H12839

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12839

LOCALITY

State(s):	North Carolina
General Locality:	Approaches to Chesapeake Bay
Sub-locality:	36 Miles East of Currituck Beach

2015

CHIEF OF PARTY
LCDR Briana J. Welton, NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12839**

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):	**North Carolina**
General Locality:	**Approaches to Chesapeake Bay**
Sub-Locality:	**36 Miles East of Currituck Beach**
Scale:	**40000**
Dates of Survey:	**07/30/2015 to 08/24/2015**
Instructions Dated:	**10/19/2015**
Project Number:	**OPR-D304-FH-15**
Field Unit:	**NOAA Ship *Ferdinand R. Hassler***
Chief of Party:	**LCDR Briana J. Welton, NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks: The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via http://www.ncei.noaa.gov/.

Table of Contents

List of Tables

List of Figures

Appendix

Descriptive Report to Accompany Survey H12839

Project: OPR-D304-FH-15

Locality: Approaches to Chesapeake Bay

Sublocality: 36 Miles East of Currituck Beach

Scale: 1:40000

July 2015 - August 2015

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: LCDR Briana J. Welton, NOAA

A. Area Surveyed

Survey H12839 was conducted in the Chesapeake Bay, with a sublocality of 36 miles East of Currituck Beach as shown in Figure 1.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
36° 30' 0.51" N 75° 18' 29.48" W	36° 11' 56.45" N 75° 12' 58.94" W

Table 1: Survey Limits

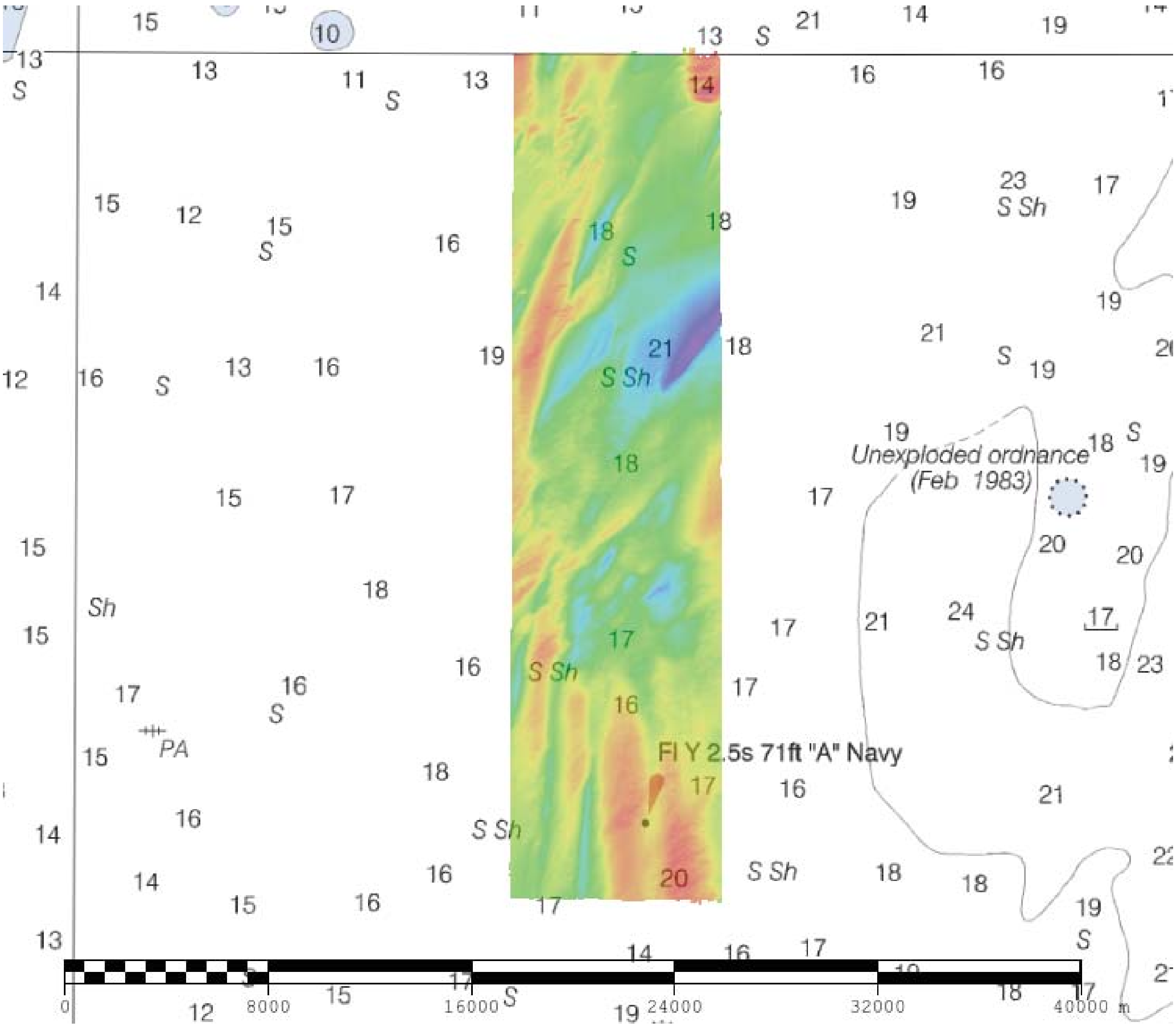


Figure 1: H12839 Survey Limits

Survey limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products. In addition, this project will improve the chart for traffic navigating the Atlantic Ocean Channel and will support Bureau of Ocean Energy Management (BOEM) research in the area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

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 Multibeam with Backscatter

Survey coverage was in accordance with the requirements listed above and in the HSSD.

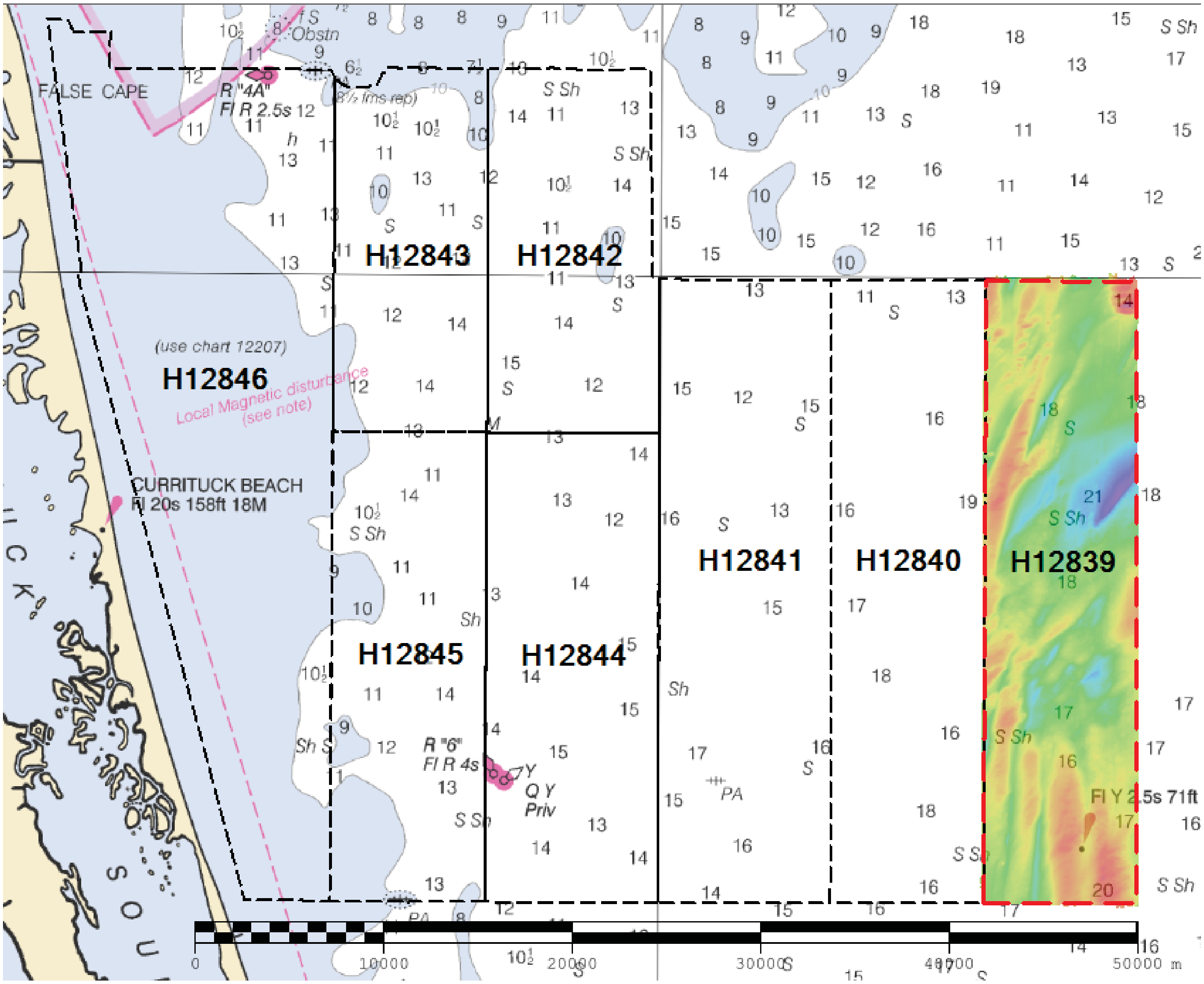


Figure 2: Survey layout for OPR-D304-FH-15 over raster chart 12200.

A.5 Survey Statistics

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

	HULL ID	*S250*	*Total*
LNM	SBES Mainscheme	0	0
	MBES Mainscheme	1112.7	1112.7
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	71.8	71.8
	Lidar Crosslines	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			80.2

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/30/2015	211
07/31/2015	212

Survey Dates	Day of the Year
08/05/2015	217
08/07/2015	219
08/08/2015	220
08/10/2015	222
08/11/2015	223
08/18/2015	230
08/19/2015	231
08/20/2015	232
08/23/2015	235
08/24/2015	236

Table 3: Dates of Hydrography

Mainscheme survey lines were run with a dual-head multibeam echosounder. Linear nautical miles were calculated using statistics from the port head.

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	3.77 meters

Table 4: Vessels Used

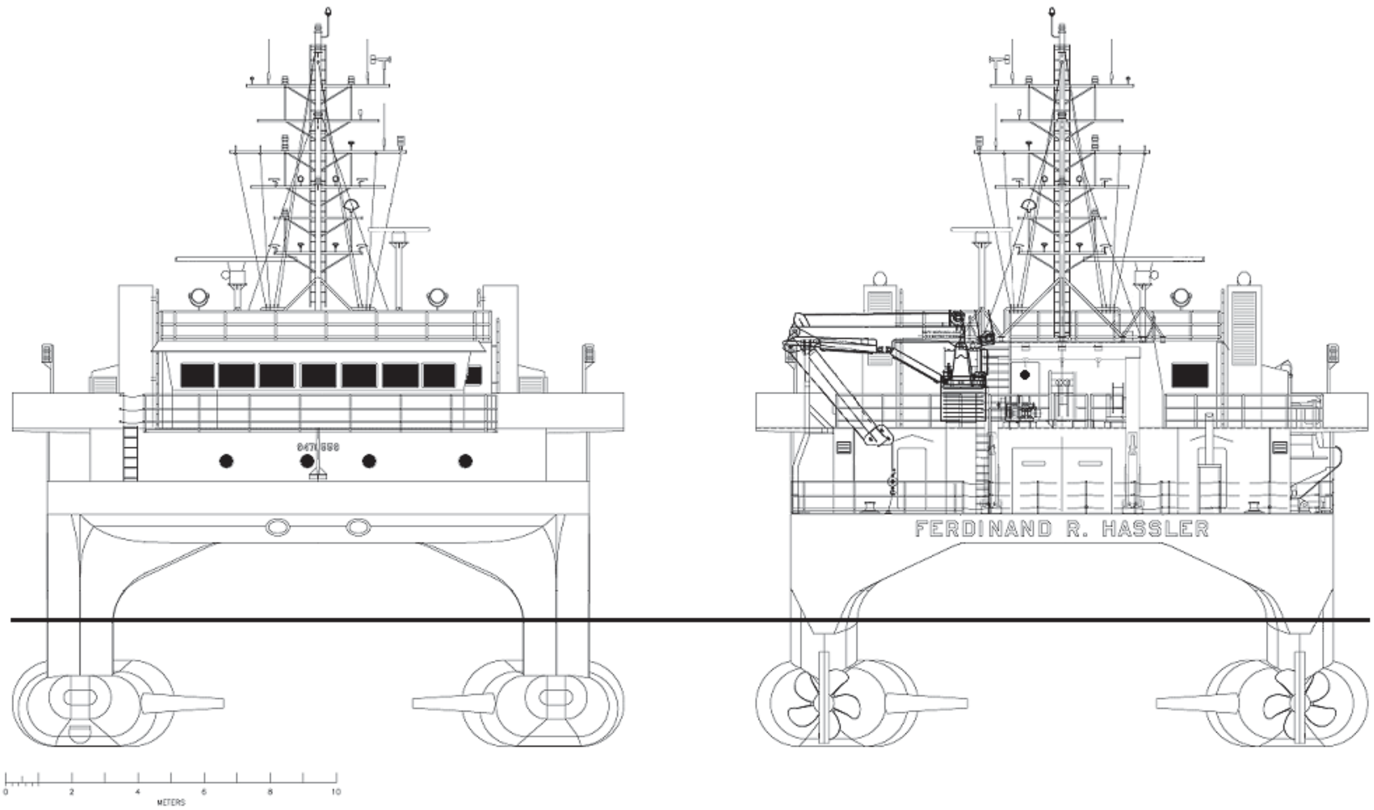


Figure 3: NOAA Ship FERDINAND R. HASSLER

NOAA Ship FERDINAND R. HASSLER (S250), shown in Figure 3, acquired all surveyed soundings during operation for H12839

B.1.2 Equipment

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

Manufacturer	Model	Type
Reson	7125	MBES
Applanix	POS M/V 320 V5	Positioning and Attitude System
Hemisphere	MBX-4	Sound Speed System
AML	MicroCTD	Sound Speed System
Brooke Ocean	MVP-200	Sound Speed System
RESON	SVP-70	Sound Speed System
Sea Bird	SBE 19+	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 6.45% of mainscheme acquisition.

A geographic plot of crosslines is shown in Figure 4. Crosslines were filtered to remove soundings greater than 45 degrees from nadir. To evaluate crossline agreement, two 2-meter surfaces were created: one from crossline depths, the other from mainscheme depths. These two surfaces were differenced using CARIS HIPS/SIPS. The 2.6 million nodes have a difference value range from -0.89 meters and 1.84 meters. The statistical analysis of the differences between the mainscheme and crossline surfaces is shown in Figure 5. The average difference between the surfaces is 0.06 meters with a standard deviation of 0.09 meters; Ninety-five percent of nodes agree within +/- 0.17 meters of the mean.

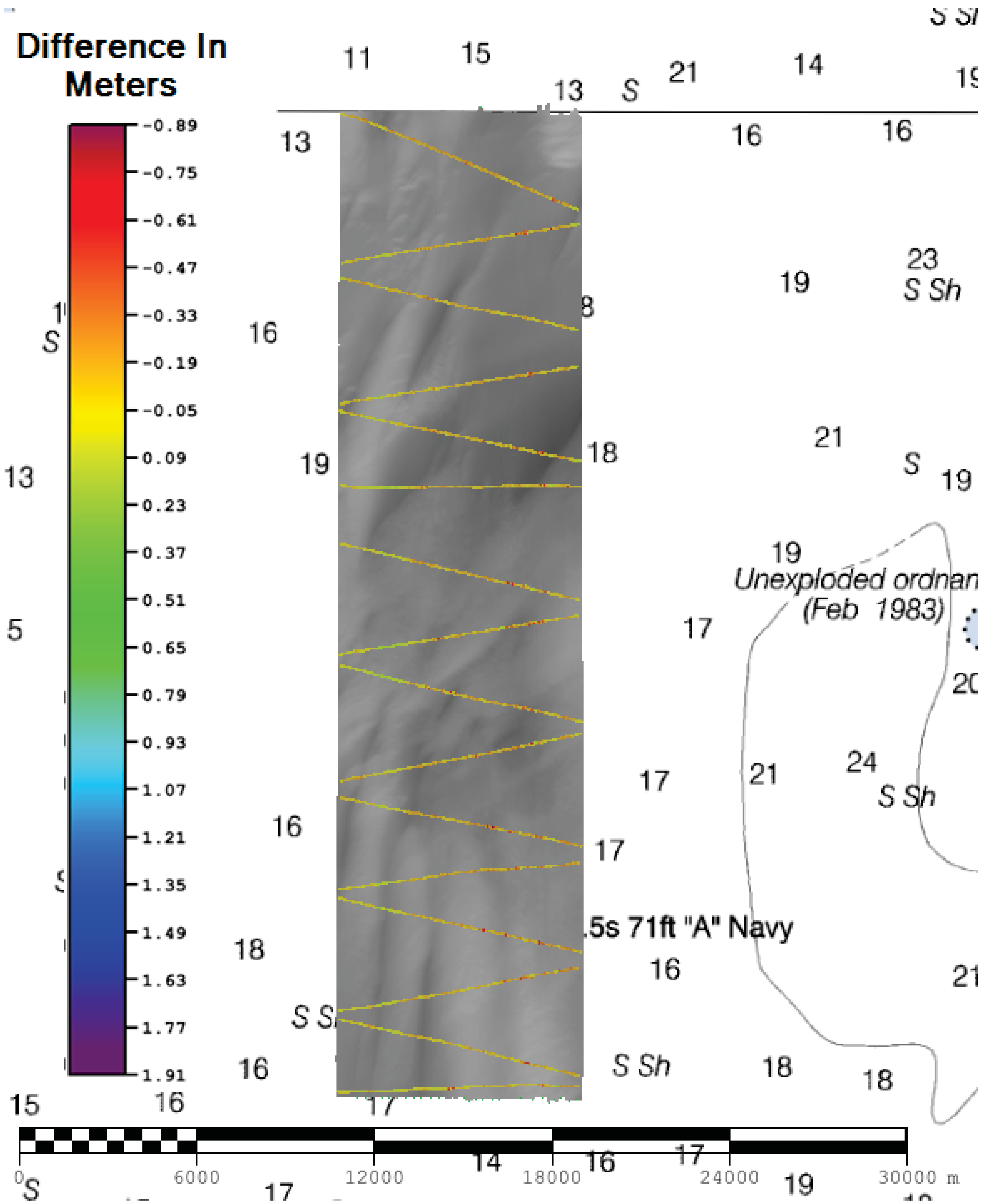


Figure 4: H12839 MBES crossline data overlaid on mainscheme data, shown in grey.

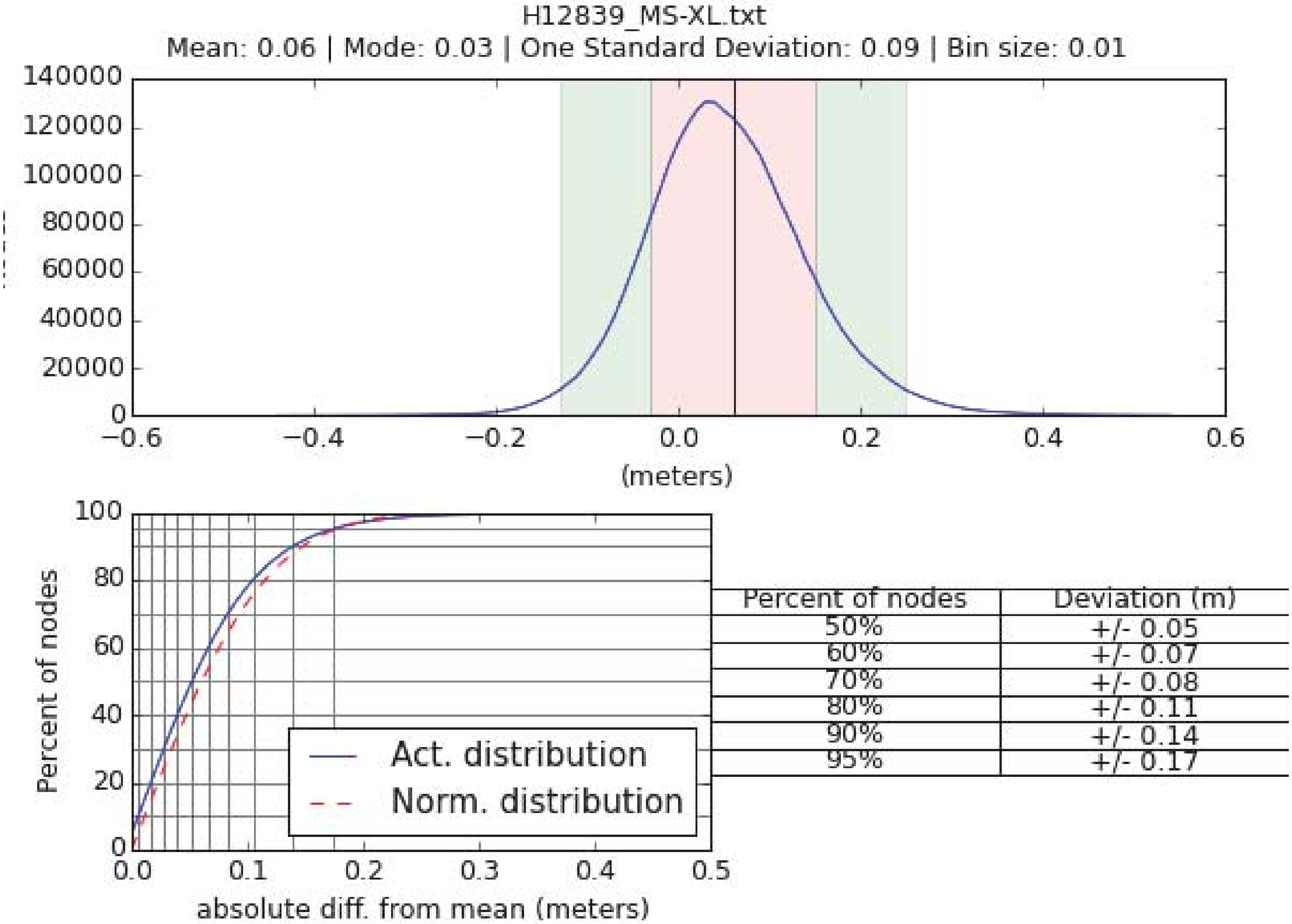


Figure 5: H12839 crossline difference statistics: mainscheme minus crossline.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning	Method
0.01 meters	0.102 meters	VDATUM

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S250	1 meters/second	1 meters/second	0.5 meters/second

Table 7: Survey Specific Sound Speed TPU Values

Two tidal models were available for water level corrections associated with survey H12839. A discrete tide zone file, produced by CO-OPS for project OPR-B304-FH-15, was provided to the field unit. Additionally, a vertical datum transformation (VDatum) model was delivered to the field unit in the project instructions. All data for survey H12839 were reduced to MLLW via VDatum. This model functioned as a gridded separation model for GPS tide computations with a 0.081 meter uncertainty. Final TPU calculations are derived from the following sources: VDatum separation model, sound velocity (MVP and surface sound velocimeter), HVF uncertainties, and SBET post processed uncertainty. Error data sources applied through CARIS processing software are listed in Figure 6.

Uncertainty	*Source*
Position	Realtime
Sonar	Vessel
Heading	Realtime
Pitch	Realtime
Roll	Realtime
Vertical	Realtime heave
Tide	Static

Figure 6: Sources of error data applied during CARIS processing.

B.2.3 Junctions

One contemporary survey, to the west, junctions with H12839. See Figure 7 for further information.

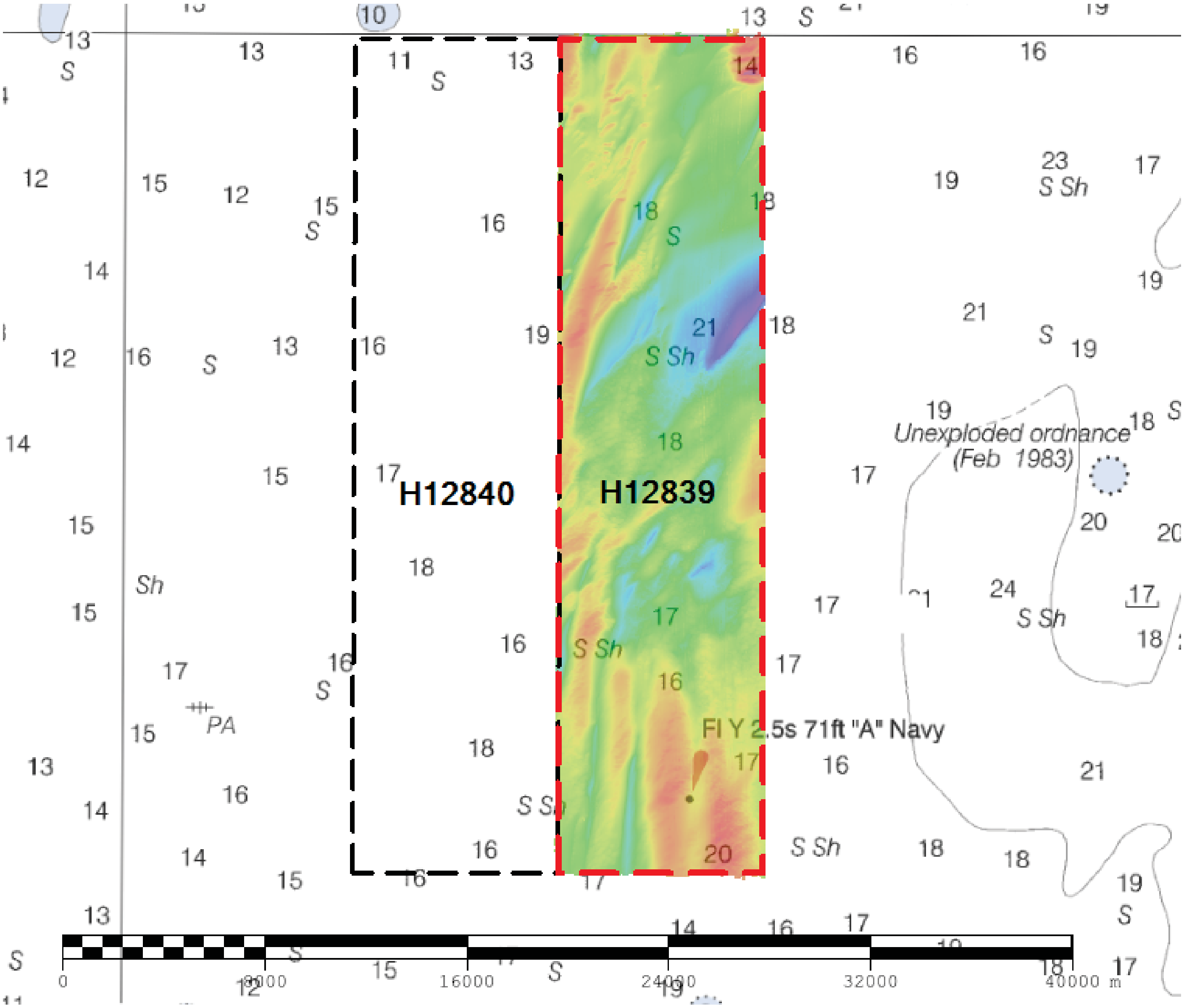


Figure 7: Junction associated with survey H12839.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12840	1:40000	2015	NOAA Ship FERDINAND R. HASSLER	W

Table 8: Junctioning Surveys

H12840

Survey H12839 junctions with its contemporary survey H12840. Nodes overlap approximately 200 meters to the west. The minimum and maximum depth difference between the two surveys is -1.07 meters and 1.14 meters respectively. Of the greater than 505 thousand overlapping nodes, the average difference is 0.14 meters with a standard deviation of 0.09 meters; Ninety-five percent of the differenced surface nodes are within +/- 0.17 meters of the mean, as shown in Figure 8.

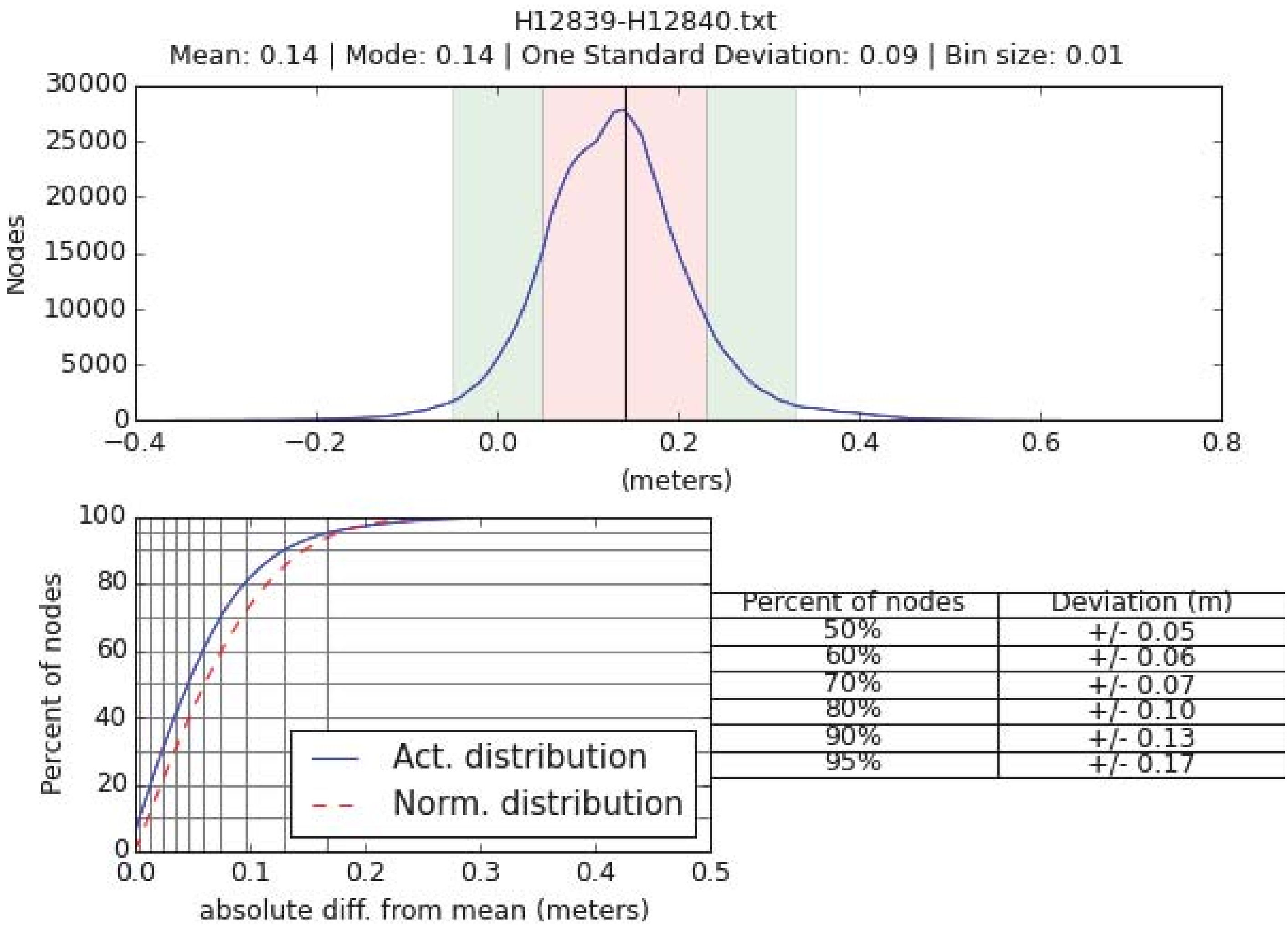


Figure 8: Difference surface statistics for H12839 and H12840.

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 Errors

Refraction issues due to environmental conditions exist in survey H12839. As shown in Figure 9, the likely culprit was the mid-water column thermocline which resides between 10 and 20 meters. This thermocline saw sound speed variations of up to 30 meters per second.

A ray tracing uncertainty analysis was performed to help identify casts that exceeded the allowance for refraction as defined in Section 5.2.3.4 Error Budget Analysis for Depths (See Figure 10). The blue lines in the graph are consecutive cast comparisons and the red dots are the allowable vertical error due to refraction. In cases where the blue line exceeds the red dots, those are examples of where the estimations show the allowable refraction error is being exceeded. As we can see, refraction issues are present on data collected between DN217 to DN220 and DN235 to DN236. Sound speed casts were taken at a very frequent rate, yet refraction still was an issue, because it was believed that the sound speed variability in nature, specifically, the survey lines may have crossed a significant below-layer sound speed gradient. An example from DN217 shows two profiles which were taken only 18 minutes apart, yet the estimated outerbeam refraction error is 0.658m (See Figure 11).

A number of methods were used to mitigate the refraction. Initially the sonars were being operated using its entire 140 degree swath. After an in port in Norfolk, VA the hydrographer instituted two changes: the use of Cast-Time to model these refraction issues and the decrease in swath width. This change most likely is the reason why data from DN238 and 239 do not exhibit the extreme refraction issues seen on the earlier days.

To mitigate the impacts of refraction on data that was already collected, a number of methods were used. First, lines from DN217, DN219, and DN220 were filtered to 66 degrees on the port side for port lines and 66 degrees on the starboard side for starboard lines. Filtered lines were then inspected by the hydrographer to ensure they did not cause holidays or remove data from the tops of shoals or features. In areas this did occur, data was re-accepted by the hydrographer in subset editor. Secondly the hydrographer utilized Subset Editor in CARIS HIPS/SIPS to further eliminate poor data (See Figures 12 and 13).

This did not eliminate all instances of refraction in H12839. Though the data does not meet allowable error budget for refraction, the surfaces do meet the Total Vertical Uncertainty requirements (See Section B.5.4 Total Vertical Uncertainty Analysis in this report for more information).

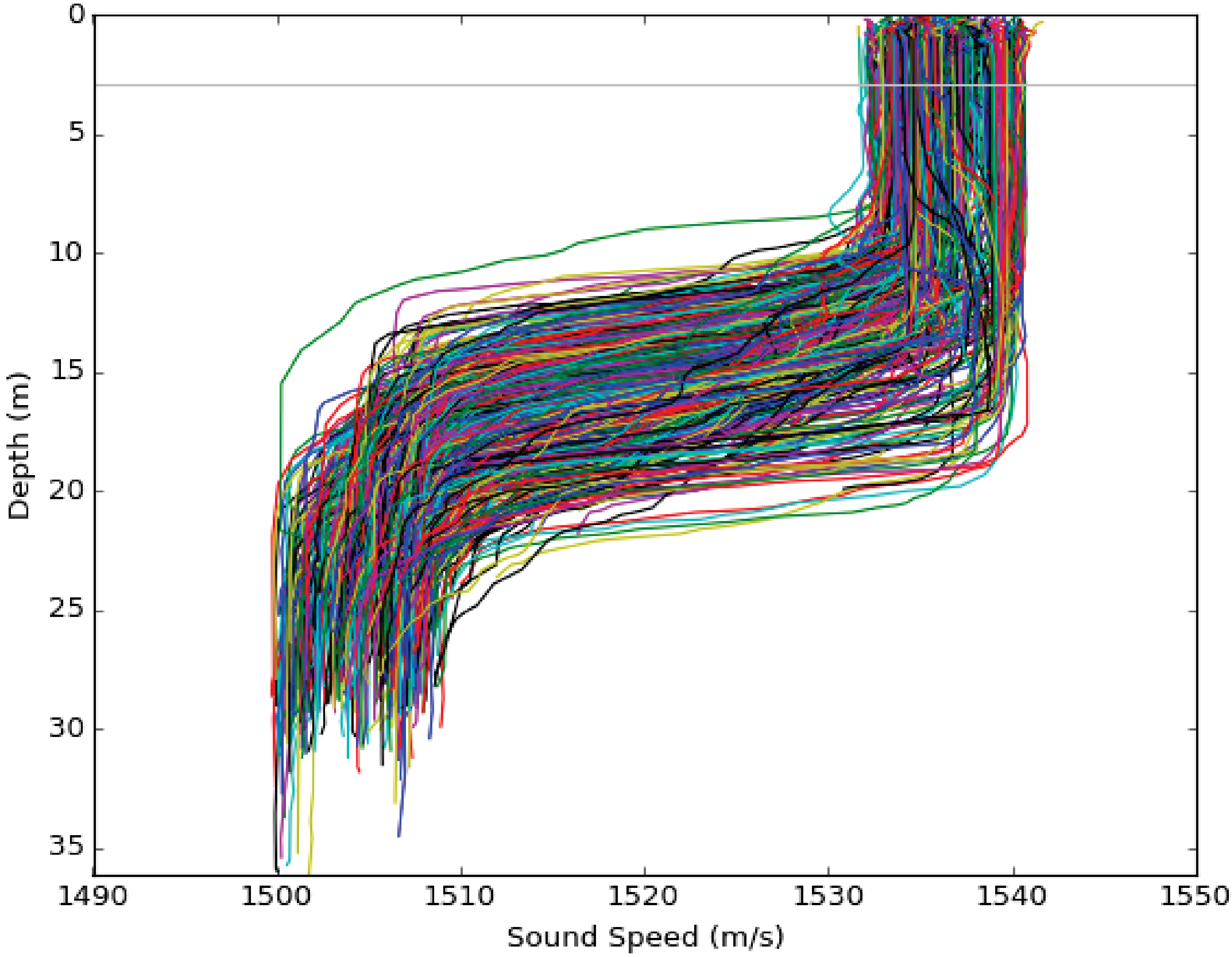


Figure 9: Sound speed measurements related to H12839.

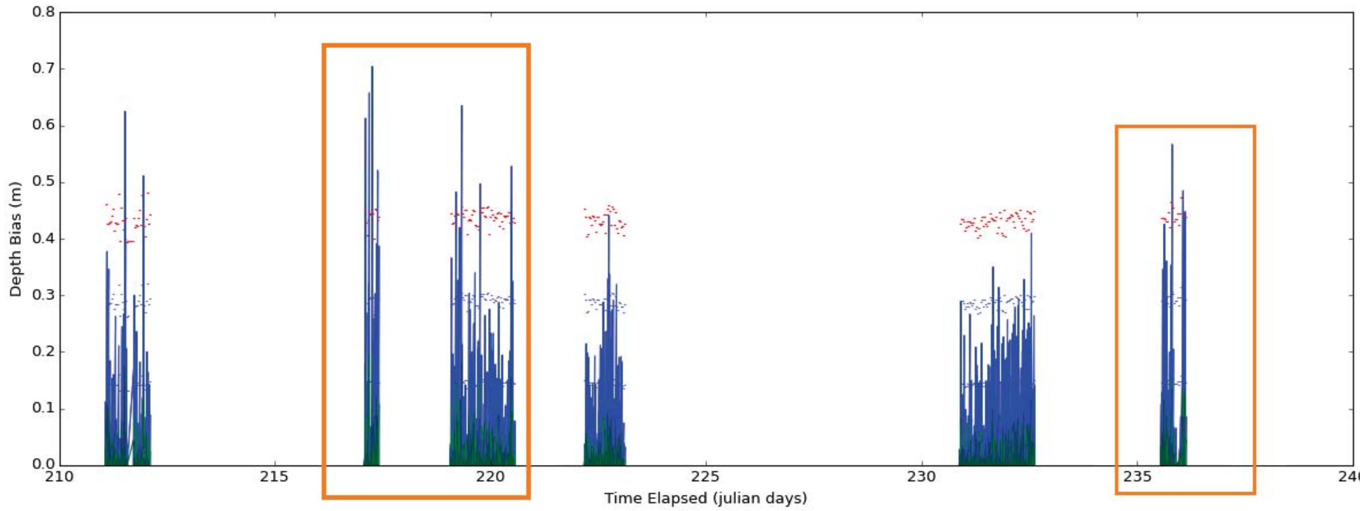


Figure 10: Ray tracing analysis.

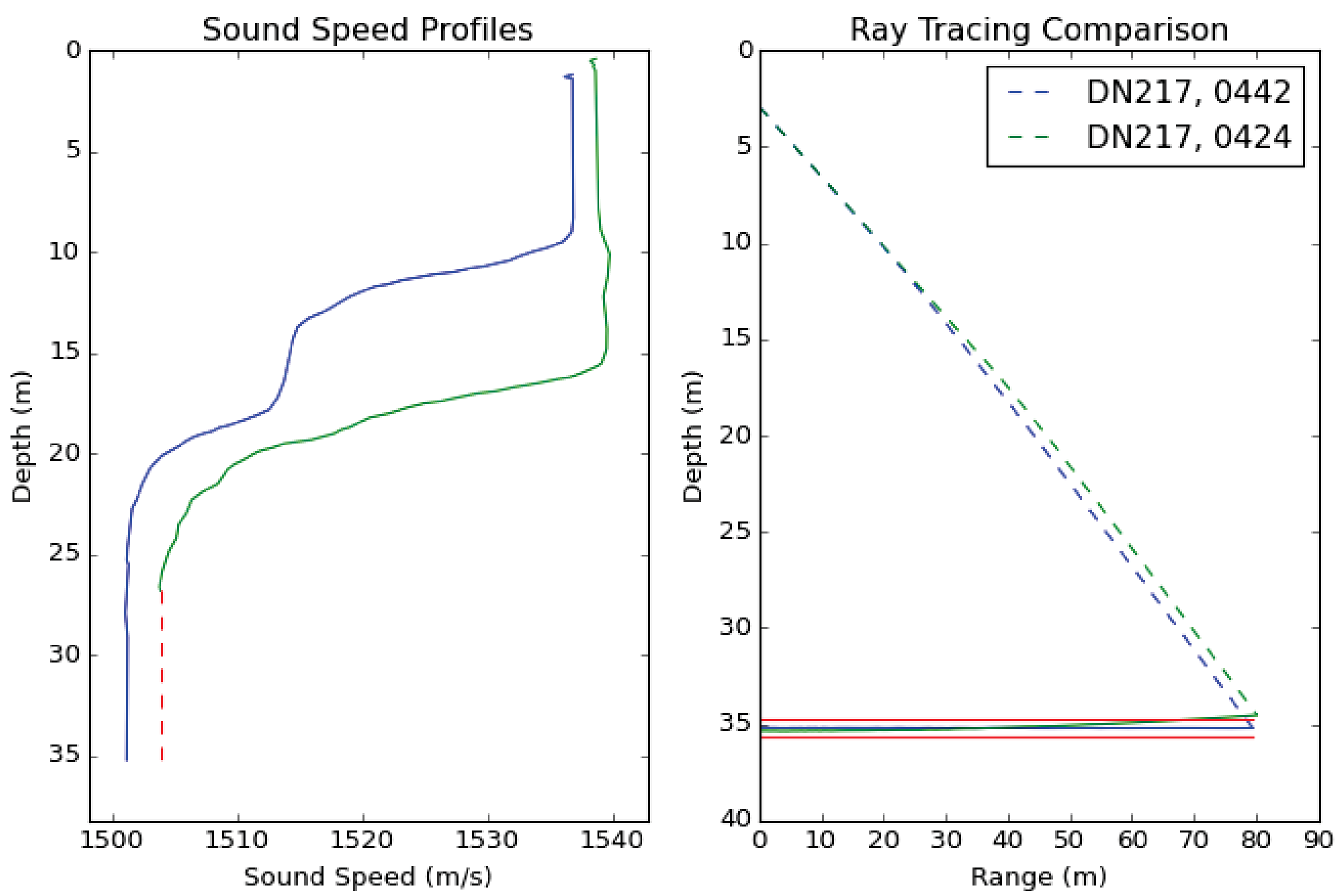


Figure 11: Example of two sound speed profiles from DN217 which were taken 18 minutes apart.

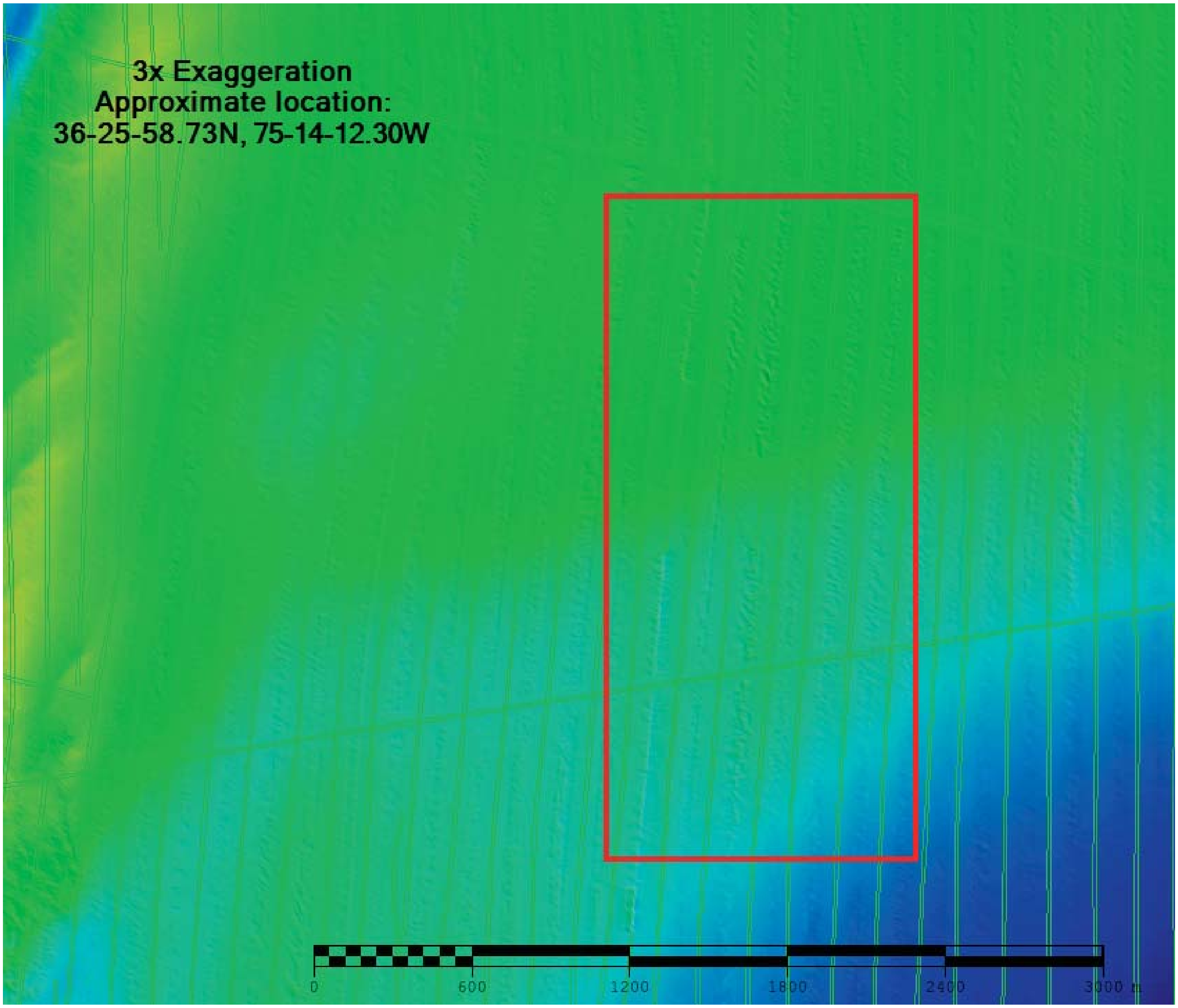


Figure 12: Example where the surface shows signs of refraction in H12839.

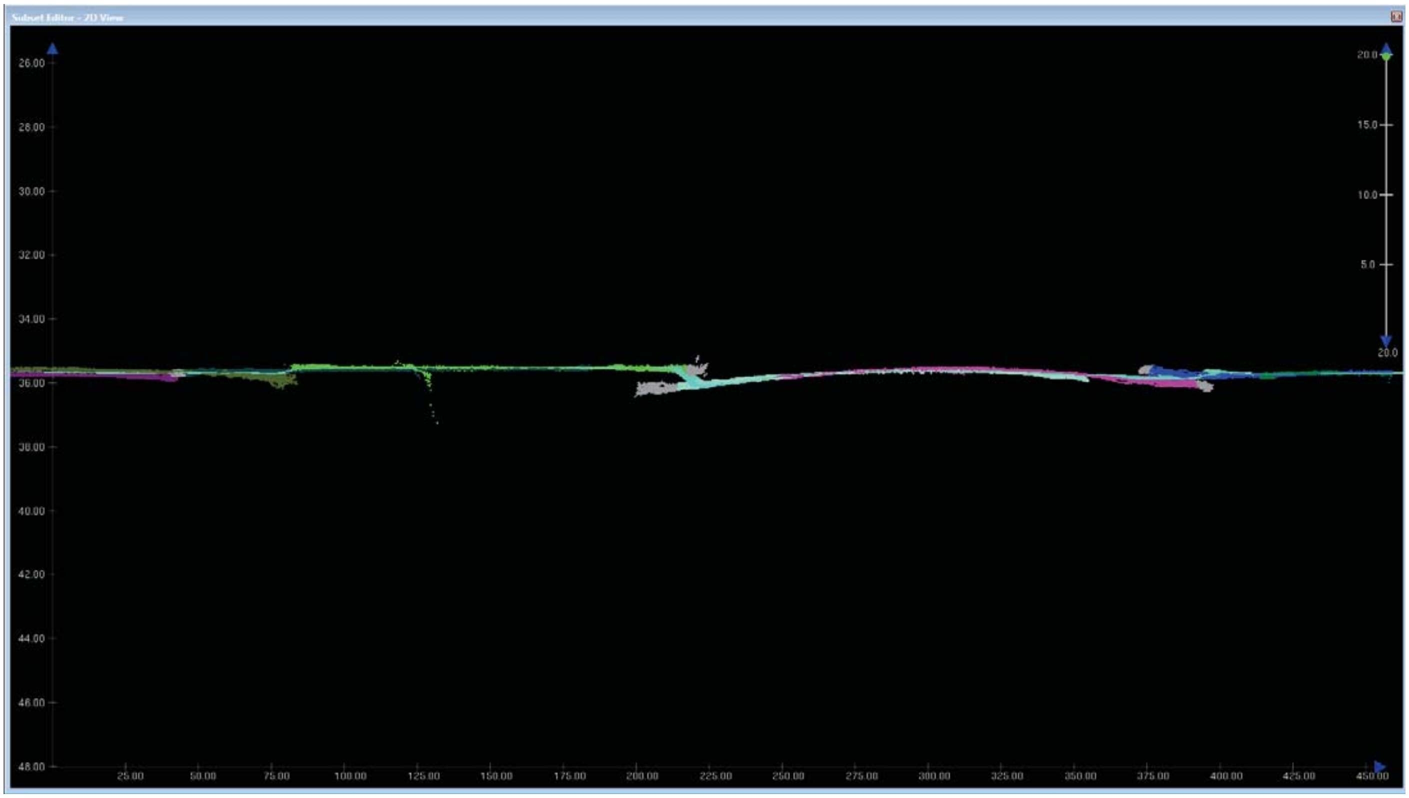


Figure 13: Subset of refraction data.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: A total of 484 sound speed measurements were taken within the boundaries of H12839 (See Figure 14). These sound speed measurements were collected using the MVP-200 approximately every 30 minutes. Comparisons were made by the survey watch to assess sound speed variation in the water column.

Sound speed corrections were applied in CARIS HIPS/SIPS using Nearest in Distance Within Time (NIDWT) of every 4 hours for the entire survey.

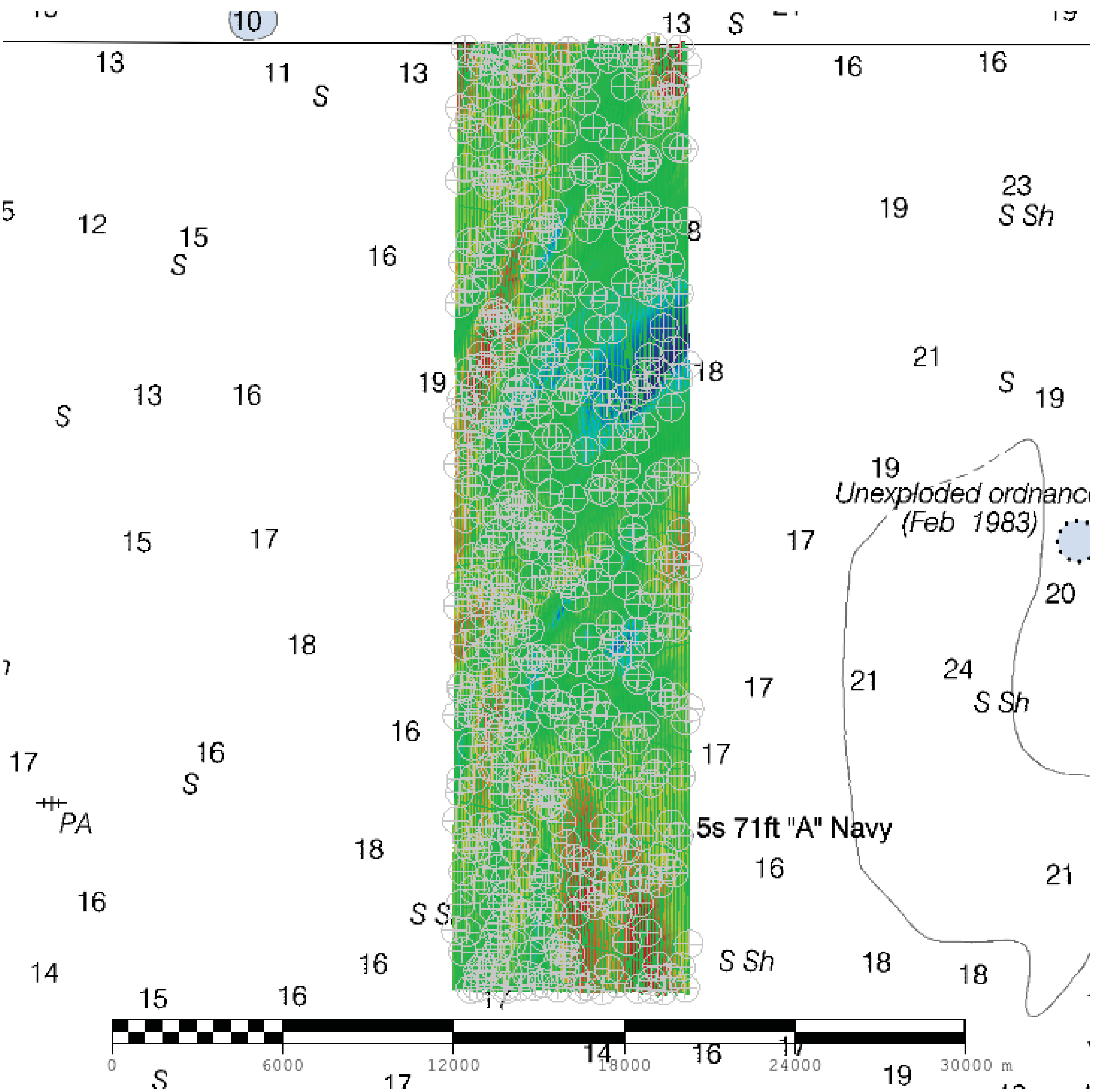


Figure 14: H12839 sound speed profile locations.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

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

Backscatter was logged in RESON datagram 7008 snippets record in the raw .s7k files. The .s7k file also holds the navigation record and bottom detections for all lines of survey H12839. The files were paired with the CARIS HDCS data, imported, and processed using Fledermaus Geocoder Toolbox (FMGT). The FMGT projects and backscatter mosaic imagery is included in the field submission. The processed mosaic is formated as a geo-referenced tiff image per specifications. The following information is provided as metadata for the processing branch:

Backscatter data processing and mosaicing performed in Fledermaus FMGT version 7.4.4b using Reson De-TVG plugins where appropriate.
Backscatter data has a histogram range of 10 to -70dB
Backscatter data is provided in separate layers broken down by survey vessel hull number and sonar operating frequency.
H12839_S250_Port_400kHz | 4m resolution mosaic | Absorption Coefficient = 100dB/km
H12839_S250_Stbd_400kHz | 4m resolution mosaic | Absorption Coefficient = 100dB/km

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile V_5_3

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
H12839_MB_2m_MLLW	CUBE	2 meters	23.55 meters - 42.38 meters	NOAA_2m	Complete MBES
H12839_MB_2m_MLLW_Final	CUBE	2 meters	23.55 meters - 40.00 meters	NOAA_2m	Complete MBES
H12839_MB_4m_MLLW	CUBE	4 meters	23.56 meters - 42.30 meters	NOAA_4m	Complete MBES
H12839_MB_4m_MLLW_Final	CUBE	4 meters	36.00 meters - 42.30 meters	NOAA_4m	Complete MBES

Table 9: Submitted Surfaces

B.5.3 Data Density

A density analysis was run to calculate the number of soundings per surface node. The results determined that 99.9% of all nodes contained five or more soundings which meets the data density specifications (See Figures 15 and 16).

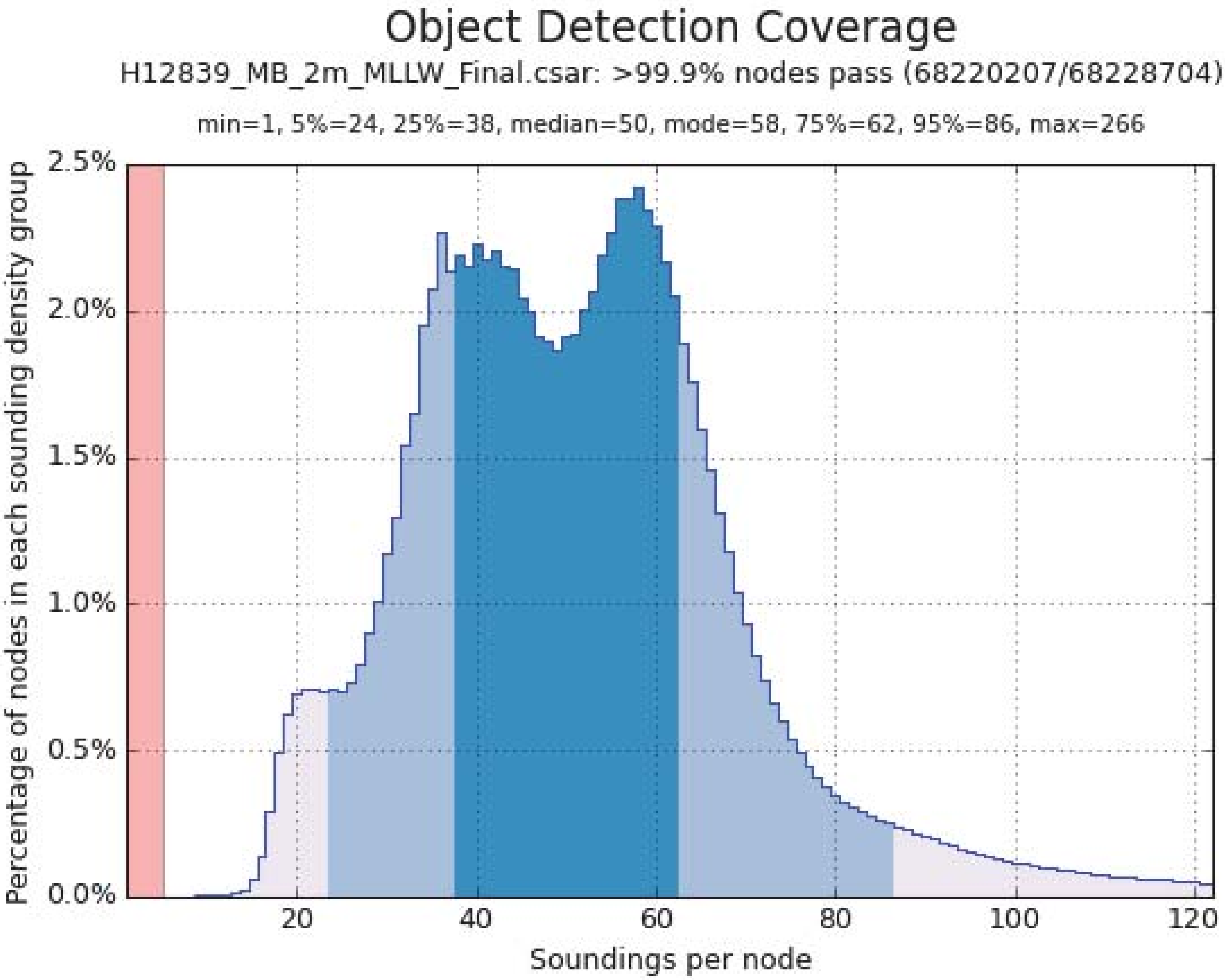


Figure 15: Data density of the 2-meter finalized surface.

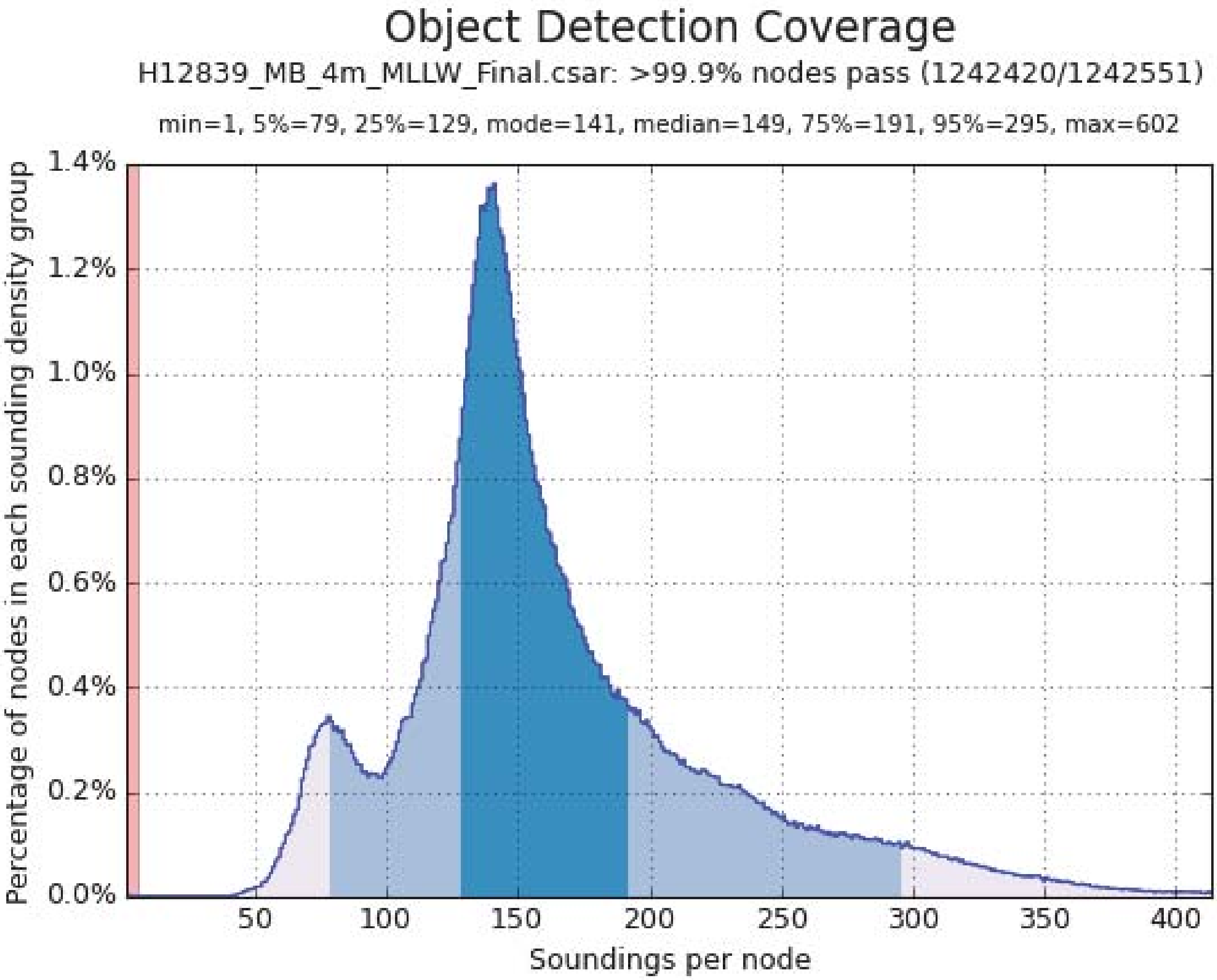


Figure 16: Data density of the 4-meter finalized surface.

B.5.4 Total Vertical Uncertainty Analysis

Pydro's Finalized CSAR QA tool was used to calculate the percentage of nodes which meet total vertical uncertainty (TVU) specifications. The resulting statistical analysis yielded 99.9% nodes both surfaces meet TVU specifications (See Figures 17 and 18). In addition, a custom layer was created for the finalized surfaces submitted in correlation with H12839. The layer was derived from the difference between the calculated uncertainties of individual nodes and the allowable uncertainty at the coupled node.

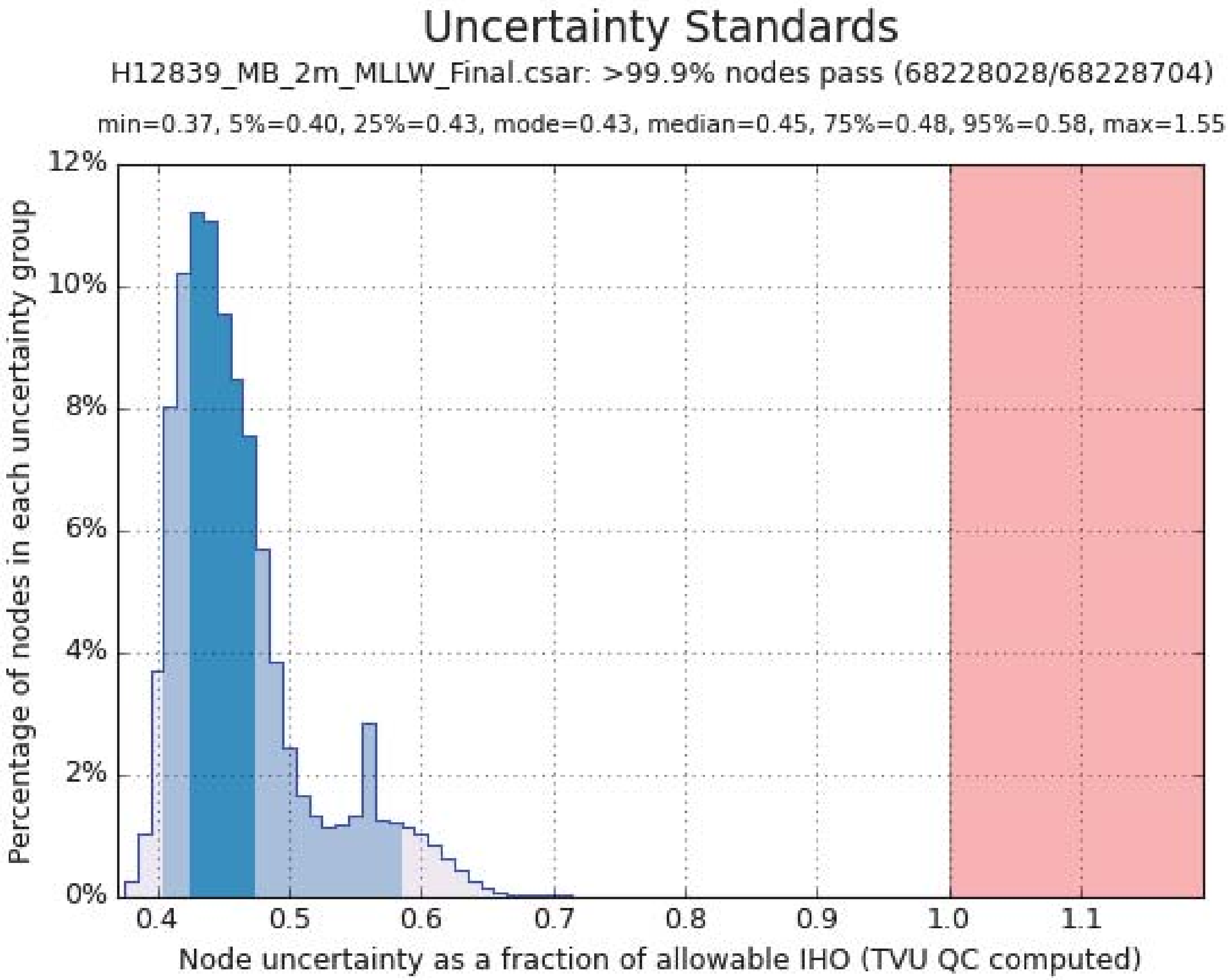


Figure 17: Total vertical uncertainty analysis for 2-meter finalized surface.

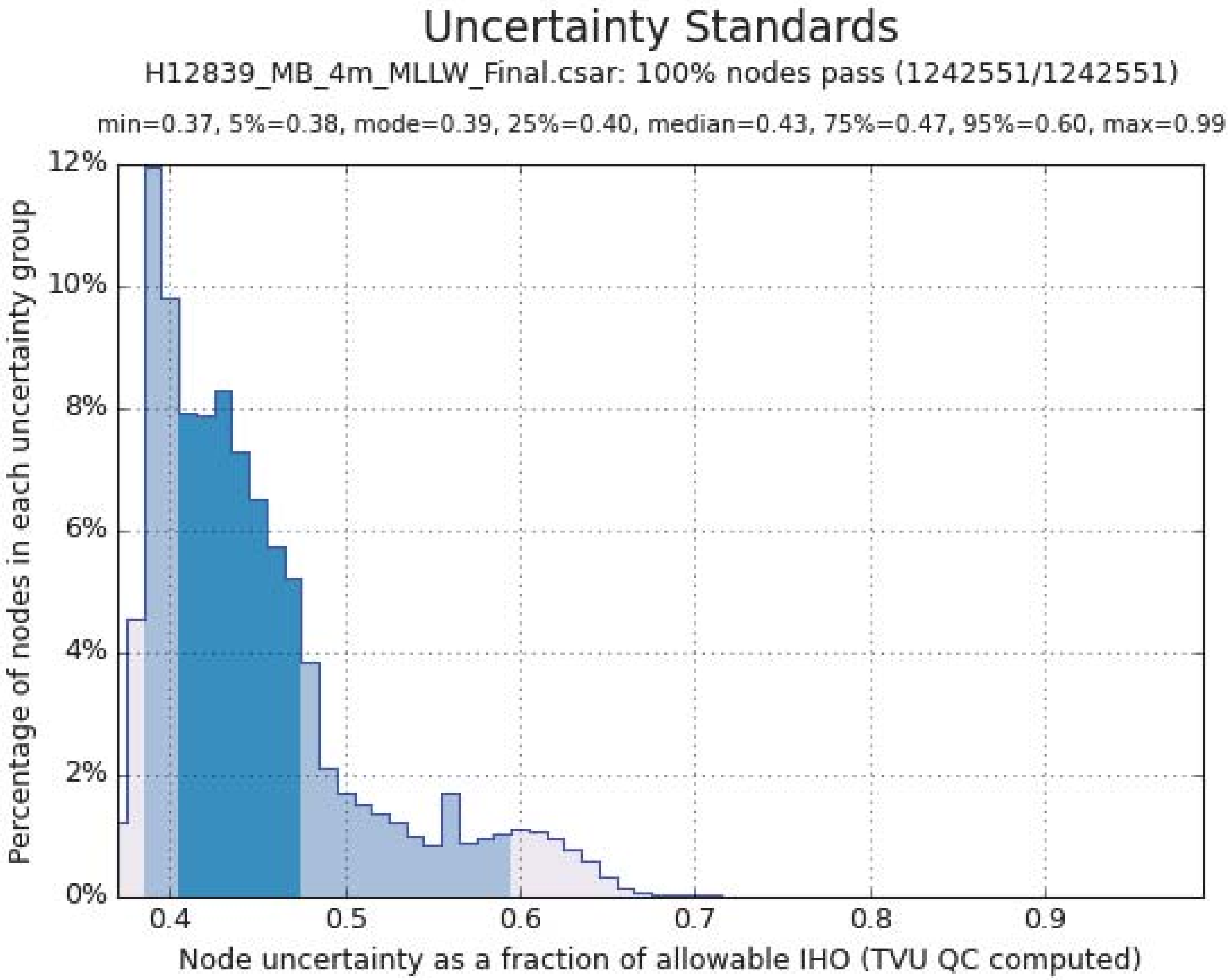


Figure 18: Total vertical uncertainty analysis for 4-meter finalized surface.

B.5.5 Designated Soundings

Within the limits of H12839, one (1) sounding is flagged as designated.

C. Vertical and Horizontal Control

All vertical and horizontal control activities conducted during the course of this survey are fully addressed in the following sections. No separate HVCR is submitted.

C.1 Vertical Control

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

Non-Standard Vertical Control Methods Used:

VDatum

Ellipsoid to Chart Datum Separation File:

2015_D304_VDatum_NAD83_MLLW

All soundings submitted for H12839 has been reduced to MLLW using documented VDatum techniques.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is UTM Zone 18N.

The following PPK methods were used for horizontal control:

Single Base

Single Base processing was the primary method used for Post Processed Kinematics (PPK) processing of Applanix TrueHeave data for Smooth Best Estimate of Trajectory (SBET) production. SBET files have been loaded for all lines for survey H12839 and are used to reduce acquired soundings to MLLW via HSD Operations Branch provided separation model.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
DUCK 3, Duck, NC	NCDU

Table 10: CORS Base Stations

DGPS was used for real-time positioning during acquisition. All lines submitted are corrected using post-processed horizontal solutions.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Driver, VA (289 kHz)

Table 11: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 Interpolation of SBETs

On occasion, the SBET altitude exhibited spikes which compromised the data's ability to meet TVU specifications. In these instances, the hydrographer utilized tools in Pydro's POSPAC Automated QC tool to interpolate the SBET (See Figure 19 for an example). The interpolated SBET was exported out of the POSPAC Automated QC tool, opened in POSPAC MMS, and exported again to ensure the SBET was in the correct datum (NAD83). The new SBET contains the prefix "interpolated" for easy identification.

The following SBETs were interpolated for H12839:
DN219 Starboard lines using interpolated_2015_219_S250S_b.sbet
DN222 Starboard lines using interpolated_2015_222_S250S.sbet and 2015_222_S250S_b.sbet

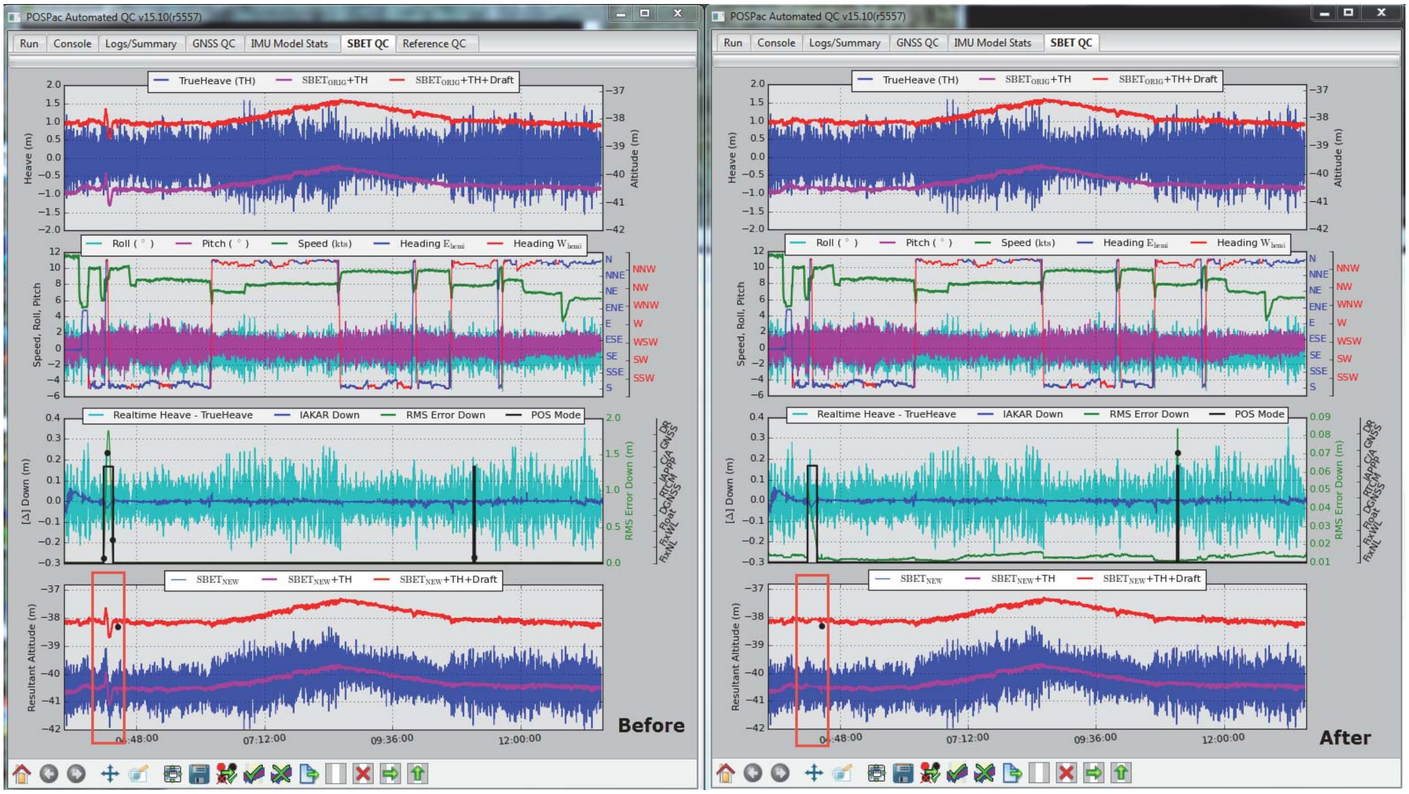


Figure 19: Example of SBET interpolation for 2015_222_S250S. The anomalous data on the left has been edited in POSPAC AutoQC and the resultant SBET is seen on the right.

D. Results and Recommendations

D.1 Chart Comparison

The hydrographer has compared a sounding plot from the surveyed area to the charted soundings. There are no charted contours to compare.

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
12200	1:419706	51	05/2014	02/27/2016	02/23/2016
12204	1:80000	38	12/2012	02/27/2016	02/23/2016

Table 12: Largest Scale Raster Charts

12200

A comparison was performed with Chart 12200 (1:419,706) using soundings derived from a 4-meter combined surface, shown in Figure 20. Most charted depths agree within 1-2 fathoms of H12839 surveyed soundings, with exception of the southeast portion of the survey.

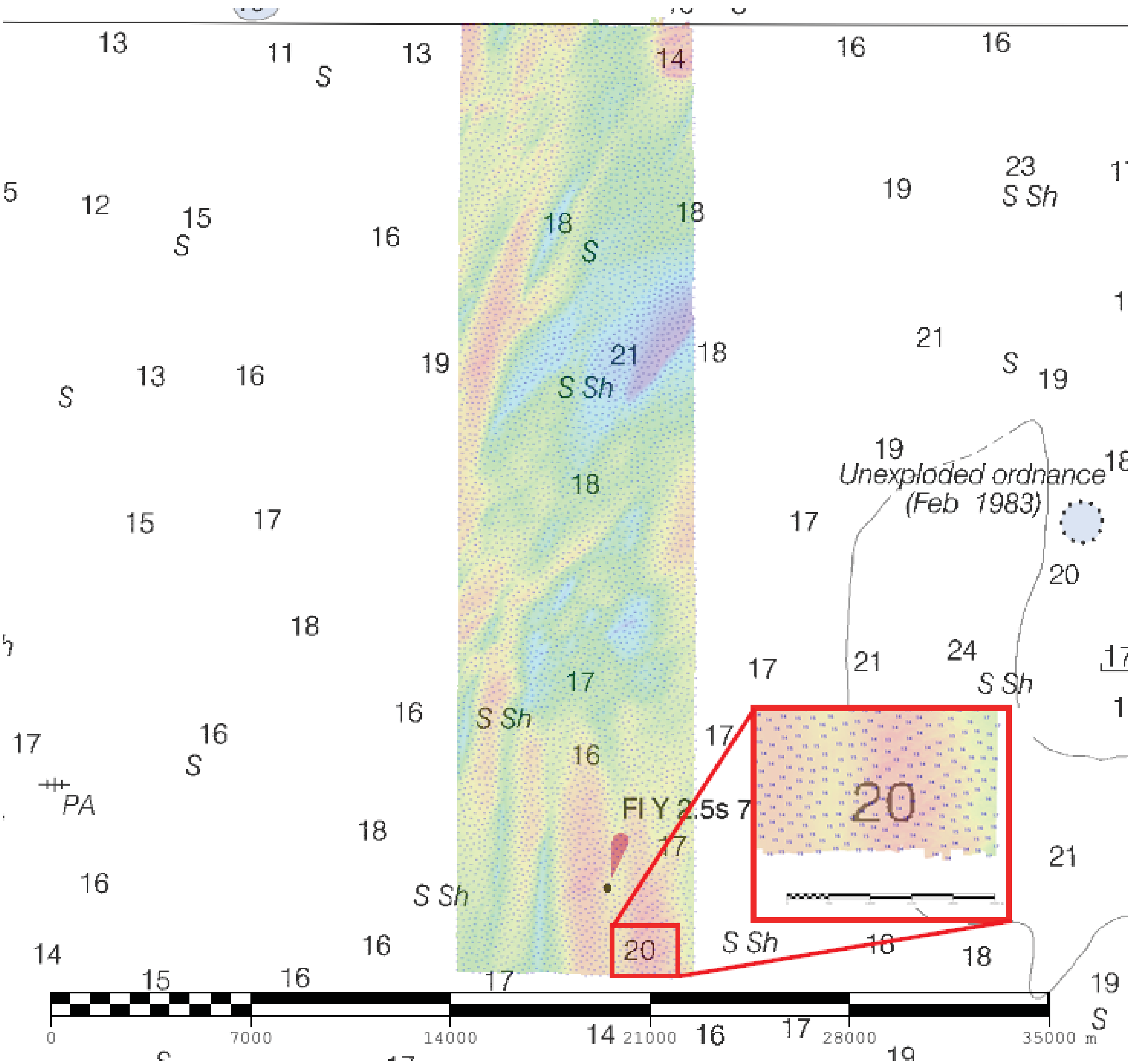


Figure 20: Chart 12200 comparison.

12204

A comparison was performed with Chart 12204 (1:80,000) using soundings derived from a 4-meter combined surface. Most charted depths agree within 2-3 feet of H12839 surveyed soundings, with exception of the area shown below in Figure 21.

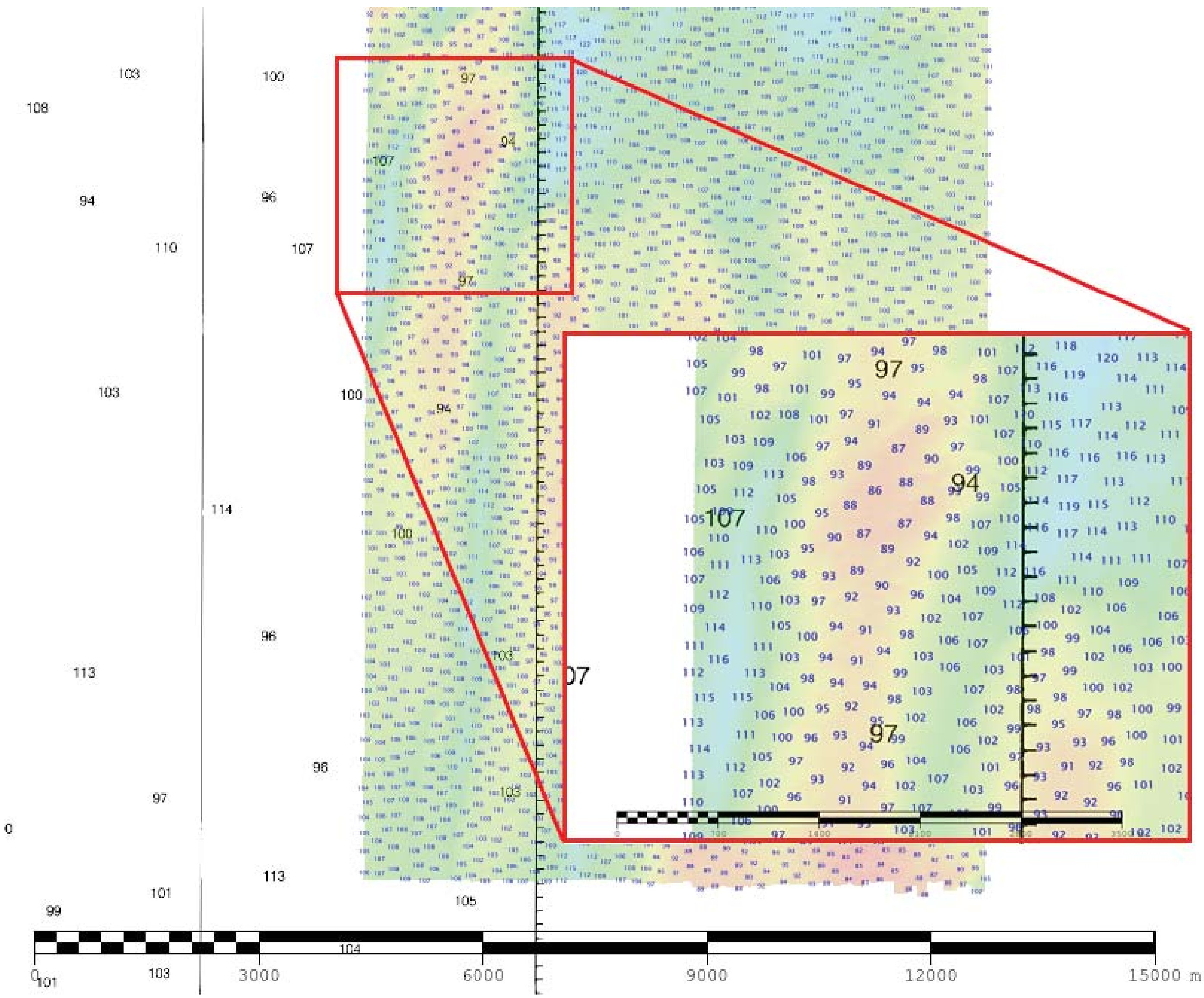


Figure 21: Chart 12204 comparison.

D.1.2 Electronic Navigational Charts

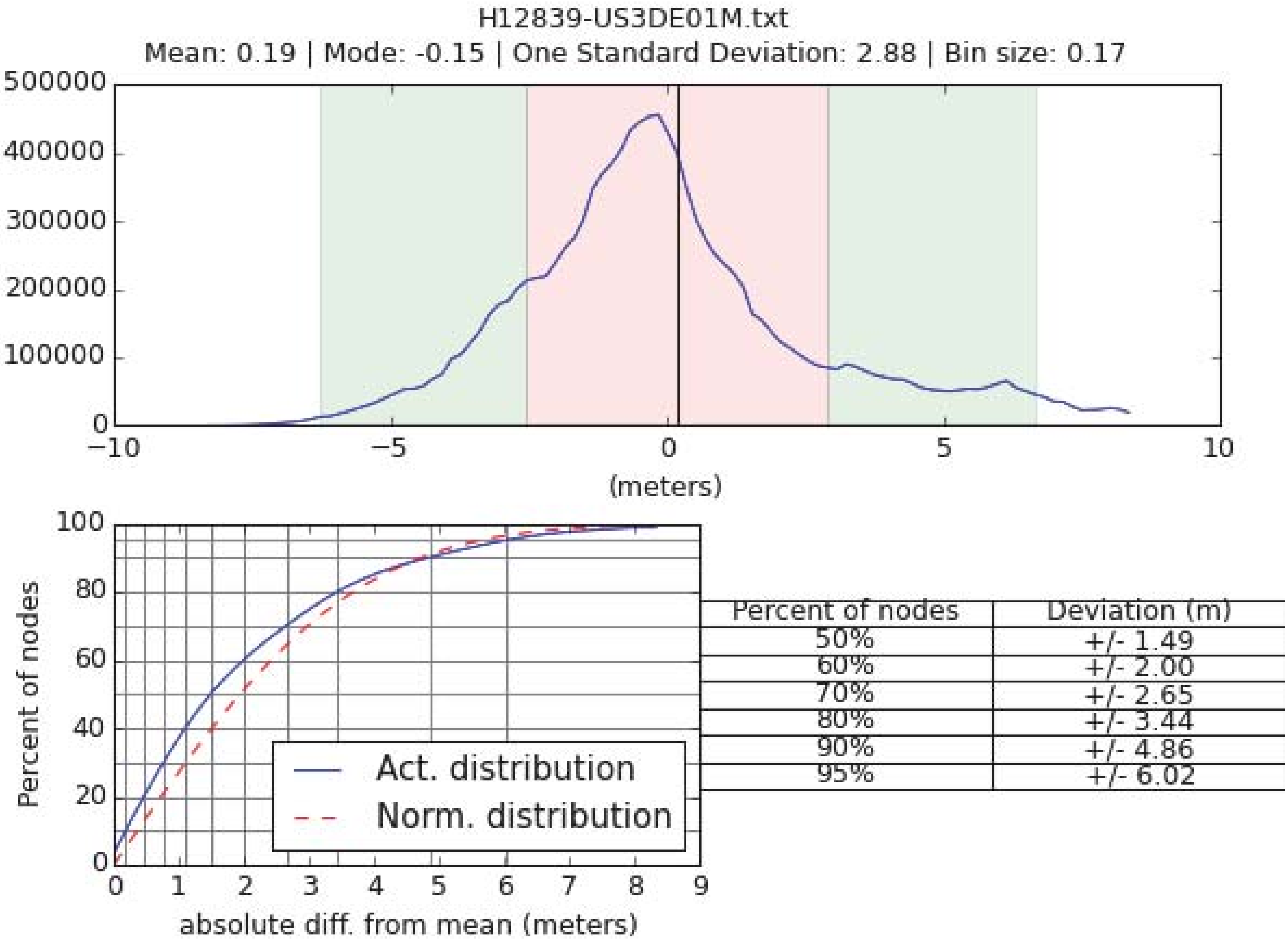
The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3DE01M	1:419706	17	01/28/2016	01/28/2016	NO
US4NC31M	1:80000	18	10/09/2014	03/07/2016	NO

Table 13: Largest Scale ENCs

US3DE01M

ENC soundings were extracted from the S-57 file and used to create an interpolated .csar surface. The interpolated surface was then differenced with the 4-meter finalized surface from survey H12839. The depth differences range from -12.87 to 11.25 meters. The high depth differences were determined to be the result of coarse resolution soundings extracted from the ENC. All other depth differences mirrored RNC depth differences, with a mean difference value of 0.19 meters, shown in Figure 22. In general, surveyed soundings were deeper than charted. Figure 23 shows a surface created by interpolating the differenced point cloud between the ENC and surveyed soundings. Negative values indicate areas where surveyed soundings are deeper than charted.



Percent of nodes	Deviation (m)
50%	+/- 1.49
60%	+/- 2.00
70%	+/- 2.65
80%	+/- 3.44
90%	+/- 4.86
95%	+/- 6.02

Figure 22: ENC US3DE01M comparison.

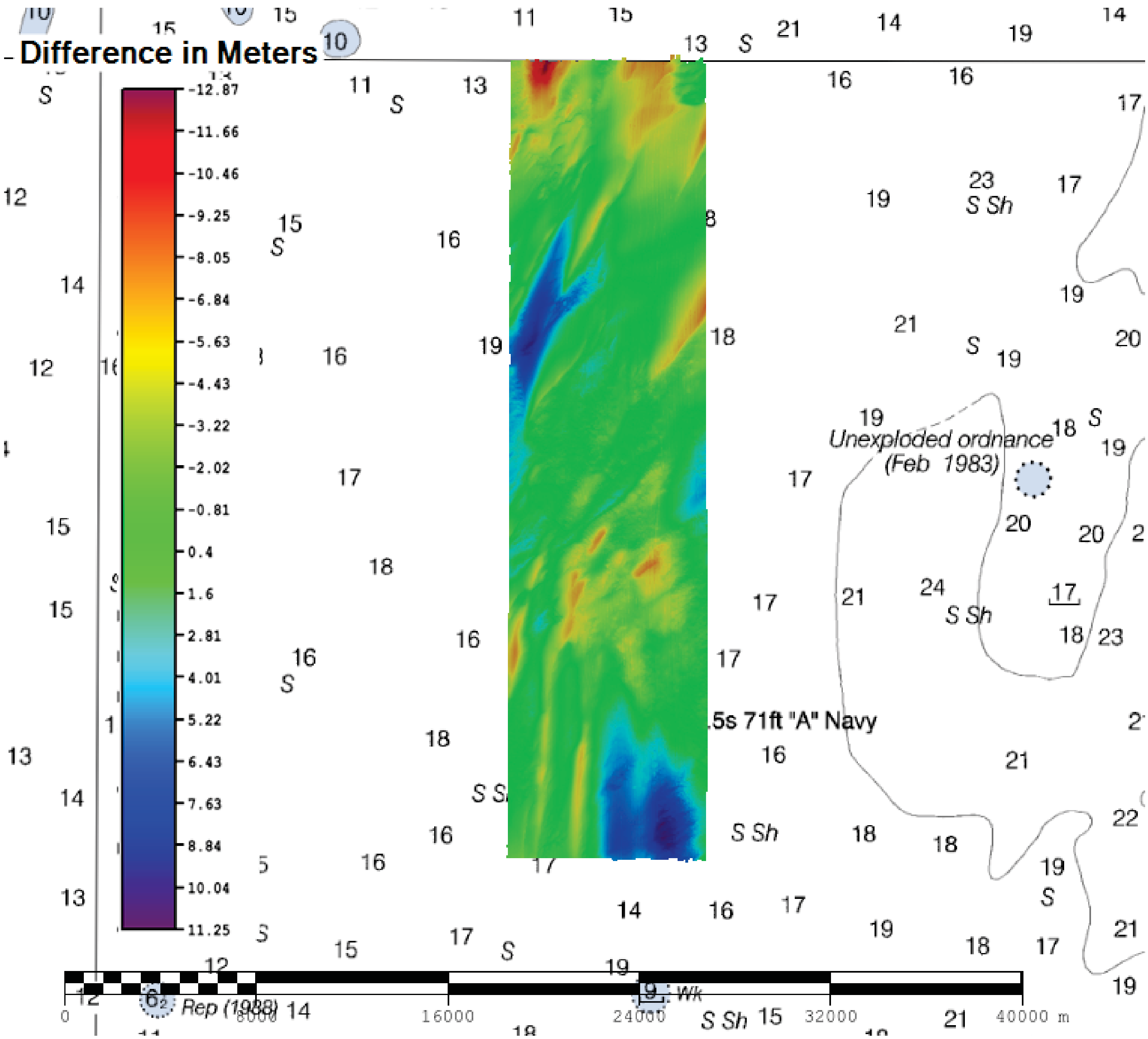


Figure 23: Difference surface between ENC US3DE01M and H12839.

US4NC31M

ENC soundings were extracted from the S-57 file and used to create an interpolated .csar surface. The interpolated surface was then differenced with the 4-meter finalized surface from survey H12839. The depth differences range from -5.27 to 3.86 meters. The high depth differences were determined to be the result of coarse resolution soundings extracted from the ENC. All other depth differences mirrored RNC depth differences, with a mean difference value of -1.20 meters, shown in Figure 24. In general, surveyed soundings were deeper than charted. Figure 25 shows a surface created by interpolating the differenced point cloud between the ENC and surveyed soundings. Negative values indicate areas where surveyed soundings are deeper than charted.

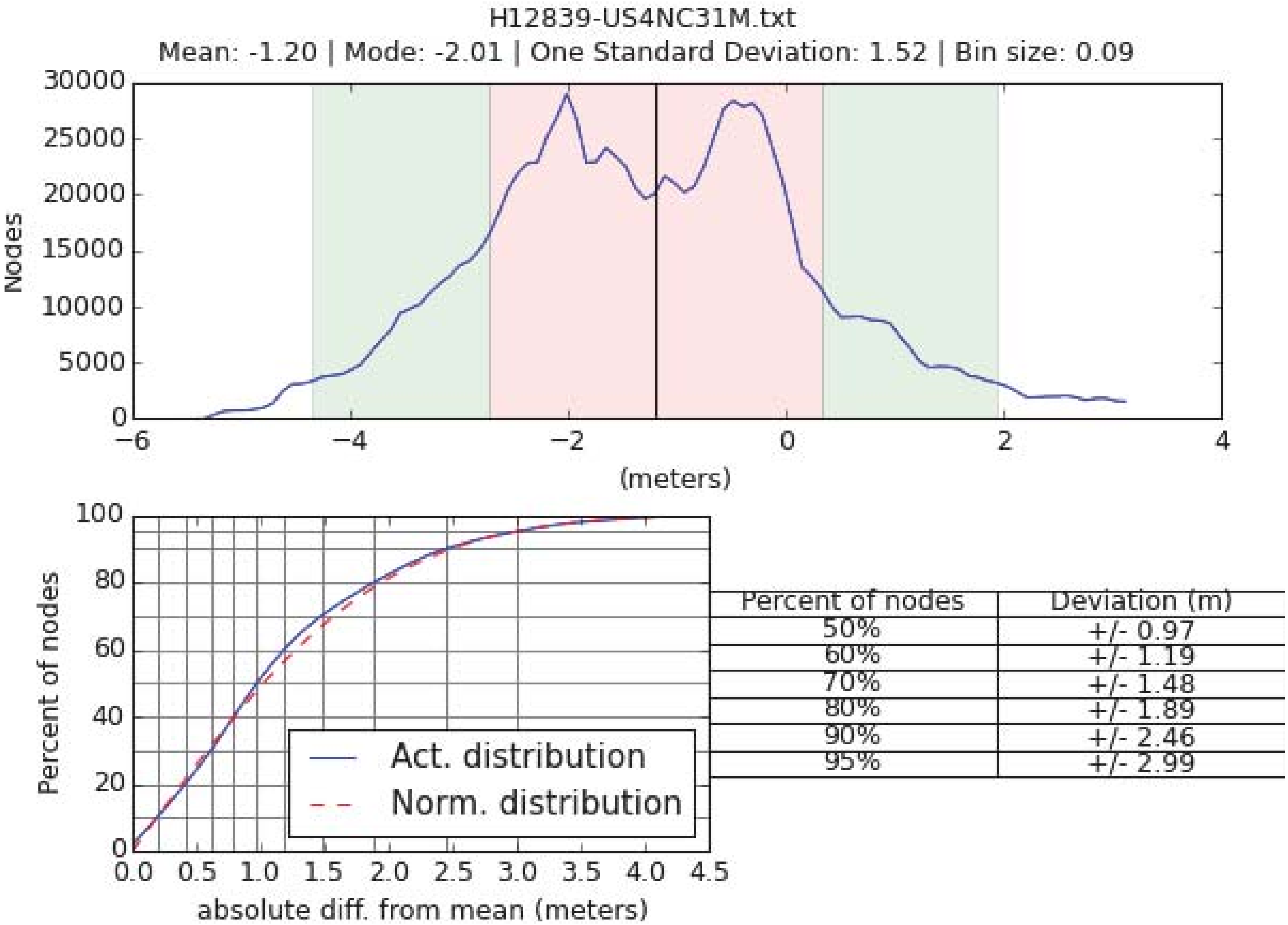


Figure 24: ENC US4NC31M comparison.

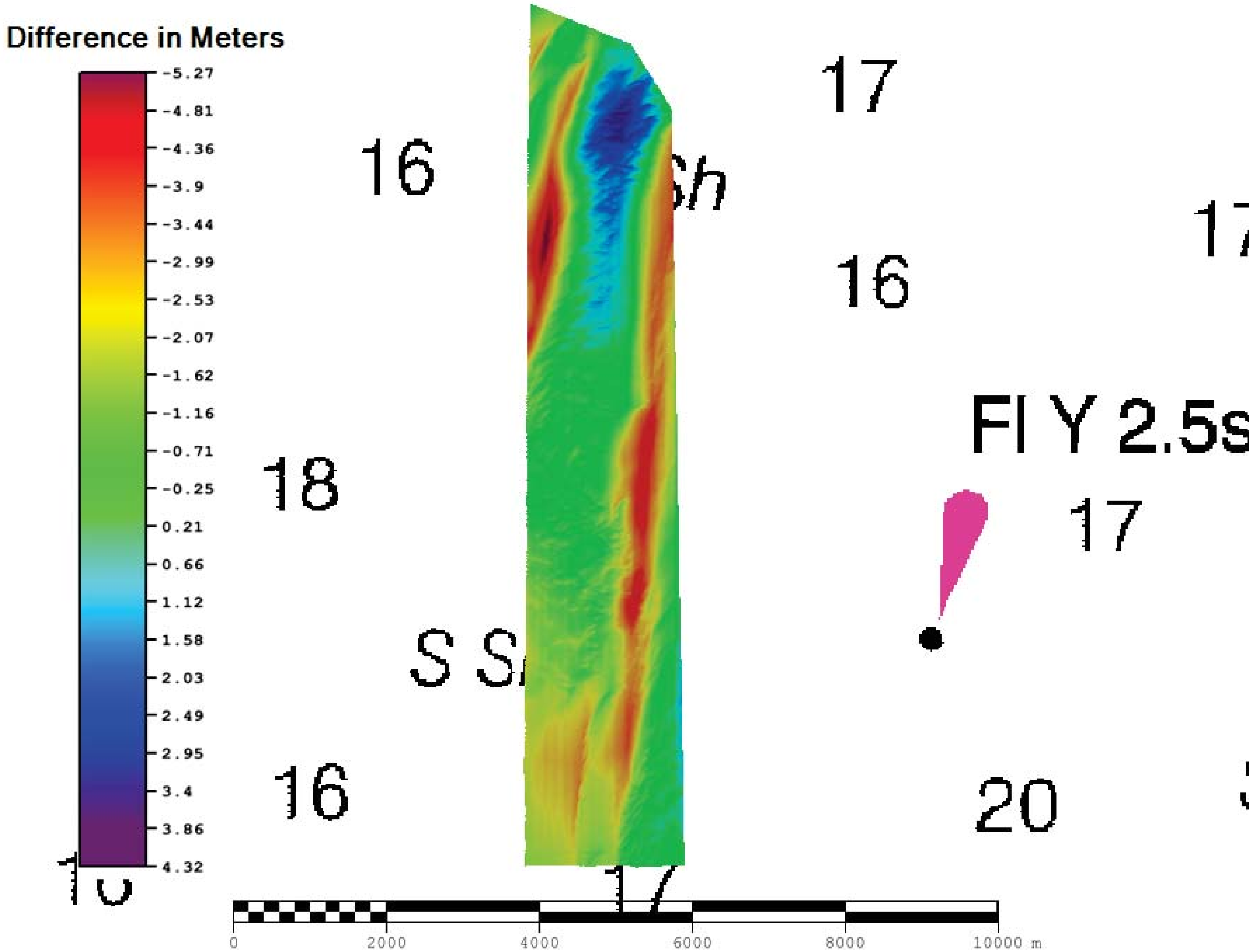


Figure 25: Difference surface between ENC US4NC31M and H12839.

D.1.3 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.4 Charted Features

No charted features exist for this survey.

D.1.5 Uncharted Features

One new obstruction was identified with 100% multibeam data. See FFF for more information.

D.1.6 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.7 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.8 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.1.9 Bottom Samples

Eight (8) bottom samples were acquired for this survey. See final feature file for more information.

D.2 Additional Results

D.2.1 Shoreline

A limited shoreline investigation was required by the project instructions but no shoreline coincides with H12839.

D.2.2 Prior Surveys

Prior survey comparisons exist for this survey, but were not investigated.

D.2.3 Aids to Navigation

ATONs were observed during H12839 survey operations. These aids were deemed to serve their intended purposes. No positioning was performed in the field or required from the project instructions.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Platforms

No platforms exist for this survey.

D.2.8 Significant Features

No Significant Features 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 Recommendation

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

D.2.11 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

Field operations for this hydrographic survey were conducted under the direct supervision of the then Chief of Party, Commander Marc S. Moser, 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 and Specifications Deliverables Manual, 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
LCDR Briana Welton, NOAA	Chief of Party	05/26/2016	WELTON.BRIANA.JANE.1267667531 2016.05.26 14:33:34 -04'00'
LT Nicholas Morgan, NOAA	Field Operations Officer	05/26/2016	MORGAN.NICHOLAS.C.1292288138 2016.05.26 12:44:42 -04'00'
PS Tyanne Faulkes	Sheet Manager	05/26/2016	Digitally signed by FAULKES.TYANNE.M.1381291550 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=FAULKES.TYANNE.M.1381291550 Date: 2016.05.26 12:57:55 -04'00'

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	Continually Operating Reference Staiton
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
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
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
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	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	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
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPE	Total Propagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : September 11, 2015

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-D304-FH-2015
HYDROGRAPHIC SHEET: H12839

LOCALITY: 36 Miles East of Currituck Beach, NC
TIME PERIOD: July 30 - August 24, 2015

TIDE STATION USED: 8651370 Duck, NC
Lat. 36° 11.0'N Long. 75° 44.8' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.027

REMARKS: RECOMMENDED ZONING

Preliminary zoning is accepted as the final zoning for project OPR-D304-FH-2015, H12839, during the time period between July 30 - August 24, 2015.

Please use the zoning file D304FH2015CORP submitted with the project instructions for D304-FH-2015. Zone SA57 is the applicable zone for H12839.

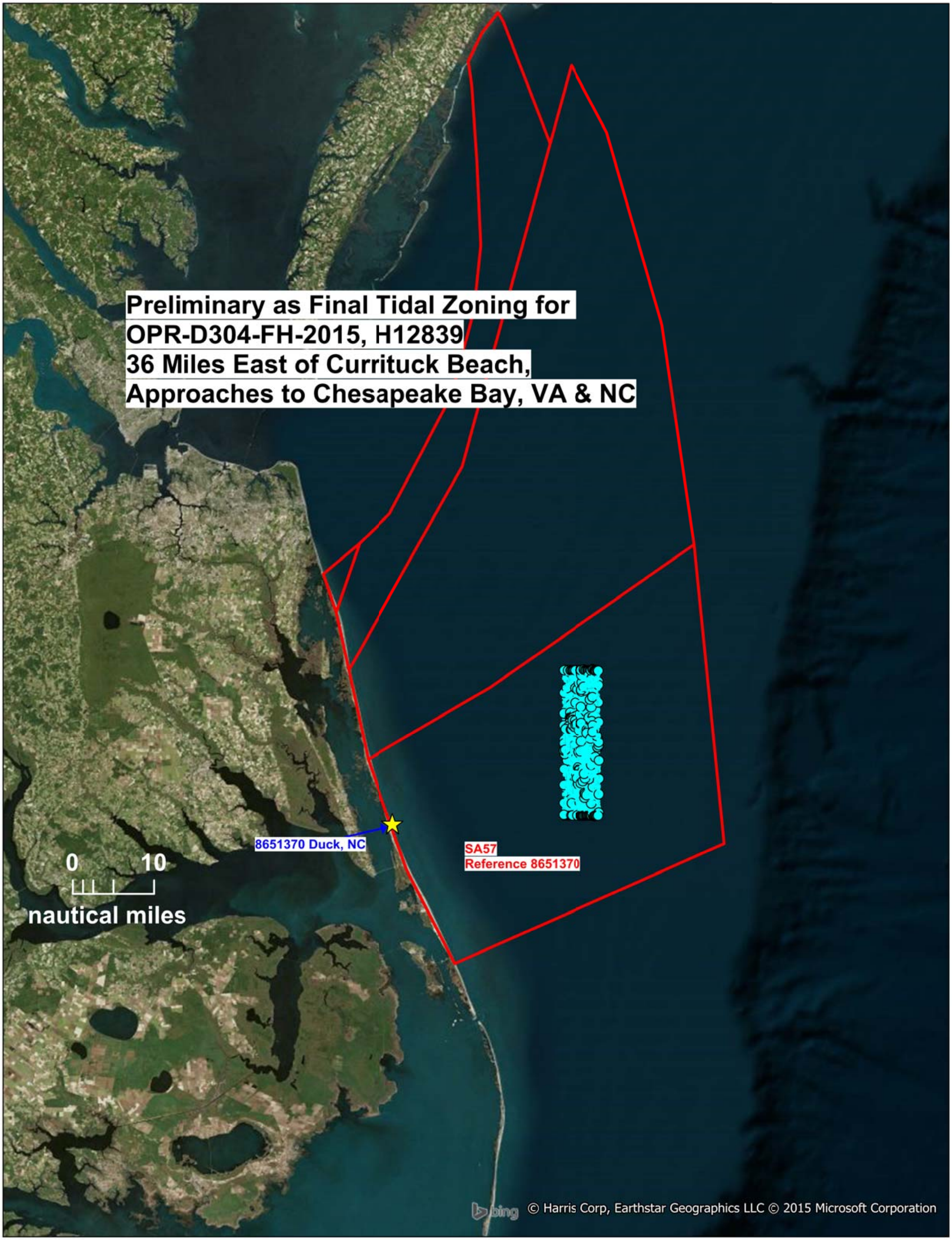
Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

HOVIS.GERALD.THOMAS.JR.1365860250

Digitally signed by HOVIS.GERALD.THOMAS.JR.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOVIS.GERALD.THOMAS.JR.1365860250
Date: 2015.09.16 08:19:04 -04'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


Preliminary as Final Tidal Zoning for
OPR-D304-FH-2015, H12839
36 Miles East of Currituck Beach,
Approaches to Chesapeake Bay, VA & NC
8651370 Duck, NC
SA57
Reference 8651370
0
10
nautical miles
© Harris Corp, Earthstar Geographics LLC © 2015 Microsoft Corporation

Year_DOY	Min Time	Max Time
2015_211	01:38:52	23:44:59
2015_212	00:10:30	02:46:42
2015_217	01:40:29	10:05:19
2015_219	01:43:49	23:54:07
2015_220	00:08:50	13:45:37
2015_222	04:00:02	23:55:09
2015_223	00:08:58	03:07:08
2015_230	20:47:22	23:54:18
2015_231	00:06:39	23:54:51
2015_232	00:06:11	15:08:06
2015_235	13:06:39	23:52:50
2015_236	00:09:26	03:30:05

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov>

OPR-D304-FH-15 ERS Checkline Analysis and VDatum ERZT comparison

3 messages

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> Wed, Aug 26, 2015 at 4:44 PM
To: Kathryn Pridgen - NOAA Federal <kathryn.pridgen@noaa.gov>, Katrina Wyllie - NOAA Federal <katrina.wyllie@noaa.gov>, Megan Greenaway - NOAA Federal <megan.greenaway@noaa.gov>
Cc: Corey Allen - NOAA Federal <Corey.Allen@noaa.gov>

Hi All,

Please find the ERS Checkline Analysis and VDatum ERZT comparison report attached to this email for your review. The ERS Check Line and Deliverables SOP was followed to create this report. Please advise if there are any questions or comments. Thanks.

V/r,
Jon

Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
29 Wentworth Road
New Castle, NH, 03854

OPR-D304-FH-15 ERS Checkline Analysis and VDatum ERZT comparison.pdf
267K

Megan Greenaway - NOAA Federal <megan.greenaway@noaa.gov> Fri, Aug 28, 2015 at 11:20 AM
To: "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
Cc: Kathryn Pridgen - NOAA Federal <kathryn.pridgen@noaa.gov>, Katrina Wyllie - NOAA Federal <katrina.wyllie@noaa.gov>, Corey Allen - NOAA Federal <Corey.Allen@noaa.gov>, Michael Gonsalves - NOAA Federal <Michael.Gonsalves@noaa.gov>

Received. Thank you for the report.

Based on this report, it is OPS assumption that the FH is recommending this project be submitted with chart datum derived from the ellipsoid by using the OPS-provided VDATUM separation model and PPK CORS single base post processed navigation.

Please confirm.

Your report looks good. For future projects please include a statement as the one above, "The FH is recommends this project be submitted with chart datum derived from the ellipsoid by using the OPS-provided VDATUM separation model and PPK CORS single base post processed navigation."
Thanks,
Megan

On Wed, Aug 26, 2015 at 4:44 PM, OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> wrote:

> Hi All,
>
> Please find the ERS Checkline Analysis and VDatum ERZT comparison report attached to this email for your review. The ERS Check Line and Deliverables SOP was followed to create this report. Please advise if there are any questions or comments. Thanks.

V/r,
Jon

Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
29 Wentworth Road
New Castle, NH, 03854

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> Sat, Oct 17, 2015 at 5:46 AM
To: Megan Greenaway - NOAA Federal <megan.greenaway@noaa.gov>
Cc: Kathryn Pridgen - NOAA Federal <kathryn.pridgen@noaa.gov>, Katrina Wyllie - NOAA Federal <katrina.wyllie@noaa.gov>, Corey Allen - NOAA Federal <Corey.Allen@noaa.gov>, Michael Gonsalves - NOAA Federal <Michael.Gonsalves@noaa.gov>

Yes, FH recommends this project be submitted with chart datum derived from the ellipsoid by using the OPS-provided VDATUM separation model and PPK CORS single base post processed navigation. Thanks.

V/r,
Jon

Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
29 Wentworth Road
New Castle, NH, 03854

On Fri, Aug 28, 2015 at 11:20 AM, Megan Greenaway - NOAA Federal <megan.greenaway@noaa.gov> wrote:

> Received. Thank you for the report.
>
> Based on this report, it is OPS assumption that the FH is recommending this project be submitted with chart datum derived from the ellipsoid by using the OPS-provided VDATUM separation model and PPK CORS single base post processed navigation.
>
> Please confirm.
>
> Your report looks good. For future projects please include a statement as the one above, "The FH is recommends this project be submitted with chart datum derived from the ellipsoid by using the OPS-provided VDATUM separation model and PPK CORS single base post processed navigation."
> Thanks,
> Megan
>
> On Wed, Aug 26, 2015 at 4:44 PM, OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> wrote:
>
> > Hi All,
> >
> > Please find the ERS Checkline Analysis and VDatum ERZT comparison report attached to this email for your review. The ERS Check Line and Deliverables SOP was followed to create this report. Please advise if there are any questions or comments. Thanks.
> >
> > V/r,
> > Jon
> >
> > Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
> > 29 Wentworth Road
> > New Castle, NH, 03854

ERS Checkline Analysis and VDatum ERZT comparison

OPR-D304-FH-15 Approaches to Chesapeake Bay

NOAA Ship *Ferdinand R. Hassler*

ERS checklines were run spanning the total project area of OPR-D304-FH-15. Bathymetry was collected, SBETs applied, and an ERZT separation model was created and a difference surface was created using the datum height of the separation model and Vdatum model. A preliminary .tid file was used with the project .zdf file.

SBETs were colored by RMS position error (both vertical and horizontal) and the highest RMS value was less than or equal to 0.07 m. This maximum uncertainty value was seen on the checkline that was run furthest away from the base station assigned for the project (DUCK). All of the other SBETs that were processed have yielded a position RMS value of less than or equal to 0.05 m This is lower than our zoned tide uncertainty value of 0.16 m, suggesting it would be beneficial to use SBETs in processing. The ERZT Vdatum difference surface was exported to ASCII and the statistics utility was used giving a mean of -0.03 m and a deviation of 0.09 m.

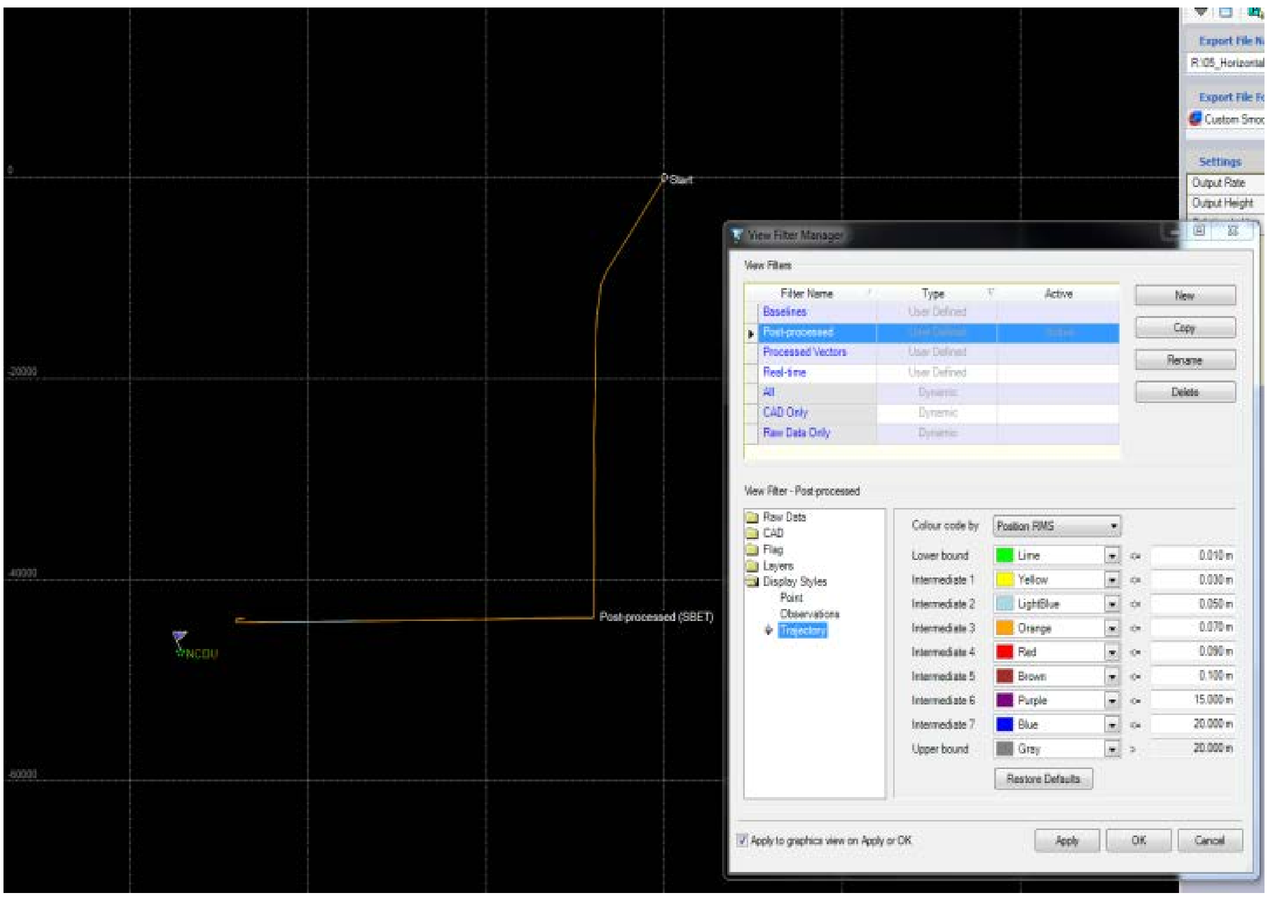


Figure 1: Day 210 Port SONAR SBET position RMS

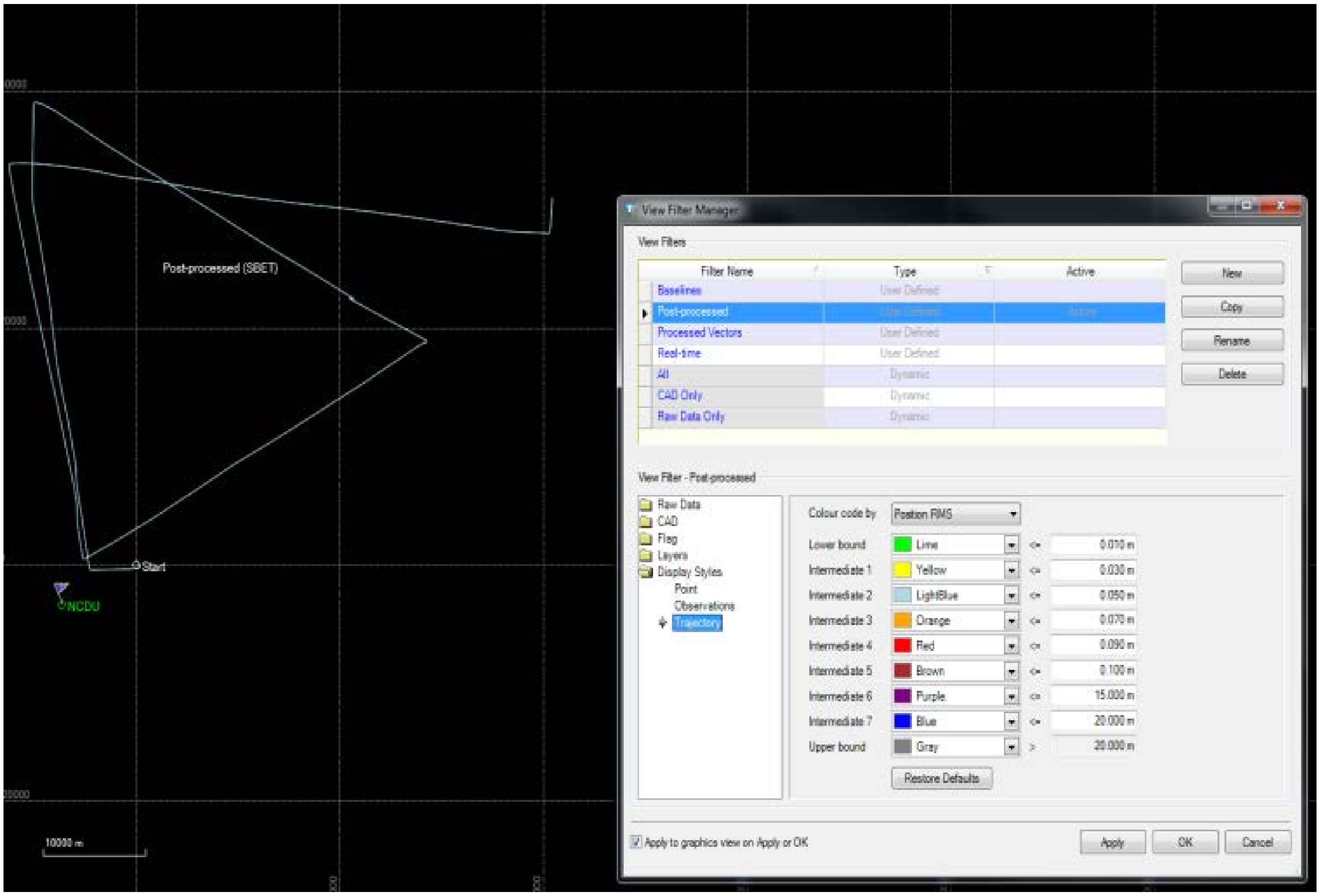


Figure 2: Day 210 Port SONAR position RMS Continued

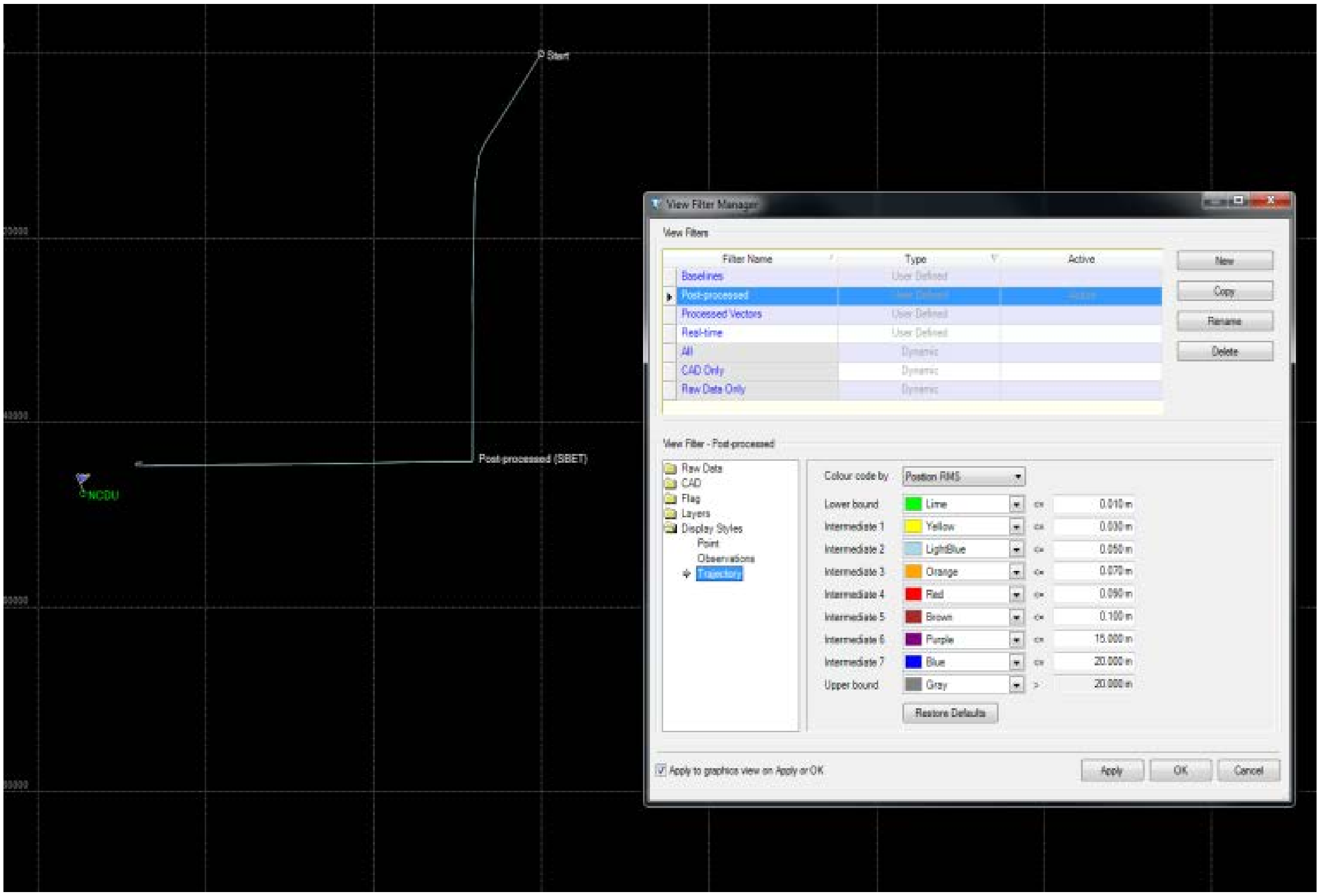


Figure 3: Day 20 Starboard SONAR SBET positon RMS

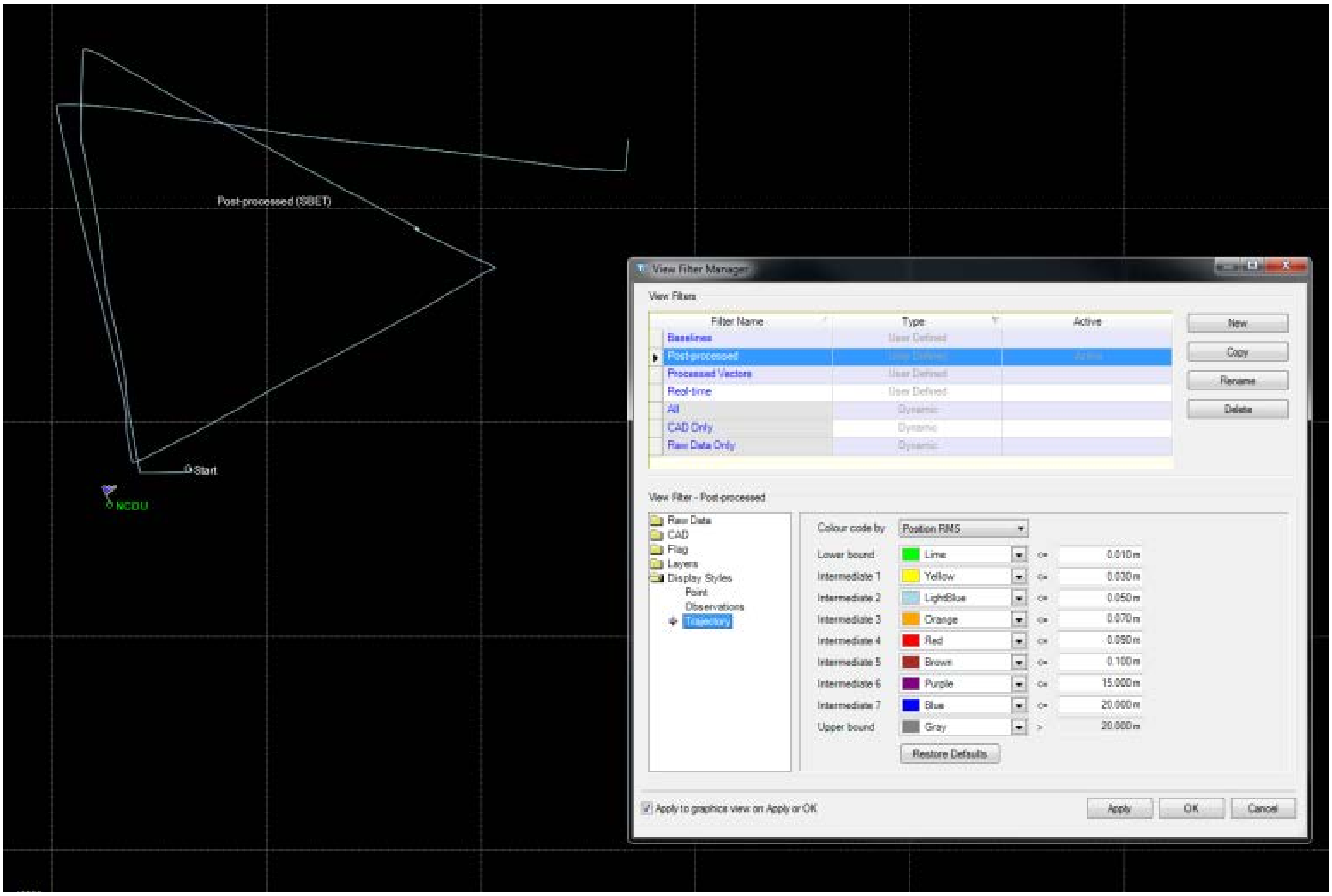
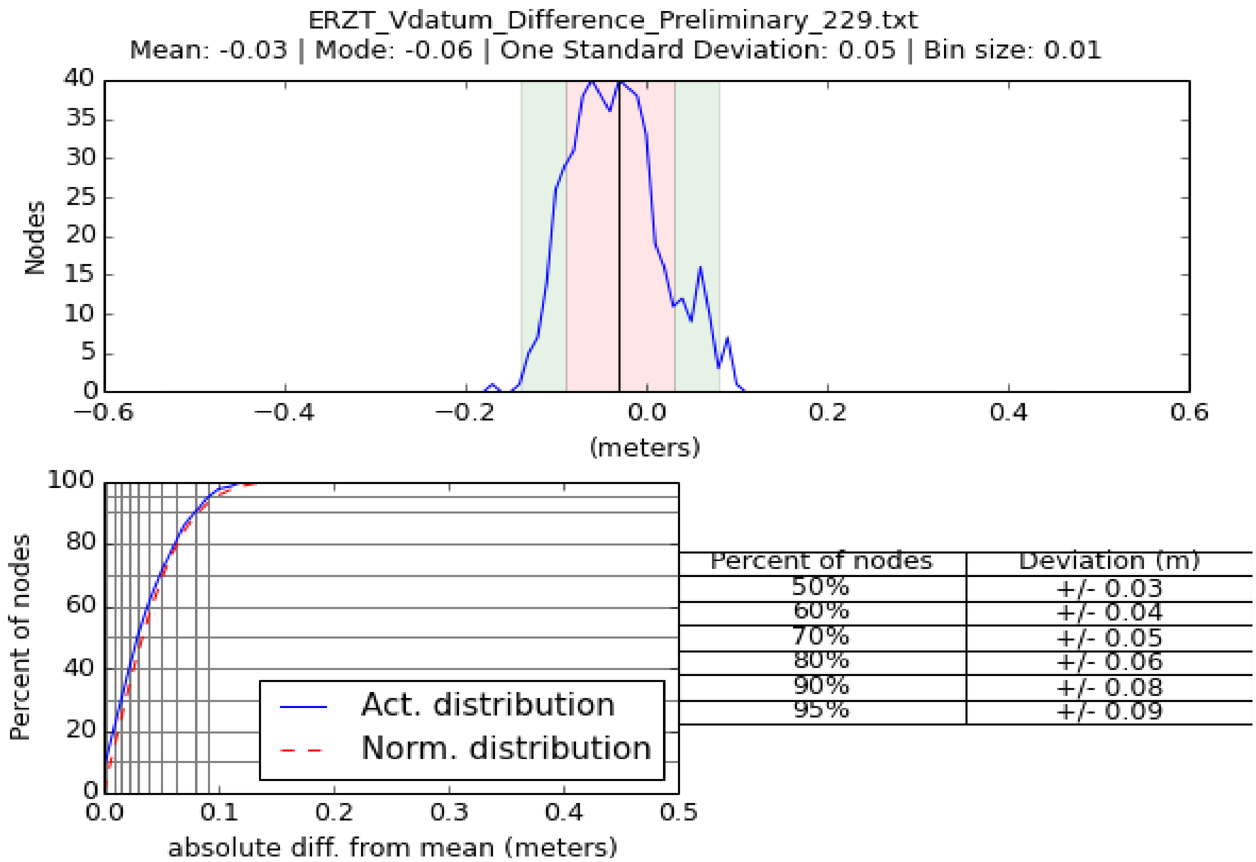


Figure 4: Day 210 Starboard SONAR SBET position RMS continued



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

Figure 5: ERZT Vdatum difference surface statistics

APPROVAL PAGE

H12839

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- H12839_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12839_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Briana J. Welton

Digitally signed by WELTON.BRIANA.JANE.1267667531
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=WELTON.BRIANA.JANE.1267667531
Date: 2017.03.09 15:41:34 -05'00'

Approved:____

Lieutenant Commander Briana Welton, NOAA
Chief, Atlantic Hydrographic Branch