H13480

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13480

LOCALITY

State(s):	New Jersey
General Locality:	Offshore New Jersey
Sub-locality:	15 NM East of Shark River

2021

CHIEF OF PARTY
Michael Gonsalves, CDR/NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13480**

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:	**15 NM East of Shark River**
Scale:	**20000**
Dates of Survey:	**08/31/2021 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:	**Multibeam Echo Sounder Backscatter Side Scan Sonar**
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.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H13480

Project: OPR-C319-FH-21

Locality: Offshore New Jersey

Sublocality: 15 NM East of Shark River

Scale: 1:20000

August 2021 - October 2021

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: Michael Gonsalves, CDR/NOAA

A. Area Surveyed

Survey H13480, located within the Approaches to New York, sub locality of 15 NM East of Shark River, 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° 17' 35.01" N 73° 44' 27.96" W	39° 57' 28.76" N 73° 32' 32.42" W

Table 1: Survey Limits

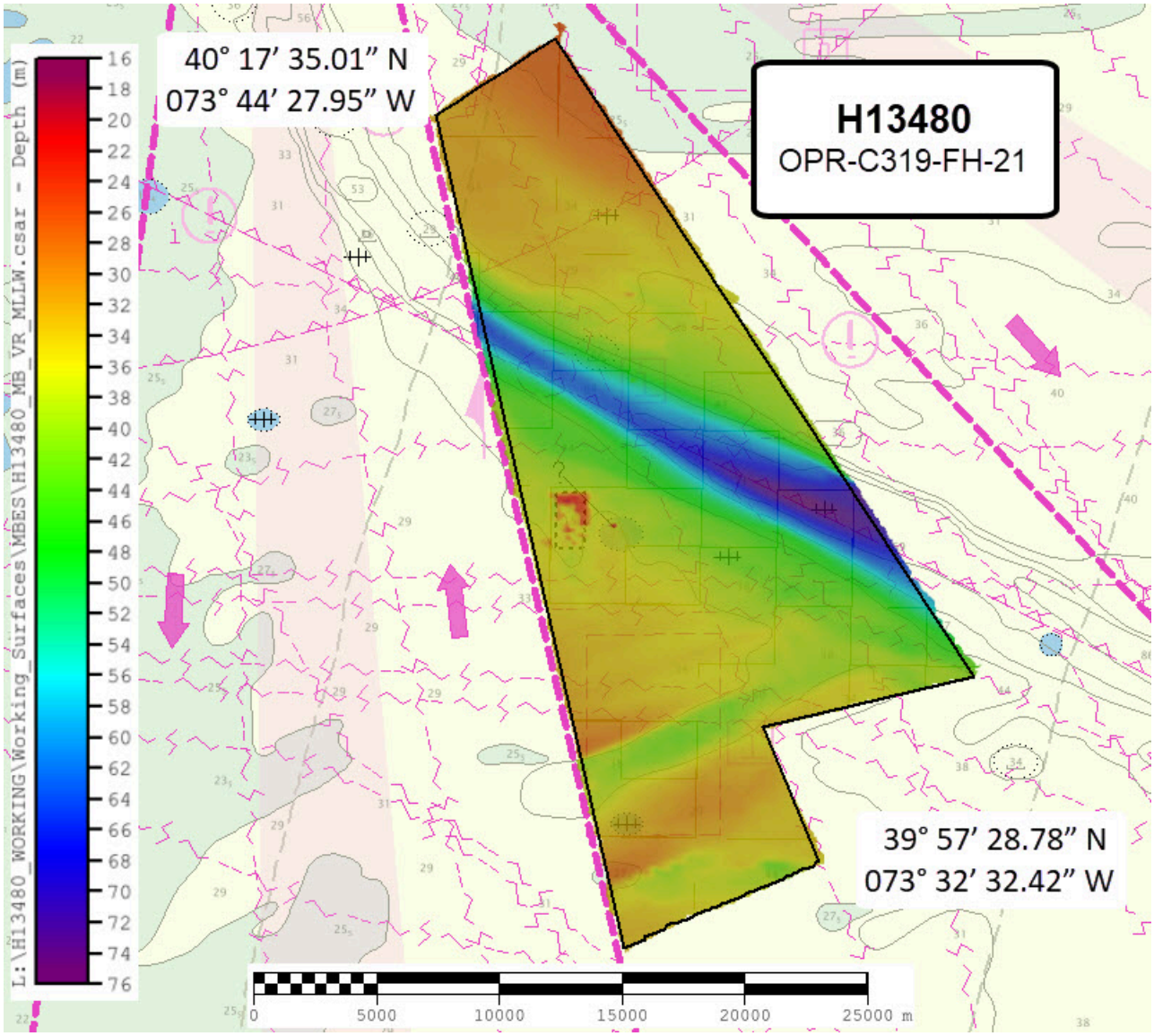


Figure 1: Survey layout for H13480, plotted over ENC US3NY01M. Black outline represents the survey limits set forth by the Project Instructions.

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

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 in H13480 meet multibeam echo sounder (MBES) coverage requirements for complete coverage, as specified by the 2021 HSSD. This includes crosslines (see Section B.2.1), NOAA allowable uncertainty (see Section B.2.2), and density requirements (see Section B.5.2).

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 Coverate (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

Survey coverage is in accordance with requirements listed in Table 2 and in the 2021 HSSD. Coverage requirements were met with 100% complete coverage multibeam echosounder (MBES) coverage (Figure 1). No holidays are present within coverage acquired for H13480.

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	1074.06	1074.06
	Lidar Mainscheme	0.0	0.0
	SSS Mainscheme	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0
	SBES/MBES Crosslines	51.04	51.04
	Lidar Crosslines	0.0	0.0
Number of Bottom Samples			8
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			82.25

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/31/2021	243
09/01/2021	244

Survey Dates	Day of the Year
09/10/2021	253
09/11/2021	254
09/12/2021	255
09/13/2021	256
09/14/2021	257
09/15/2021	258
09/16/2021	259
09/29/2021	272
09/30/2021	273
10/07/2021	280

Table 4: Dates of Hydrography

Complete coverage MBES acquisition was conducted between 08/31/2021 and 09/30/2021. Eight bottom samples were collected on 10/07/2021 to conclude data acquisition for H13480.

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 2: NOAA ship Ferdinand Hassler (S250)

B.1.2 Equipment

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

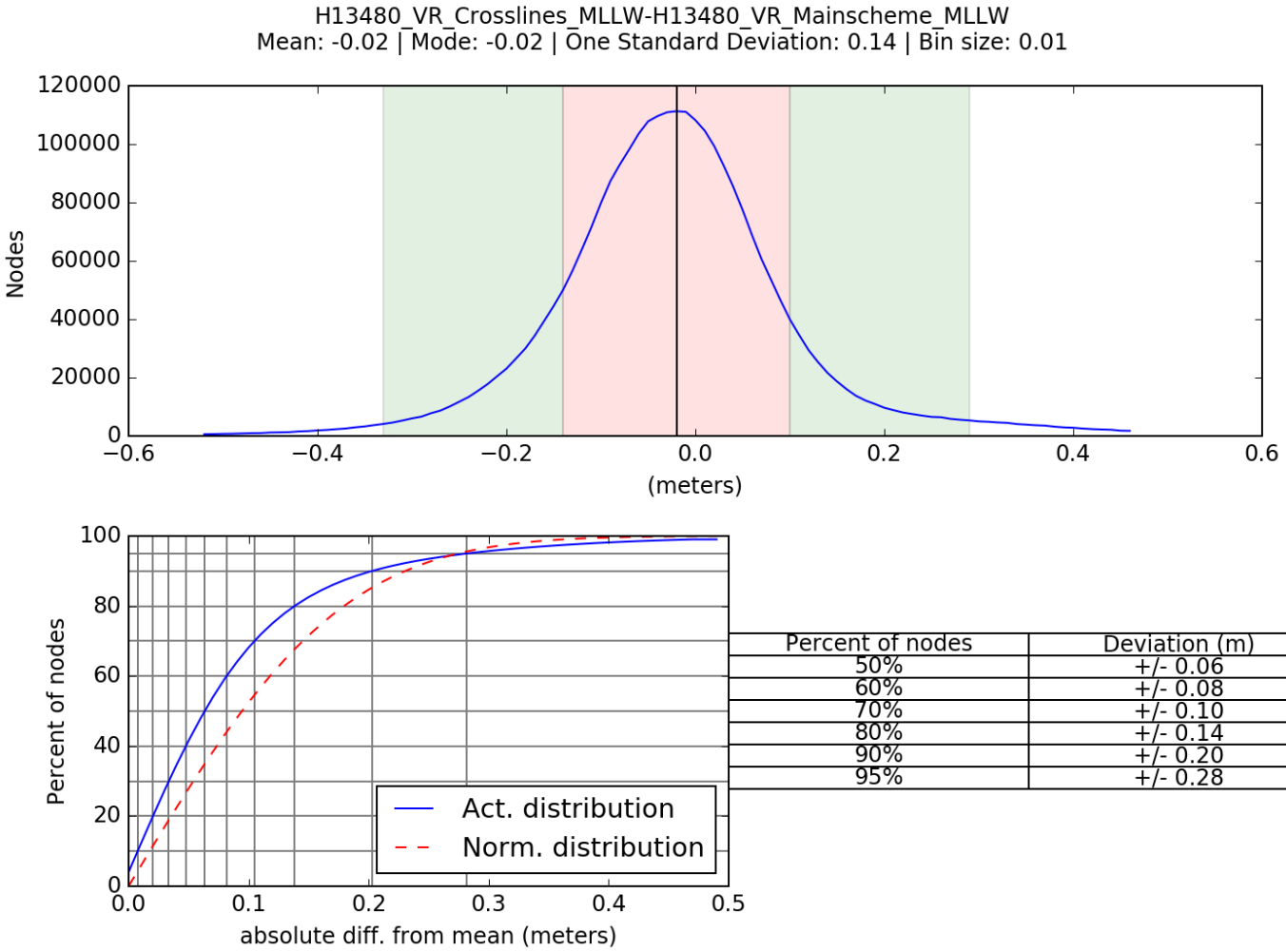
Manufacturer	Model	Type
Kongsberg Maritime	EM 2040	MBES
Kongsberg Maritime	EM 2040	MBES Backscatter
Klein Marine Systems	System 5000	SSS
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
AML Oceanographic	MVP-X	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound 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

B.2 Quality Control

B.2.1 Crosslines

S250 collected 51.04 linear nautical miles of MBES crosslines, or 4.75% 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 0.02m with a standard deviation of 0.14m (Figure 3). Over 99.5% of nodes pass the fraction of allowable error analysis (Figure 4). The crosslines acquired have good temporal and geographic distribution, and there is no indication of any comparison issues (Figure 5).



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.14
90%	+/- 0.20
95%	+/- 0.28

Figure 3: H13480 crossline/mainscheme comparison statistics

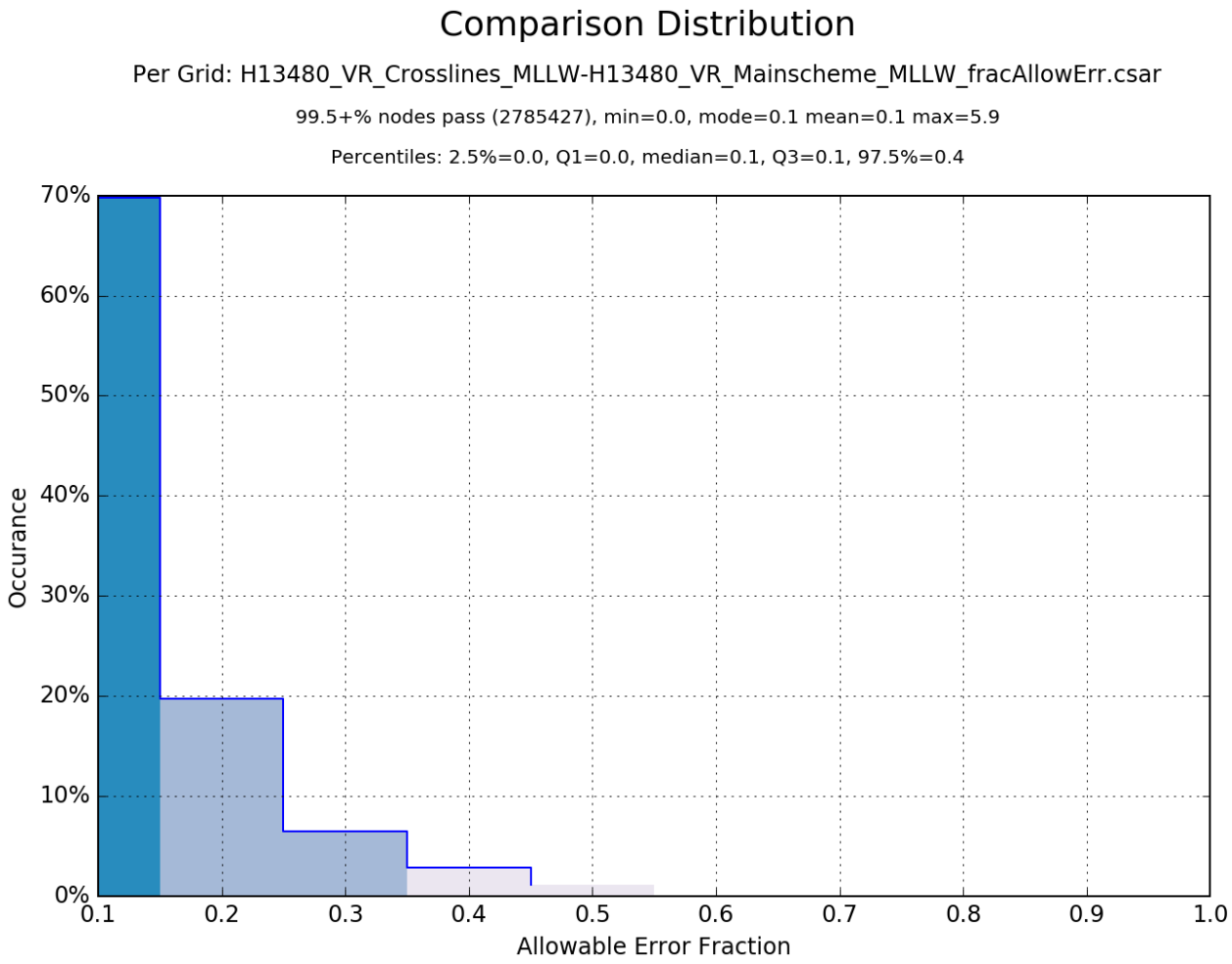


Figure 4: H13480 crossline/mainscheme fraction of allowable error statistics

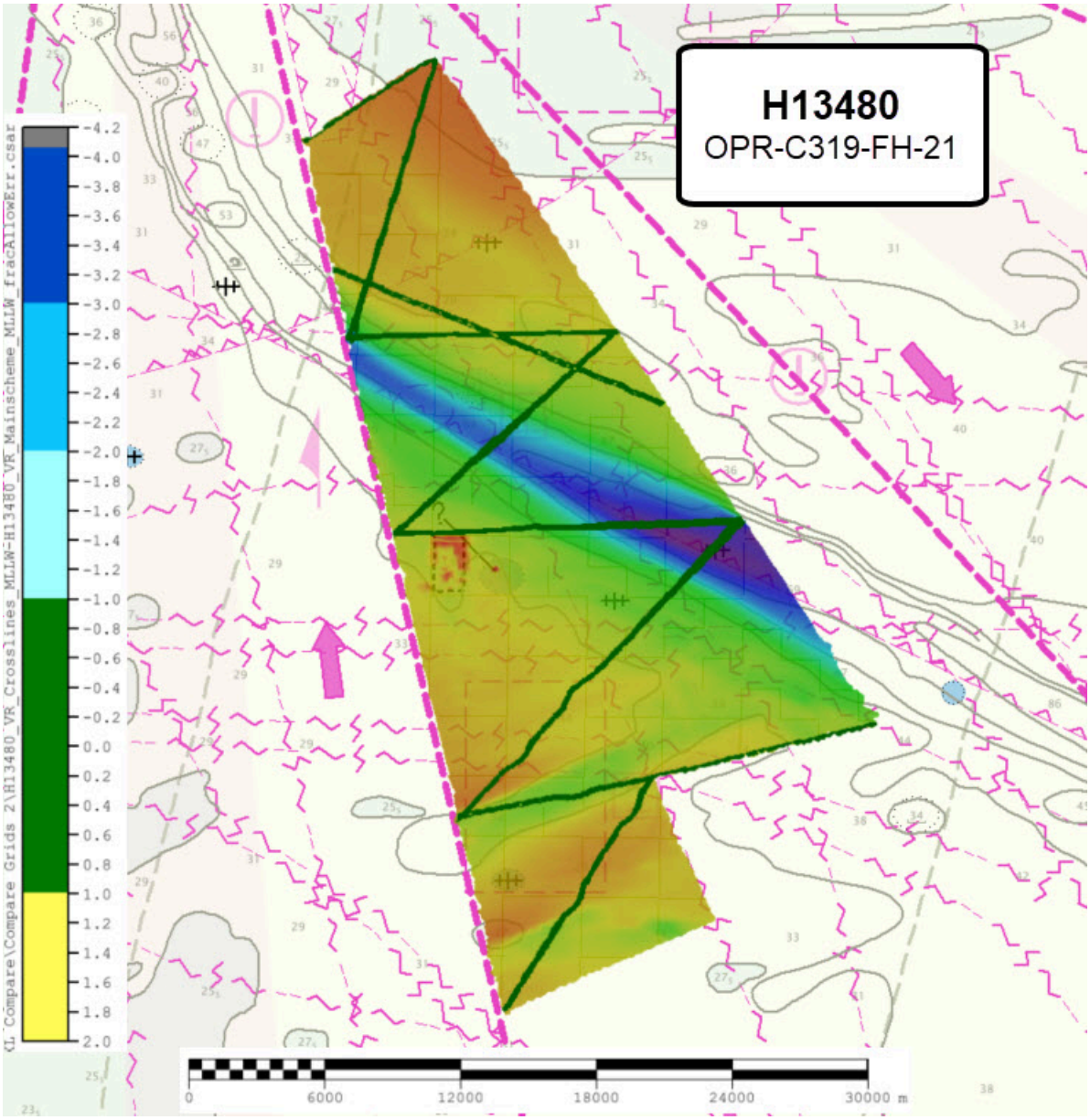


Figure 5: H13480 crosslines overlaid on mainscheme MBES coverage. Crosslines colored by results of fraction of allowable error analysis.

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	0 meters/second	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 6).

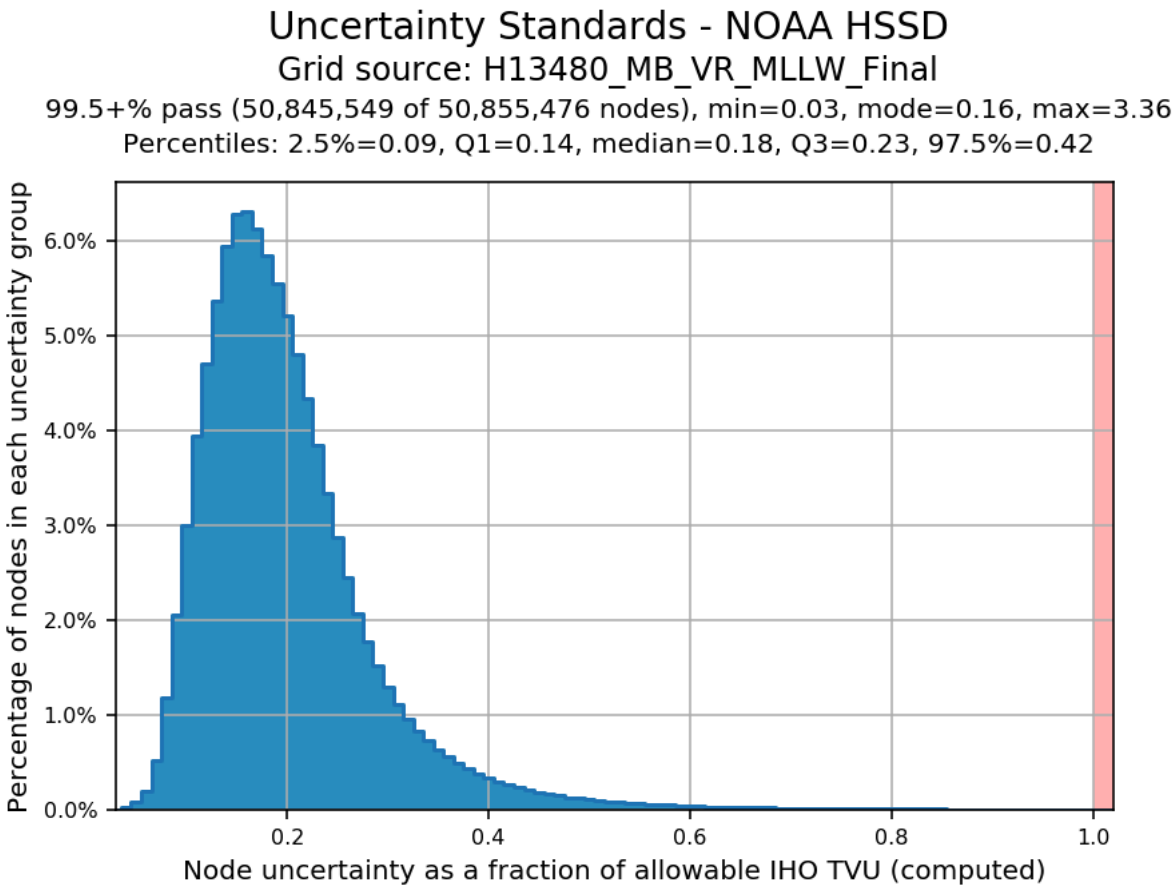


Figure 6: H13480 uncertainty standards.

B.2.3 Junctions

There are four surveys that junction with H13480. W00481 is a historical survey conducted by NOAA Ship Nancy Foster in 2018 (Figure 7). H12628 is a historical survey conducted by NOAA Ship Ferdinand Hassler in 2013 (Figure 7). The remaining two surveys were conducted with H13480 while on OPR-C319-FH-21: H13474 and H13477 (Figure 7). Information from junction analyses is below.

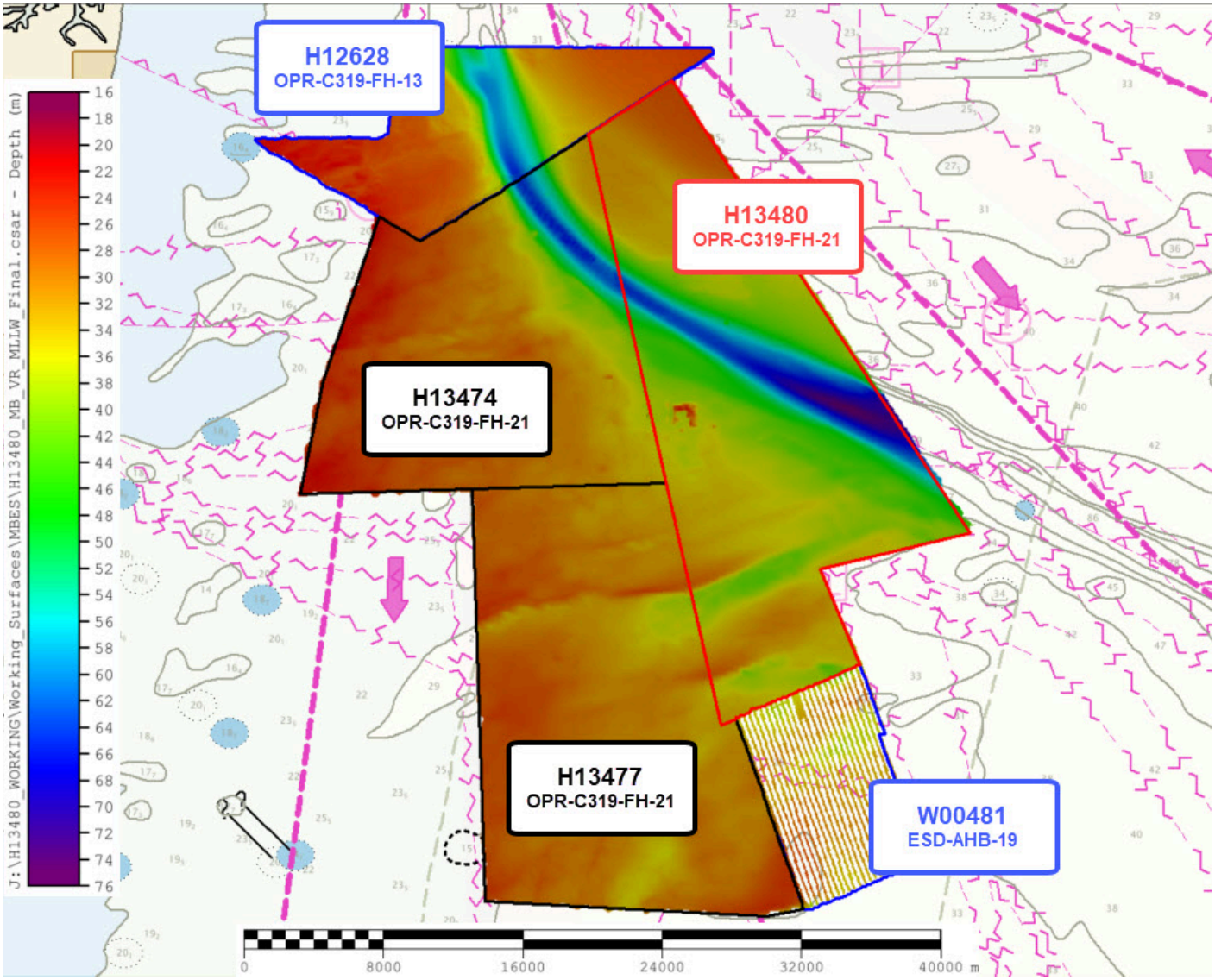


Figure 7: H13480 (outlined in red) with contemporary surveys H13474 and H13477 (outlined in black), and historical surveys W00481 and H12628 (outlined in blue).

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
W00481	1:40000	2018	Nancy Foster	S
H12628	1:40000	2013	Ferdinand Hassler	NW
H13474	1:20000	2021	Ferdinand Hassler	W
H13477	1:20000	2021	Ferdinand Hassler	SW

Table 9: Junctioning Surveys

W00481

Historical survey W00481 junctions with the southern edge of H13480 (Figure 8). A single resolution CUBE surface of H13480 data at the 2m resolution and a single resolution BAG surface of W00481 at the 2m resolution were differenced. The mean difference between bathymetric surface nodes was 1.02m with a standard deviation of 0.48m (Figure 9). Upon inspection of the difference statistics and the Fraction of Allowable Error surface, failed nodes are variably distributed across the junction area (Figure 8). Visual review of the W00481 bathymetric surface suggests the presence of vertical offsets likely caused by SBET issues and/or heave artifacts (Figure 10). This offset was described in the DR for W00481 for an area of coverage that does not junction with H13480 and was identified by comparing data from W00481 to previous coverage. However, no previous data were available at the time of acquisition on the portion of W00481 that does junction with H13480, so the offset in this area was not detected in 2018. Nancy Foster personnel determined that the data acquired for W00481 were not adequate to superscede previous data for charting purposes and this conclusion is further supported by the contemporary junction analysis with H13480.

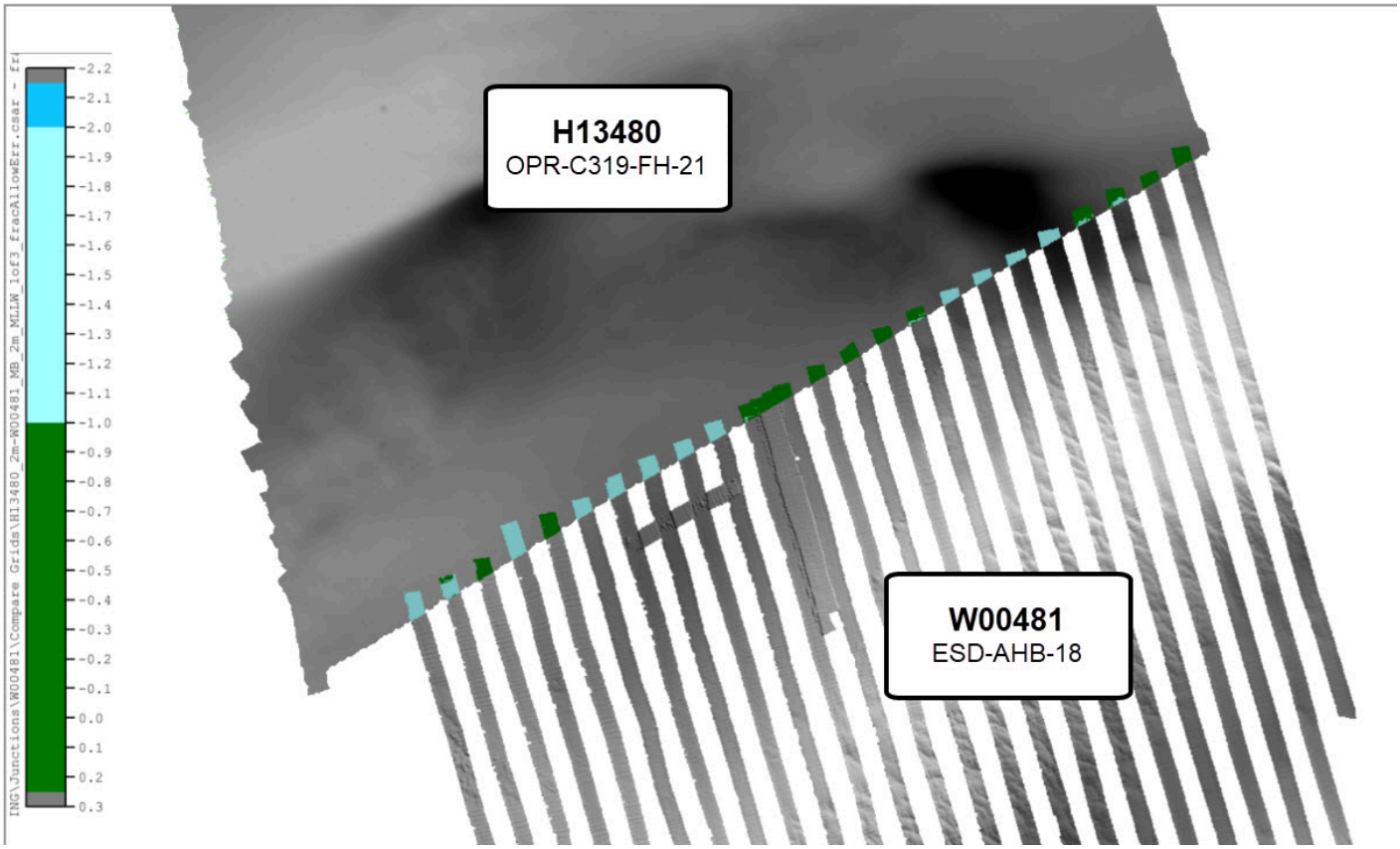
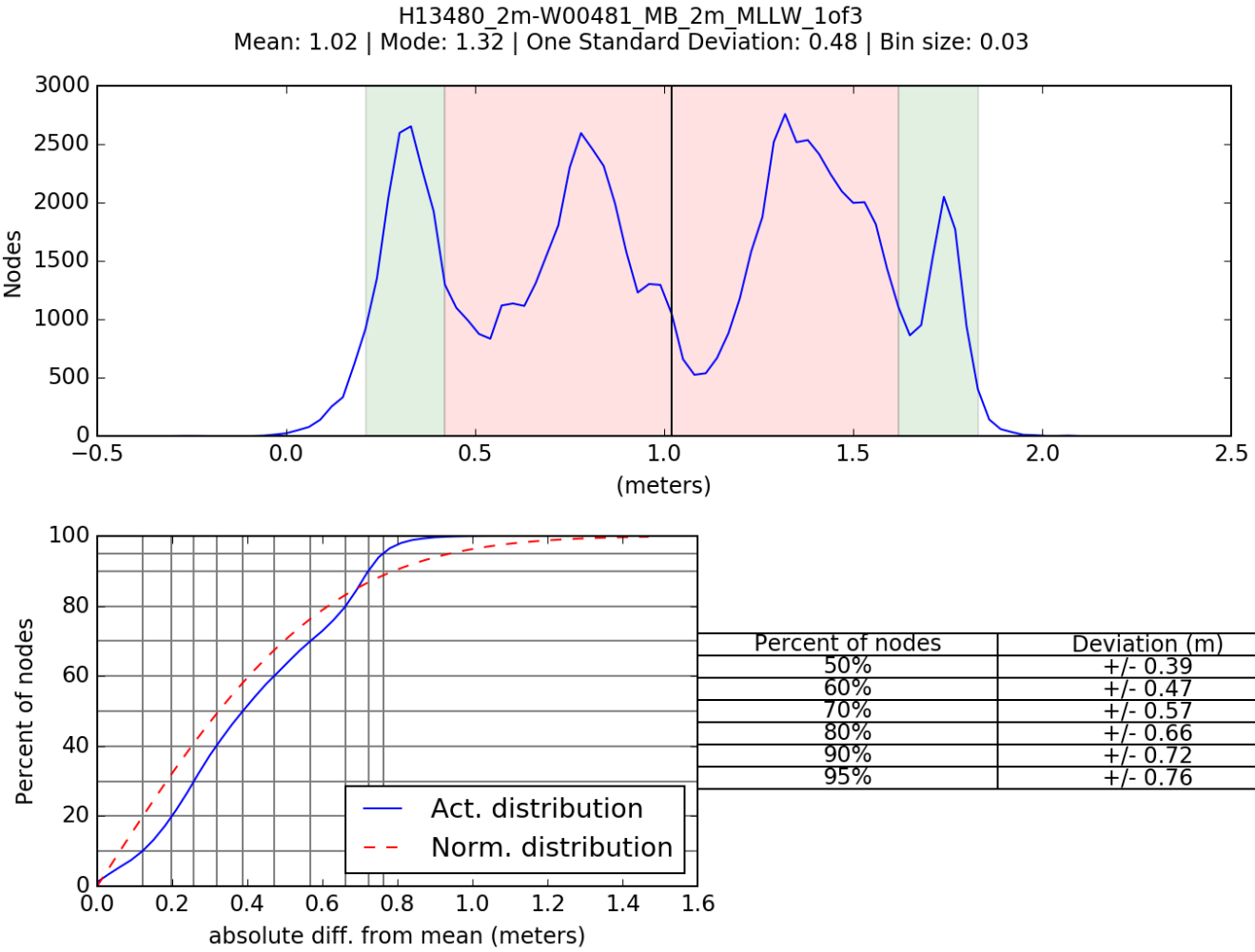


Figure 8: Fraction of Allowable Error surface (shown in color) from junction analysis between H13480 and W00481.



Percent of nodes	Deviation (m)
50%	+/- 0.39
60%	+/- 0.47
70%	+/- 0.57
80%	+/- 0.66
90%	+/- 0.72
95%	+/- 0.76

Figure 9: H13480 and W00481 surface difference comparison statistics.

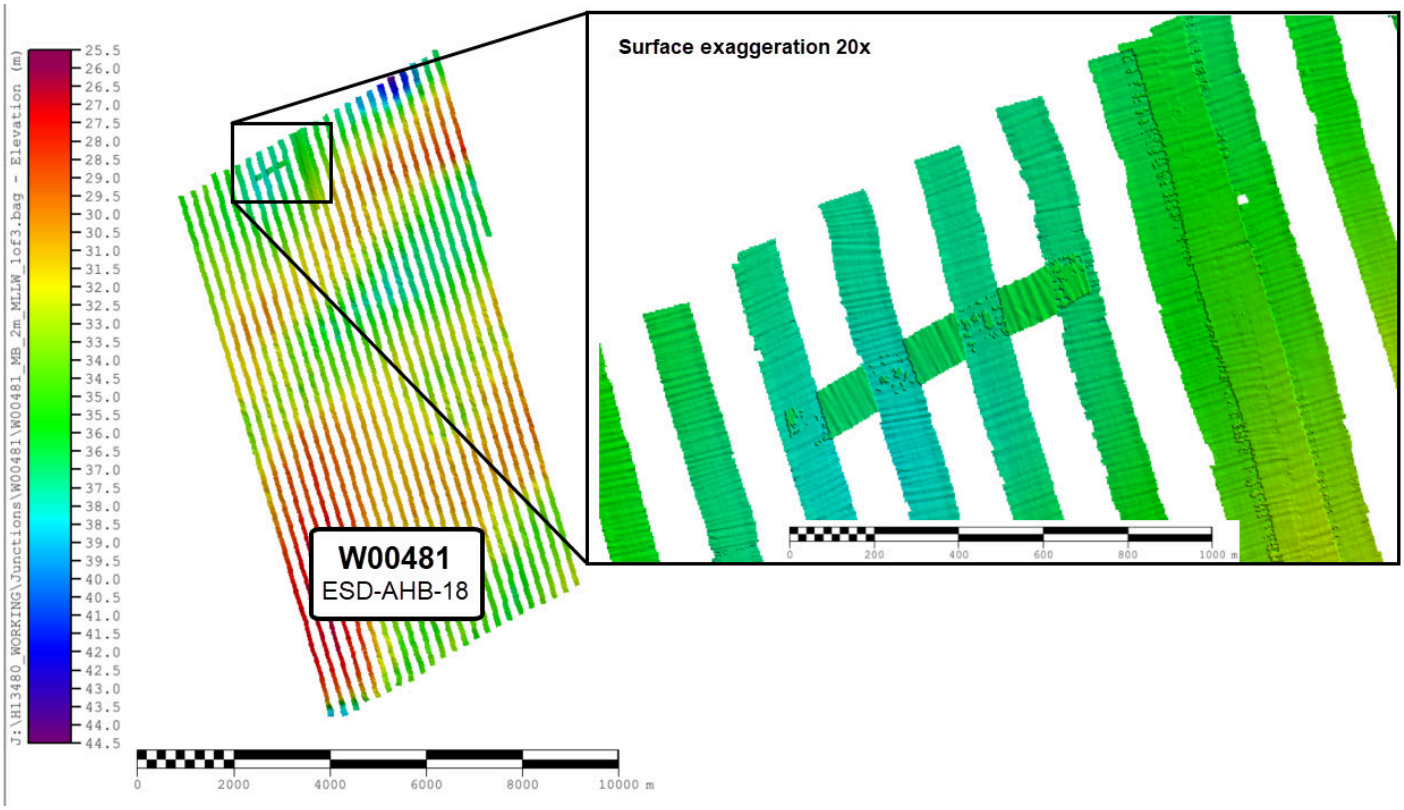


Figure 10: Vertical offsets in the W00481 bathymetric surface likely caused by SBET and/or heave issues.

H12628

The north west side of Survey H13480 junctioned with Survey H12628 (Figure 11). A 4m single resolution Combined Uncertainty and Bathymetry Estimator (CUBE) surface of H13480 data and a 4m single resolution BAG surface of H12628 data were differenced. The mean difference between bathymetric surface nodes was 0.05m with a standard deviation of 0.10m. Statistics and visual inspection indicate that surveys H13480 and H12628 are in general agreement (Figure 12).

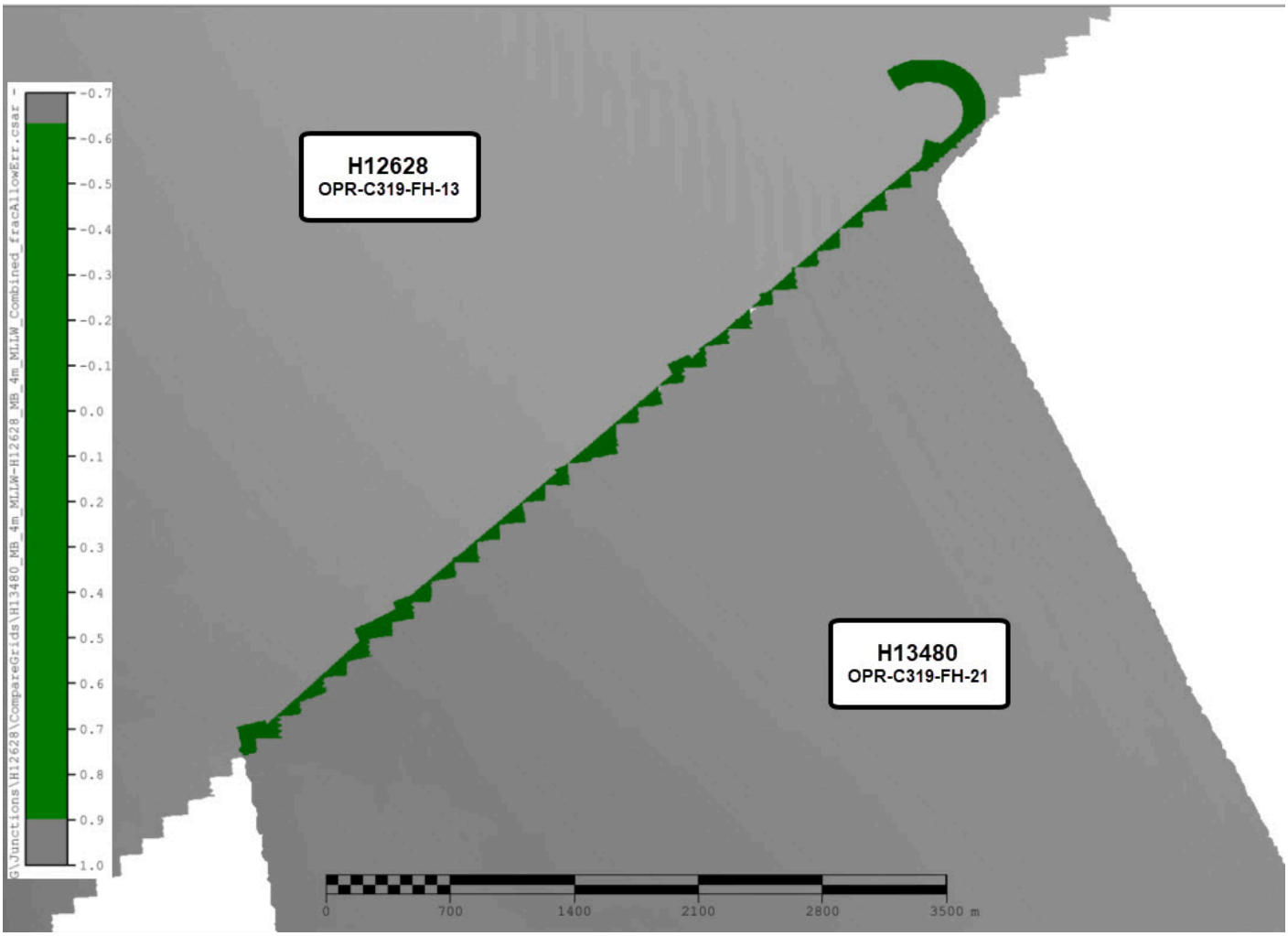
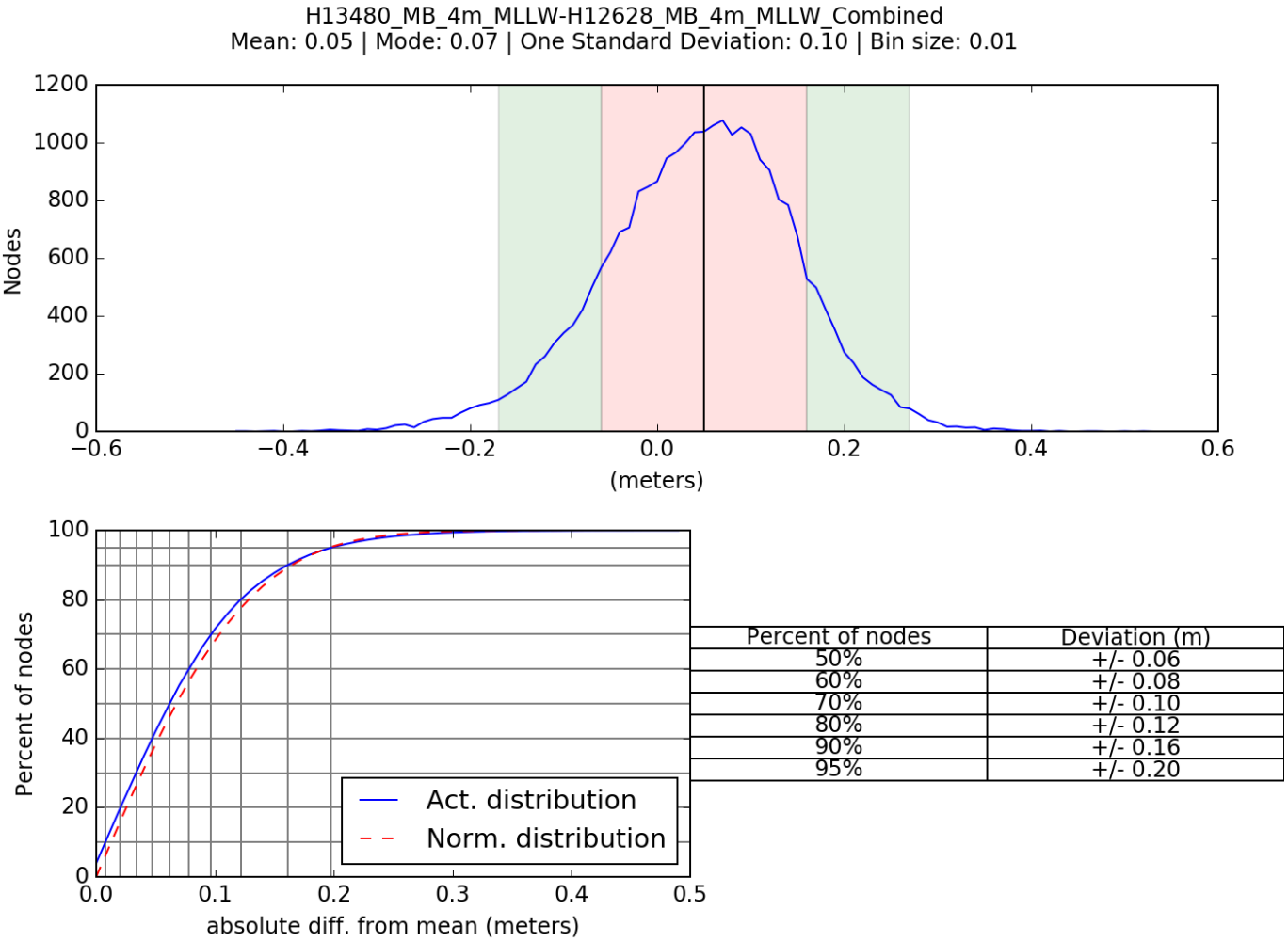


Figure 11: Fraction of allowable error between Survey H13480 and H12628 shown in color. Visual inspection indicates that the surveys are in general agreement.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.12
90%	+/- 0.16
95%	+/- 0.20

Figure 12: H13480 and H12628 surface difference comparison statistics.

H13474

The west side of Survey H13480 junctioned with Survey H13474 (Figure 13). A variable resolution (VR) Combined Uncertainty and Bathymetry Estimator (CUBE) surface of H13480 data and a VR CUBE surface of H13474 data were differenced. The mean difference between bathymetric surface nodes was 0.01m with a standard deviation of 0.11m. Statistics and visual inspection indicate that surveys H13480 and H13474 are in general agreement (Figure 14).

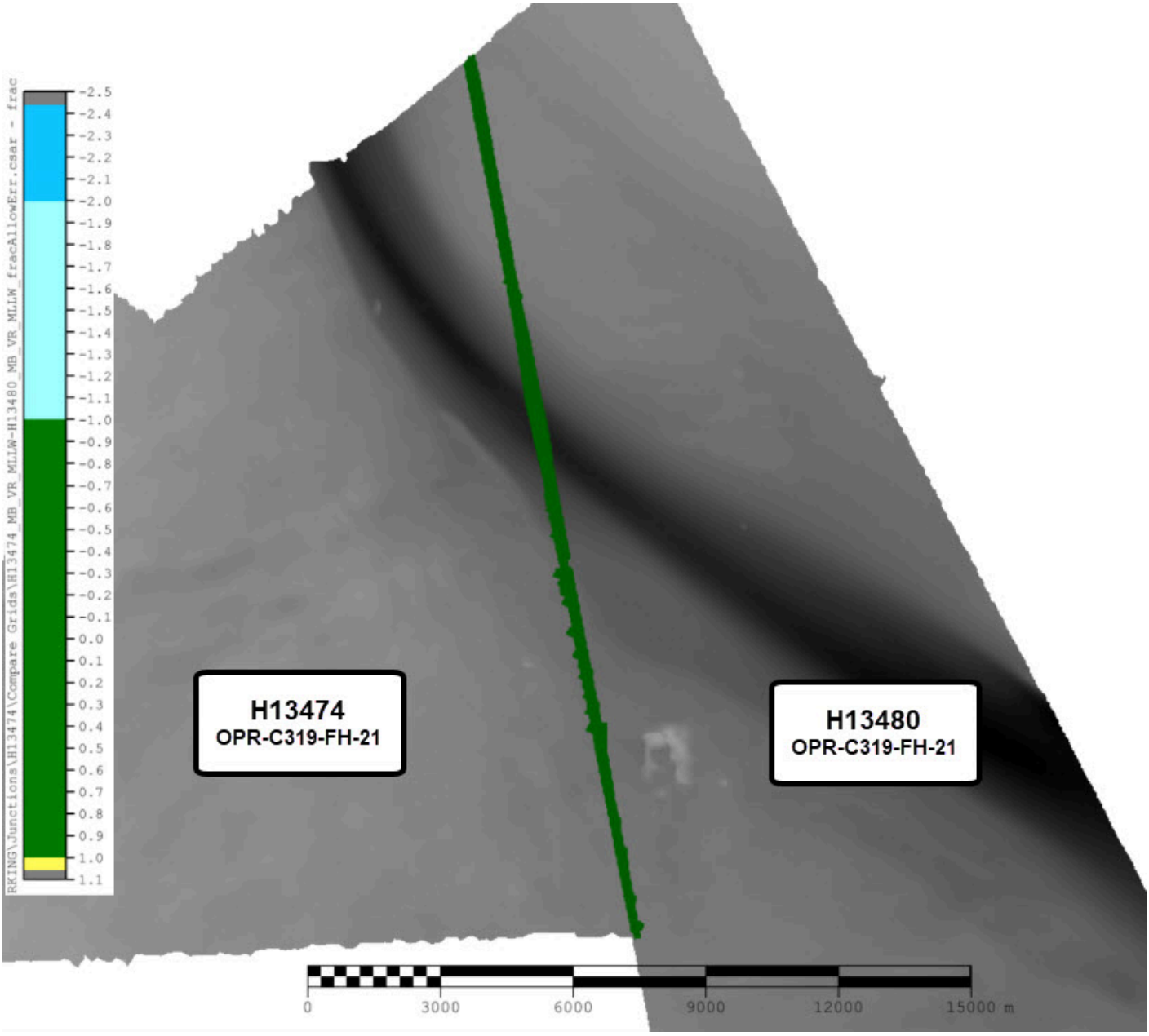
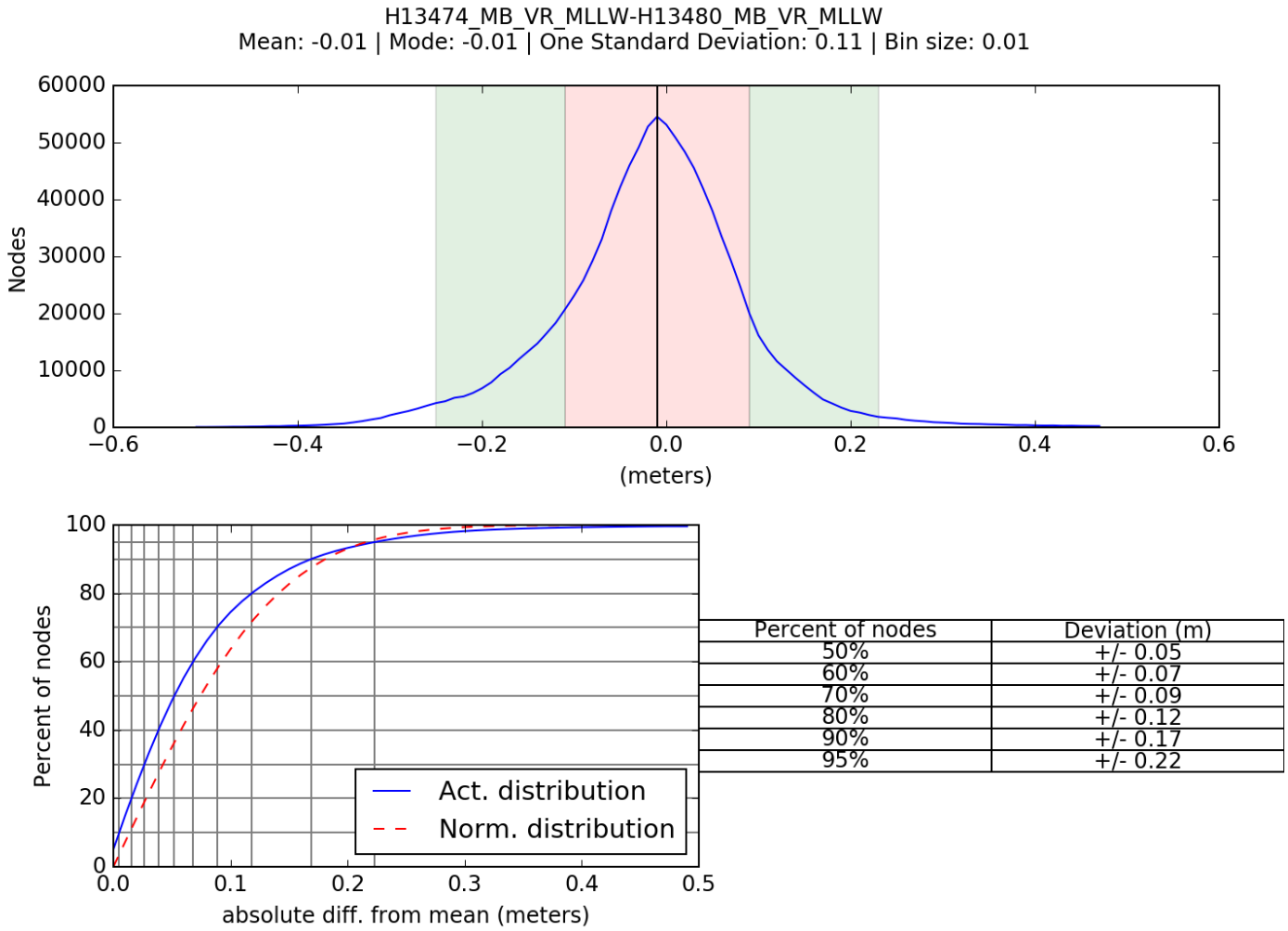


Figure 13: Fraction of allowable error between Survey H13480 and H13474 shown in color. Visual inspection indicates that the surveys are in general agreement.



Percent of nodes	Deviation (m)
50%	+/- 0.05
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.12
90%	+/- 0.17
95%	+/- 0.22

Figure 14: H13480 and H13474 surface difference comparison statistics.

H13477

The south west side of Survey H13480 junctioned with Survey H13477 (Figure 15). A variable resolution (VR) Combined Uncertainty and Bathymetry Estimator (CUBE) surface of H13480 data and a VR CUBE surface of H13477 data were differenced. The mean difference between bathymetric surface nodes was 0.00m with a standard deviation of 0.12m. Statistics and visual inspection indicate that surveys H13480 and H13477 are in general agreement (Figure 16).

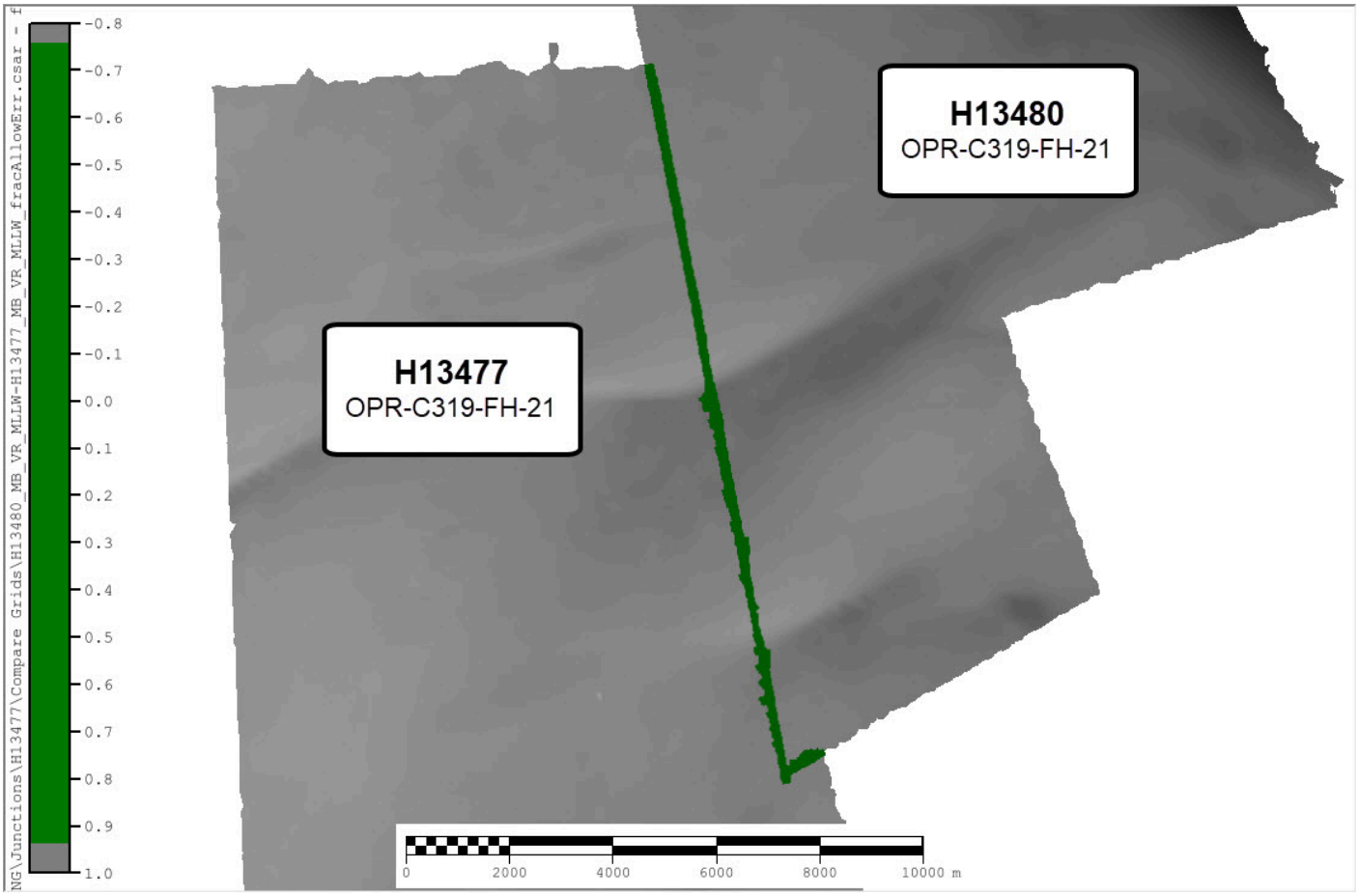
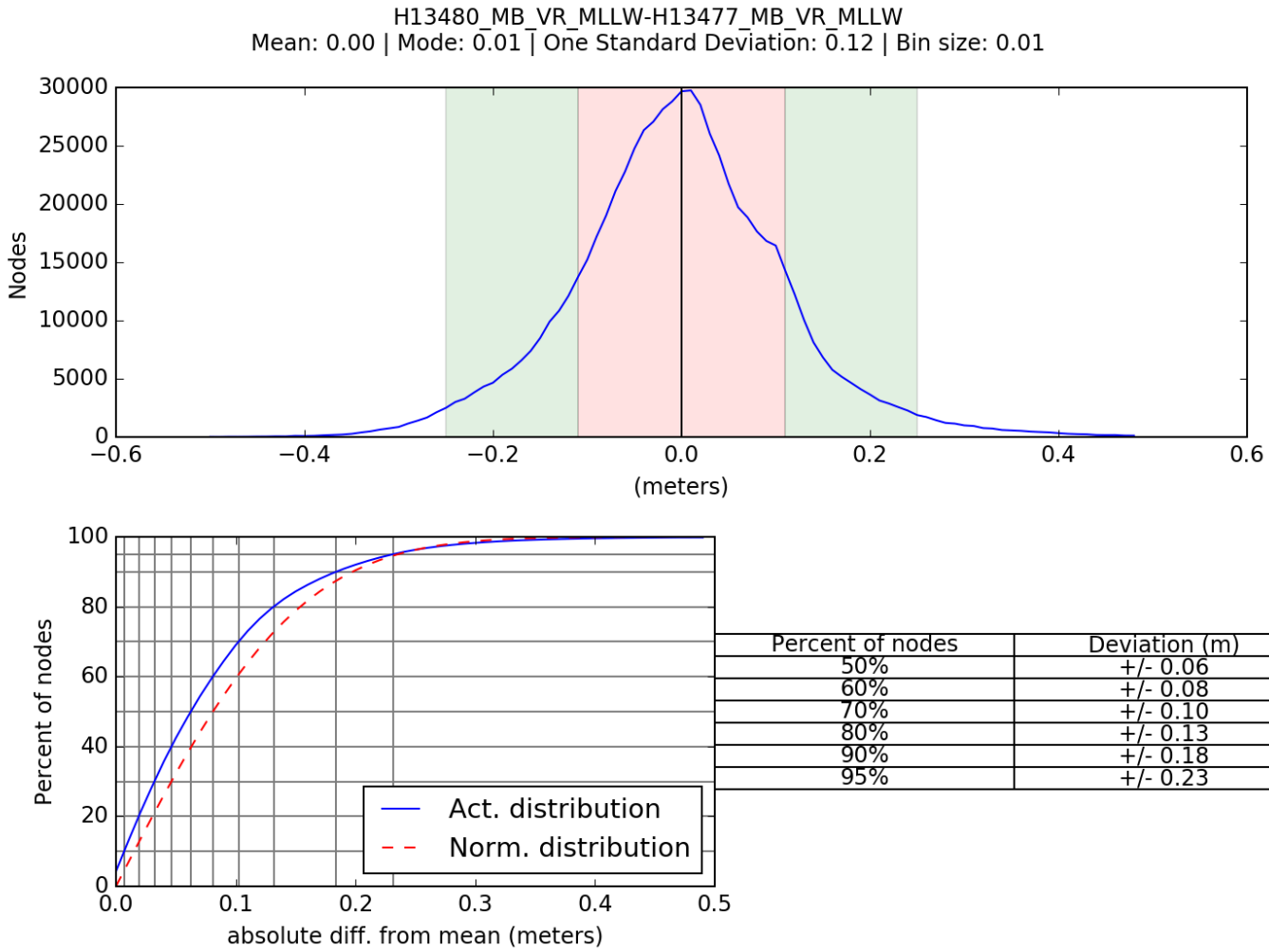


Figure 15: Fraction of allowable error between Survey H13480 and H13479 shown in color. Visual inspection indicates that the surveys are in general agreement.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.18
95%	+/- 0.23

Figure 16: H13480 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

Anomalous sound speed casts causing refraction in processing

During visual inspection of H13480's bathymetric surface, areas of severe refraction were noted in the northeast area of the sheet. The visual extents of the refraction and the extents of SVP casts used for

processing appeared to be correlated (Figure 17), so a detailed review of SVP casts for Julian Day 255 was conducted. A total of 12 MVP casts were collected for the day and two casts were observed to have measured temperature profiles that did not completely capture the extent of the thermocline (Figure 18). This resulted in the calculated sound velocity profile used for processing to also not be representative of the water column, resulting in the outer swath edges of the affected lines to be refracted upward by up to 1m (Figure 19).

The two anomalous profiles were removed from the concatenated master SVP file used for processing, but have been retained in the delivered Raw and Processed data directories. The affected lines from day 255 were recorrected for sound speed using the updated master file and the "nearest in time" option during georeferencing. As a result of reprocessing, the affected lines show little to no evidence of refraction (Figure 19).

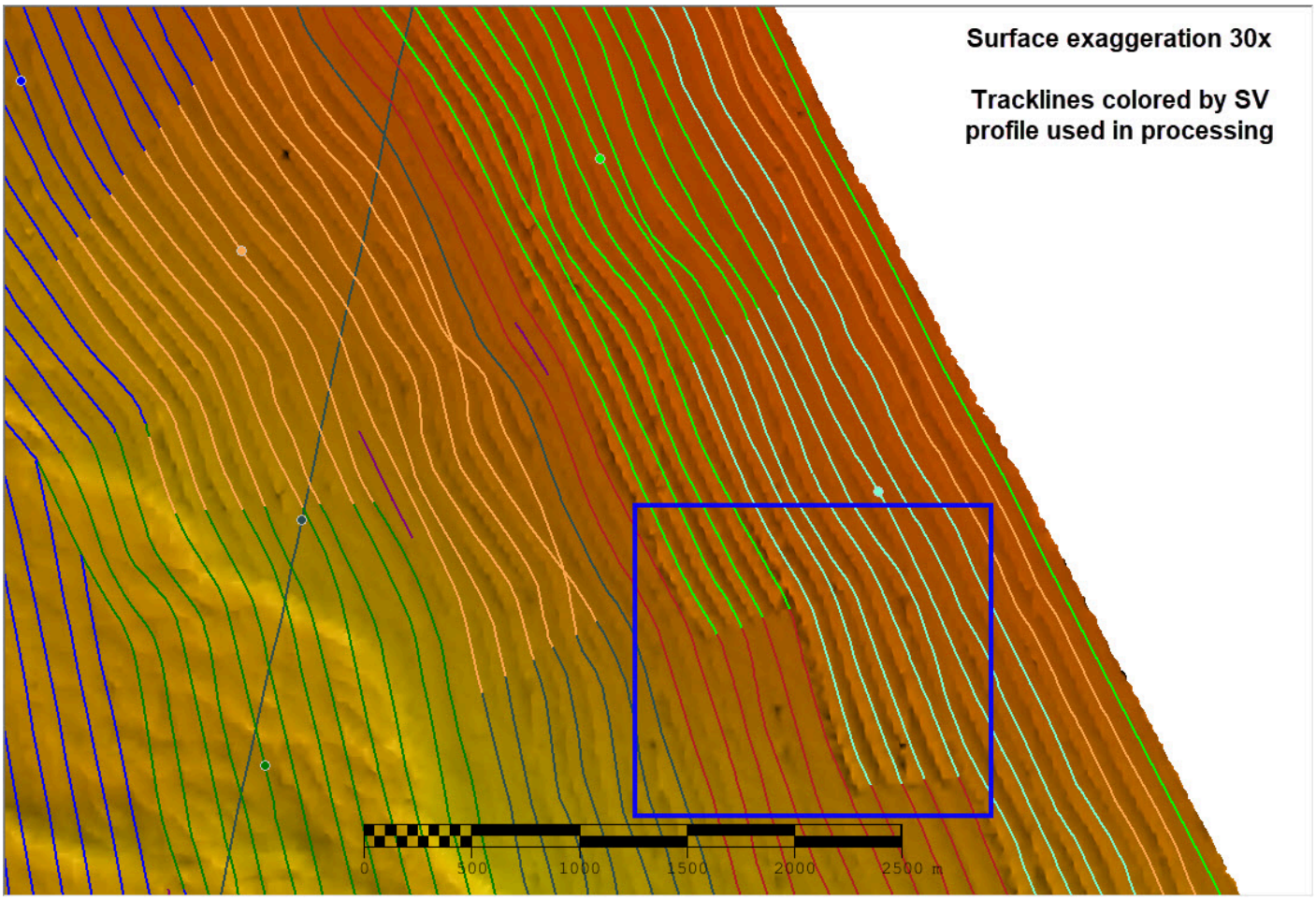


Figure 17: Example area of refraction visible in the bathymetric surface being geographically correlated with SVP used for processing.

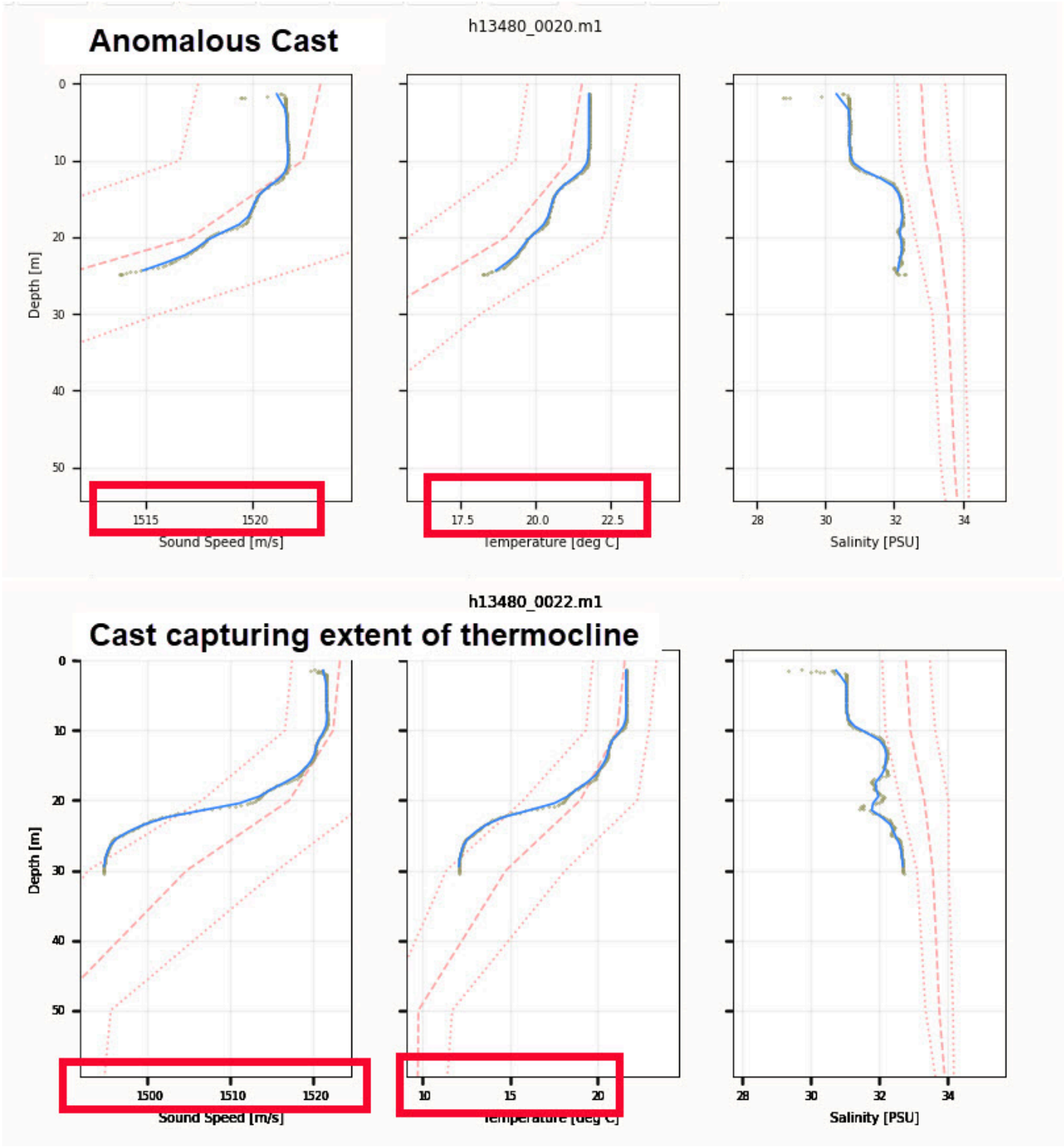


Figure 18: Comparison of MVP casts taken on Julian Day 255. Profile in the top pane did not completely encompass the thermocline, resulting in refraction of affected lines.

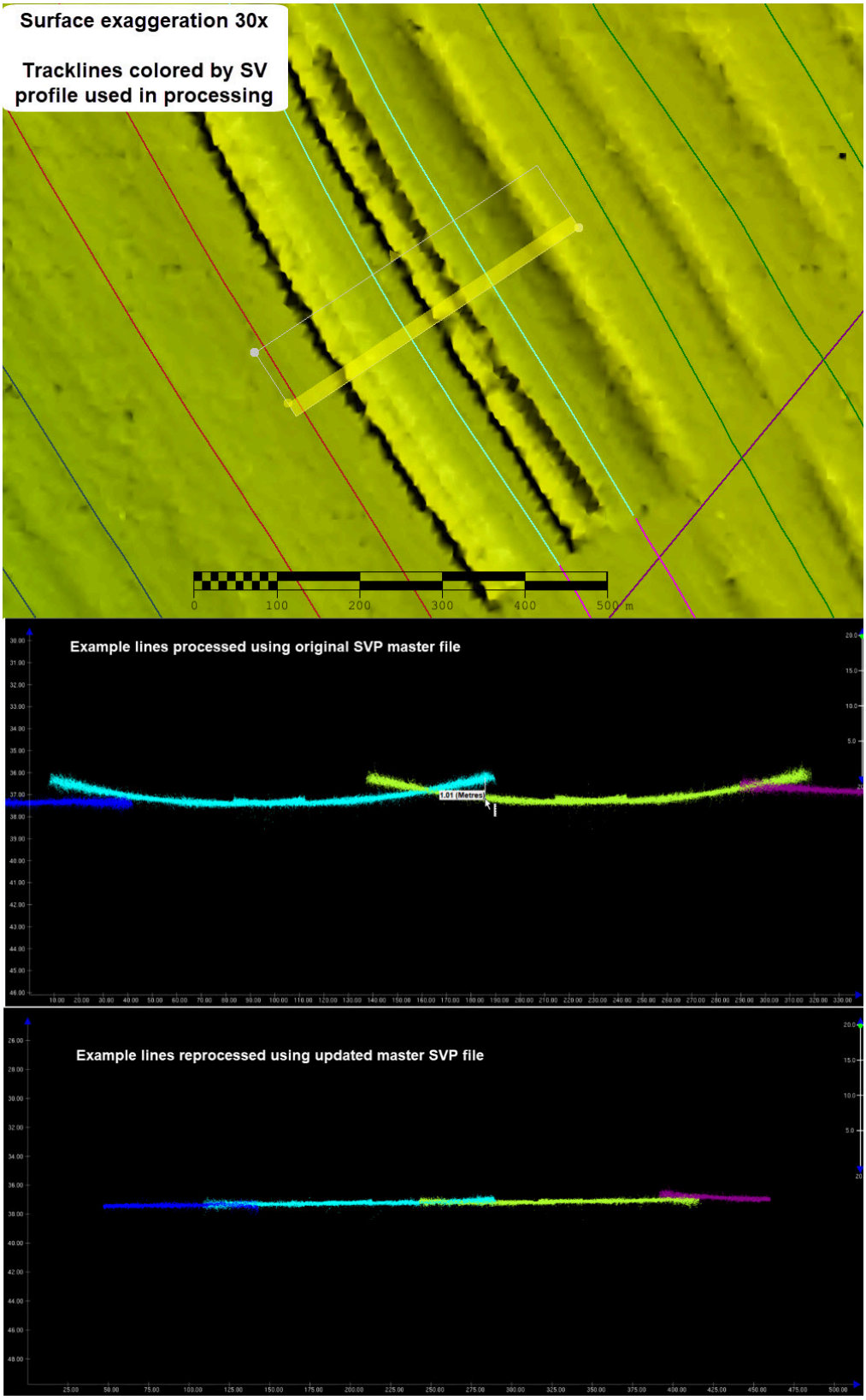


Figure 19: 2D view of MBES lines showing refraction (middle pane) and the results of reprocessing using updated master SVP file (bottom pane).

B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

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 70 sound speed profiles were collected within the survey limits of H13480 and display good spatial diversity (Figure 20). 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 with the exception of a portion of lines from Julian Day 255 which were processed using methods described in Section B.2.5 above.

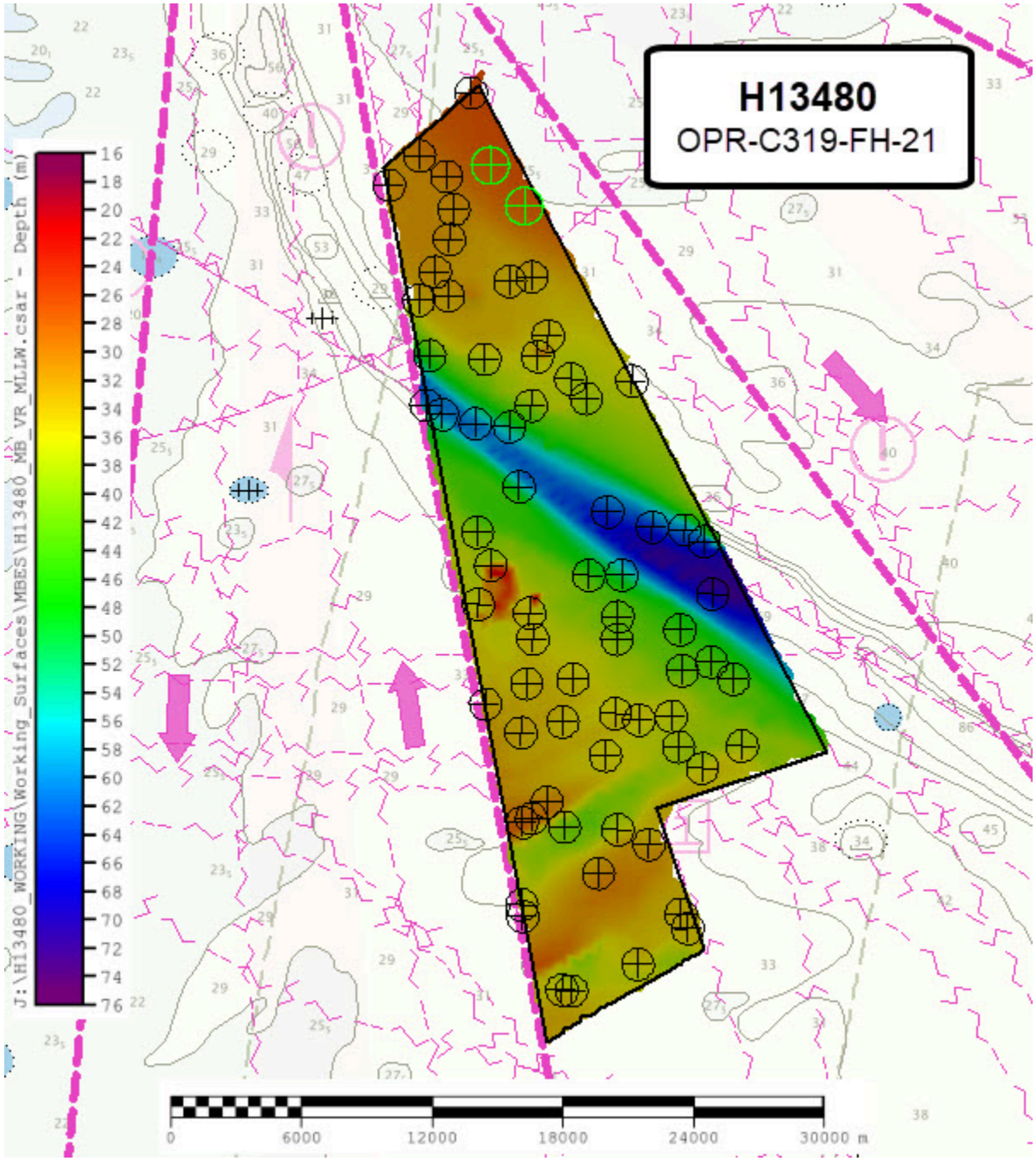


Figure 20: Overview of all SVP casts taken on H13480. Black targets represent casts used for processing. Green targets represent two casts removed from the master SVP file.

B.2.8 Coverage Equipment and Methods

S250 acquired 100% complete coverage MBES to meet complete coverage requirements on survey H13480, as specified in the project instructions, using dual Kongsberg EM2040 multibeam 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 include in the final processed data submission package (Figure 21).

While there are no holidays present within the bathymetric surface, there are sixteen holidays present within the backscatter mosaic. These holidays were created by either insufficient overlap of adjacent MBES swaths, or by the exclusion of crosslines and development lines from the mosaic (Figure 21).

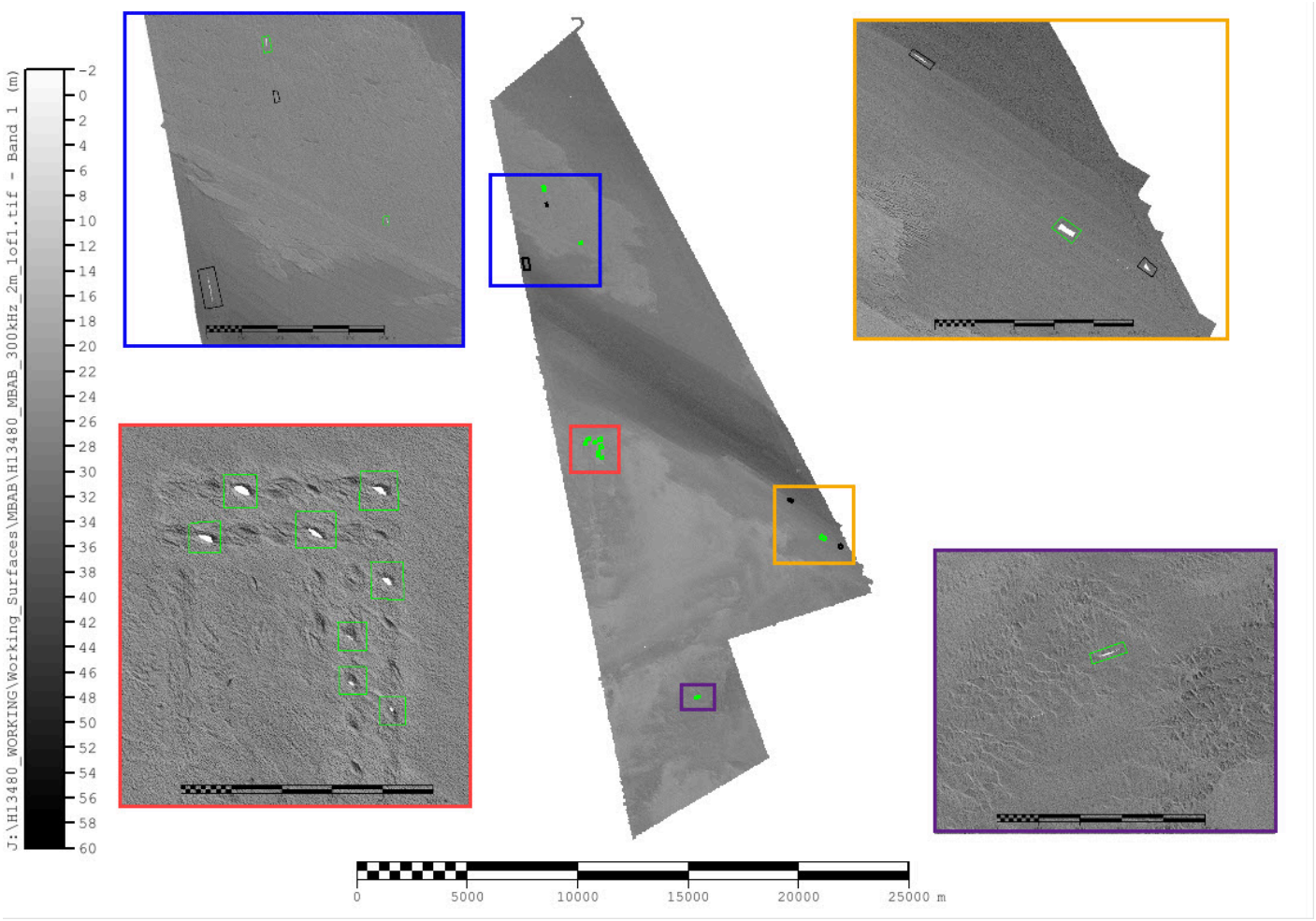


Figure 21: H13480 300kHz backscatter mosaic. Green boxes indicate holidays created by exclusion of lines perpendicular to mainscheme. Black boxes indicate holidays created by insufficient MBES swath overlap.

B.5 Data Processing

B.5.1 Primary Data Processing Software

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

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
H13480_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	17.0 meters - 75.2 meters	NOAA_VR	Complete MBES
H13480_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	16.3 meters - 75.2 meters	NOAA_VR	Complete MBES
H13480_MBAB_2m_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	NOAA_2m	Complete MBES

Table 10: Submitted Surfaces

Complete coverage requirements were met by complete coverage multibeam as specified under section 5.2.2.3 of the 2021 HSSD. Over 99.5% of bathymetric grid nodes meet density requirements specified in the 2021 HSSD (Figure 22). The location of failed nodes was examined and these nodes were found to be distributed along MBES swath edges where there was no overlap with neighboring swaths (Figure 23). Failed density nodes also occur along the slope found in the middle of the sheet and over prominent features (Figure 23).

After multiple rounds of surface cleaning, 27 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.

Five lines of side scan imagery were collected over an uncharted obstruction. Due to the small coverage extents and orientation of the lines, a mosaic was not created for submission. However, the raw and processed data are included in the submission package for H13480.

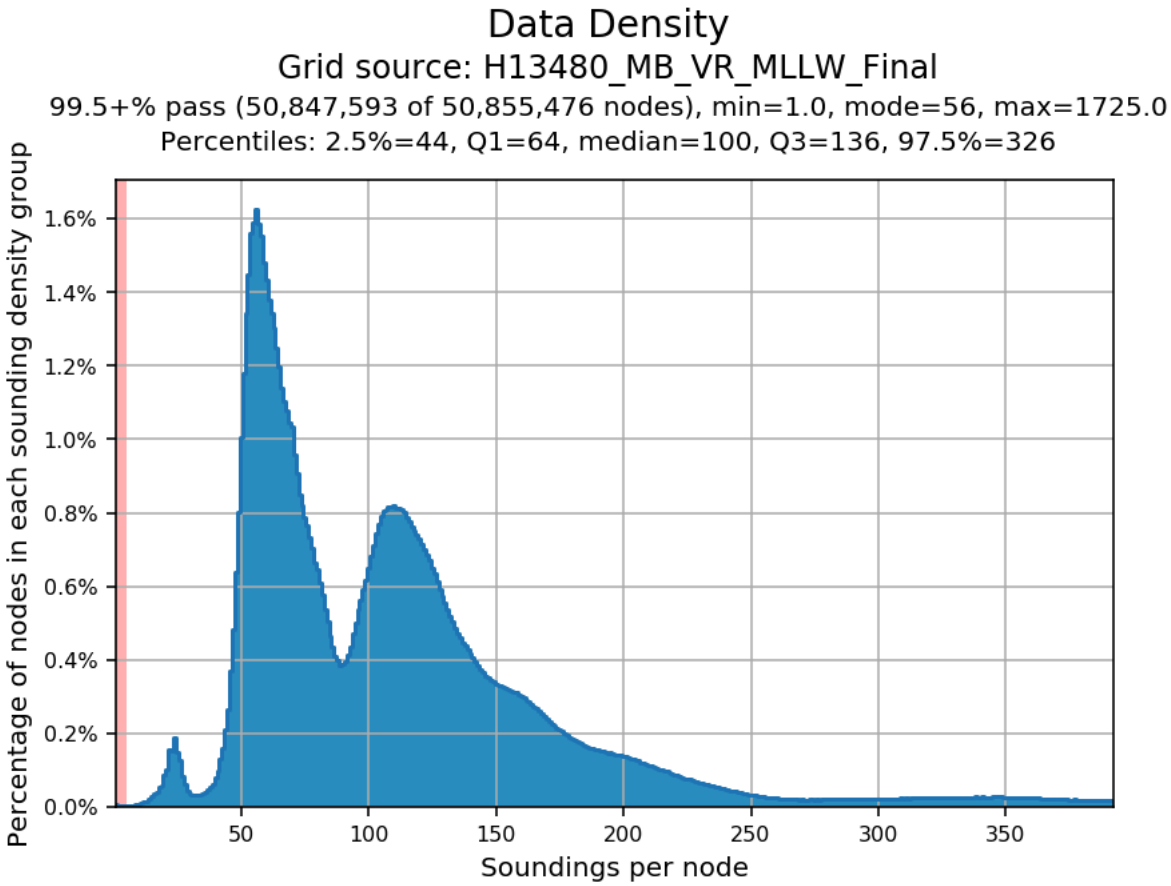


Figure 22: H13480 density statistics

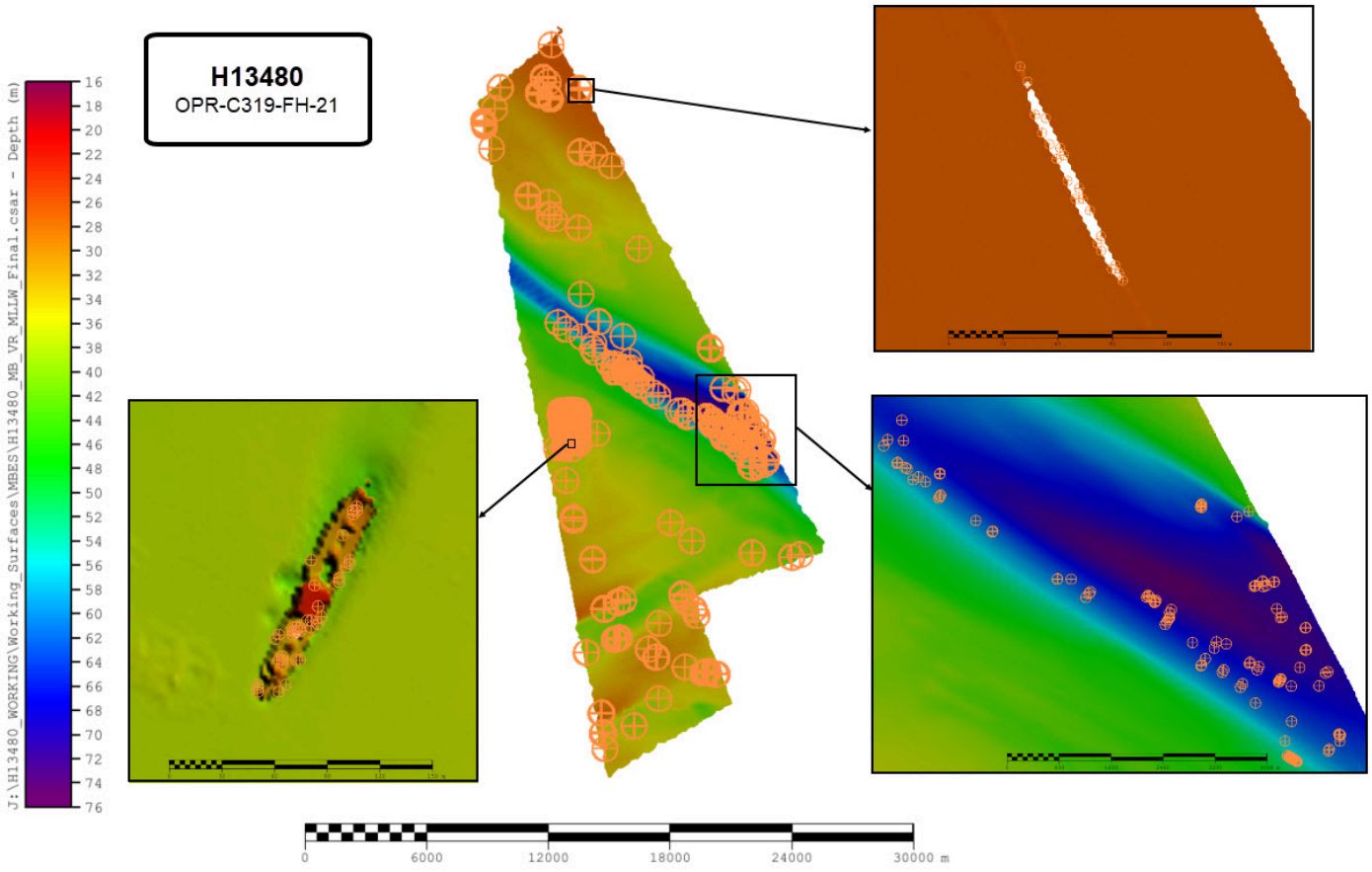


Figure 23: Example areas of bathymetric nodes not meeting density standards (indicated by orange targets). Over significant features (lower left), along a slope and deeper area (lower right), and along gaps between MBES swaths (upper right).

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 H13480.

C.1 Vertical Control

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

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-C319-FH-21_NAD83_VDatum_MLLW

Table 11: ERS method and SEP file

All soundings submitted for H13480 are reduced to MLLW 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 18.

The following PPK methods were used for horizontal control:

- RTX

Trimble-RTX service was used with an Applanix POS MVv5 GNSS_INS system to obtain highly accurate ellipsoidally referenced position data to meet ERS specifications for H13480 MBES data from vessel S250.

WAAS

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 H13480 should supersede charted data. A chart comparison was conducted between survey H13480 and previously charted ENC US3NY01M in accordance with methods outlined in the DAPR. Survey data and previously charted contours and soundings are in general agreement. However, evidence

of shoaling was seen in the southern area of the sheet (Figure 24). This soaling does not pose a hazard to navigation since soundings on the shoal are 35m and greater.

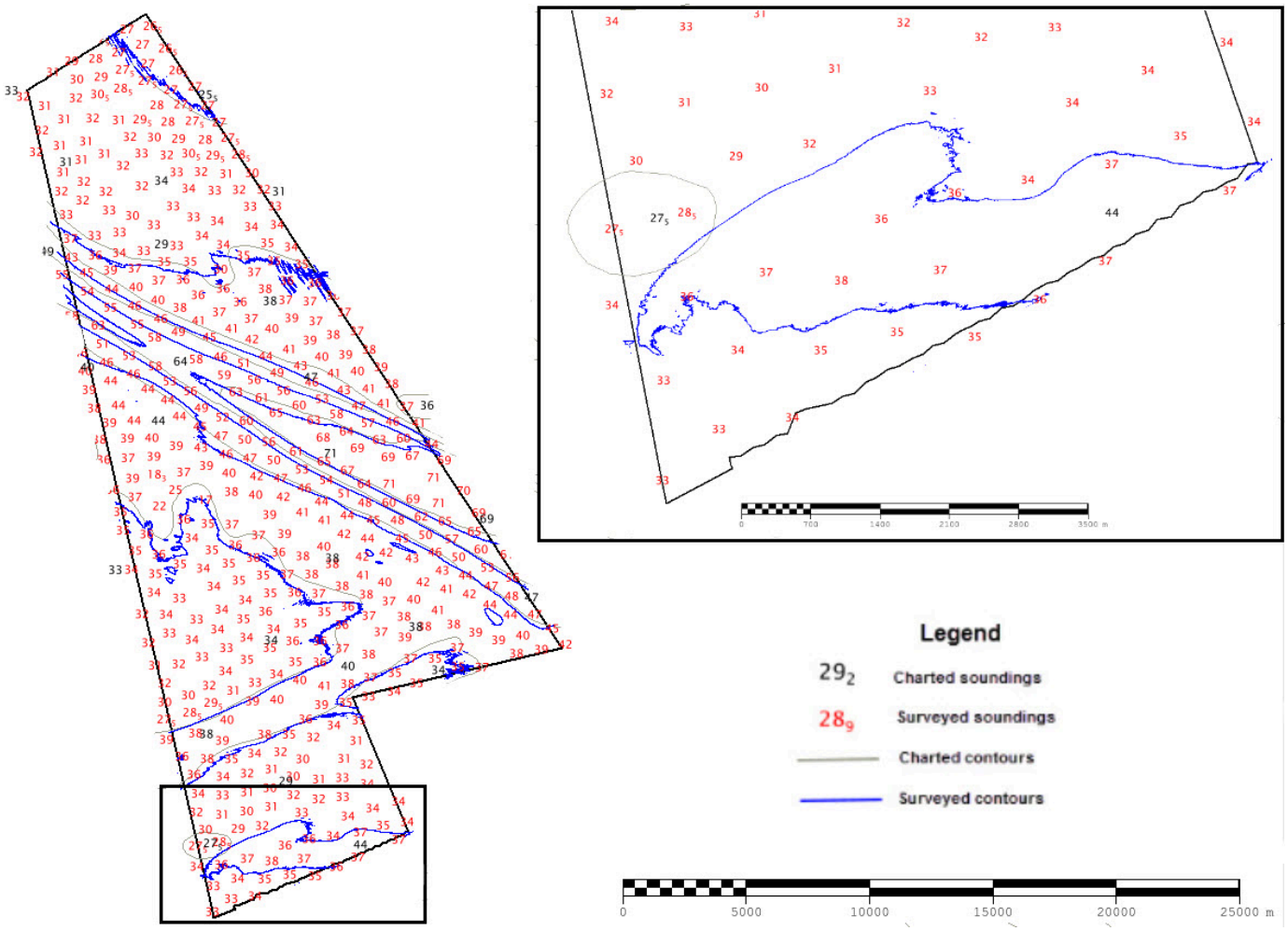


Figure 24: Comparison of survey data with charted soundings and contours from ENC US3NY01M. Area of shoaling in the southern area of the sheet does not pose a hazard to navigation.

Concur with clarification. As described in section D.1 of the HSSD. The field did not perform a chart comparison to two additional largest scale charts that are covering a section of the H13480 multibeam limits

The following ENCs were not used to performed chart comparison. US4NJ23M scale 1:80,000 and US4NY1AM scale 1:80,000.

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	1:400000	49	08/03/2020	02/18/2021

Table 12: Largest Scale ENCs

Concur with clarification. The survey limits are also covered by ENC US4NJ23M (1:80,000) and US4NY1AM (1:80,000)

D.1.2 Shoal and Hazardous Features

While evidence of shoaling is present in the southern area of the sheet, it does not pose a hazard to navigation. No Danger to Navigation Reports were submitted for this survey.

D.1.3 Charted Features

Twenty six charted features were assigned for investigation. Six obstructions were found appropriate for deletion, including five Unverified Charted Features (UCFs). Six new obstructions are recommended to be charted. Reference the sections below and the Final Feature File (FFF) for more information.

D.1.4 Uncharted Features

Six new obstructions were identified, investigated, and are included in the FFF.

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

Aids to navigation (ATONs) exist for this survey, but were not investigated.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Eight bottom samples were assigned and investigated (Figure 25). Reference the FFF for sample attribution.

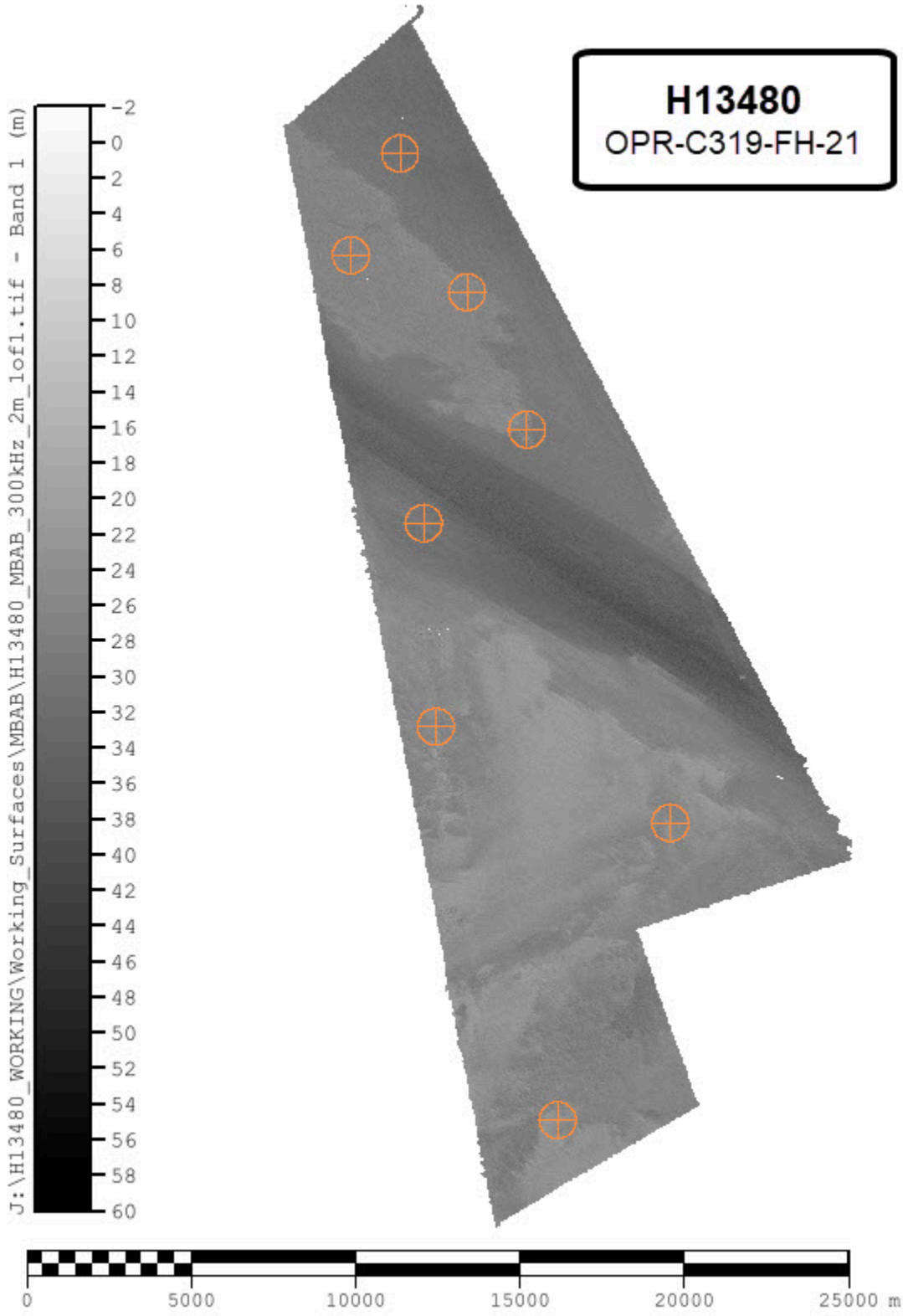


Figure 25: Bottom sample locations (orange targets) overlaid on H13480's 300kHz backscatter mosaic.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Seventeen charted submarine cables were assigned for investigation. No evidence of these cables was seen in the MBES coverage. These features are not included in the FFF 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 15:37:15 -04'00'
Jeffery Douglas, LT/NOAA	Operations Officer	02/17/2022	
Erin Cziraki	Sheet Manager	02/17/2022	CZIRAKI.ERIN.KAYE.1550015338 Digitally signed by CZIRAKI.ERIN.KAYE.1550015338 Date: 2022.02.18 15:29:08 -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