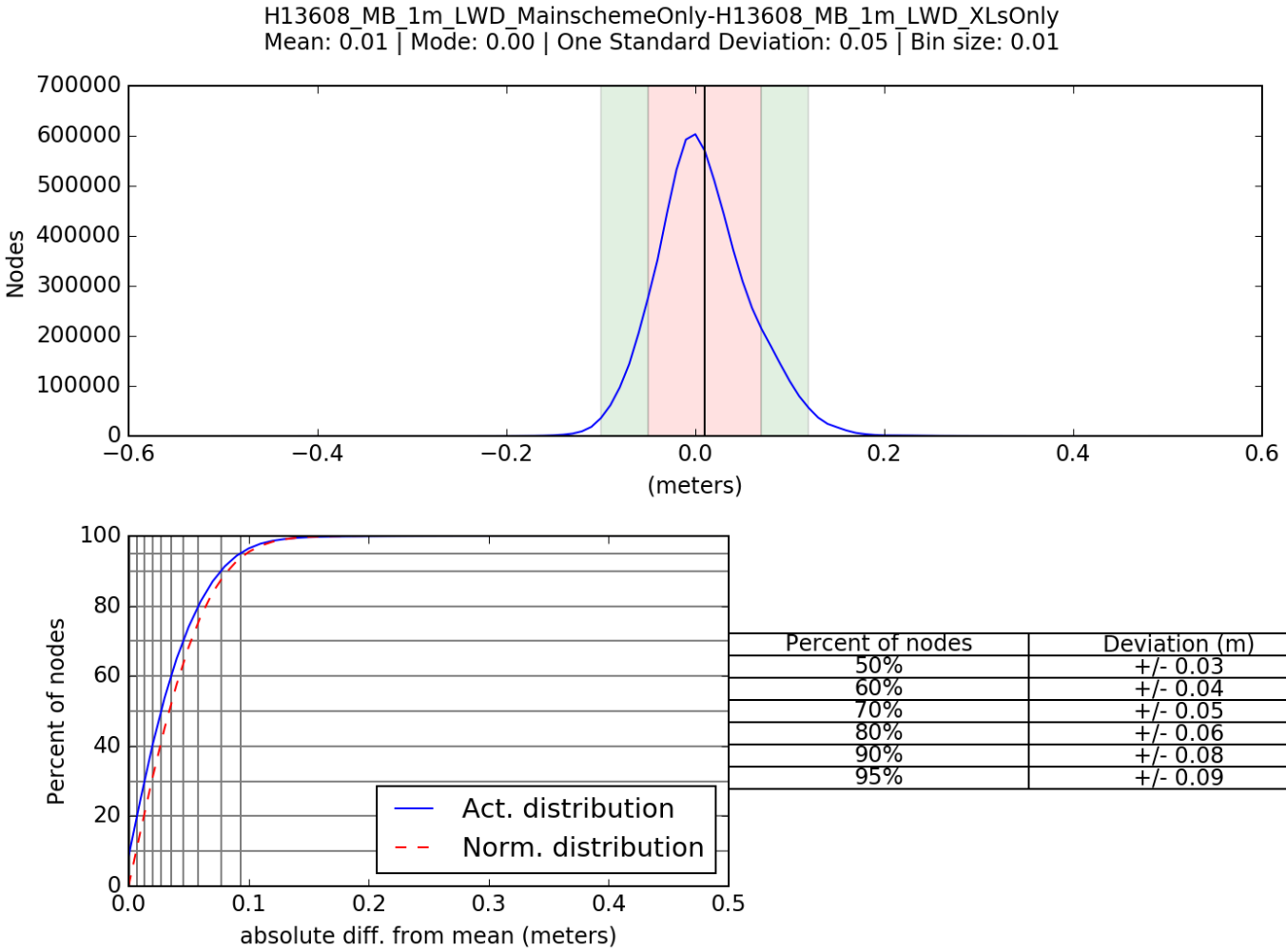


Figure 7: H13608 MBES crossline data, shown in fraction of allowable error difference statistics, overlaid on mainscheme data, plotted on ENCs US4OH01M and ENC US5OH11M.



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.09

Figure 8: H13608 crossline/mainscheme comparison statistics.

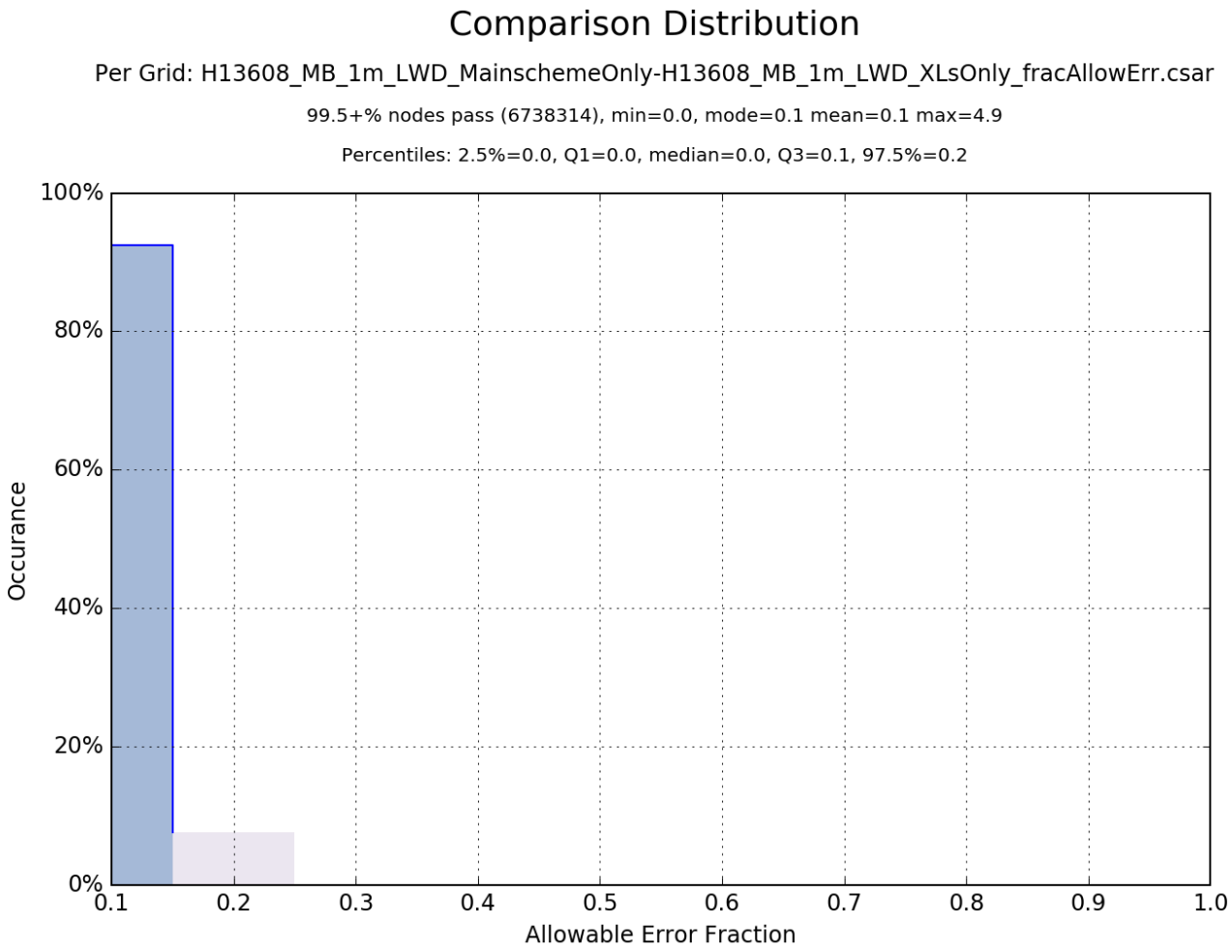


Figure 9: H13608 crossline fraction of allowable error statistics.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.045 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S222	N/A meters/second	4 meters/second	N/A meters/second	0.2 meters/second
2903	4 meters/second	N/A meters/second	N/A meters/second	0.2 meters/second
2904	4 meters/second	N/A meters/second	N/A meters/second	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The bathymetric surface's uncertainty layer is compliant with 2022 HSSD uncertainty standards. One-hundred percent of nodes pass uncertainty standards (Figure 10).

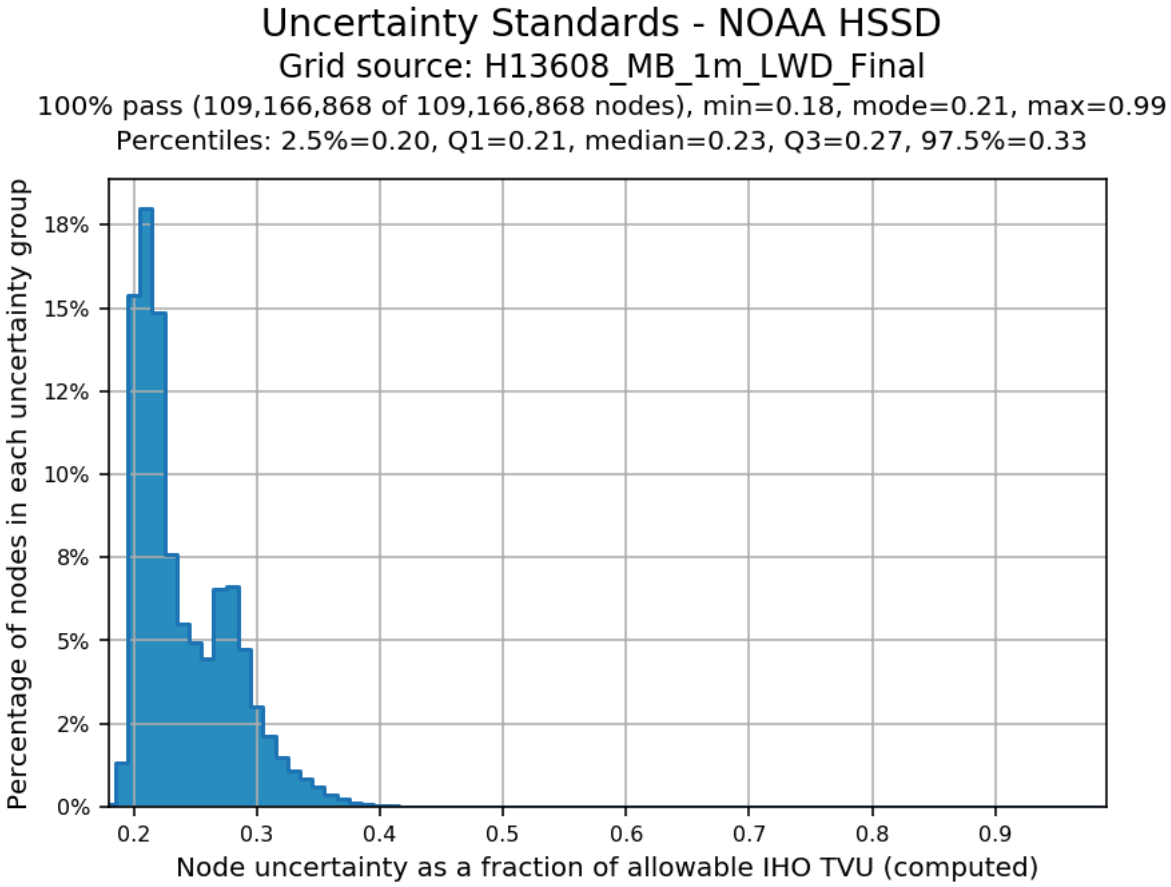


Figure 10: H13608 uncertainty standards.

B.2.3 Junctions

H13608 junctions with two contemporary surveys within the OPR-W386-TJ-22 project- H13607 and H13615.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13607	1:5000	2022	NOAA Ship Thomas Jefferson	W
H13615	1:10000	2022	NOAA Ship Thomas Jefferson	N

Table 9: Junctioning Surveys

H13607

The western edge of sheet H13608 junctions with sheet H13607. A 1m Single Resolution (SR) CUBE surface of H13608 data and a 50cm SR CUBE surface of H13607 data were differenced (Figure 11). The mean difference between bathymetric surface nodes was 0.06m with a standard deviation of 0.07m (Figure 12). Over 99.5% of nodes are compliant with fraction of allowable error standards (Figure 13). Statistics and visual inspection indicate that surveys H13608 and H13607 are in general agreement.

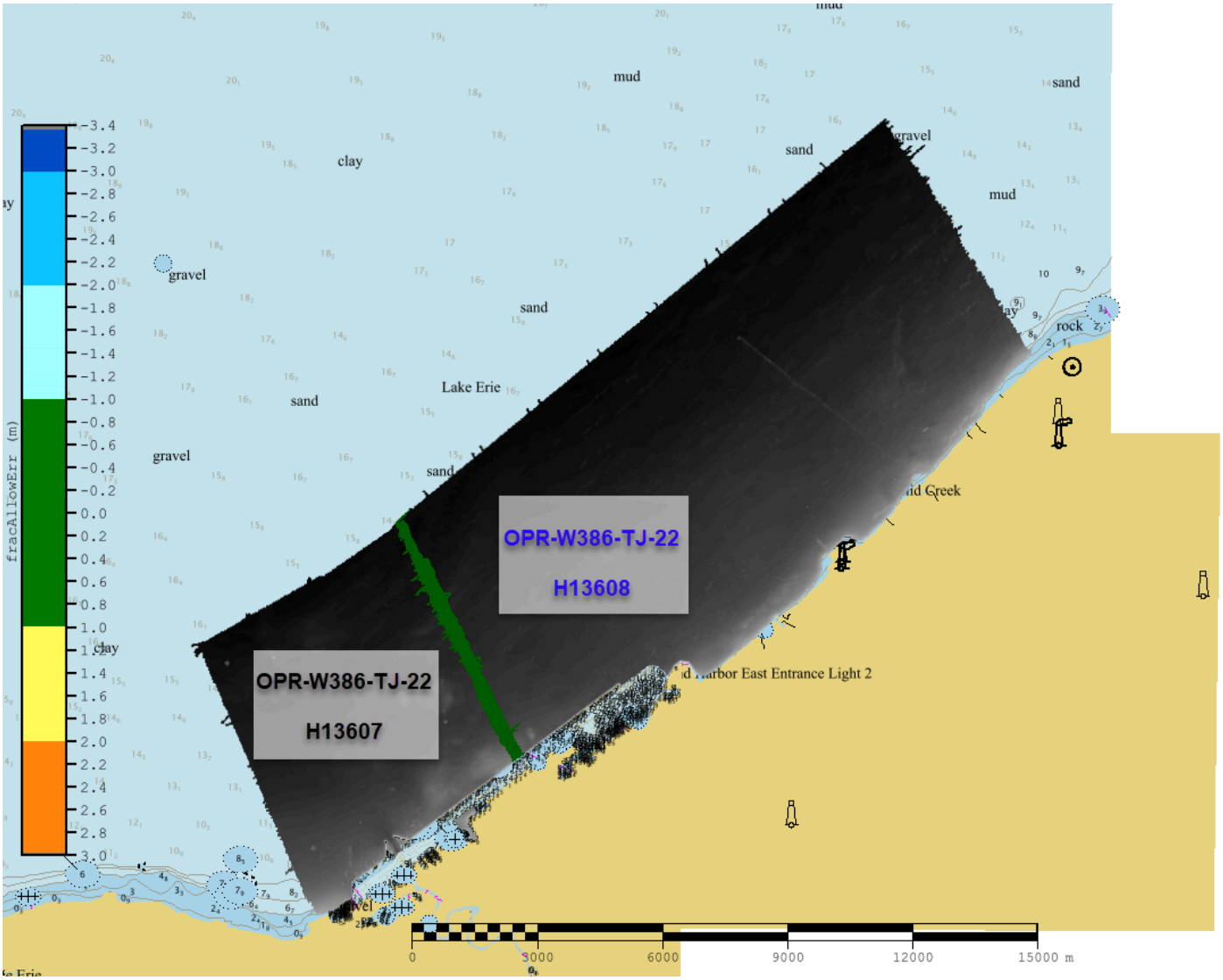
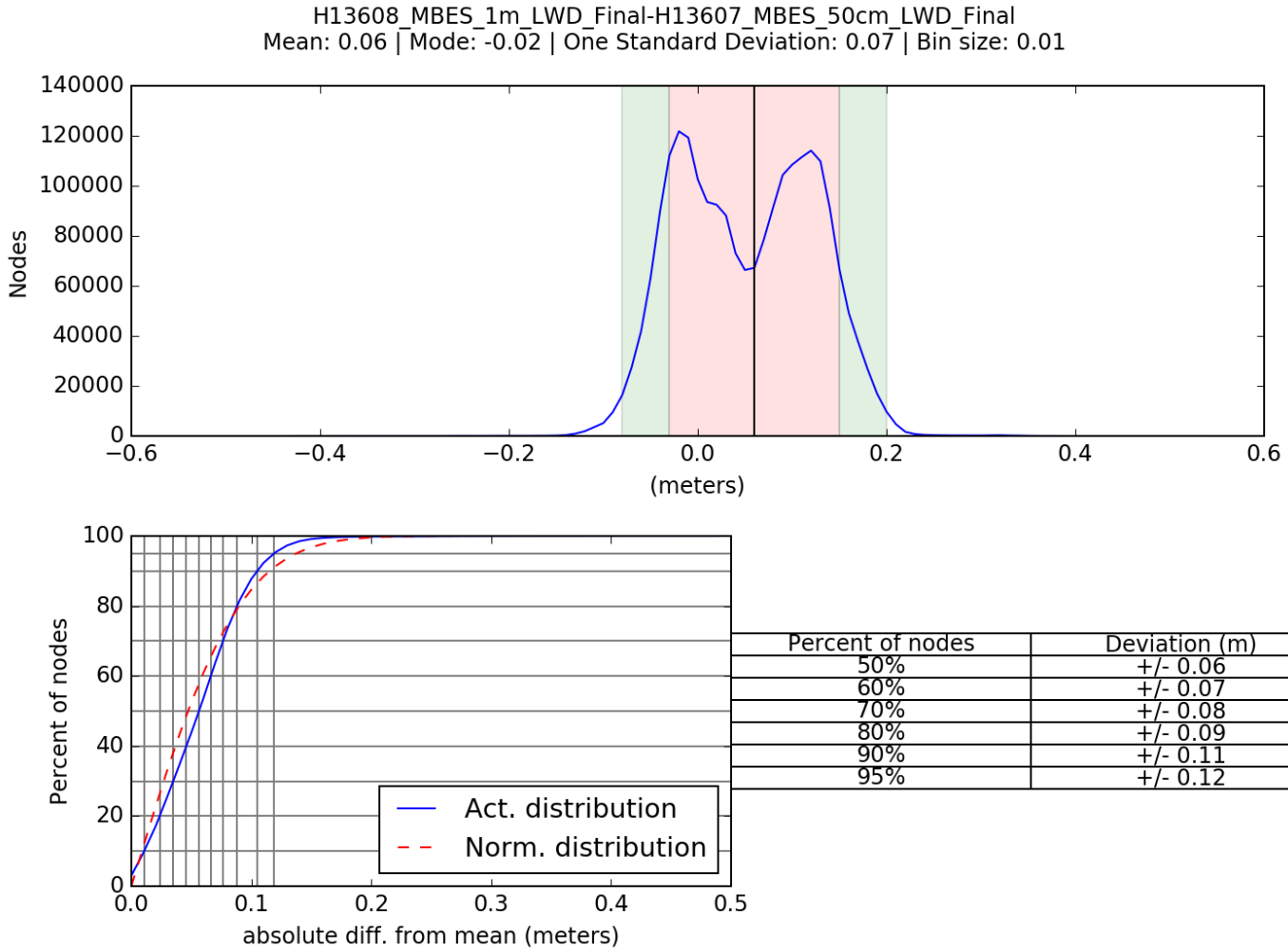


Figure 11: Fraction of allowable error surface difference comparison in color between H13608 and H13607, plotted over ENC US4OH01M and ENC US5OH11M.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.08
80%	+/- 0.09
90%	+/- 0.11
95%	+/- 0.12

Figure 12: H13608 and H13607 surface difference comparison statistics.

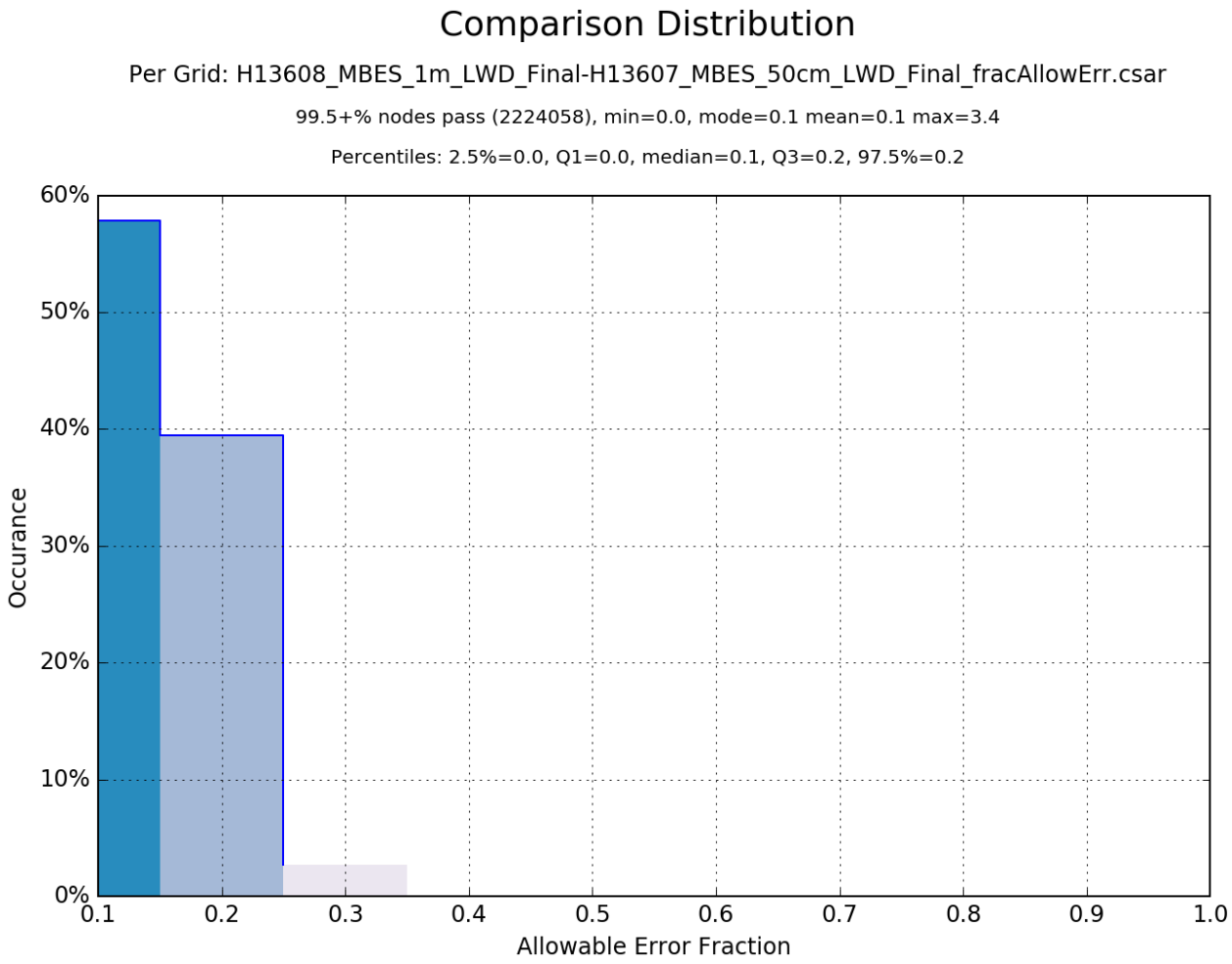


Figure 13: H13608 and H13607 fraction of allowable error statistics.

H13615

The northern edge of sheet H13608 junctions with sheet H13615. A 1m SR CUBE surface of H13608 data and a 1m SR CUBE surface of H13615 data were differenced (Figure 14). The mean difference between bathymetric surface nodes was 0.00m with a standard deviation of 0.09m (Figure 15). Over 99.5% of nodes are compliant with fraction of allowable error standards (Figure 16). Statistics and visual inspection indicate that surveys H13608 and H13615 are in general agreement.

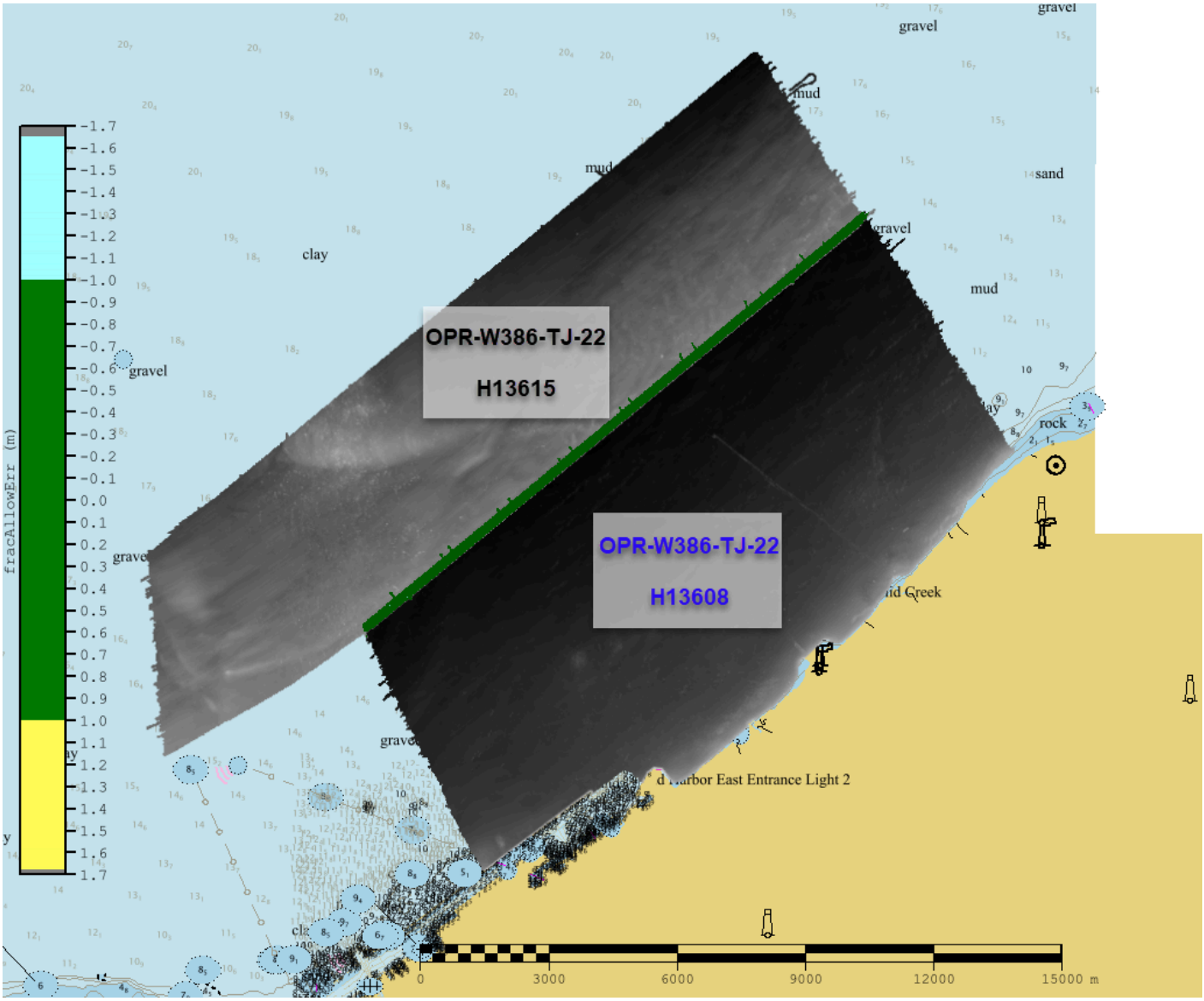
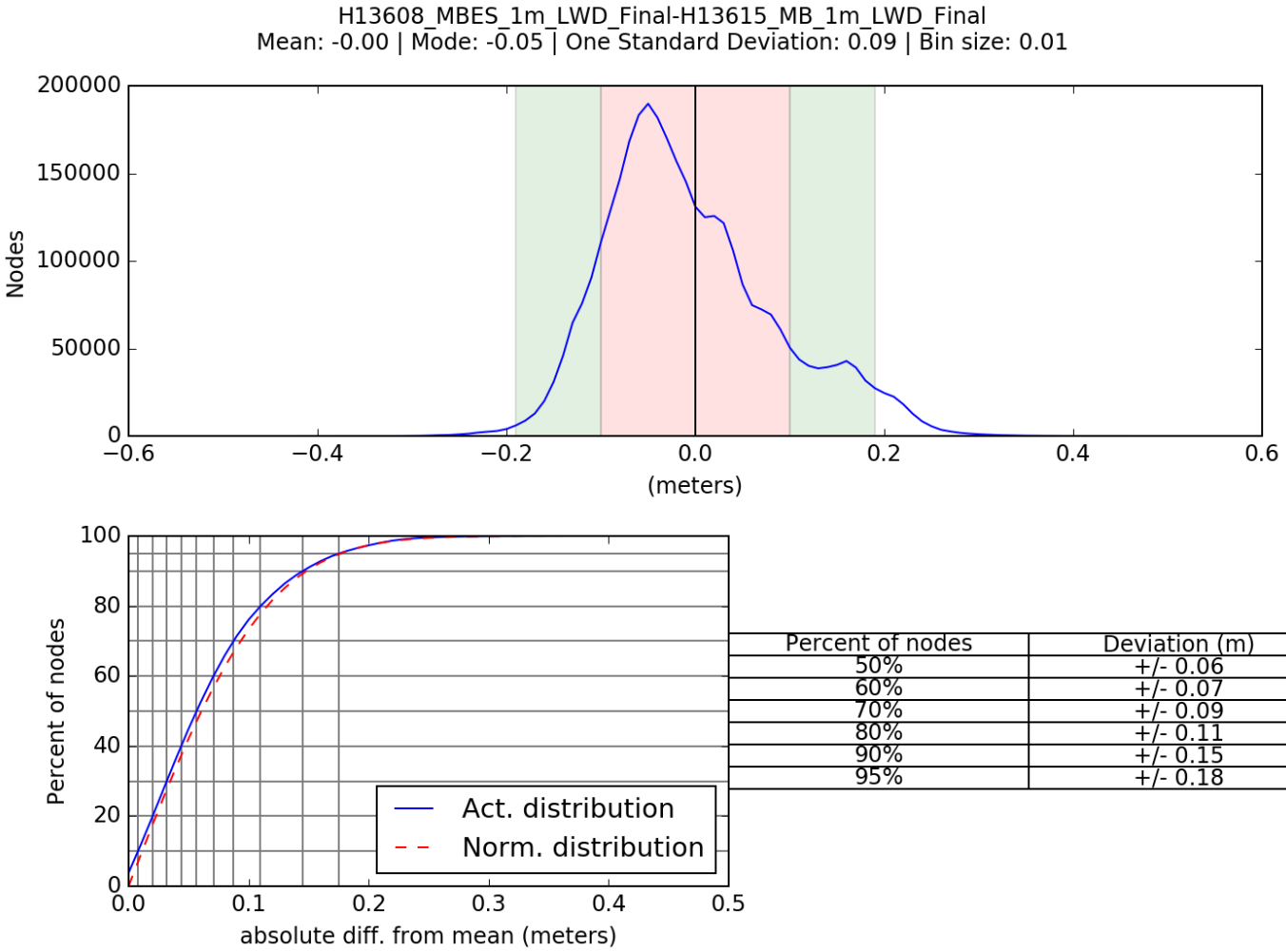


Figure 14: Fraction of allowable error surface difference comparison in color between H13608 and H13615, plotted over ENC US4OH01M and ENC US5OH11M.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.11
90%	+/- 0.15
95%	+/- 0.18

Figure 15: H13608 and H13607 surface difference comparison statistics.

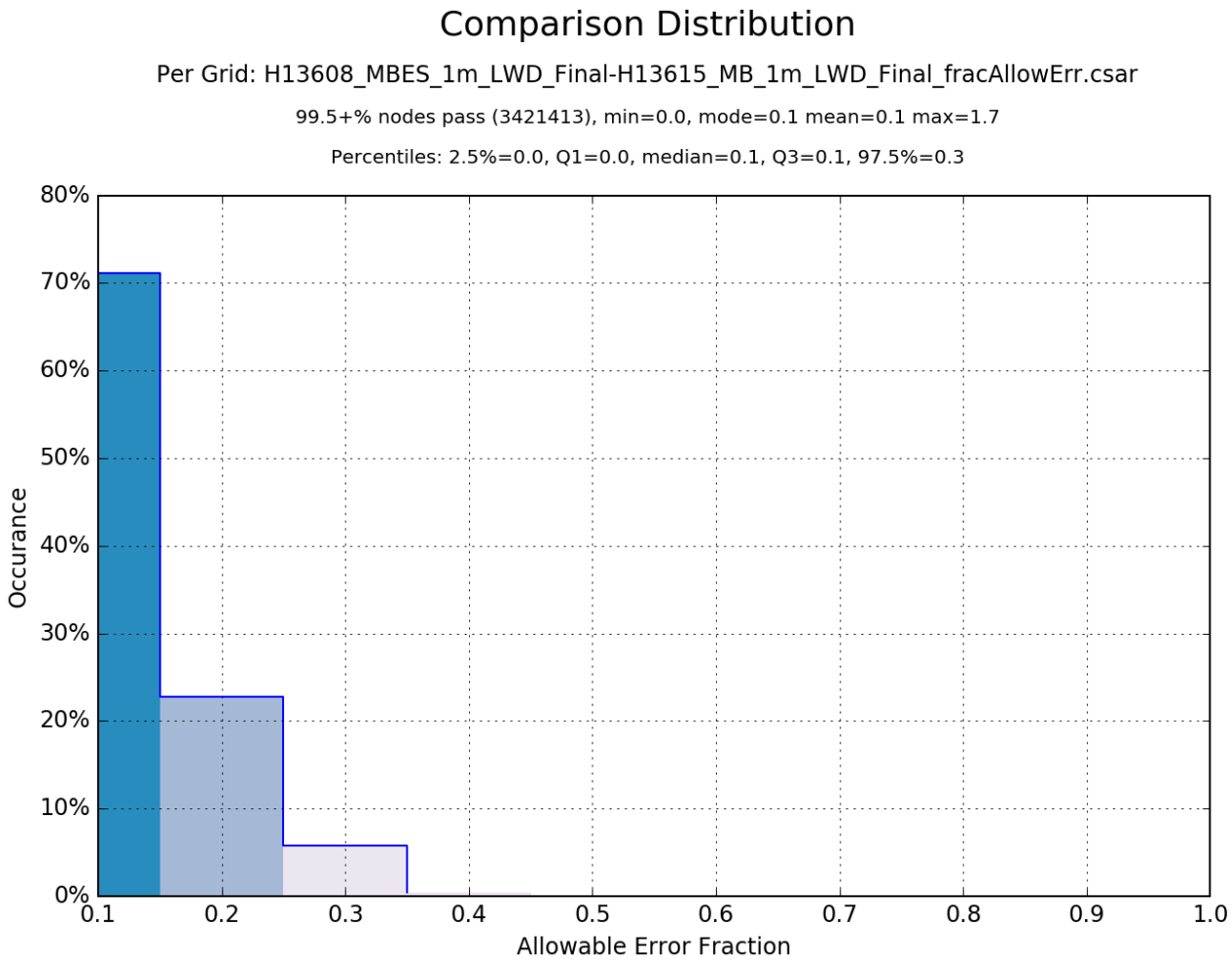


Figure 16: H13608 and H13615 fraction of allowable error statistics.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

B.2.6 Factors Affecting Soundings

Sound Speed Refraction

H13608 is located in an area that exhibits intense thermal stratification in the water column. This thermal layering greatly affects sound speed and results in refraction that can be observed in the MBES surface (Figure 17). The impacts on sounding depth accuracy are within allowable uncertainty standards, as outlined in the 2022 HSSD.

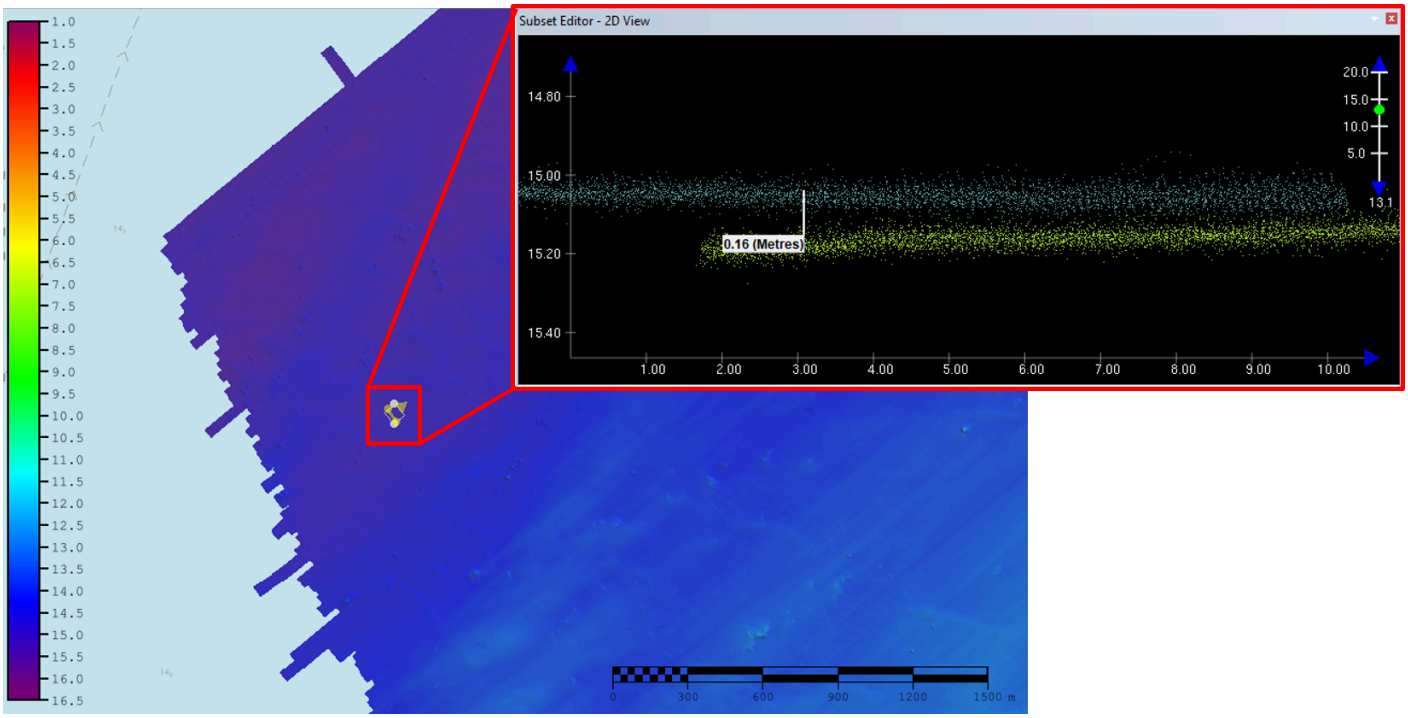


Figure 17: Example of the impact of sound speed seen throughout H13608 in Caris subset editor.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts to acquire sound velocity profiles were conducted using a MVP-200 and a Seabird SeaCat 19+ V2 CTD at the start of each acquisition day and at a minimum of once every four hours during acquisition. Cast frequency was increased in areas where a change in surface sound speed of greater than two meters per second was detected. All sound speed methods were used as detailed in the DAPR.

A total of 172 sound speed profiles were collected for H13608 and display good spatial and depth diversity (Figure 18). Nine of these 172 sound speed profiles were taken outside of the coverage extents for H13608, not more than 500m away, and display profiles representative of the area. All sound speed profile data were concatenated into a master file for the sheet. MBES data were corrected by applying profiles taken nearest in distance within time (4 hours) using this master file.

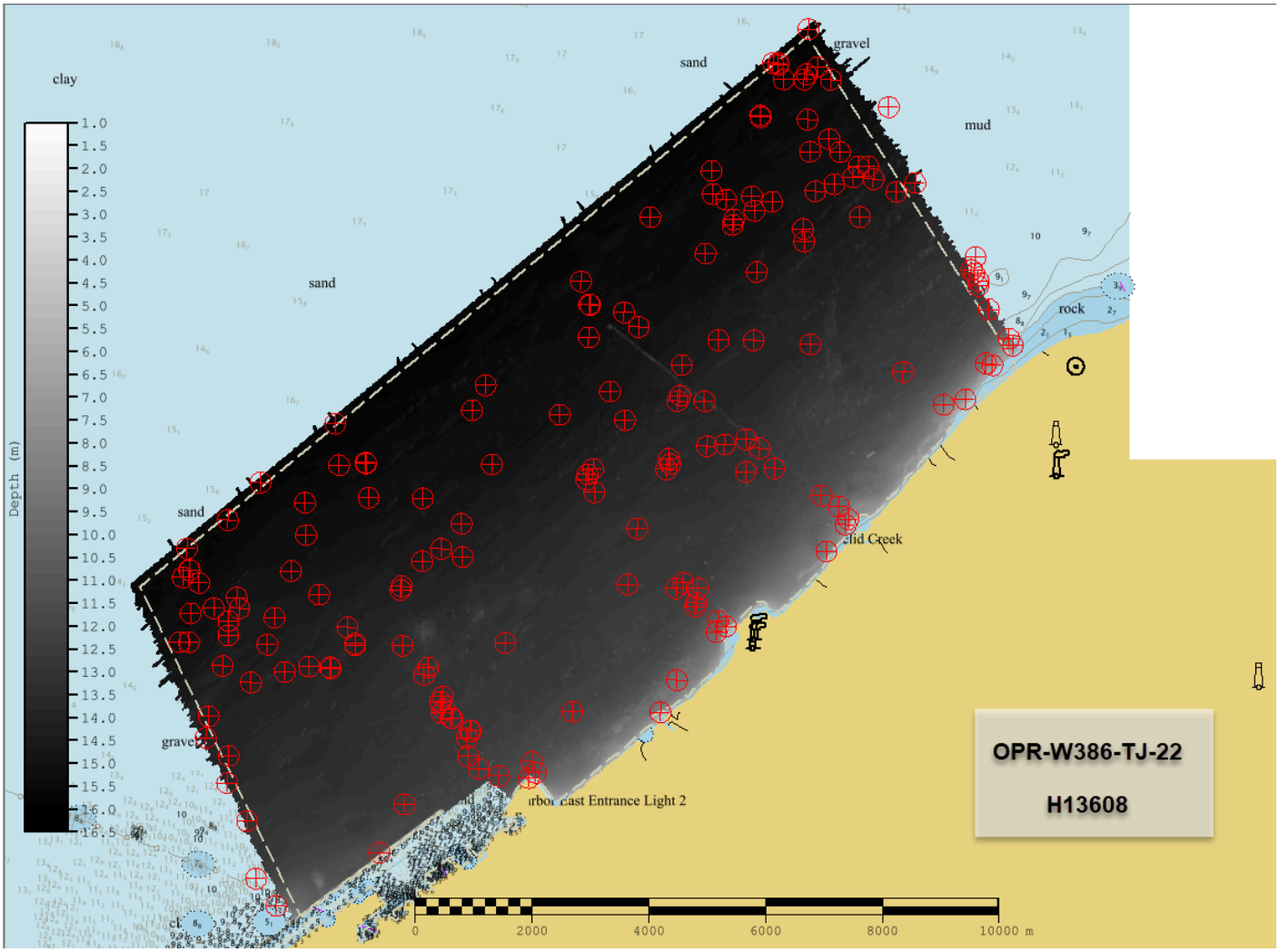


Figure 18: Overview of all sound speed casts collected on H13608. Cast locations shown as red targets overlaid on greyscale MBES surface.

B.2.8 Coverage Equipment and Methods

Complete coverage requirements were met by 100% complete coverage MBES as specified under section Section 5.2.2.3 of the 2022 HSSD. Vessels S222, 2903, and 2904 were outfitted with Kongsberg EM2040 MBES systems and were used to acquire 100% complete coverage MBES, crosslines, developments, and holidays.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

All equipment and survey methods were used as detailed in the DAPR. Raw MBES backscatter was flagged as part of the .all file from the Kongsberg EM2040 systems. Backscatter was processed in the QPS Fledermaus GeoCoder Toolbox (FMGT) software, and the exported geotiffs are included in the final processed data submission package (Figure 19).

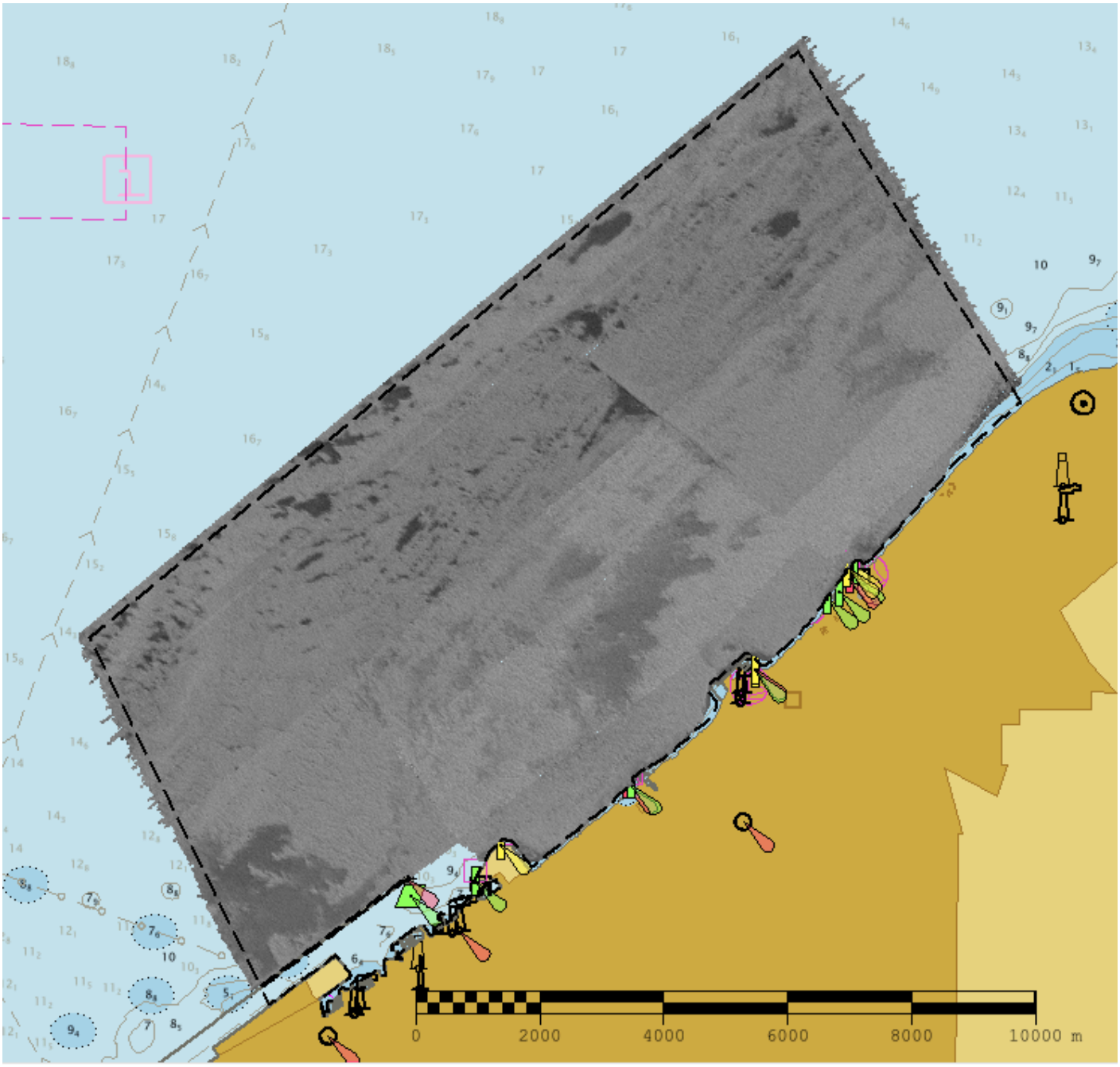


Figure 19: 300kHz backscatter mosaics from data acquired by S222, 2903, and 2904.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2022.

Feature Object Catalog NOAA Profile Version 2022 was used for all S-57 attribution in the Final Feature File. All other software were used as detailed in the DAPR.

B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13608_MB_1m_LWD	CARIS Raster Surface (CUBE)	1 meters	1.2 meters - 16.3 meters	NOAA_1m	Complete MBES
H13608_MB_1m_LWD_Final	CARIS Raster Surface (CUBE)	1 meters	1.2 meters - 16.3 meters	NOAA_1m	Complete MBES
H13608_MBAB_2m_S222_300kHz_1of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13608_MBAB_2m_2903_300kHz_2of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13608_MBAB_2m_2904_300kHz_3of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES

Table 10: Submitted Surfaces

Complete coverage requirements were met by 100% complete coverage MBES as specified under section 5.2.2.2 of the 2022 HSSD; reference Survey Correspondence for approval of SR grid. The grid met density standards outlined in Section 5.1.3 of the 2022 HSSD (Figure 20).

While there are visible gaps in the bathymetric surface in areas of 100% complete MBES coverage, they are not large enough to meet the definition of a holiday for complete coverage requirements. One holiday exists within survey H13608 as discussed in Section A.4.

Pydro QC Tools Detect Fliers was used with the experimental option 7 "Noisy Margins" selected to find fliers in a finalized 1m SR surface. Obvious noise was rejected by the Hydrographer in Caris Subset Editor. After multiple rounds of data cleaning, Detect Fliers found 958 potential fliers. Upon further inspection, these flagged grid's nodes are considered to be accurate representations of the lakebed and have been retained in the submitted surfaces; most are located along the rocky breakwaters within the sheet (Figure 21).

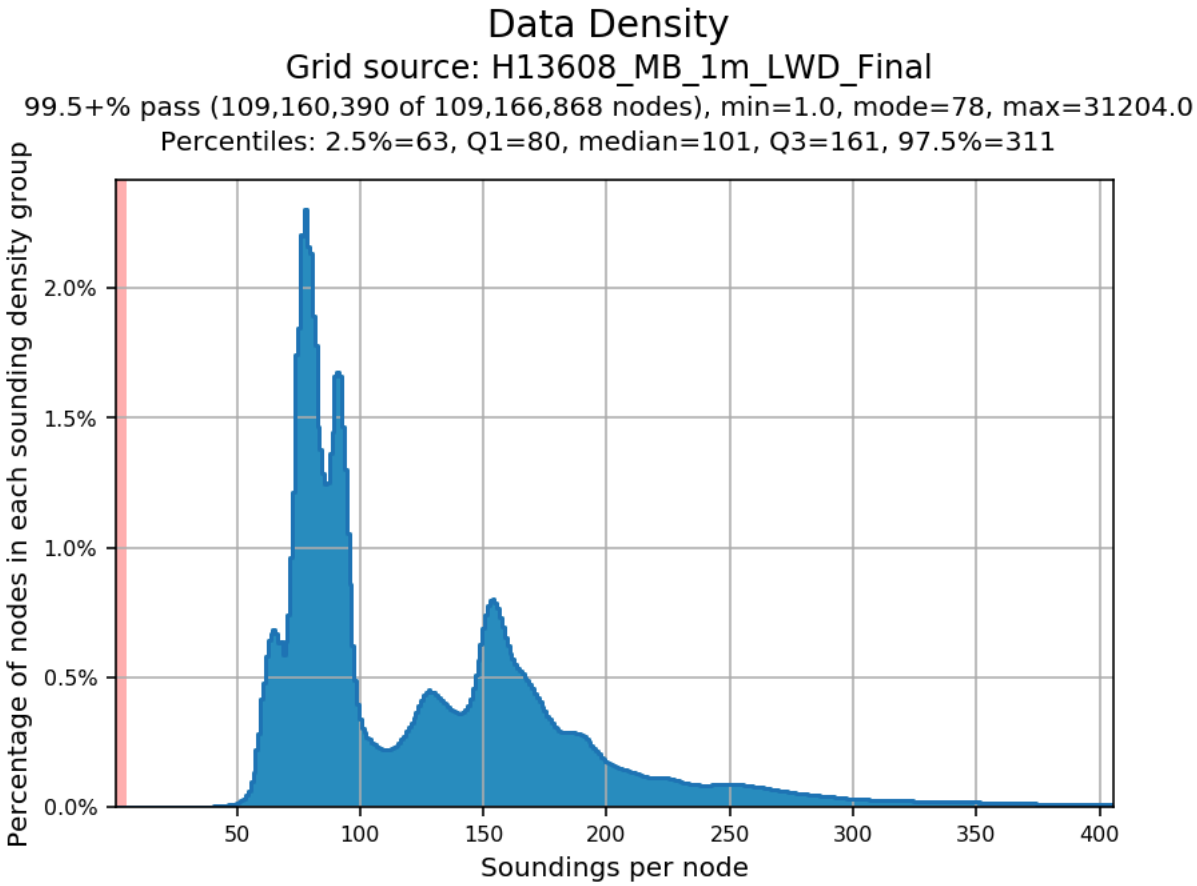


Figure 20: H13608 data density.

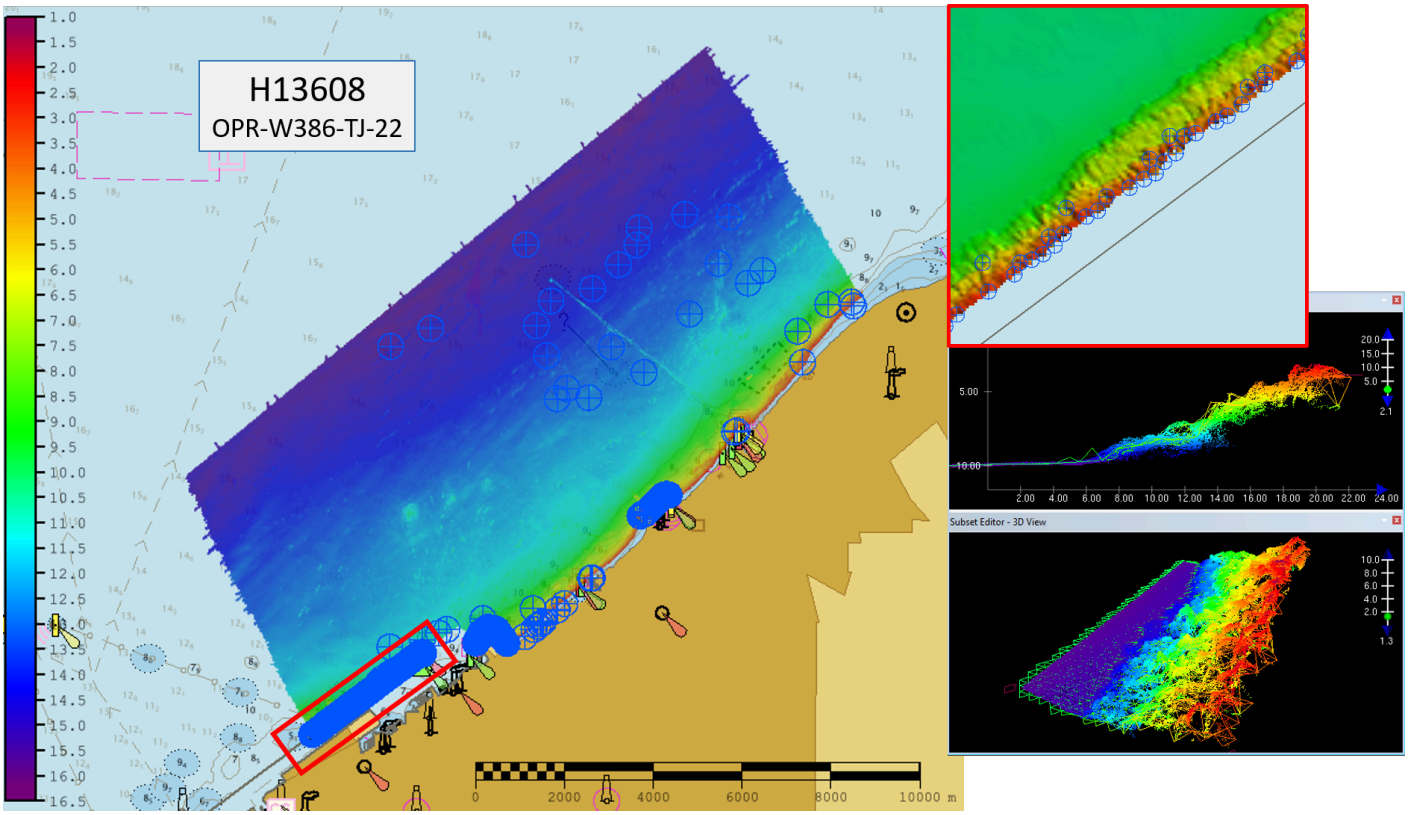


Figure 21: Overview of flagged nodes, shown as blue targets, with inset showing a 2D and 3D subset view of the breakwater where most of the flagged nodes exist.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

C.1 Vertical Control

The vertical datum for this project is Low Water Datum IGLD-1985.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-W386-TJ-22_NAD83_2011_VDatum_LWD_IGLD85

Table 11: ERS method and SEP file

All soundings submitted for H13608 are reduced to LWD IGLD-85 using VDatum techniques as outlined in the DAPR.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 17.

The following PPK methods were used for horizontal control:

- RTX

Trimble-RTX service was used with an Applanix POS MVv5 GNSS_INS system and POSPac MMS software to obtain highly accurate ellipsoidally referenced position data to meet ERS specifications in accordance with the 2022 HSSD for H13608 MBES data from vessels S222, 2903, and 2904.

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition on vessels S222, 2903, and 2904.

D. Results and Recommendations

D.1 Chart Comparison

Surveyed soundings and contours were compared against previously charted data on ENC US4OH01M and ENC US5OH11M. Depth values in the 9.1 to 36.5 m charted depth area were found to be in general agreement with previously charted soundings. Nearshore charted depth contours - 1.8, 3.6, 5.4, 7.3, and

9.1 m - were generally seen 20 to 120 meters further offshore than surveyed data, though isolated rocks throughout these areas affect future contour placement (Figure 22).

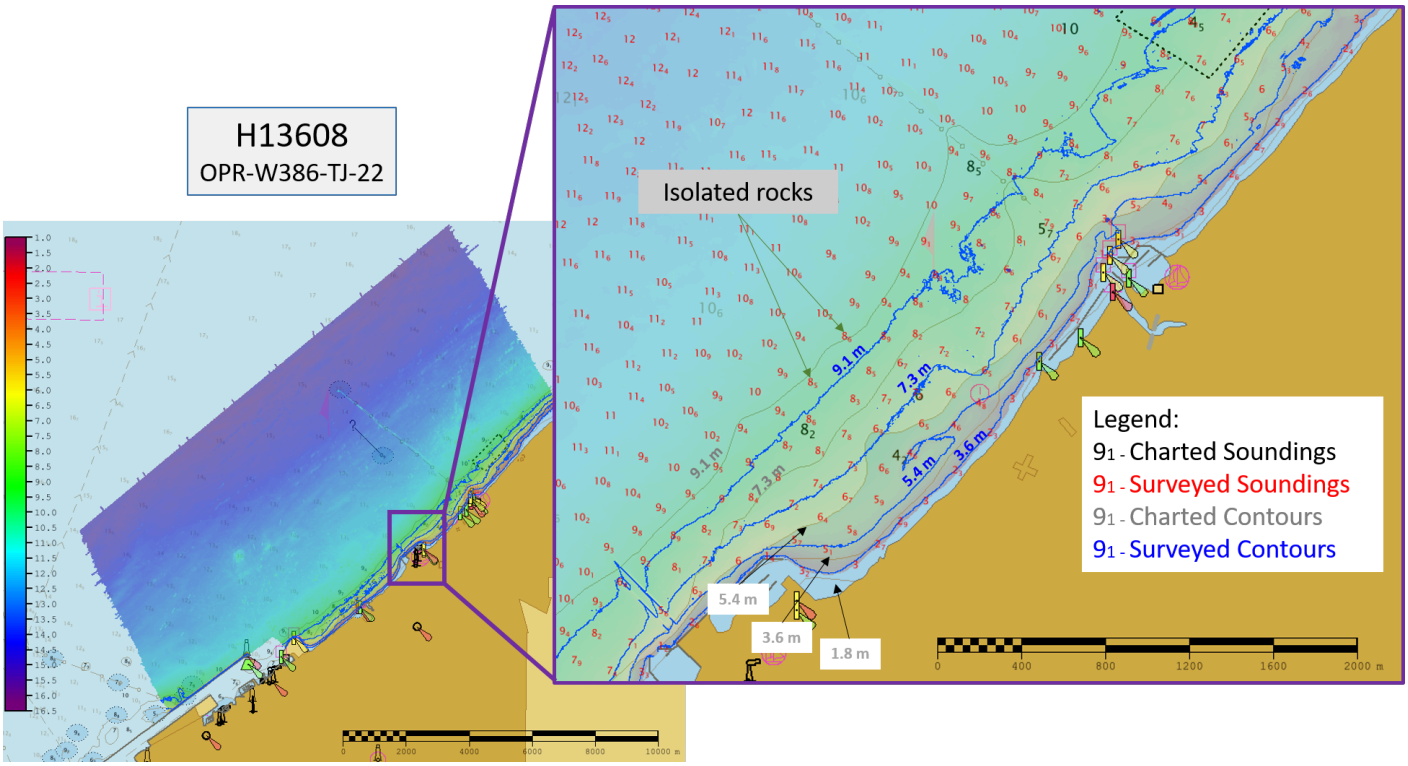


Figure 22: Example of surveyed contours (blue) existing inshore of charted contours (gray).

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US4OH01M	1:80000	16	04/27/2018	05/15/2020
US5OH11M	1:10000	21	06/22/2021	06/22/2021

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

A charted, unverified, dangerous wreck was assigned and investigated, but was not seen in the complete coverage MBES within 500m of the charted location. An anti-DtoN report was not submitted for the wreck

due to to its charted location being outside of recommended traffic routes. Additionally, no DtoN reports were submitted for this survey.

Several isolated, natural features exist that are shallower than their corresponding depth area. These features were not considered to be DtoNs based on the area's Category Zone of Confidence (CATZOC) their proximity (within 100 m) to other charted features such as fish havens, breakwaters, and the 9.1 m contour (Figure 23). They have been designated per Section 5.2.1.2.3 in the 2022 HSSD and are represented in the final submitted surface.

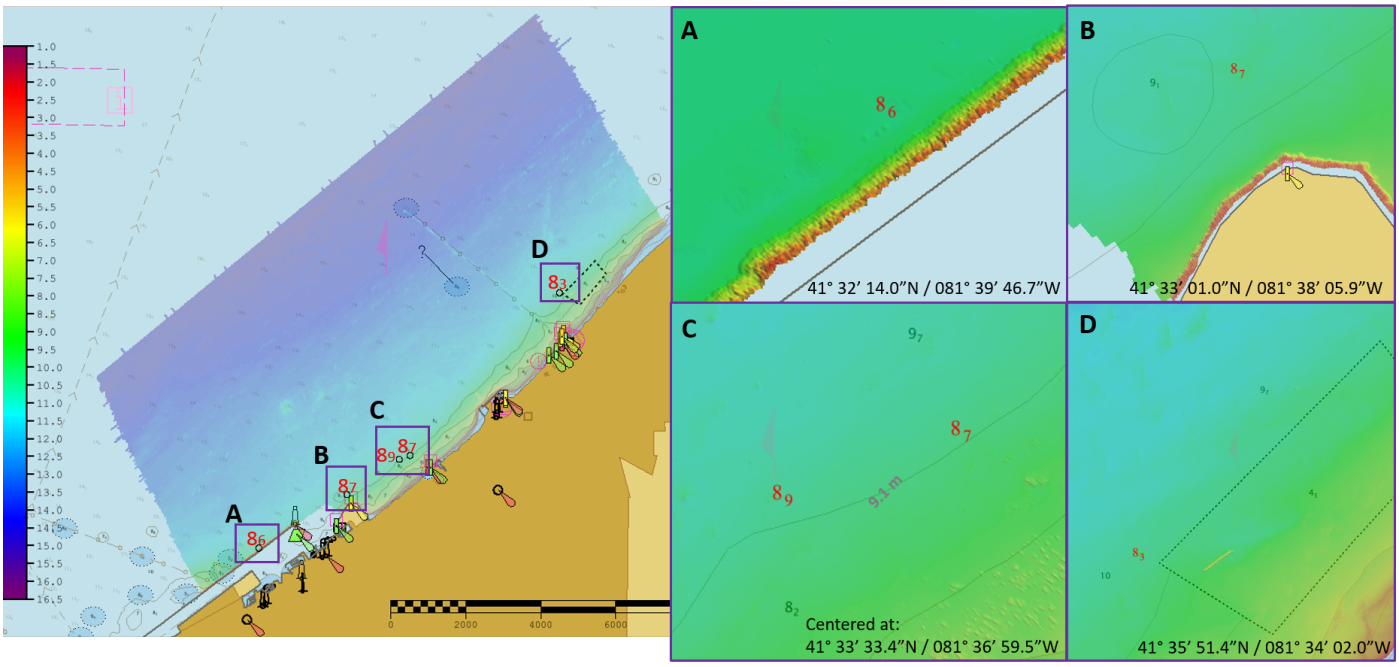


Figure 23: Isolated features with least depth less than the surrounding depth area - 9.1 - 36.5 m.

D.1.3 Charted Features

A total of 36 charted features were assigned for investigation. Twenty-nine charted features were assigned but were not investigated due to their location within the deprioritized CRANES area of the sheet. Seven charted features were investigated using 100% complete coverage MBES. Based on the H13608 data, five were deemed appropriate for deletion and two should be retained as charted. None of the charted assigned features were considered to be Dangers to Navigation (DTONs). Reference the Final Feature File (FFF) included with the submission of this project for further information.

D.1.4 Uncharted Features

Fifteen uncharted features were identified and investigated using 100% complete coverage MBES; none were considered to be DTONs. Reference the FFF for more information.

D.1.5 Channels

Channels exist within the survey limits, but were not investigated due to their location in the deprioritized survey area.

D.2 Additional Results

D.2.1 Aids to Navigation

Three charted AtoNs exist within the assigned sheet limits. All were investigated and confirmed to be on station. No AtoN reports were filed with the U.S. Coast Guard.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Thirteen bottom samples were assigned for investigation, but one sample did not yield a return. The twelve acquired bottom samples are included in the FFF.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

One pipeline and one crib were assigned and investigated within H13608; features are seen in the MBES coverage approximately 50-150 meters from their charted location. Three uncharted pipelines and two cribs were also identified and investigated using 100% complete MBES coverage. None of these features were considered to be dangerous to navigation. Reference the FFF for more information.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

Large piles of sediment were found in several areas in the southwestern portion of the sheet (Figure 24). These sediment mounds appear to be anthropogenic in origin and are possibly the leftovers from dredging.

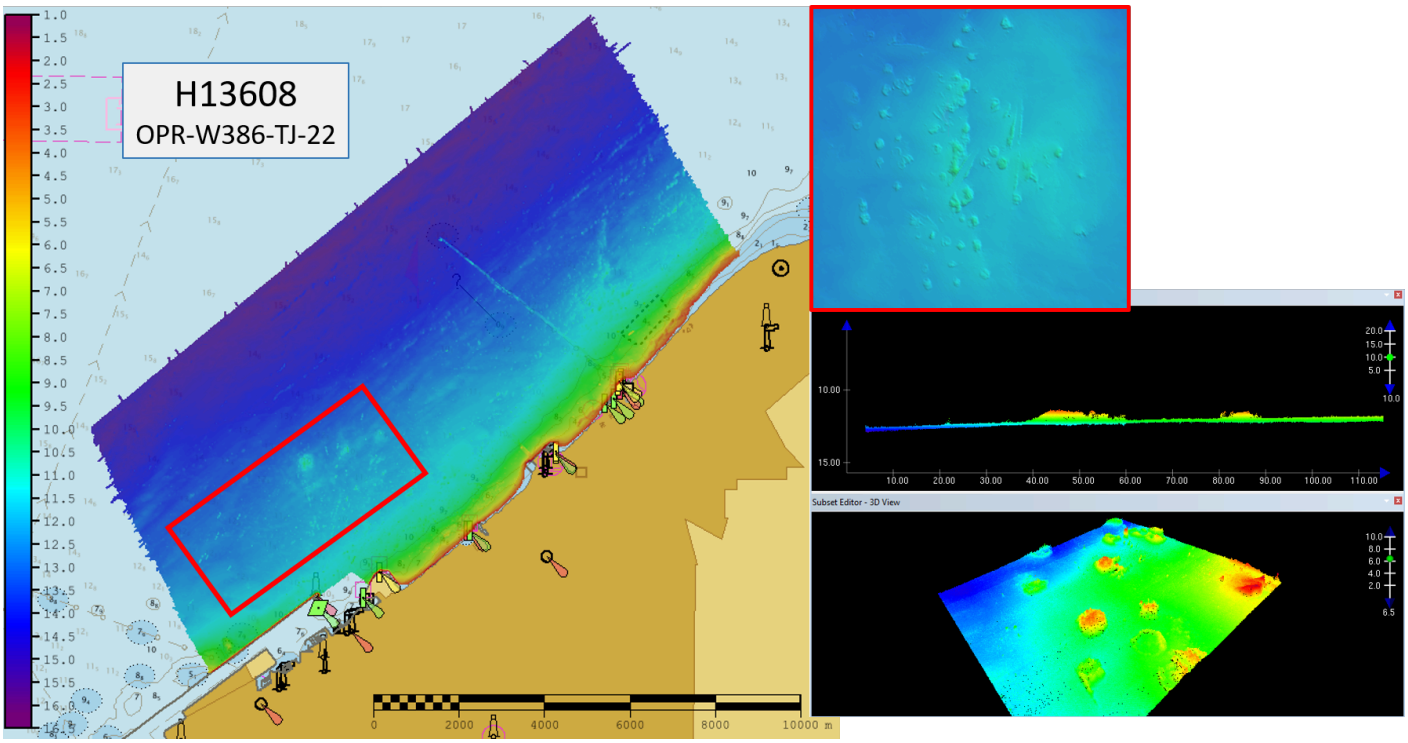


Figure 24: Overview of survey H13608 where red box outlines the area containing sediment piles. The inset shows a 2D and 3D subset view of the piles.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.10 New Survey Recommendations

No new surveys or further investigations are recommended for this area.

D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Matthew J. Jaskoski, CDR/NOAA	Chief of Party	12/13/2022	JASKOSKI.MATTHEW.JACOB.1275636262 2022.12.13 09:17:28 -05'00'
Sydney M. Catoire, LT/NOAA	Field Operations Officer	12/13/2022	CATOIRE.SYDNEY.MARIE.1120060623 Digitally signed by CATOIRE.SYDNEY.MARIE.1120060623 Date: 2022.12.13 09:15:17 -05'00'
Erin K. Cziraki	Chief Survey Technician	12/13/2022	CZIRAKI.ERIN.KAYE.1550015338 Digitally signed by CZIRAKI.ERIN.KAYE.1550015338 Date: 2022.12.13 09:49:55 -05'00'
Sophie Caradine-Taber	Sheet Manager	12/13/2022	CATOIRE.SYDNEY.MARIE.1120060623 Digitally signed by CATOIRE.SYDNEY.MARIE.1120060623 Date: 2022.12.19 09:52:08 -05'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File