H13476

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13476

LOCALITY

State(s):	New Jersey
General Locality:	Offshore New Jersey
Sub-locality:	Ambrose Channel Outbound

2021

CHIEF OF PARTY
Michael Gonsalves, CDR/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H13476

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):	**New Jersey**
General Locality:	**Offshore New Jersey**
Sub-Locality:	**Ambrose Channel Outbound**
Scale:	**20000**
Dates of Survey:	**08/04/2021 to 10/07/2021**
Instructions Dated:	**04/23/2021**
Project Number:	**OPR-C319-FH-21**
Field Unit:	**NOAA Ship *Ferdinand R. Hassler***
Chief of Party:	**Michael Gonsalves, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar Multibeam Echo Sounder Backscatter**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

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 18N,MLLW. 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 H13476

Project: OPR-C319-FH-21

Locality: Offshore New Jersey

Sublocality: Ambrose Channel Outbound

Scale: 1:20000

August 2021 - October 2021

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: Michael Gonsalves, CDR/NOAA

A. Area Surveyed

Survey H13476, located within the Approaches to New York, sub-locality of Ambrose Channel Outbound, was conducted in accordance with coverage requirements set forth in the Project Instructions OPR-C319-FH-21 (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
40° 4' 39.44" N 73° 53' 8.55" W	39° 52' 14.45" N 73° 47' 16.75" W

Table 1: Survey Limits

Survey data were acquired in accordance with the requirements set forth by the Project Instructions (PI) and the Hydrographic Surveys Specification and Deliverables (HSSD) dated April 2021.

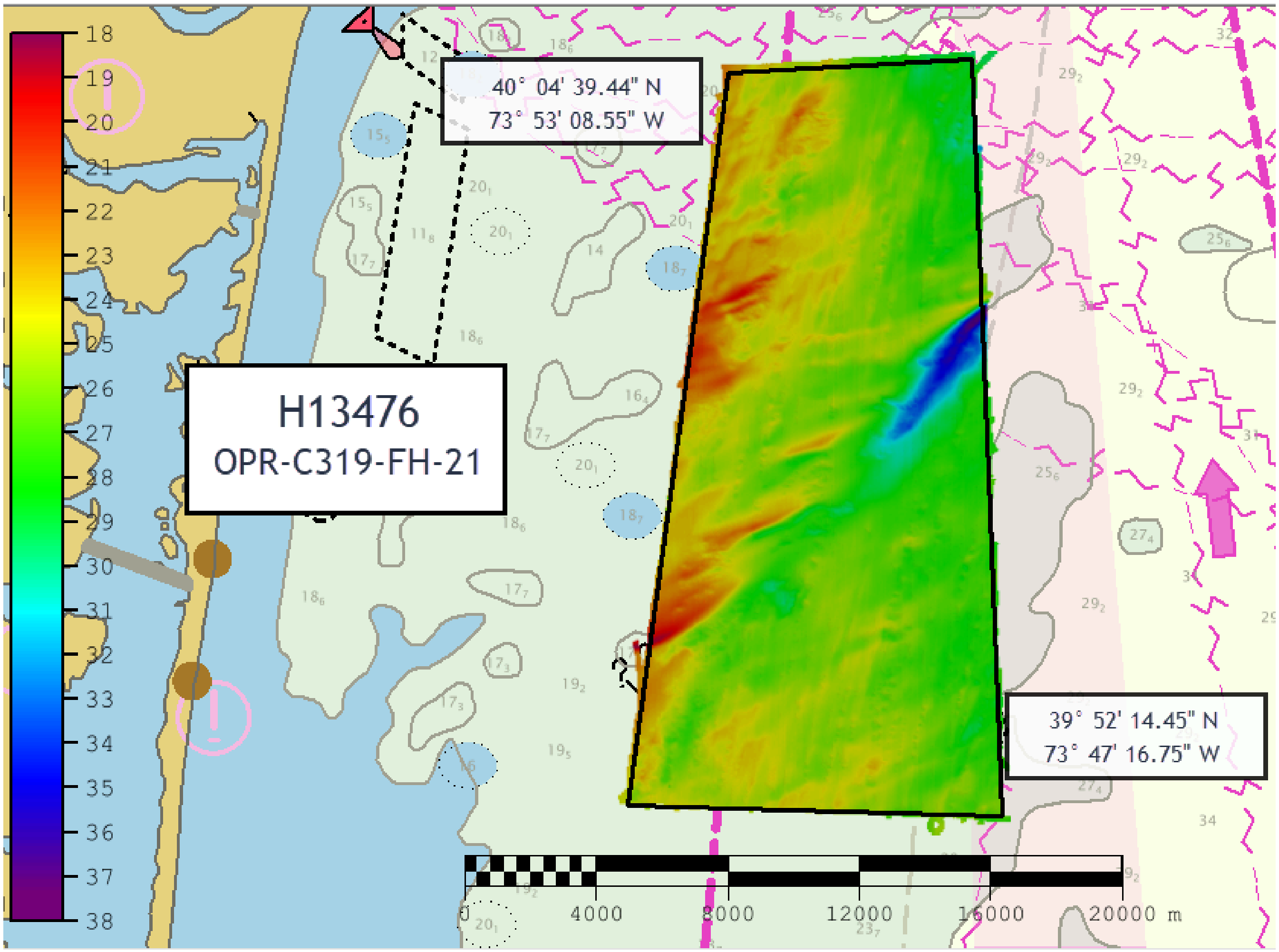


Figure 1: Survey layout for H13476, plotted over ENC US3NY01M. Black outline represents the survey limits set forth by the project instructions.

A.2 Survey Purpose

The Port of New York and New Jersey, is the largest importer of goods in the United States by volume, handling over 74,000,000 short tons in 2018. With larger Post-Panamax ships with deeper drafts often calling upon the Port of New York and New Jersey, accurate navigational charts are essential for the continued safe transit of vessels in and out of the Port.

This 930 square nautical mile survey area offshore of the coast of New Jersey encompasses two traffic separation schemes for large vessels calling upon the Port of New York and New Jersey, and will supersede 1970 vintage chart data for the area.

This project will provide modern bathymetric data to update National Ocean Service (NOS) nautical charting products as well as support the Seabed 2030 global mapping initiative in this heavily trafficked area, which supports commerce along the eastern seaboard.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired for H13476 meets multibeam echo sounder (MBES) coverage combined with 100% side scan sonar (SSS) coverage requirements for complete coverage as required by the 2021 HSSD. This includes crosslines (see section B.2.1), NOAA allowable uncertainty (see section B.2.10), and density requirements (see section B.2.11).

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 2021 HSSD Section 6.2)

Table 2: Survey Coverage

Survey coverage is in accordance with requirements listed in Table 2 and the 2021 HSSD. Coverage requirements were met with a combination of 100% complete coverage MBES and 100% SSS with concurrent MBES coverage (Figure 2). Complete coverage MBES was used to re-acquire areas of poor-quality SSS data created by refraction (see Section B.2.6). Due to operational practices of breaking side scan lines every 15 minutes, there are roughly 15 small holidays through out sheet H13476 (Figure 3).

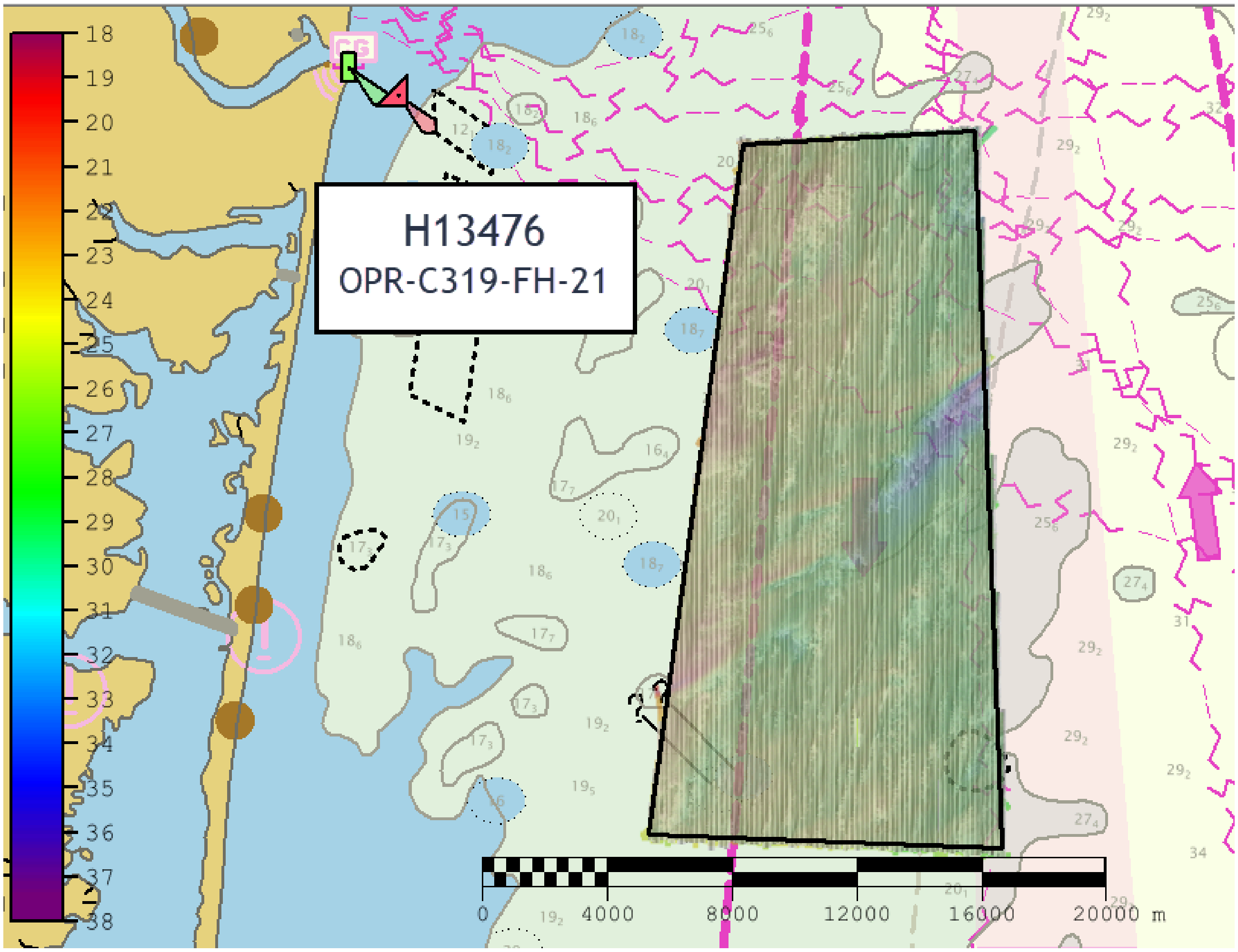


Figure 2: Complete coverage SSS (greyscale) plotted over MBES coverage acquired on H13476. Black outline represents sheet limits assigned in the PI.

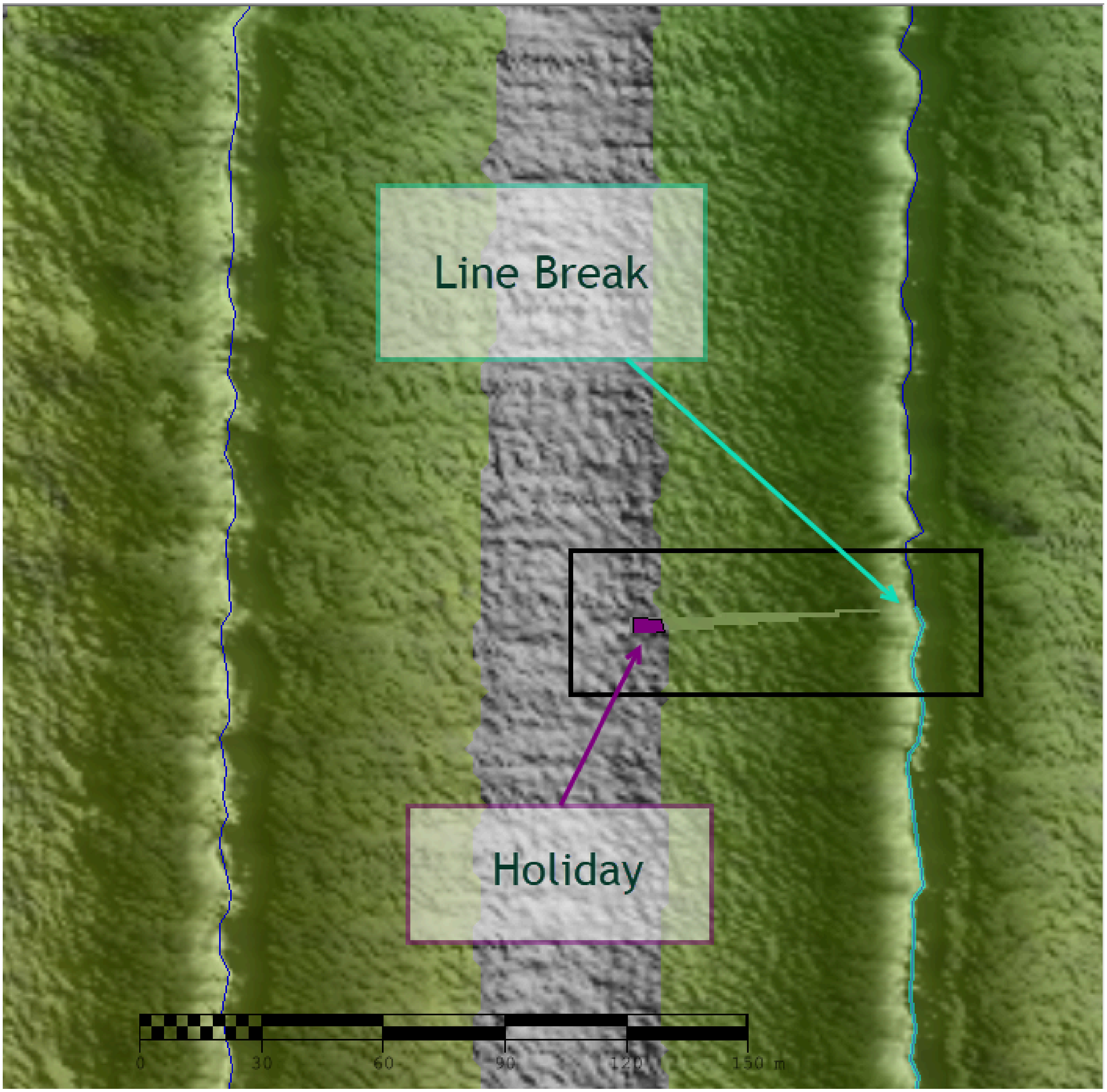


Figure 3: An example of the holidays present in sheet H13476. The gap in data is represented by the purple area within the black box.

A.6 Survey Statistics

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

	HULL ID	*S250*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0
	MBES Mainscheme	972.44	972.44
	Lidar Mainscheme	0.0	0.0
	SSS Mainscheme	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0
	MBES/SSS Mainscheme	745.63	745.63
	SBES/MBES Crosslines	48.26	48.26
	Lidar Crosslines	0.0	0.0
Number of Bottom Samples			4
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			64.16

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/04/2021	216
08/05/2021	217
08/06/2021	218
08/07/2021	219
08/08/2021	220
08/11/2021	223
08/12/2021	224
09/02/2021	245
09/03/2021	246
09/27/2021	270
09/28/2021	271
11/09/2021	313
10/07/2021	280

Table 4: Dates of Hydrography

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	***S250***
LOA	37.7 meters
Draft	3.85 meters

Table 5: Vessels Used

Figure 4: NOAA ship Ferdinand Hassler (S250)

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040	MBES
Klein Marine Systems	System 5000	SSS
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
AML Oceanographic	MVP-X	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System
Sea-Bird Scientific	SBE 19plus	Conductivity, Temperature, and Depth Sensor

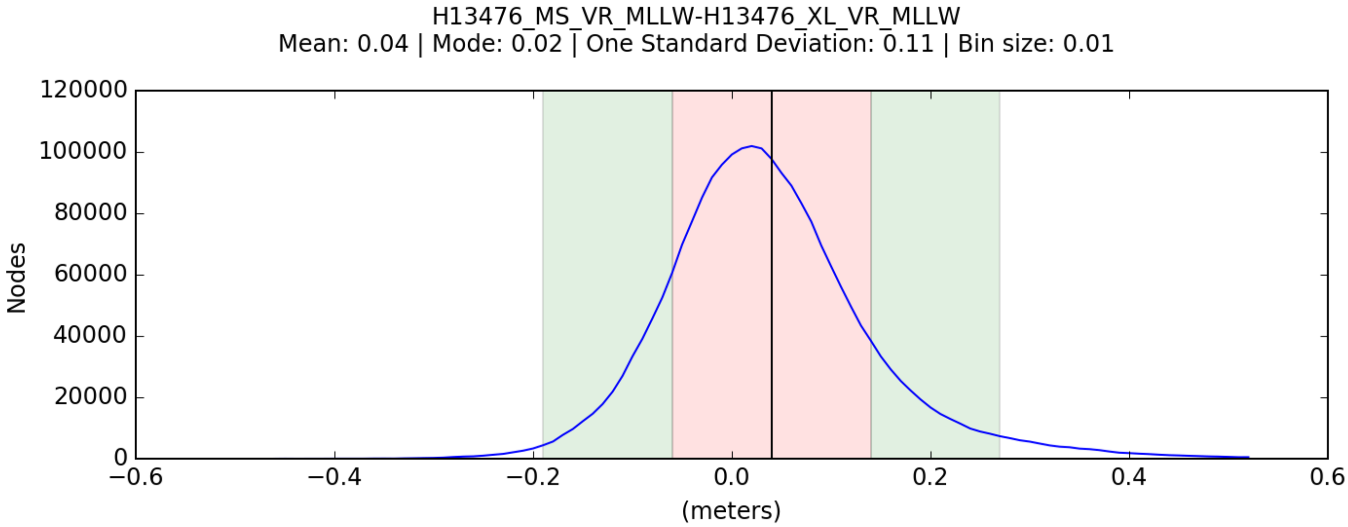
Table 6: Major Systems Used

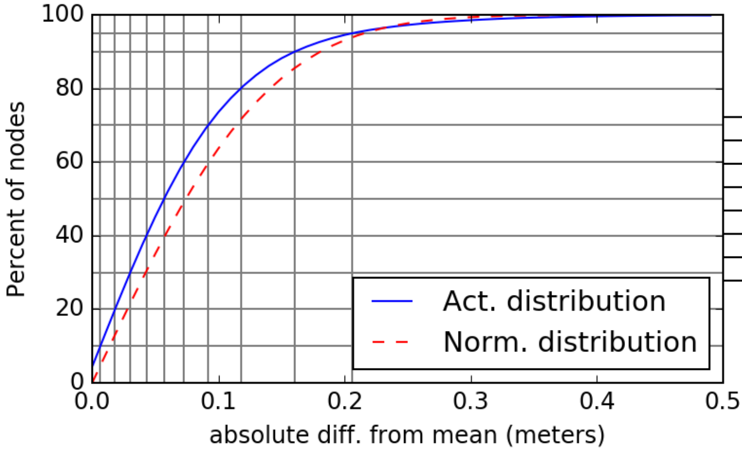
Vessel configurations, equipment operations, data acquisition, and processing were consistent with specifications described in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

S250 collected 48.26 linear nautical miles of MBES crosslines, or 4.96% of mainscheme MBES data. A variable resolution (VR) Combined Uncertainty and Bathymetry Estimator (CUBE) surface of mainscheme data and a VR CUBE surface of crossline data were differenced - the resulting mean was 0.04m with a standard deviation of 0.11m (Figure 5). Over 99.5% of nodes pass the fraction of allowable error analysis (Figure 6). The crosslines acquired have good temporal and geographic distribution and there is no indication of any comparison issues (Figure 7).





Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.12
90%	+/- 0.16
95%	+/- 0.21

Figure 5: H13476 crossline/mainscheme comparison statistics.

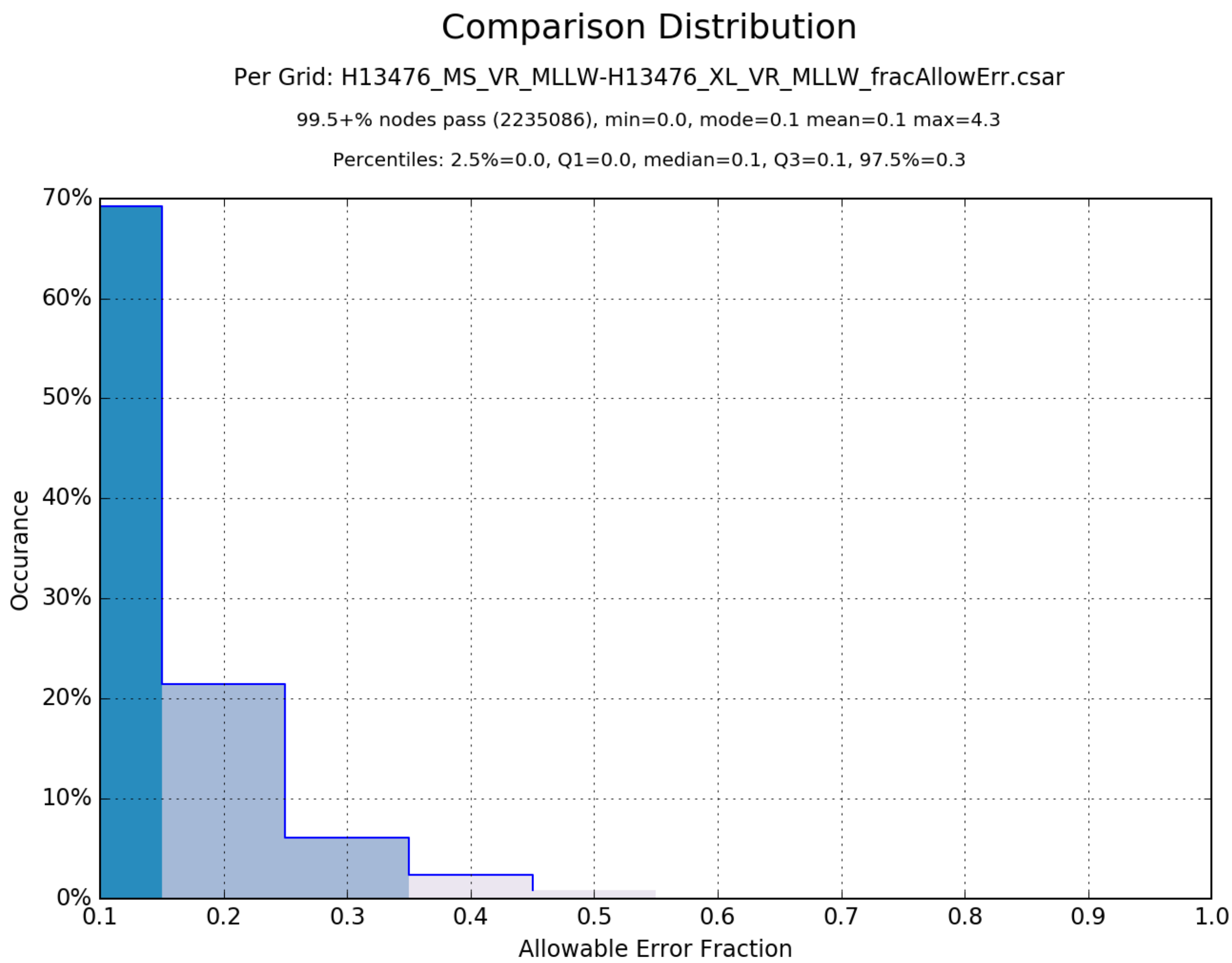


Figure 6: H13476 crossline/mainscheme fraction of allowable error statistics.

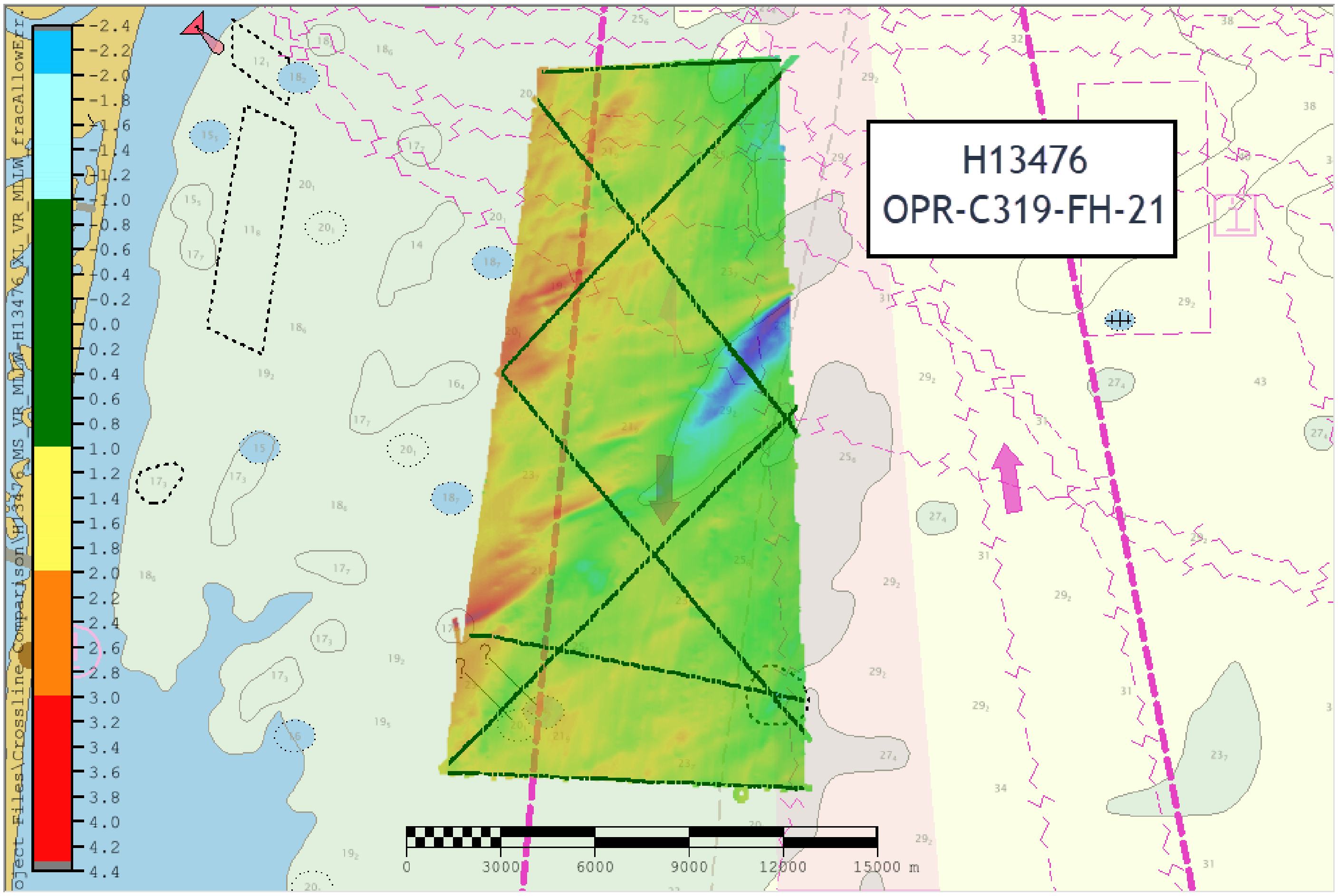


Figure 7: H13476 crosslines overlaid on mainscheme MBES coverage. Crosslines are colored by results of fraction of allowable error analysis.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.092 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S250	4 meters/second	4 meters/second	N/A	0.5 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The bathymetric surface's uncertainty layer is compliant with the 2021 HSSD uncertainty standards. Over 99.5% of all nodes pass uncertainty standards (Figure 8).

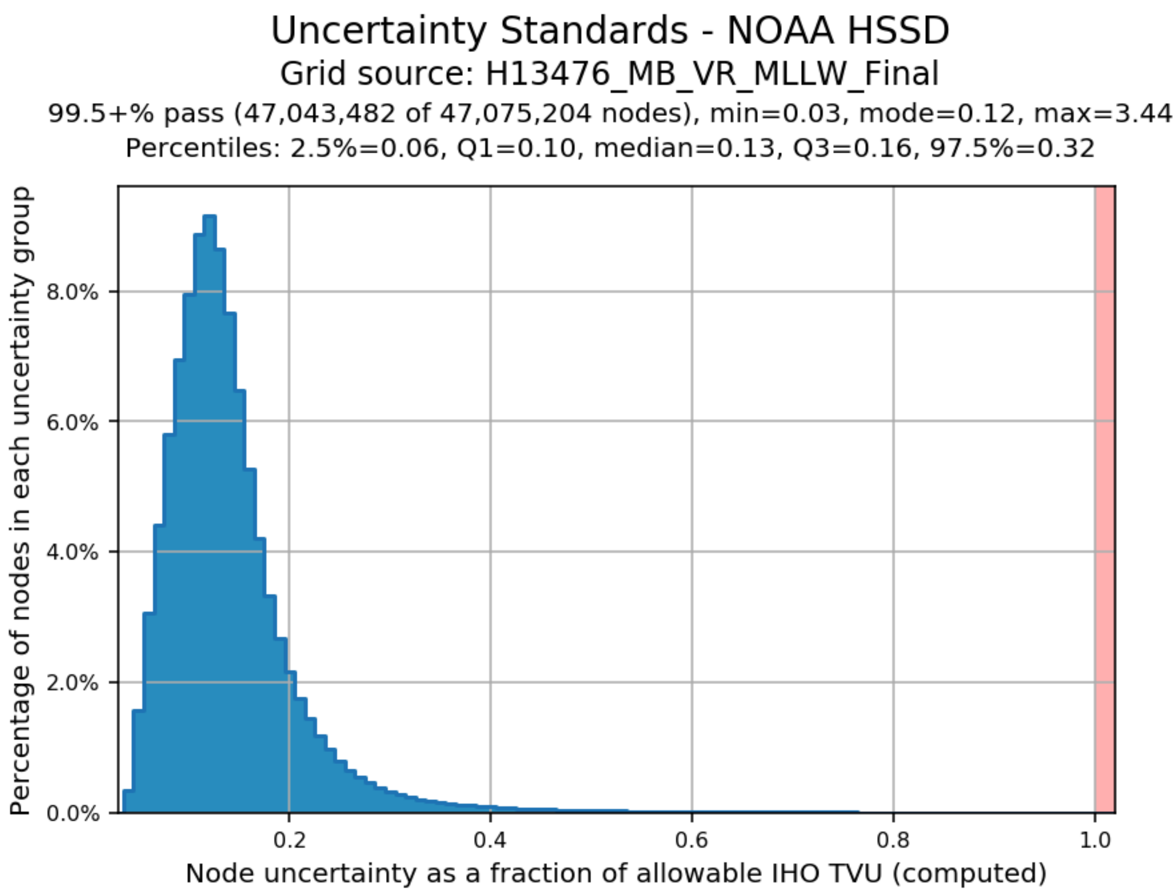


Figure 8: H13476 uncertainty standards.

B.2.3 Junctions

There are four surveys that junction with H13476. H11536 is a historical survey conducted by Science Applications International Corporation (SAIC) in project OPR-C303-KR-06 (Figure 9). The remaining three surveys were conducted with H13476 while on OPR-C319-FH-21: H13474, H13477, and H13478. Information from junction analyses with H11536, H13474, and H13477 is below. Reference the respective Descriptive Reports (DRs) for the junction analyses of the remaining contemporary survey from OPR-C319-FH-21.

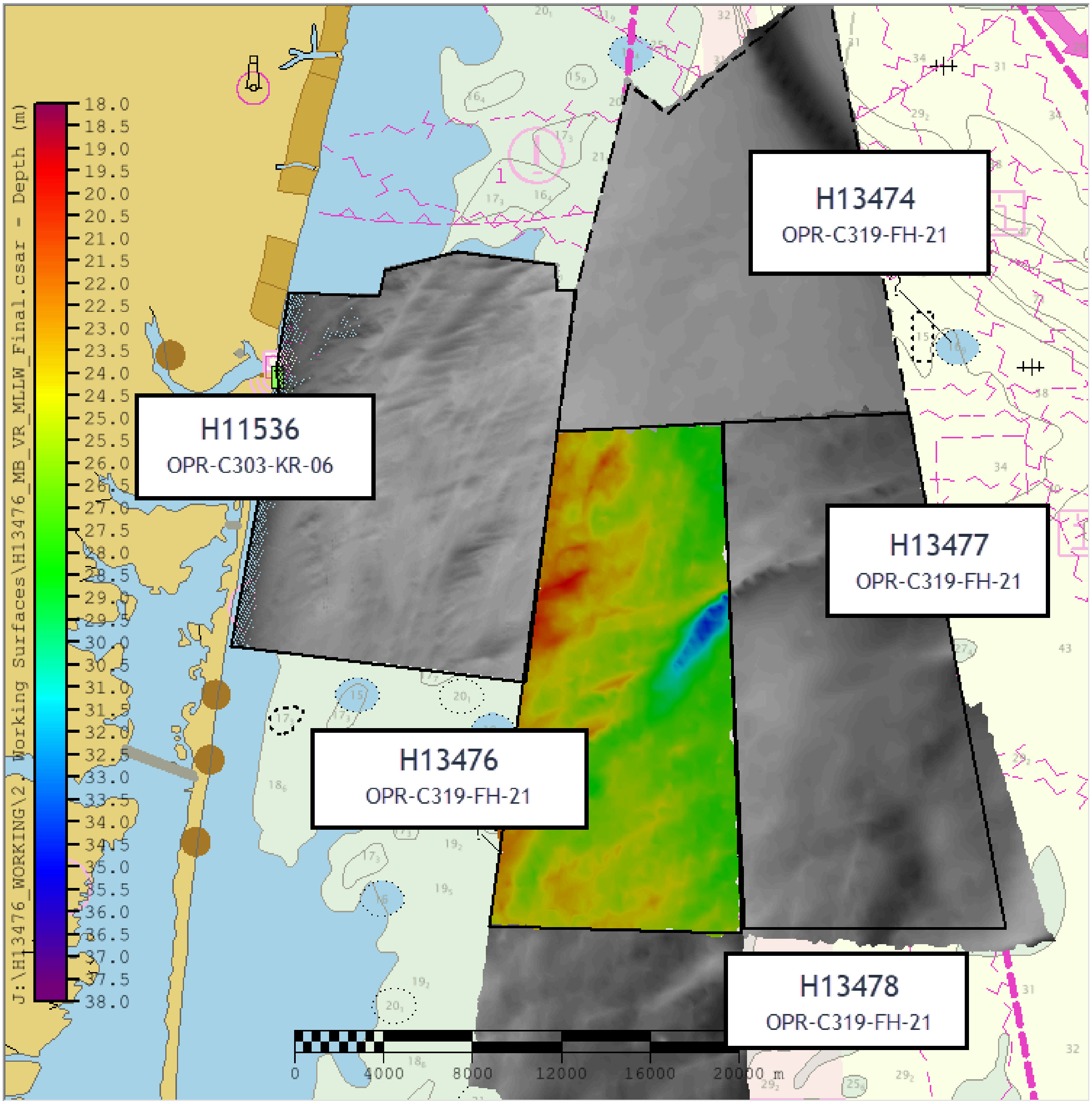


Figure 9: H13476 (in color) with contemporary surveys H13474 and H13477 and historical survey H11536.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H11536	1:20000	2006	SAIC	W
H13474	1:20000	2021	Ferdinand R. Hassler	N
H13477	1:20000	2021	Ferdinand R. Hassler	E

Table 9: Junctioning Surveys

H11536

Historical survey H11536 junctions with the north west edge of H13476 (Figure 10). A single resolution (SR) Combined Uncertainty Bathymetric Estimator (CUBE) surface of H13476 data at the 2m resolution and a single resolution BAG surface of H11536 at the 2m resolution were differences. The mean differences between bathymetric surface nodes was 0.05m with a standard deviation of 0.13 (Figure 11). Statistics and visual inspection indicate that survey H13476 and H11536 are in general agreement.

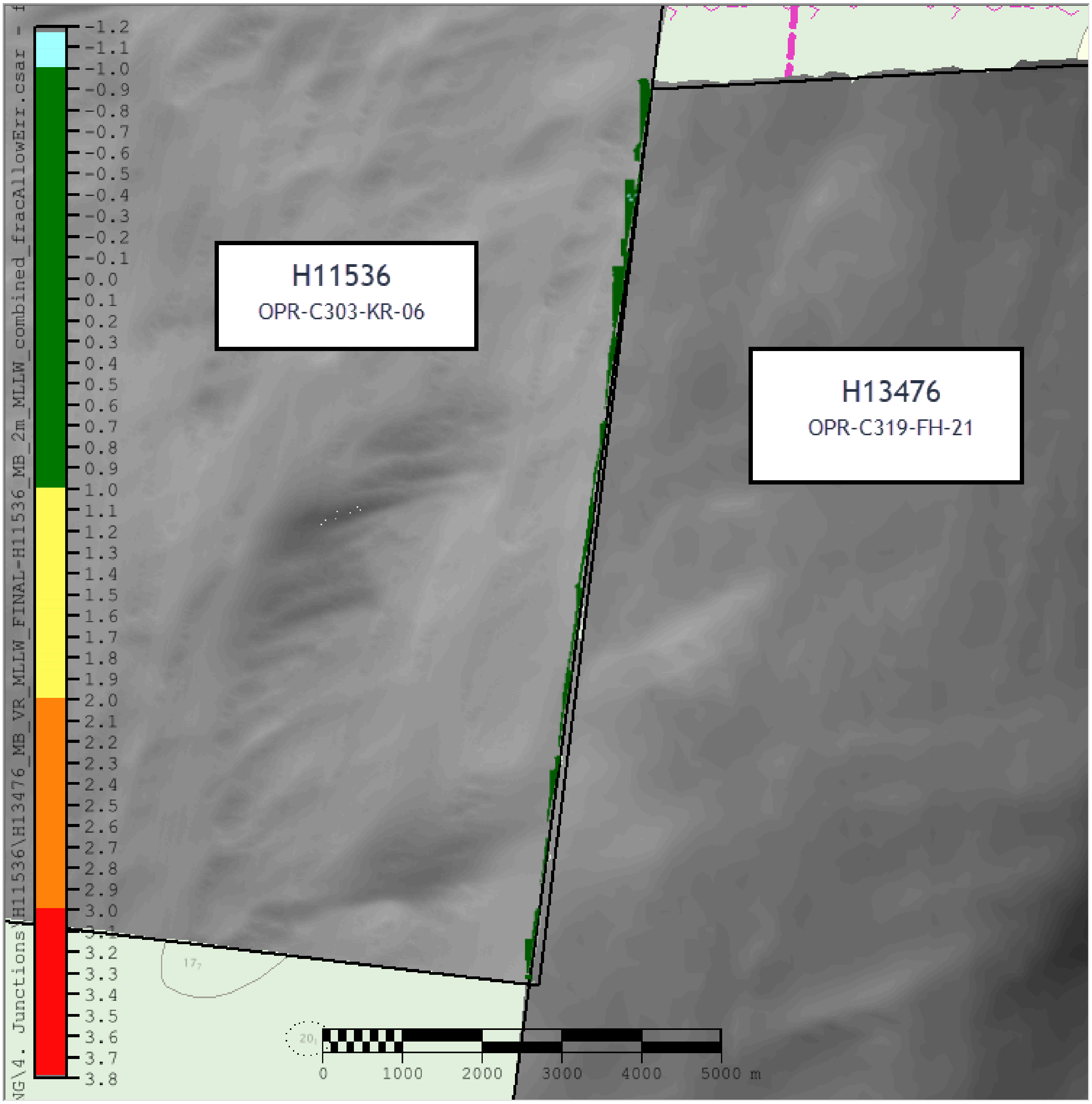
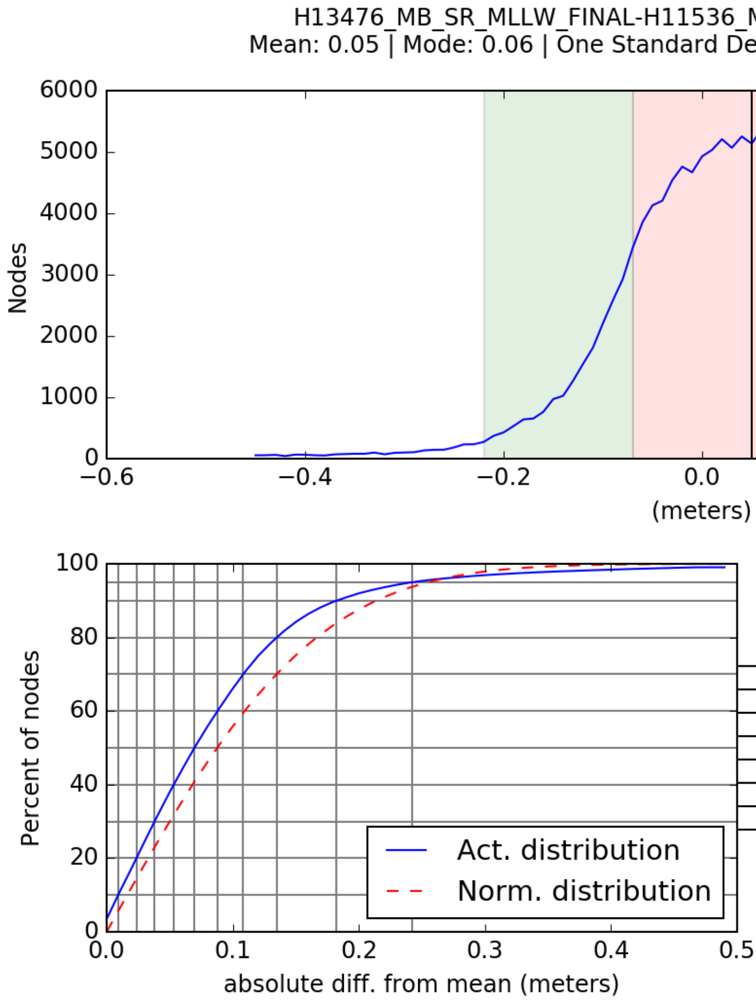


Figure 10: Fraction of allowable error between survey H13476 and H11536 shown in color. Visual inspection indicates that the surveys are in general agreement.



Percent of nodes	Deviation (m)
50%	+/- 0.07
60%	+/- 0.09
70%	+/- 0.11
80%	+/- 0.14
90%	+/- 0.18
95%	+/- 0.24

Figure 11: H13476 and H11536 surface difference comparison statistics.

<u>H13474</u>

The north side of sheet H13476 junctions with sheet H13474 (Figure 12). A variable resolution (VR) CUBE surface of H13476 data and a VR CUBE surface of H13477 data were differenced. The mean difference between bathymetric surface nodes was 0.05m with a standard deviation of 0.13m (Figure 13). Statistics and visual inspection indicate that the surveys H13474 and H13476 are in general agreement.

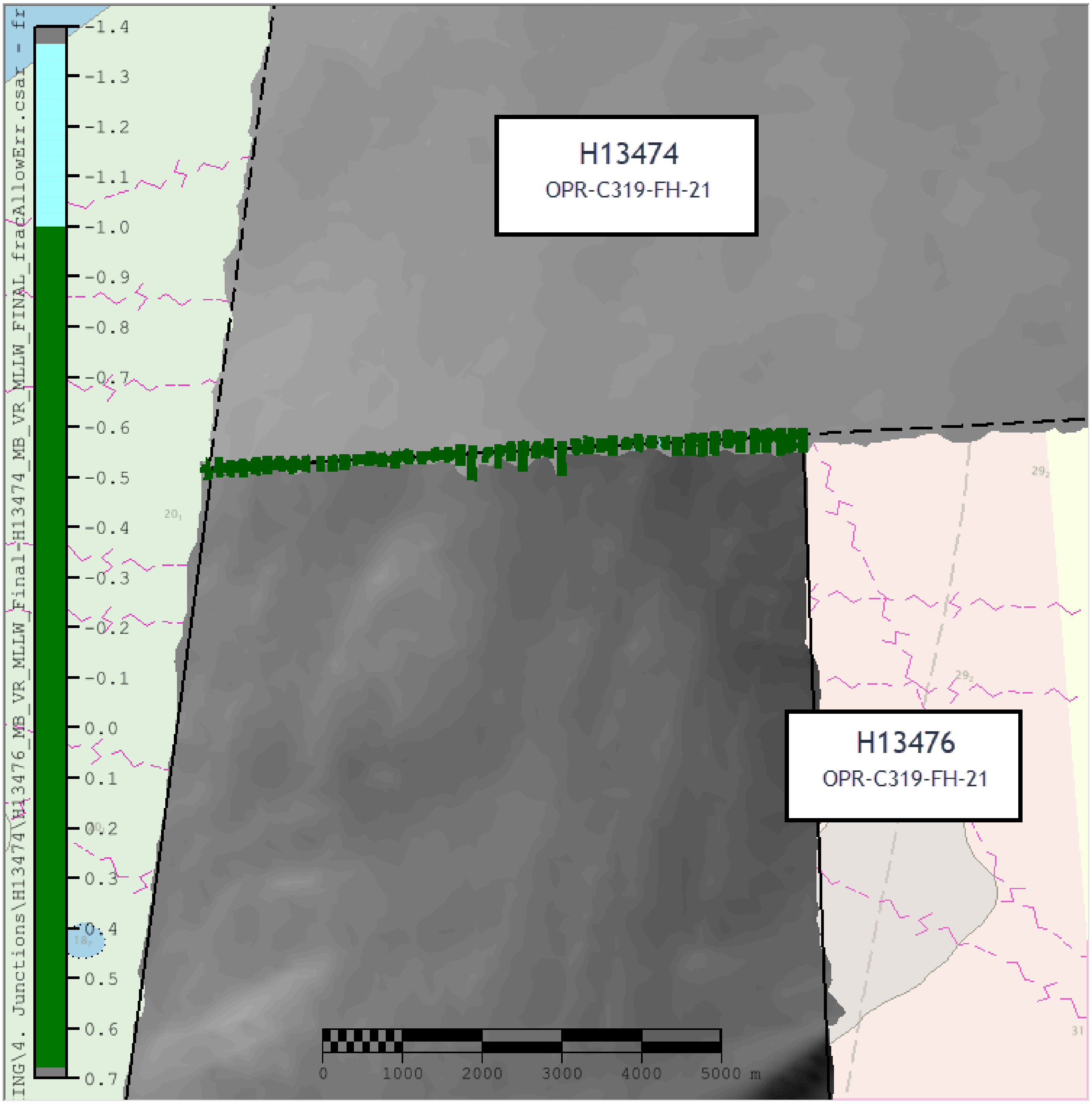
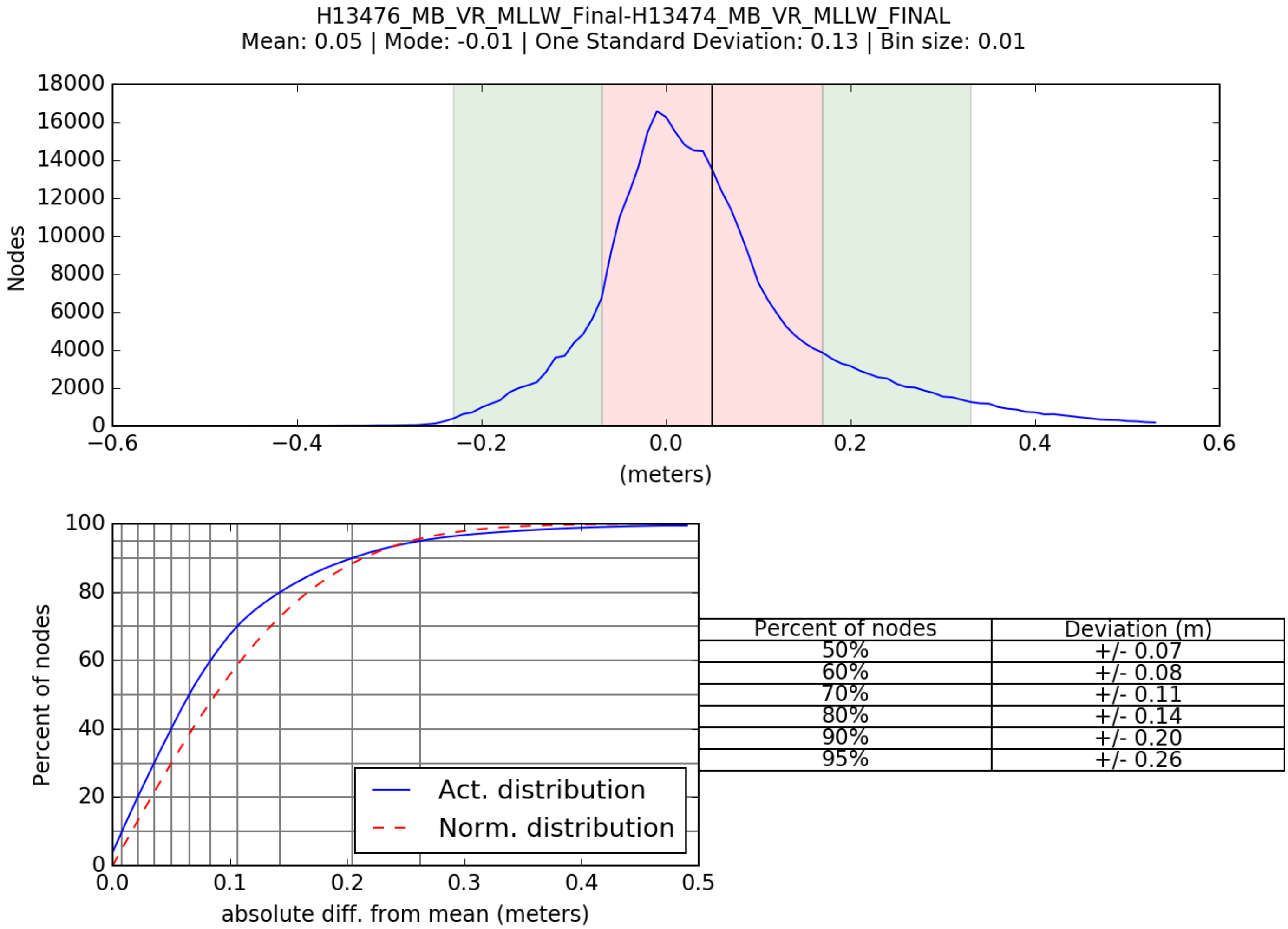


Figure 12: Fraction of allowable error surface (shown in color) from junction analysis between H13474 and H13476.



Percent of nodes	Deviation (m)
50%	+/- 0.07
60%	+/- 0.08
70%	+/- 0.11
80%	+/- 0.14
90%	+/- 0.20
95%	+/- 0.26

Figure 13: H13474 and H13476 surface difference comparison statistics.

<u>H13477</u>

The east side of sheet H13476 junctioned with survey H13477 (Figure 14). A VR CUBE surface of H13476 data and a VR CUBE surface of H13477 data were differenced. The mean difference between bathymetric surface nodes was -0.01m with a standard deviation of 0.10m (Figure 15). Statistics and visual inspection indicate that the surveys H13476 and H13477 are in general agreement.

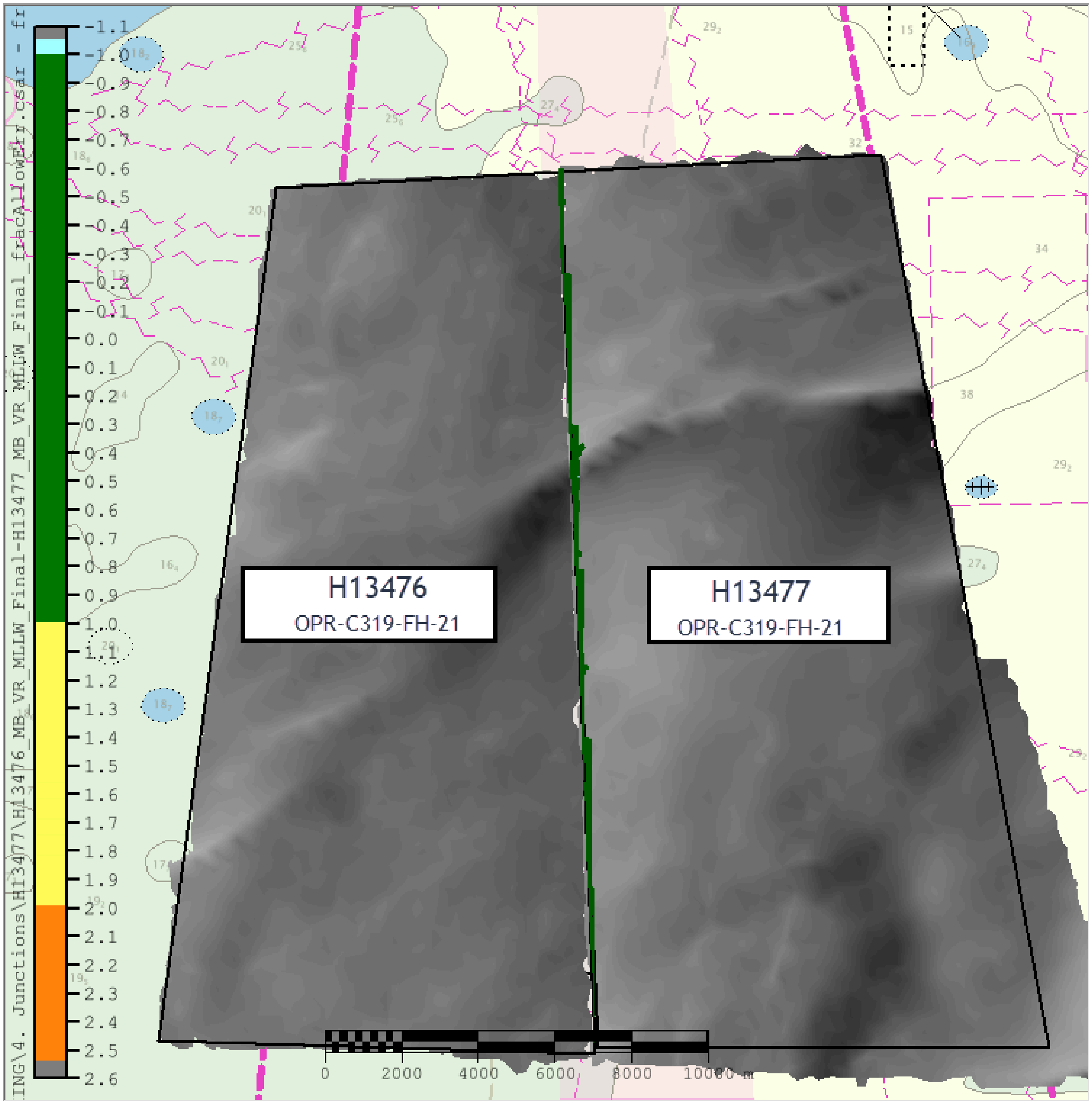
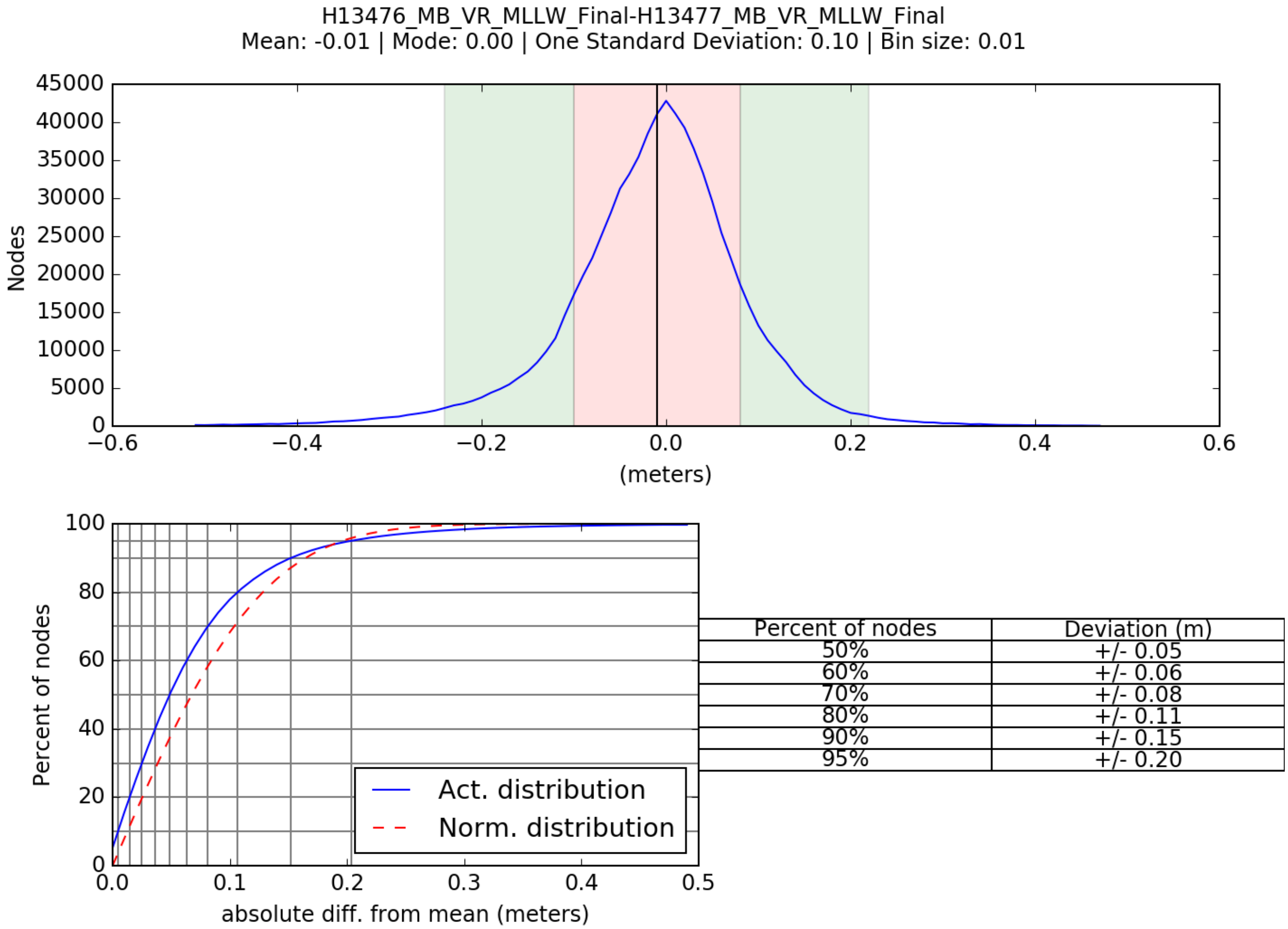


Figure 14: Fraction of allowable error surface (shown in color) from junction analysis between H13476 and H13477.



Percent of nodes	Deviation (m)
50%	+/- 0.05
60%	+/- 0.06
70%	+/- 0.08
80%	+/- 0.11
90%	+/- 0.15
95%	+/- 0.20

Figure 15: H13476 and H13477 surface difference comparison 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

Timing offset in heave message from POS file creating heave artifact.

During survey post-processing and QC, a visual inspection of H13476's bathymetric surface was conducted and a heave artifact was discovered along one line of data collected on Julian Day 220 (Line 163). Data from this line appear to be offset from neighboring lines in an undulating pattern in the along track direction up to 1m vertically (Figure 16). An investigation into the cause of this artifact was undertaken and traced to a missing heave message within the POS data file applied to this line. This missing heave message was discovered later in the field season while wrapping up data collection for OPR-C319-FH-21 and was found to only affect the first POS file logged just after GPS week change. The field unit contacted Applanix support who conducted additional data forensics discovering that the heave message was present in the files, but was offset by three minutes, causing Caris to not be able to read the message correctly. The cause of this timing offset remains unknown and Applanix support suggested not starting or stopping POS logging within the first three minutes of GPS week changeover. A record of these communications can be found in DR Appendix II: Supplemental Records.

Since the field unit was still on site for operations on OPR-C319-FH-21 when the heave artifact was discovered, the decision was made to re-acquire the affected lines for other sheets. However, due to field unit oversight, Line 163 was not reacquired before the end of operations. A detailed review of the data was conducted to search for significant features or shoaling and none was observed so the affected line has been retained in the delivered bathymetric surfaces. The hydrographer is confident that the presence of the heave artifact does not significantly degrade the coverage quality for this survey and that all data is appropriate to supersede prior data.

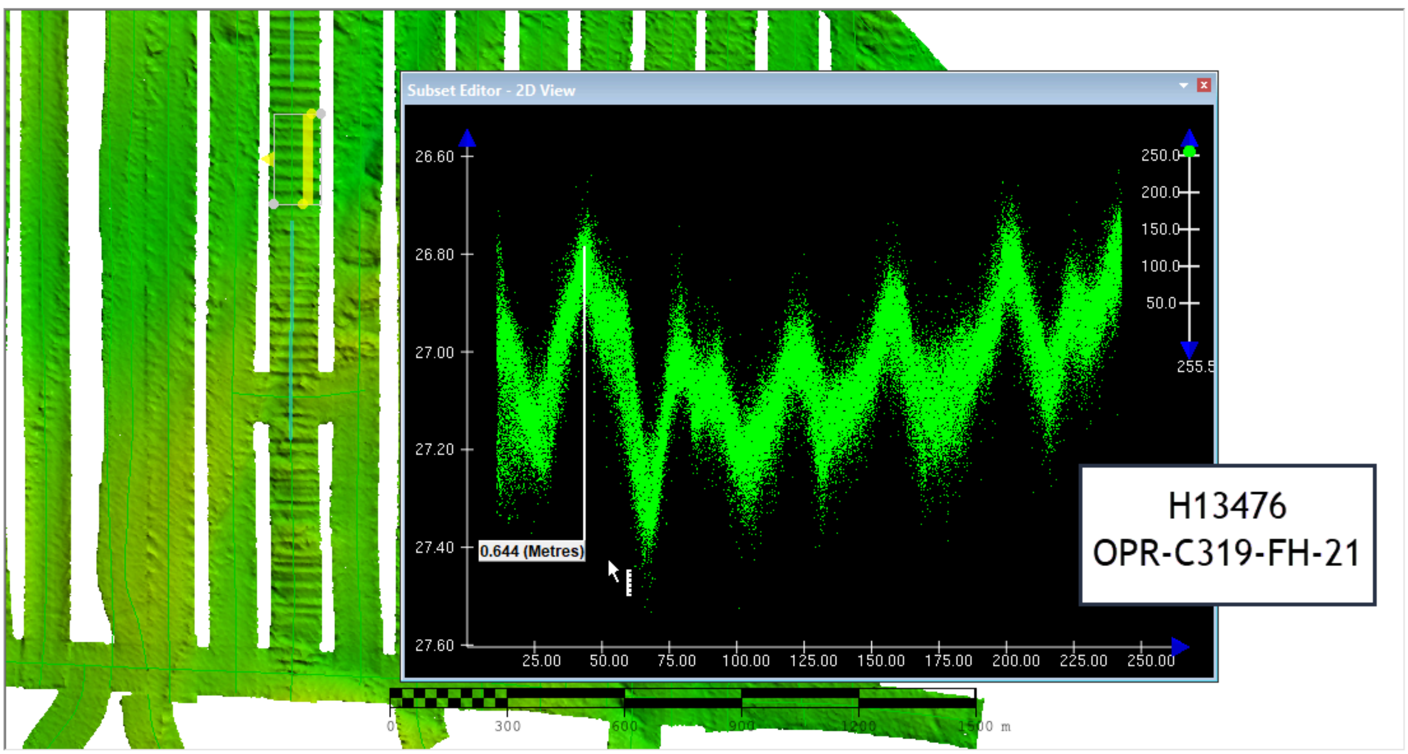


Figure 16: Visual details of heave artifact observed on Julian Day 220, line 163.
The 2D view of MBES data showing undulating pattern displaced .644m vertically.

B.2.6 Factors Affecting Soundings

<u>Refraction in SSS data</u>

H13476 was located in an area that frequently exhibits intense density stratification. This layering greatly affects sound speed and results in refraction that can be observed in the SSS imagery (Figure 17). In areas where depth allowed, the side scan towfish was lowered below the pycnocline but in some areas this was not possible. Refraction was observed on numerous days throughout the entire sheet. In areas of bad refraction, coverage was re-acquired using 100% MBES coverage.

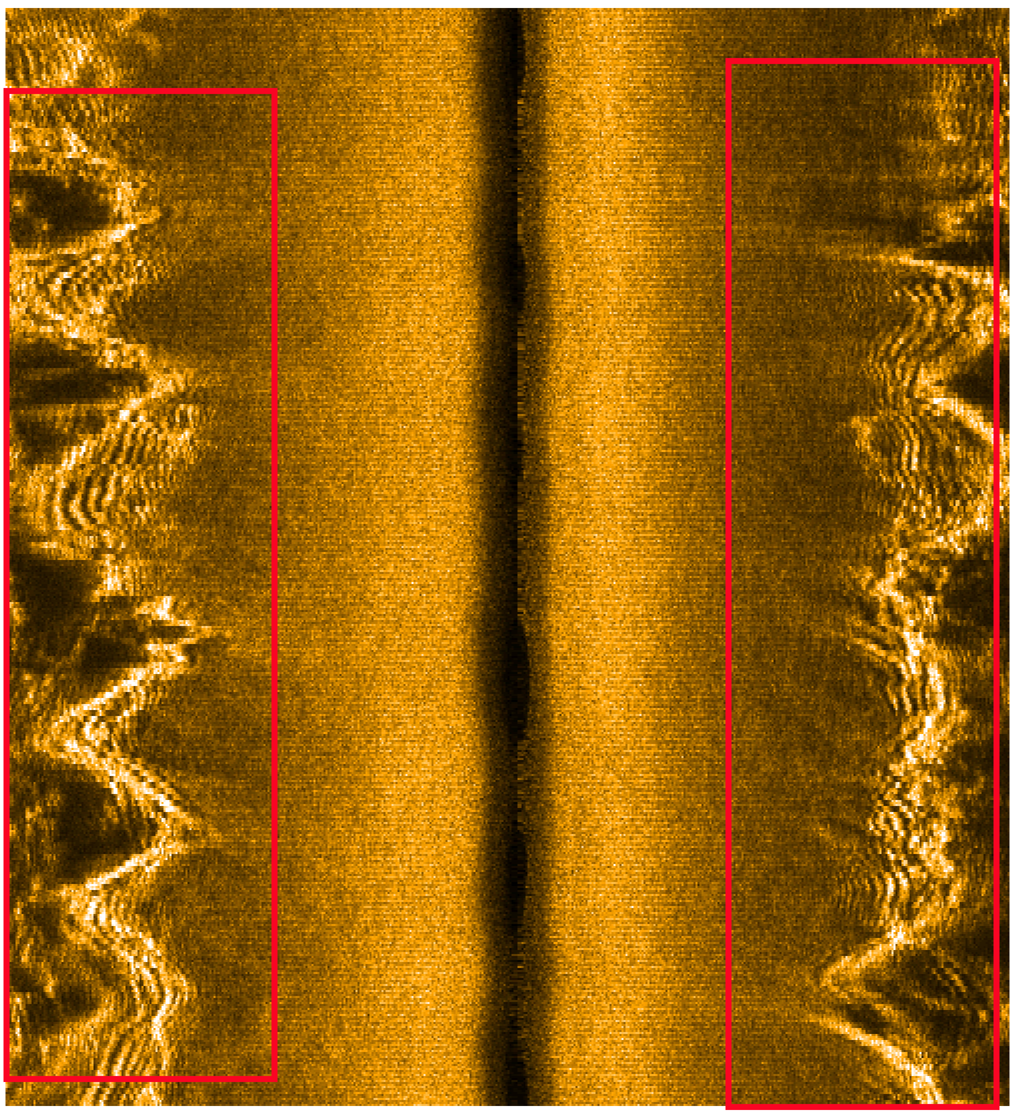


Figure 17: An example of refraction that was observed throughout H13476.

Sound speed issues in MBES data

H13476 was located in an area that frequently exhibits intense density stratification. This layer greatly affects sound speed and results in refraction that can be observed in the outer beams of the MBES data (Figure 18).

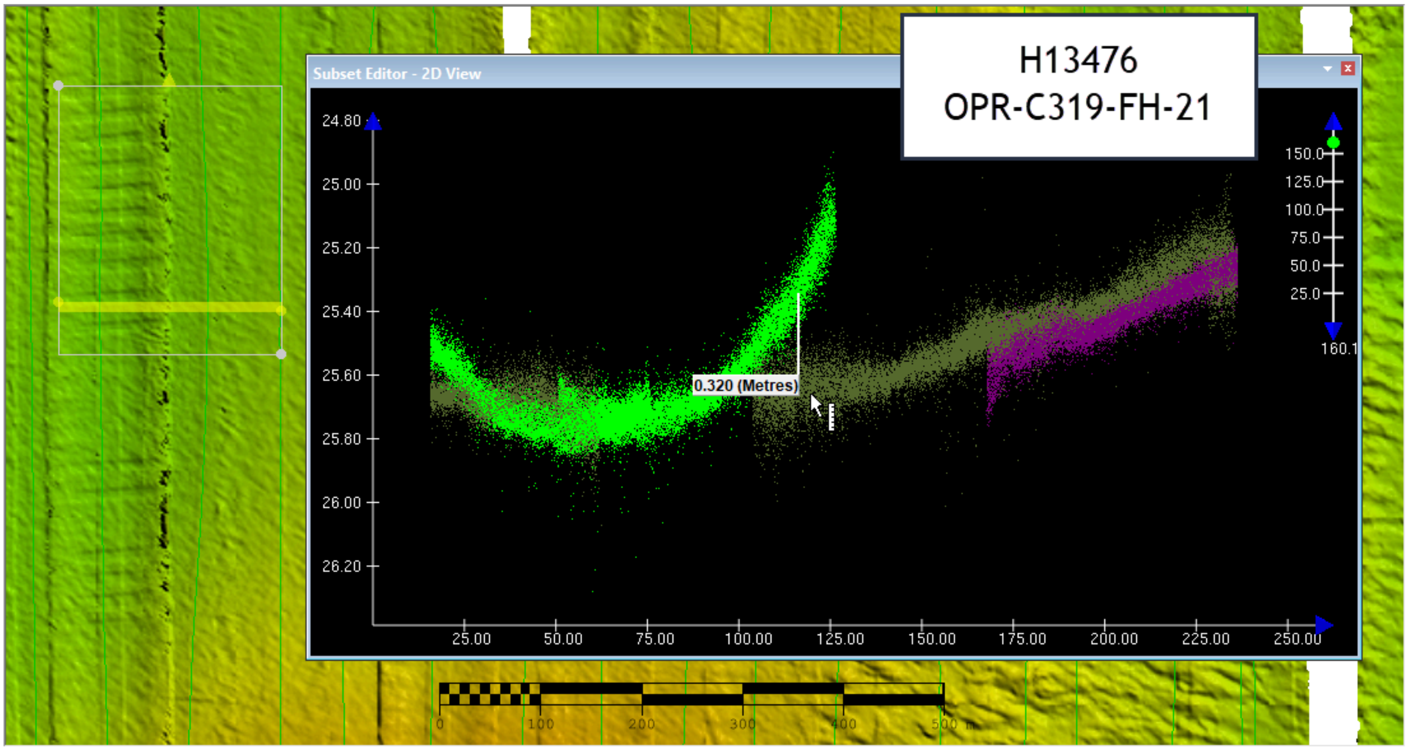


Figure 18: An example of refraction that was observed throughout H13476 MBES data.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at the start of each acquisition day and within four hours of each previous cast per the 2021 HSSD specifications. S250 conducted casts using a Rolls Royce Brooke Ocean Moving Vessel Profiler (MVP) 200 and a Seabird SBE 19+ CTD. Variations in surface sound speed were monitored by the survey watch to assess appropriate cast frequency.

A total of 81 sound speed profiles were collected within the limits of H13476 and display good spatial diversity (Figure 19). All sound speed profile data were concatenated into a master file for the sheet. MBES data were corrected by applying profiles nearest in distance in time (4 hours) using this master file.

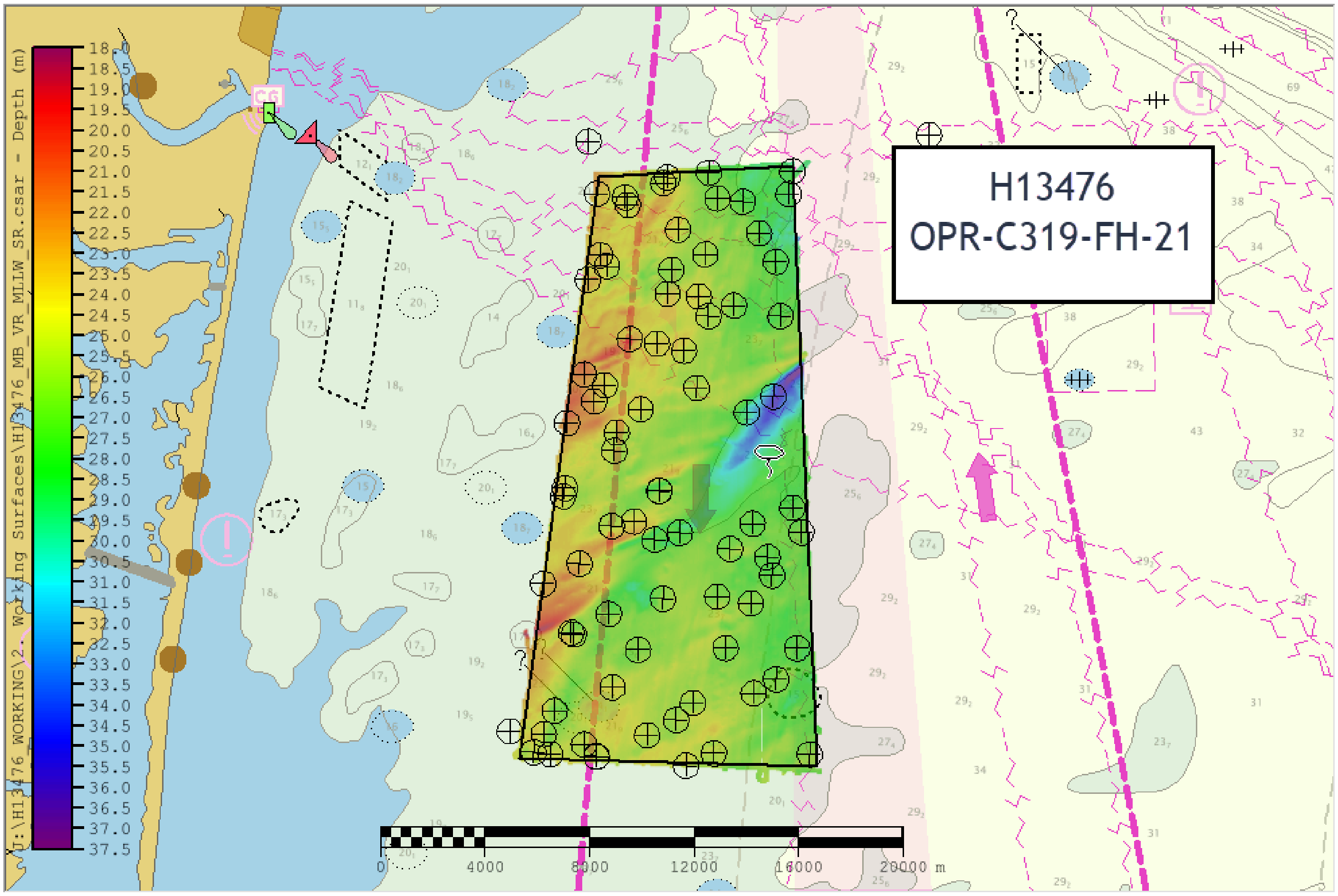


Figure 19: Overview of all SVP casts taken on H13476.

B.2.8 Coverage Equipment and Methods

S250 acquired 100% SSS coverage with concurrent MBES and 100% complete coverage MBES to meet complete coverage requirements on survey H13476, as specified in the PI, using a Klein 5000 V2 towfish and dual Kongsberg EM2040 MBES systems.

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 QPS Fledermaus GeoCoder Toolbox (FMGT) software, and the exported geotiffs are included in the final processed data submission package (Figure 20).

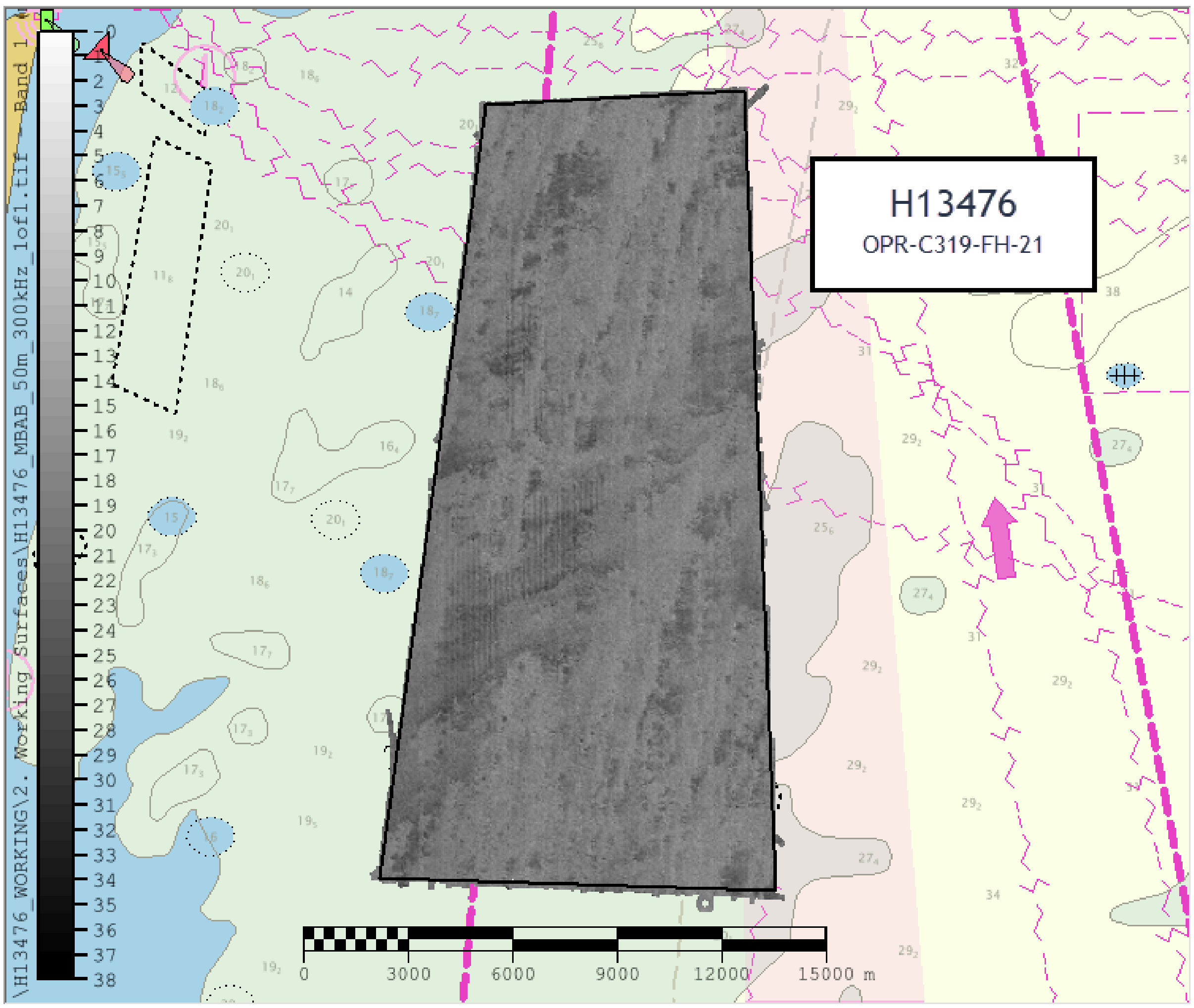


Figure 20: H13476 300kHz backscatter mosaic. Mosaic shown has a 50m resolution for display purposes only. Mosaic in deliverables package has a 2m resolution.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2021.

Refer to the DAPR for information on the Bathymetry Data Processing Software.

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
H13476_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	18.1 meters - 36.5 meters	NOAA_VR	Complete MBES
H13476_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	18.1 meters - 37.7 meters	NOAA_VR	Complete MBES
H13476_SSSAB_1m_455kHz_1of1	SSS Mosaic	1 meters	0.0 N/A - 0.0 N/A	N/A	100% SSS
H13476_MBAB_2m_300kHz_1of1	MB Backscatter Mosaic	2 meters	0.0 N/A - 0.0 N/A	NOAA_2m	Complete MBES

Table 10: Submitted Surfaces

Complete coverage requirements were met by 100% side scan sonar coverage with concurrent multibeam and complete coverage multibeam as specified under section 5.2.2.3 of the 2021 HSSD. All bathymetric grids of H13476 meet density requirements specified in the 2021 HSSD (Figure 21). The location of failed nodes was examined and those nodes were found to be distributed along MBES swath edges were there was no overlap with neighboring swaths, because coverage was being met via 100% SSS ensonification. (Figure 22).

After multiple round of cleaning, eight fliers remain as detected by NOAA's QC Tools Flier Finder available in the Pydro XL-19 suite. Upon further inspection, these flagged grid nodes are considered to be accurate representations of the sea floor and have been retained in the submitted surfaces.

While there are data gaps present in both the MBES surface and the SSS mosaic (Figure 23), the combined coverage resulted in no holidays present within the assigned survey limits.

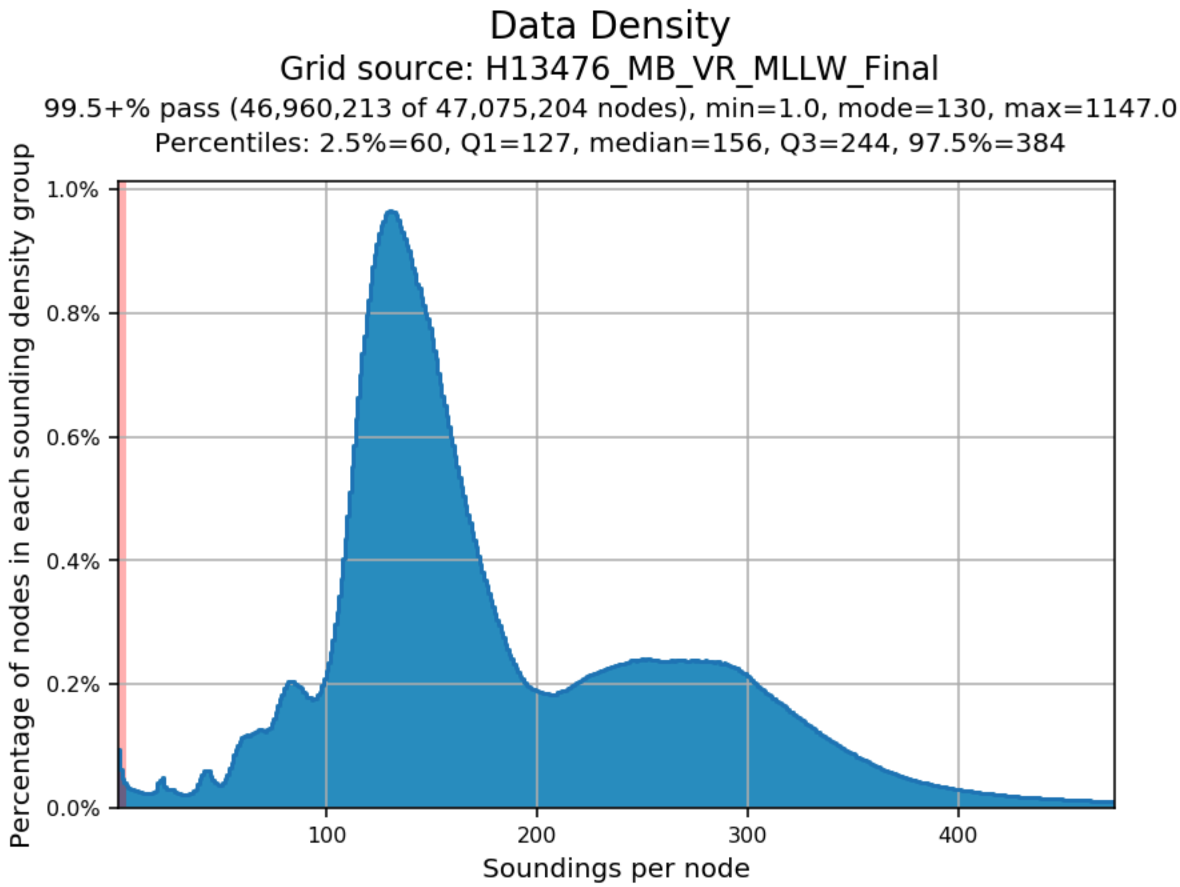


Figure 21: H13476 density statistics

Figure 22: Example of distribution of nodes not meeting density standards (indicated by orange target).

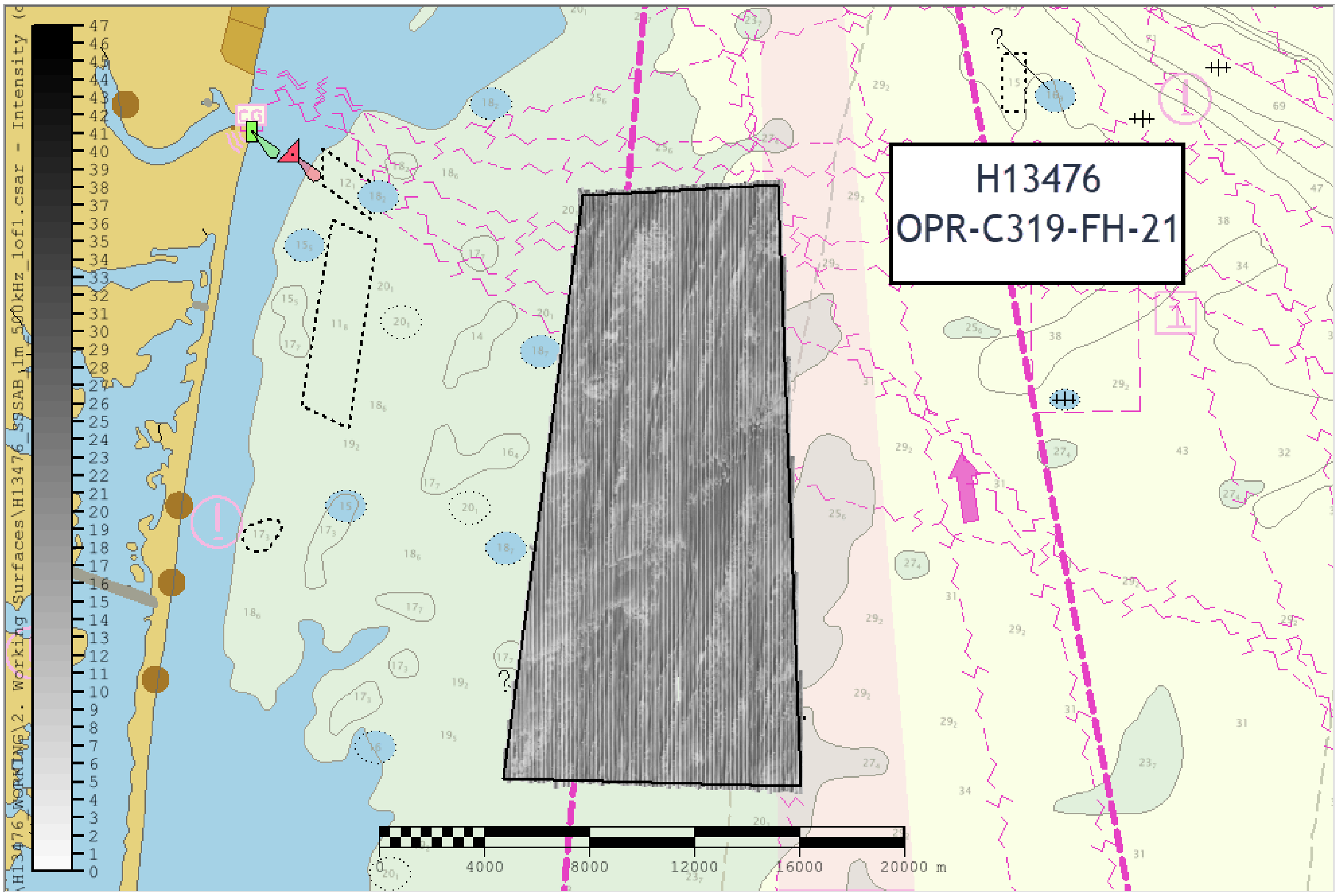


Figure 23: H13476 SSS mosaic with a 1m resolution. Gaps in coverage were addressed with complete MBES coverage.

C. Vertical and Horizontal Control

Field installed tide and GPS stations were not utilized for this survey. There is no HVCR report included with the submission of H13476.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

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 18.

<u>The following PPK methods were used for horizontal control:</u>

- RTX

Trimble-RTX service was used with an Applanix POS MV v5 GNSS_INS system to obtain highly accurate ellipsoidally referenced position data to meet ERS specifications for H13476 MBES data from vessel S250.

<u>WAAS</u>

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition on vessel S250.

D. Results and Recommendations

D.1 Chart Comparison

All data from H13476 should supersede charted data. A chart comparison was conducted between survey H13476 and previously charted ENC US3NY01M in accordance with methods outlined in the DAPR. See figure 24 and additional information in the following sections.

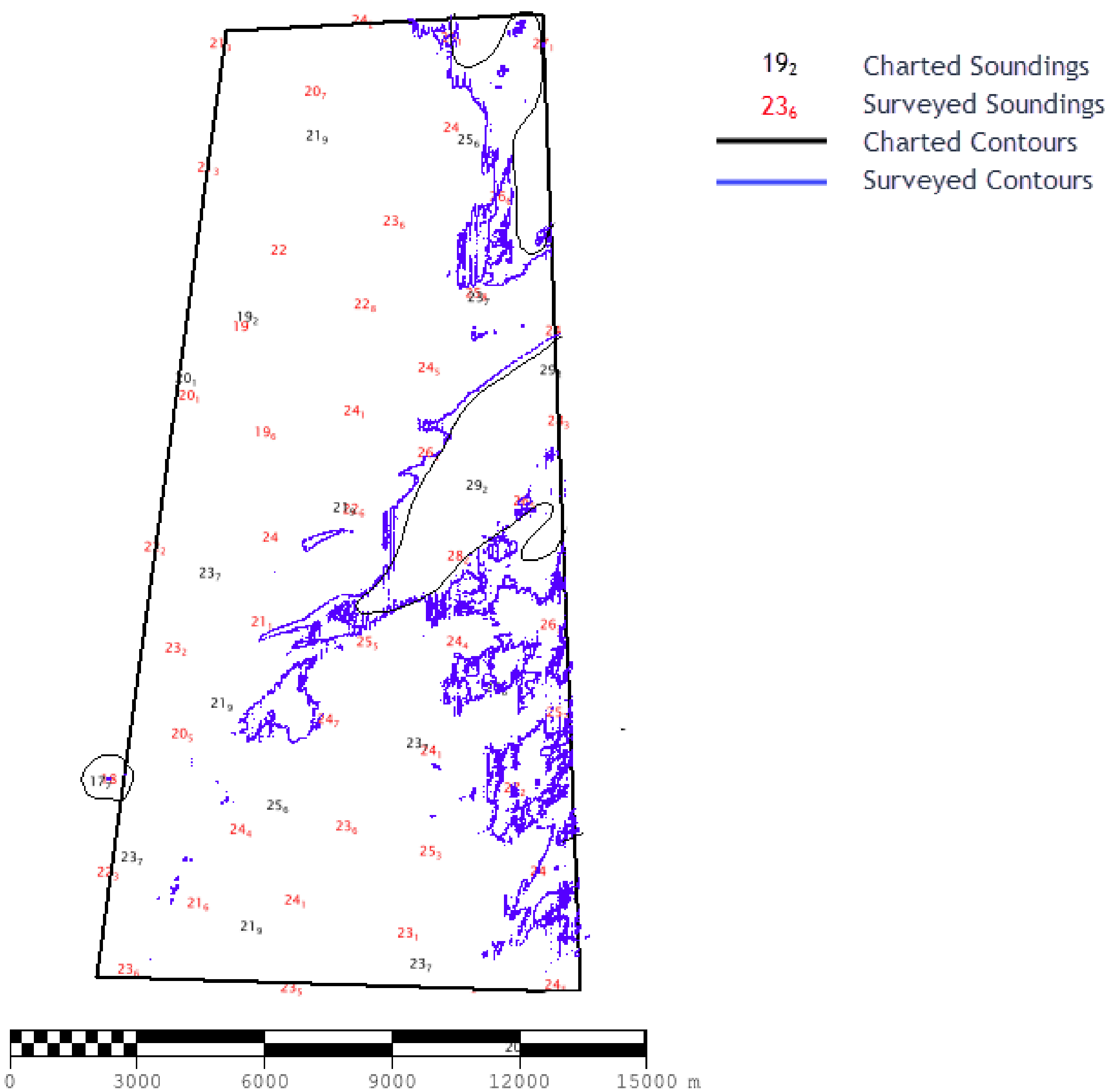


Figure 24: Comparison of survey data with charted soundings and contours of ENC US3NY01M.

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
US3NY01M	1:40000	49	08/03/2020	02/18/2021

Table 11: Largest Scale ENCs

Concur with clarification the largest ENC is US4NJ23M at 1:80,000 scale

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

A total of nine charted features were investigated. Six of the features were submarine cables. See section D.2.5 for further information. The other three features were wrecks, two of which were unverified charted features. All three wrecks were not observed in complete coverage MBES and were deemed appropriate for deletion.

D.1.4 Uncharted Features

Six uncharted features were observed and investigated. Reference the Final Feature File for further information.

D.1.5 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

No Aids to navigation (ATONs) exist for this survey.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Four bottom samples were assigned and investigated. Reference the Final Feature File for location and sample attribution.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Six charted submarine cables were assigned for investigation. No evidence of these cables was observed in either the MBES or SSS coverage. These features were not included in the Final Feature File since no discrepancies were noted.

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

No abnormal seafloor or environmental conditions exist for this survey.

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
Michael Gonsalves, CDR/NOAA	Chief of Party	02/17/2022	GONSALVES.MICHAEL.OLIVER.1275635126 Digitally signed by GONSALVES.MICHAEL.OLIVER.1275635126 Date: 2022.03.30 15:21:33 -04'00'
Jeffery Douglas, LT/NOAA	Operations Officer	02/17/2022	
Chloe Arboleda	Sheet Manager	02/17/2022	ARBOLEDA.CHLOE ELIZABETH.B.1550062760 Digitally signed by ARBOLEDA.CHLOE ELIZABETH.B.1550062760 Date: 2022.02.19 09:45:52 -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