H12811

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12811

LOCALITY

State(s):	Rhode Island
General Locality:	Rhode Island Sound and Approaches
Sub-locality:	10 NM Southeast of Nomans Land

2015

CHIEF OF PARTY
LCDR Briana Welton, NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12811**

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):	**Rhode Island**
General Locality:	**Rhode Island Sound and Approaches**
Sub-Locality:	**10 NM Southeast of Nomans Land**
Scale:	**40000**
Dates of Survey:	**07/16/2015 to 07/26/2015**
Instructions Dated:	**05/22/2015**
Project Number:	**OPR-B307-FH-15**
Field Unit:	**NOAA Ship Ferdinand R. Hassler**
Chief of Party:	**LCDR Briana 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 https://www.ncei.noaa.gov/.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H12811

Project: OPR-B307-FH-15

Locality: Rhode Island Sound and Approaches

Sublocality: 10 NM Southeast of Nomans Land

Scale: 1:40000

July 2015 - July 2015

NOAA Ship Ferdinand R. Hassler

Chief of Party: LCDR Briana Welton, NOAA

A. Area Surveyed

The survey area is located in Rhode Island Sound, within the sub-locality approximately 8.5NM south of Martha's Vineyard as shown in Figure 1.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 20' 0.7" N 70° 42' 42.2" W	41° 6' 52.4" N 70° 33' 25.4" W

Table 1: Survey Limits

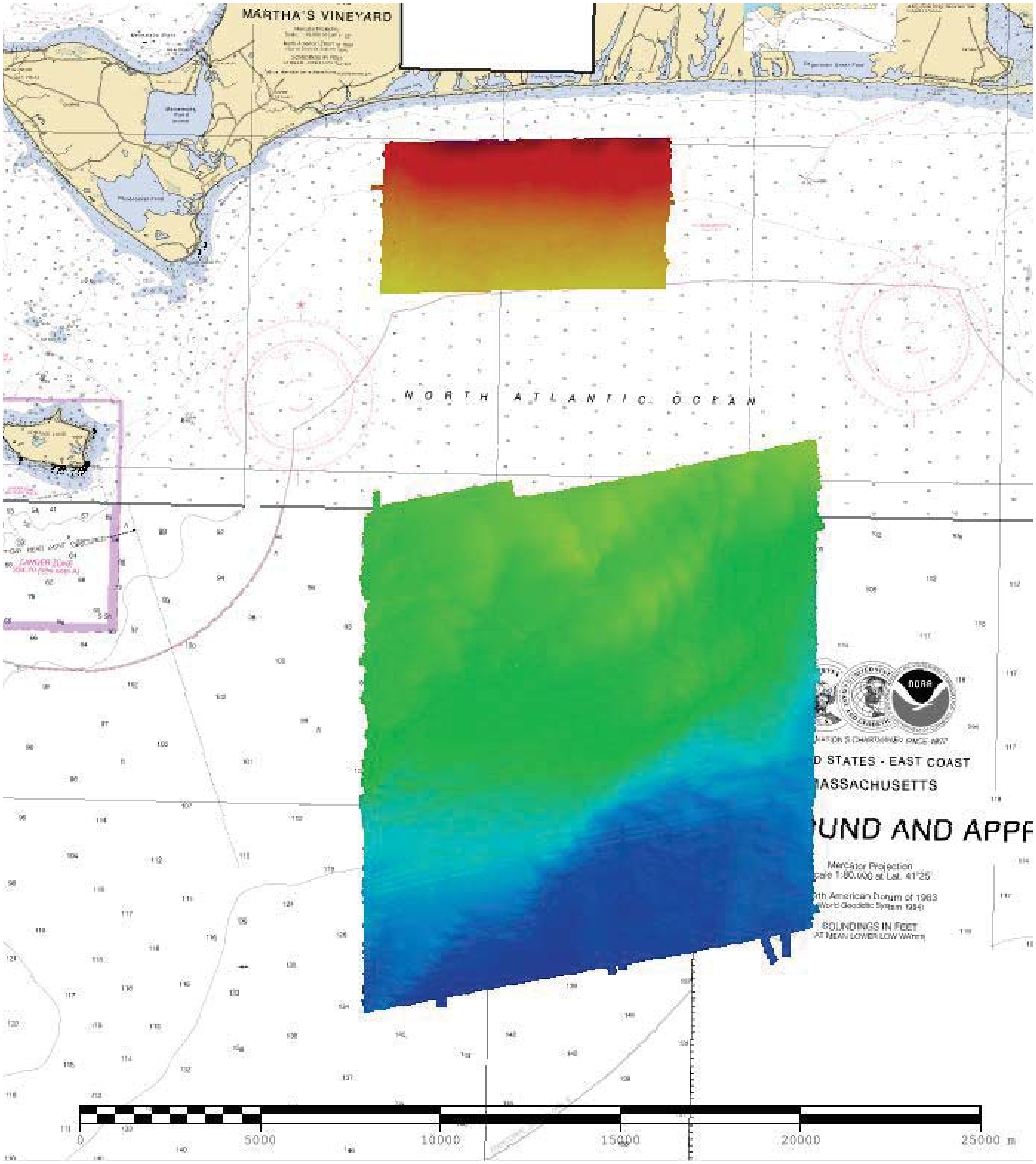


Figure 1: H12811 survey limits

Survey limits were extended to include portions of sheet H12810. The northernmost section was surveyed separately to avoid large amounts of fishing boat traffic. The southern edge of survey acquisition coverage was extended to increase ship efficiency by minimizing maneuvering.

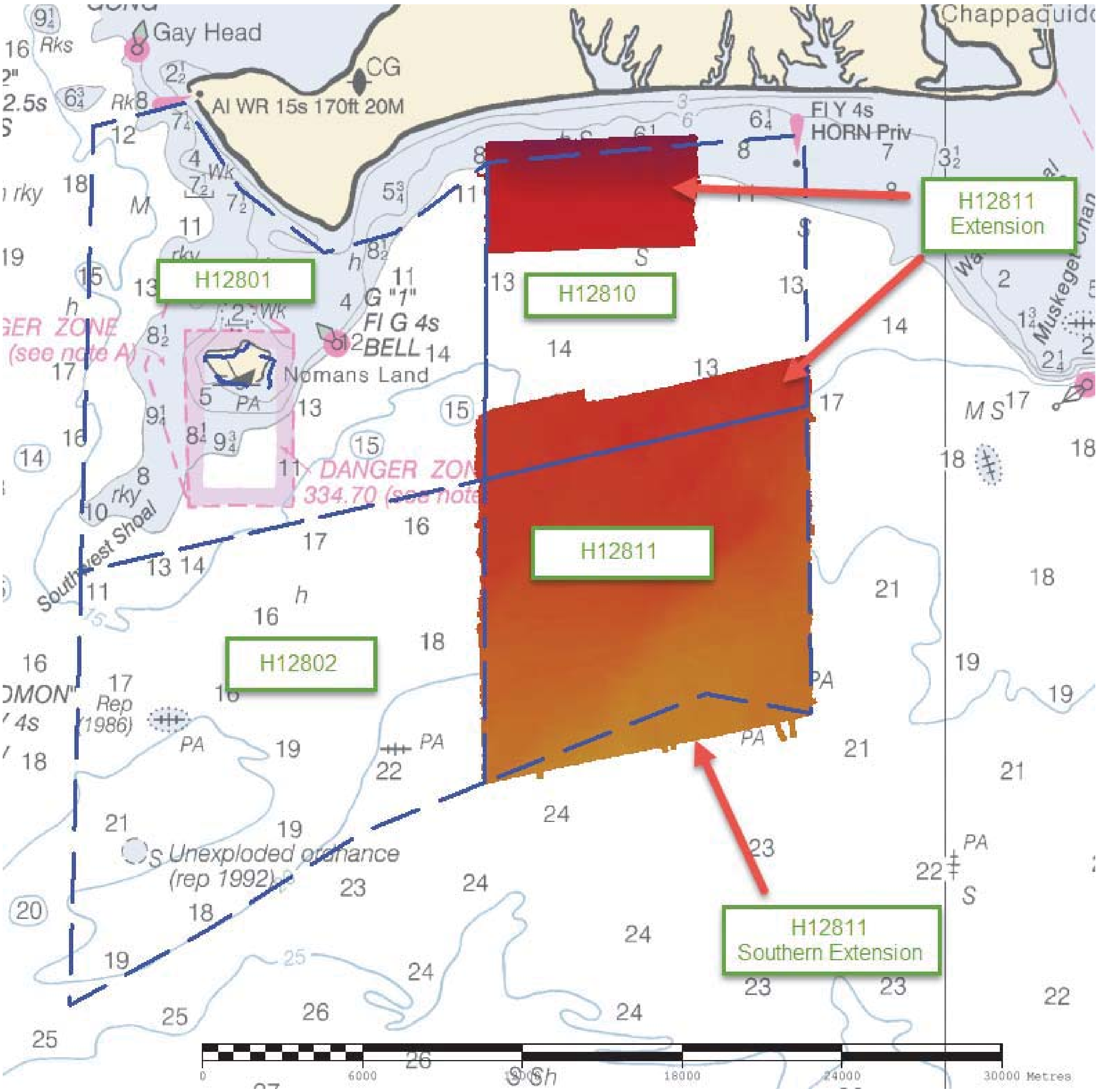


Figure 2: H12811 Coverage Modifications

A.2 Survey Purpose

To support safe navigation through the acquisition and processing of hydrographic survey data for updating nautical charts and by the identification and dissemination of dangers to navigation as identified during the course of survey operations.

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 MBES with backscatter

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

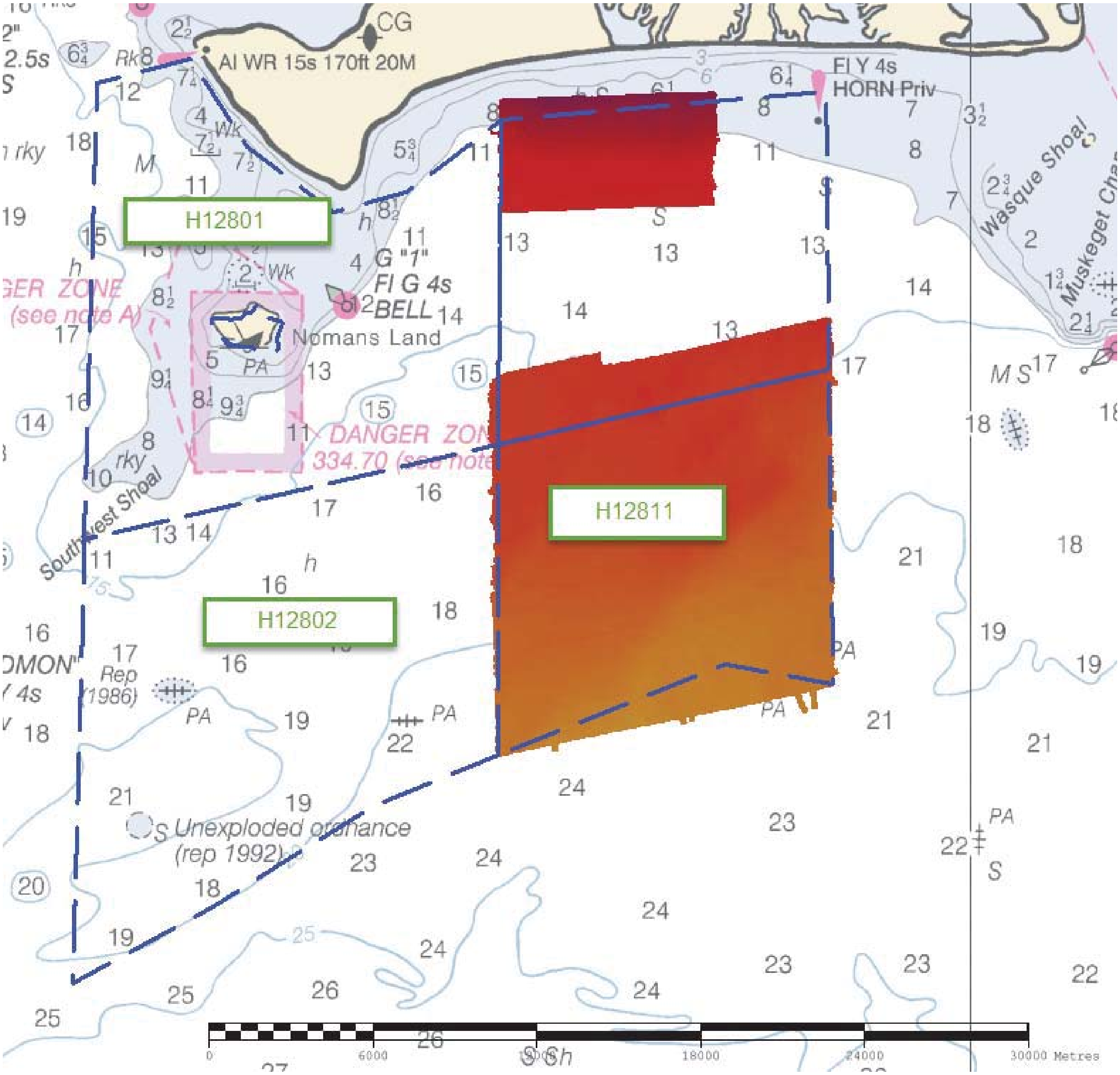


Figure 3: Coverage overview of H12811

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	873.319	873.319
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	60.701	60.701
	Lidar Crosslines	0	0
Number of Bottom Samples			6
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			60.04

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/16/2015	197
07/17/2015	198

Survey Dates	Day of the Year
07/18/2015	199
07/19/2015	200
07/20/2015	201
07/21/2015	202
07/22/2015	203
07/23/2015	204
07/24/2015	205
07/25/2015	206
07/26/2015	207

Table 3: Dates of Hydrography

Mainscheme survey lines were run with a dual-head multibeam echosounder. Linear nautical miles for the dual-head system were calculated using statistics from the starboard 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 4: NOAA Ship FERDINAND R. HASSLER alongside pier at Marine Operations Center - Atlantic

NOAA Ship FERDINAND R. HASSLER (S250), shown in Figure 4, acquired all data within the limits of H12811.

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	Positioning System
AML	MicroCTD	Sound Speed System
Brooke Ocean	MVP-200	Sound Speed System
RESON	SVP-70	Sound Speed System
Sea Bird	SBE 19+	Conductivity, Temperature, and Depth Sensor

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 6.95% of mainscheme acquisition.

A geographic plot of cross lines is shown in Figure 5. Crosslines were filtered to remove soundings greater than 45 degrees from nadir. To evaluate cross line agreement, two 2-meter surfaces were created: one from crossline soundings, the other from mainscheme soundings. These two surfaces were differenced using CARIS BASE Editor. The difference surface has a maximum difference of -2.63 meters. The statistical analysis of the differences between the mainscheme and crossline surfaces is shown in Figure 6. The average difference between the surfaces is 0.01 meters with a standard deviation of 0.11meters meters; 95% of nodes agree within +/- 0.22 meters from the mean.

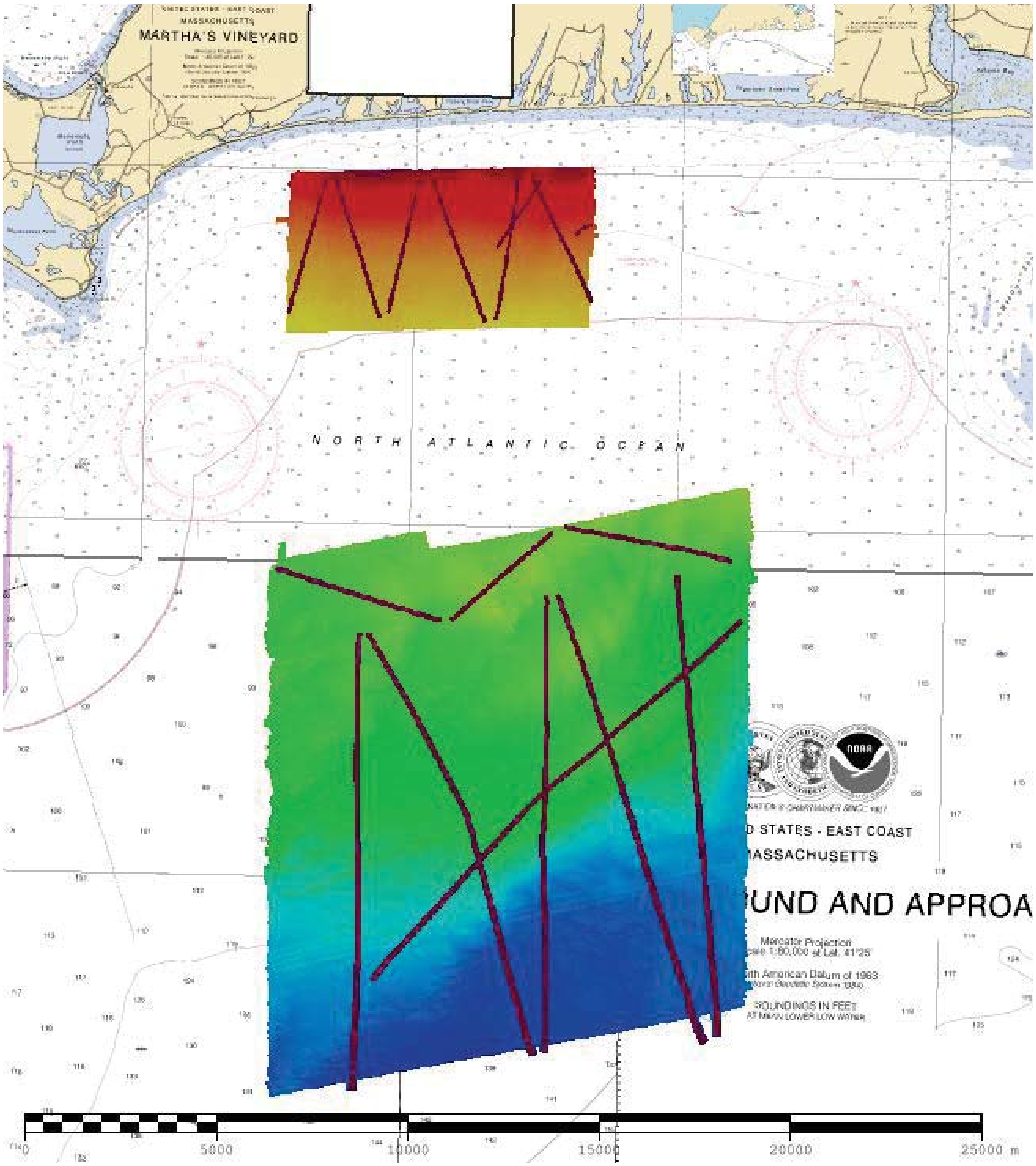


Figure 5: H12811 MBES crossline data, shown in purple, overlaid on mainscheme surface.

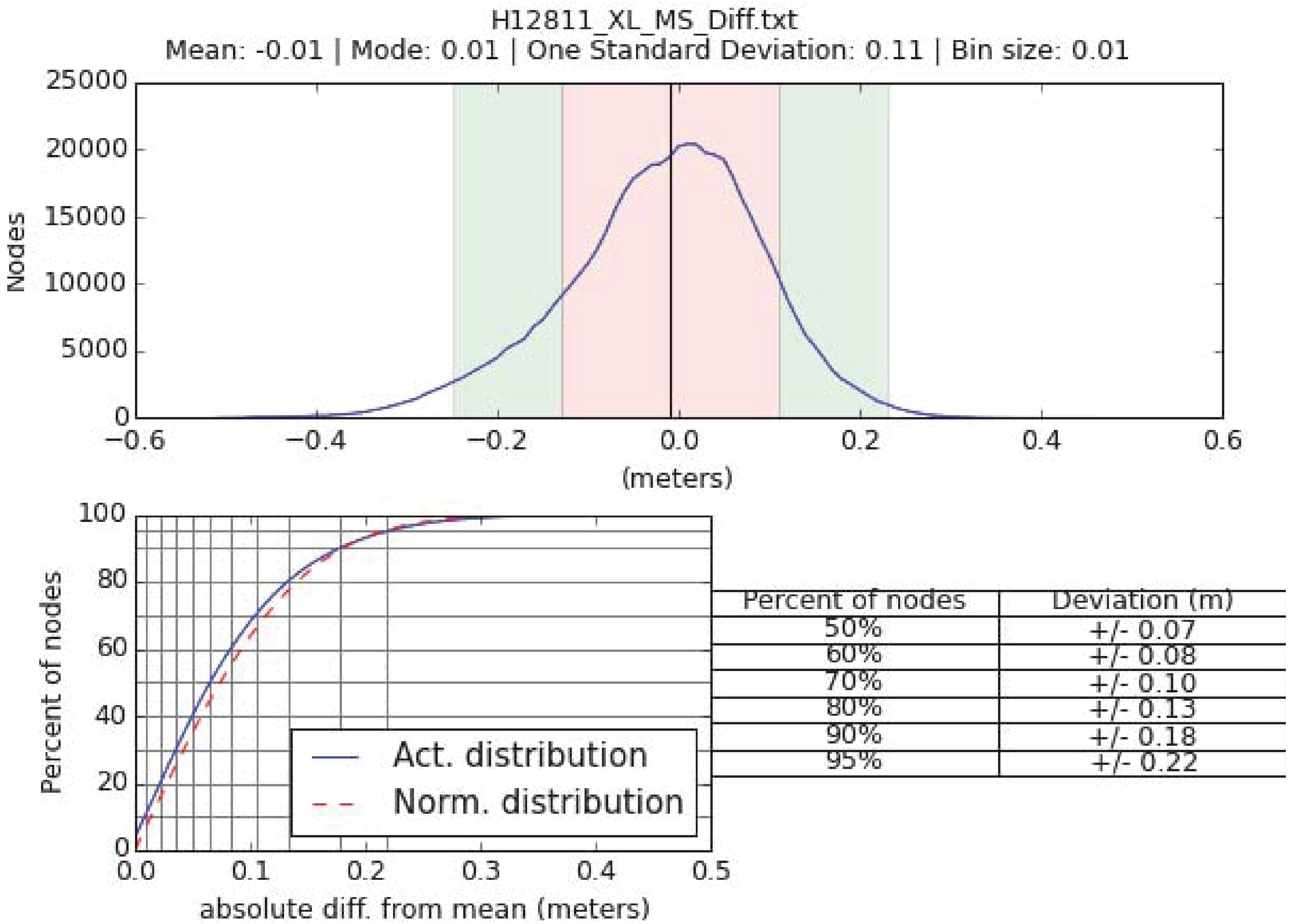


Figure 6: H12811 MBES crossline statistical analysis.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning	Method
0.01 meters	0.132 meters	

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S250	1.0 meters/second	1.0 meters/second	0.5 meters/second

Table 7: Survey Specific Sound Speed TPU Values

All data for survey H12811 were reduced to MLLW via a vertical datum transformation (VDatum) model which was provided to the field unit by HSD OPS. The tide TPU values were provided in the Project Instructions.

B.2.3 Junctions

Two junction comparisons were completed for H12811 as shown in Figure 7. Both surveys were completed by NOAA Ship FERDINAND R. HASSLER: H12801 and H12802 in 2015. Both Surveys are also part of the same project, OPR-B307-FH-15. All junction surfaces were subtracted from the surface of H12811 to assess sounding consistency.

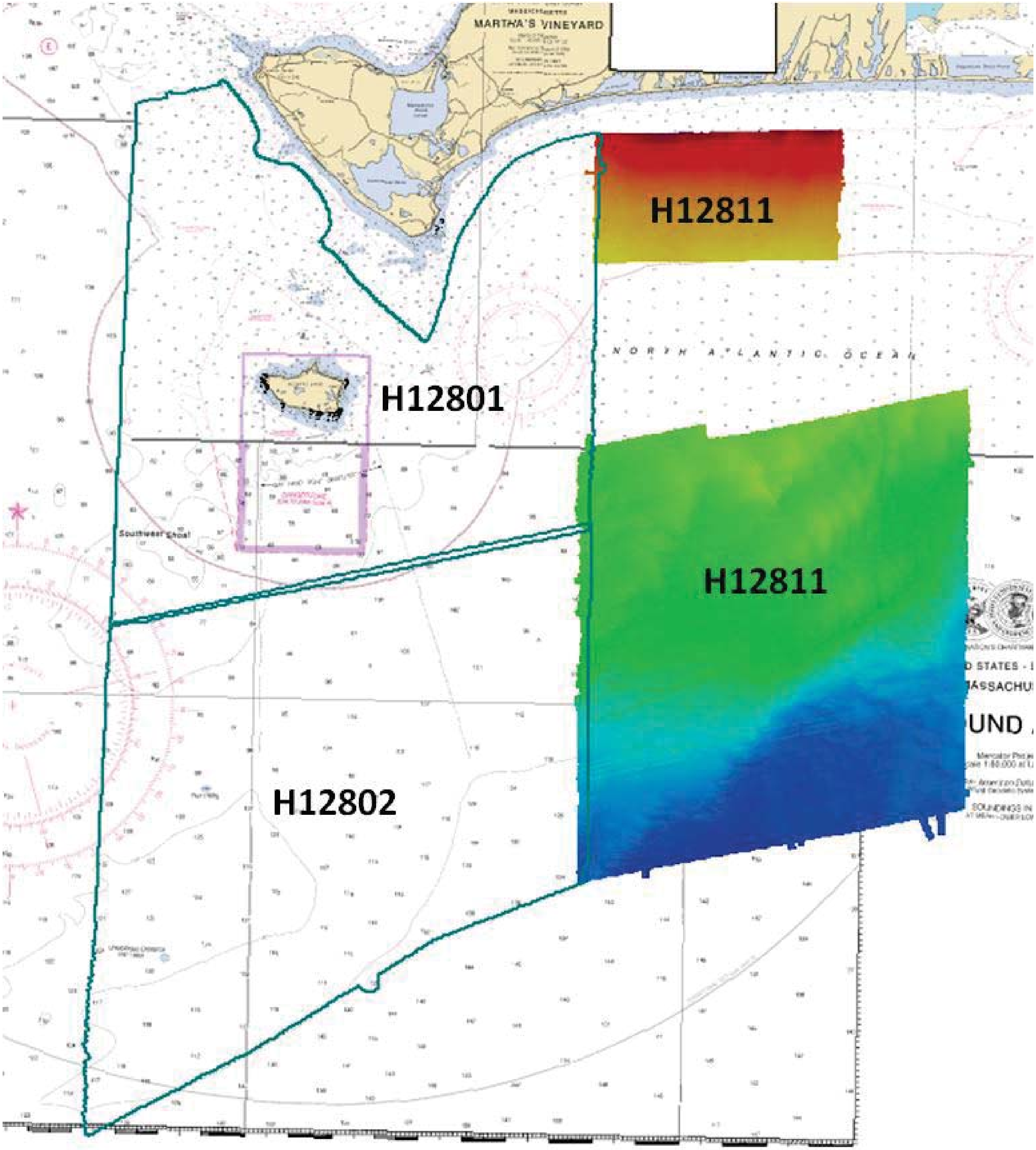


Figure 7: H12811 and junction surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12801	1:20000	2015	NOAA Ship FERDINAND R. HASSLER	W
H12802	1:40000	2015	NOAA Ship FERDINAND R. HASSLER	W

Table 8: Junctioning Surveys

H12801

The area of overlap between sheet H12811 and its junction sheet H12801, shown in Figure 8, was reviewed in CARIS subset editor. H12811 was subtracted from the surface of the junctioning survey to assess sounding consistency.

Survey H12801 was conducted by NOAA Ship FERDINAND R. HASSLER in 2015 during the course of project OPR-B307-FH-15. A difference surface analysis between H12811 and H12801 2-meter resolution surfaces, which included over 1 million nodes, showed H12811 on average 0.04 meters deeper then H12801, with a standard deviation of 0.11 meters. 95% of all differences are less than 0.22 meters from the mean.

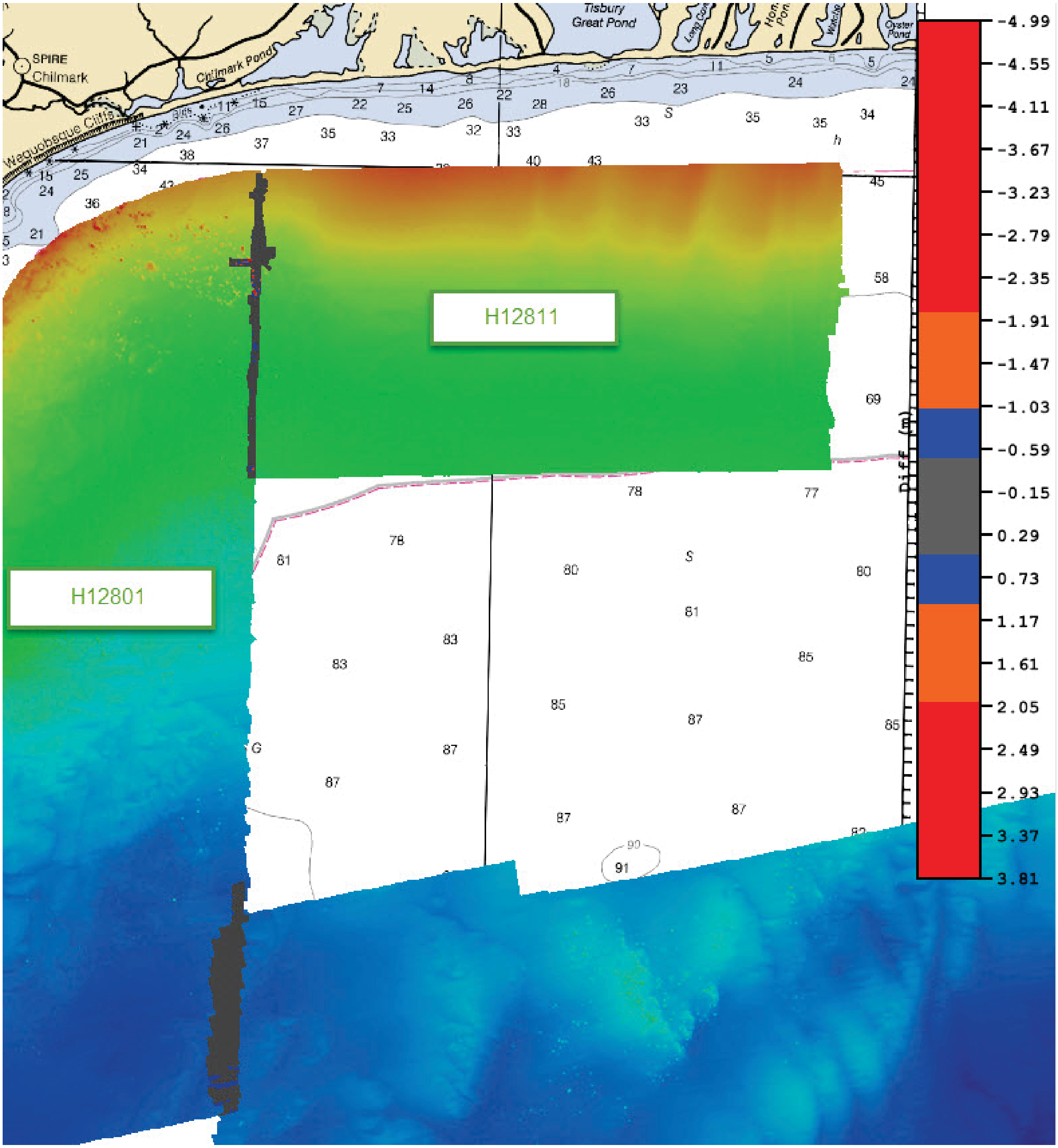
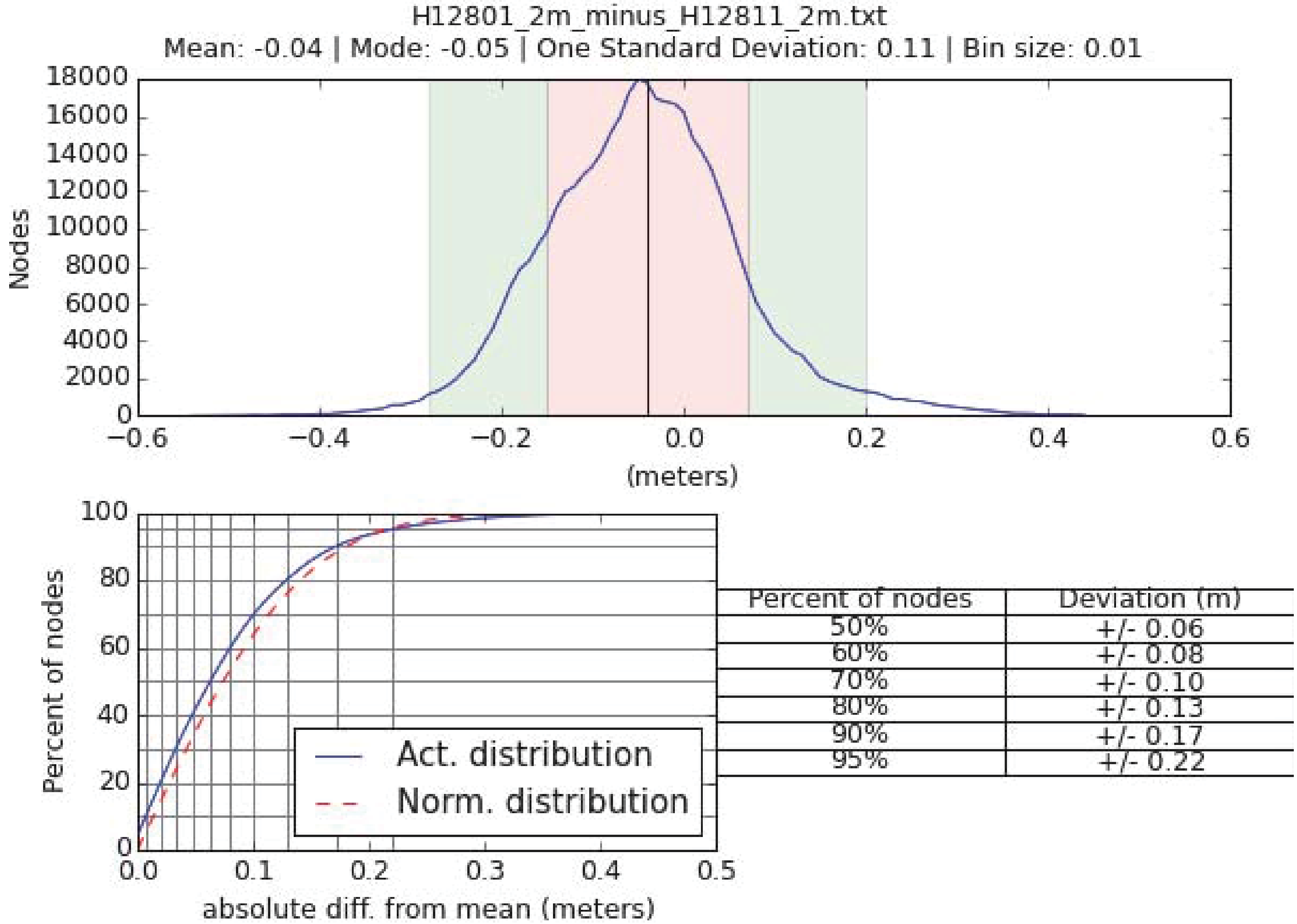


Figure 8: Junctioning area between surveys H12811 and H12801



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.17
95%	+/- 0.22

Figure 9: Junction comparison statistics of H12811 and H12802

<u>H12802</u>

The area of overlap between sheet H12811 and its junction sheet H12802, shown in Figure 10, was reviewed in CARIS subset editor. The junctioning survey was subtracted from the surface of H12811 to assess sounding consistency.

Survey H12802 was conducted by NOAA Ship FERDINAND R. HASSLER in 2015 during the course of project OPR-B307-FH-15. A difference surface analysis between H12811 and H12802 4-meter resolution surfaces, which included over 1 million nodes, showed H12811 on average 0.28 meters deeper then H12802, with a standard deviation of 0.20 meters. 95% of all differences are less than 0.38 meters from the mean.

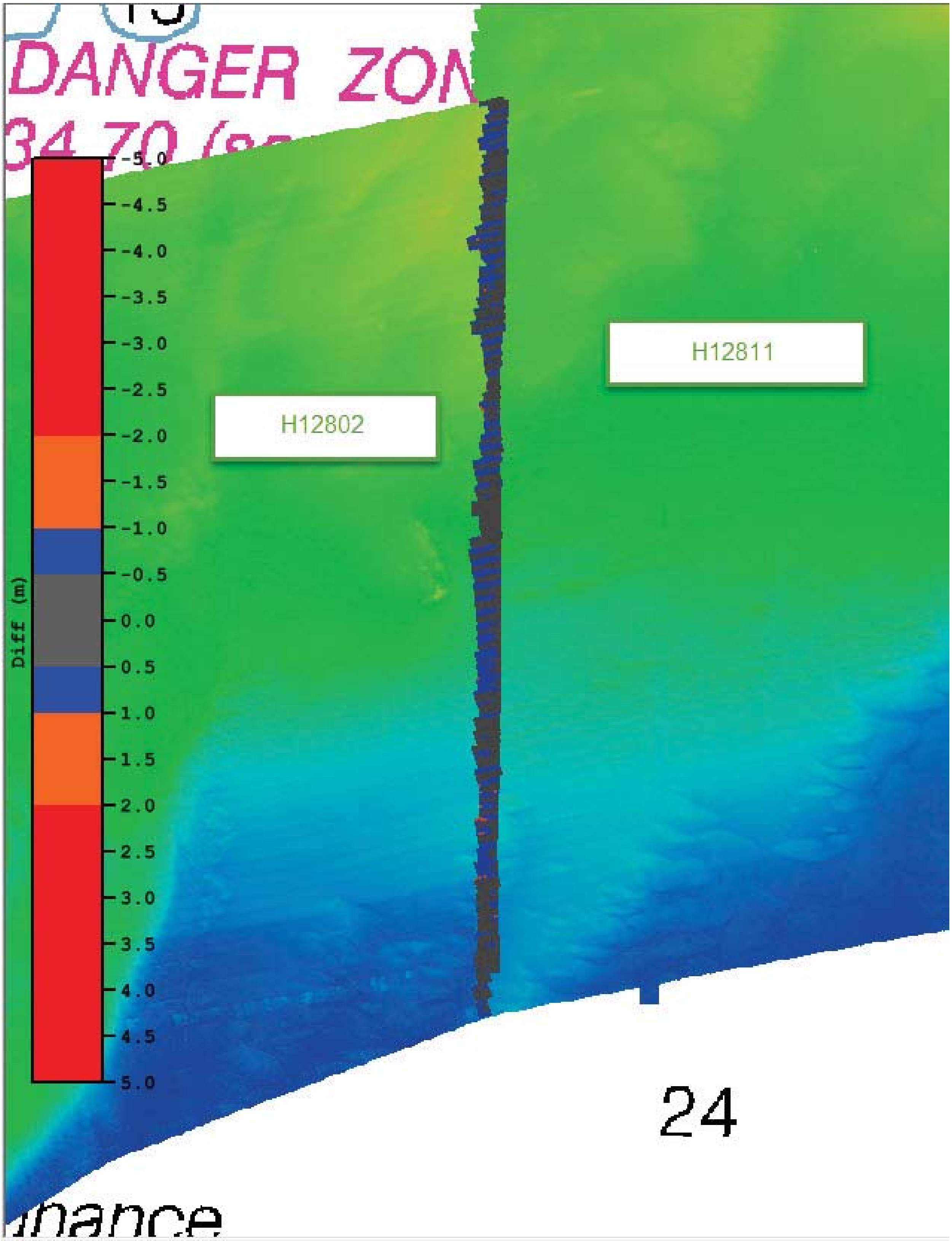


Figure 10: Junctioning area between H12811 and H12802

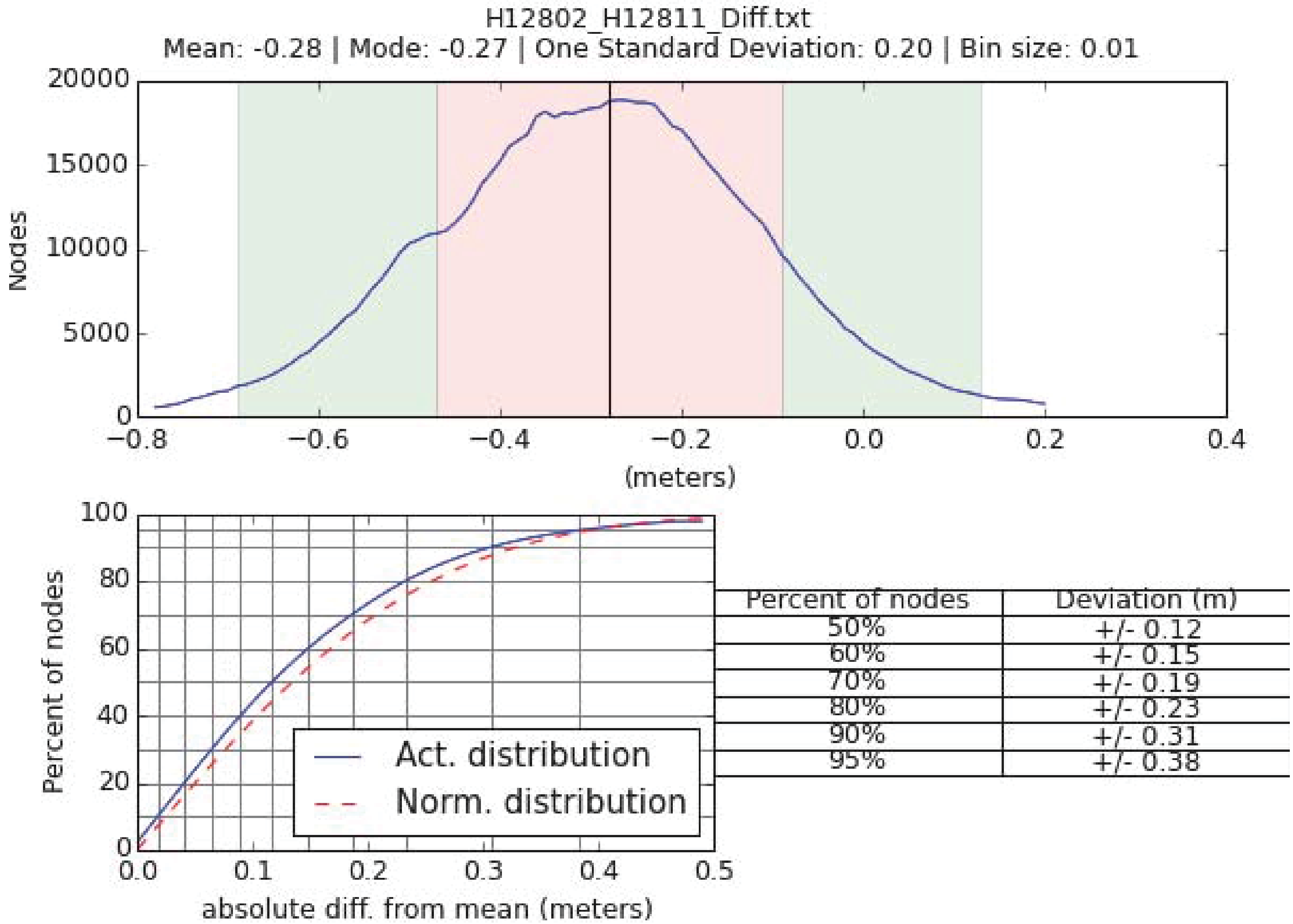


Figure 11: Junction comparison statistics of H12811 and H12802

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

HYPACK Forcing File Extenstions

Every line acquired in the extents of survey H12811 had two file extensions added on to it during acquisition. This resulted in the raw survey lines being name XXX_XXXX.hsx.s7k. The only negative effect of this was seen in backscatter processing with Fledermaus FMGT. The extension .hsx extension was removed for processing.

B.2.6 Factors Affecting Soundings

Surface Sound Speed Spikes

A holiday located at approximately south west from the 125 foot sounding on chart 13218 was caused by a spike in the surface sound speed profile. The hydrographer tried to interpolate over this spike the port and starboard line 000_0804.HSX for DN198 in CARIS Attitude Editor but the interpolation did not improve the data quality. The data was removed as it did not meet specification.

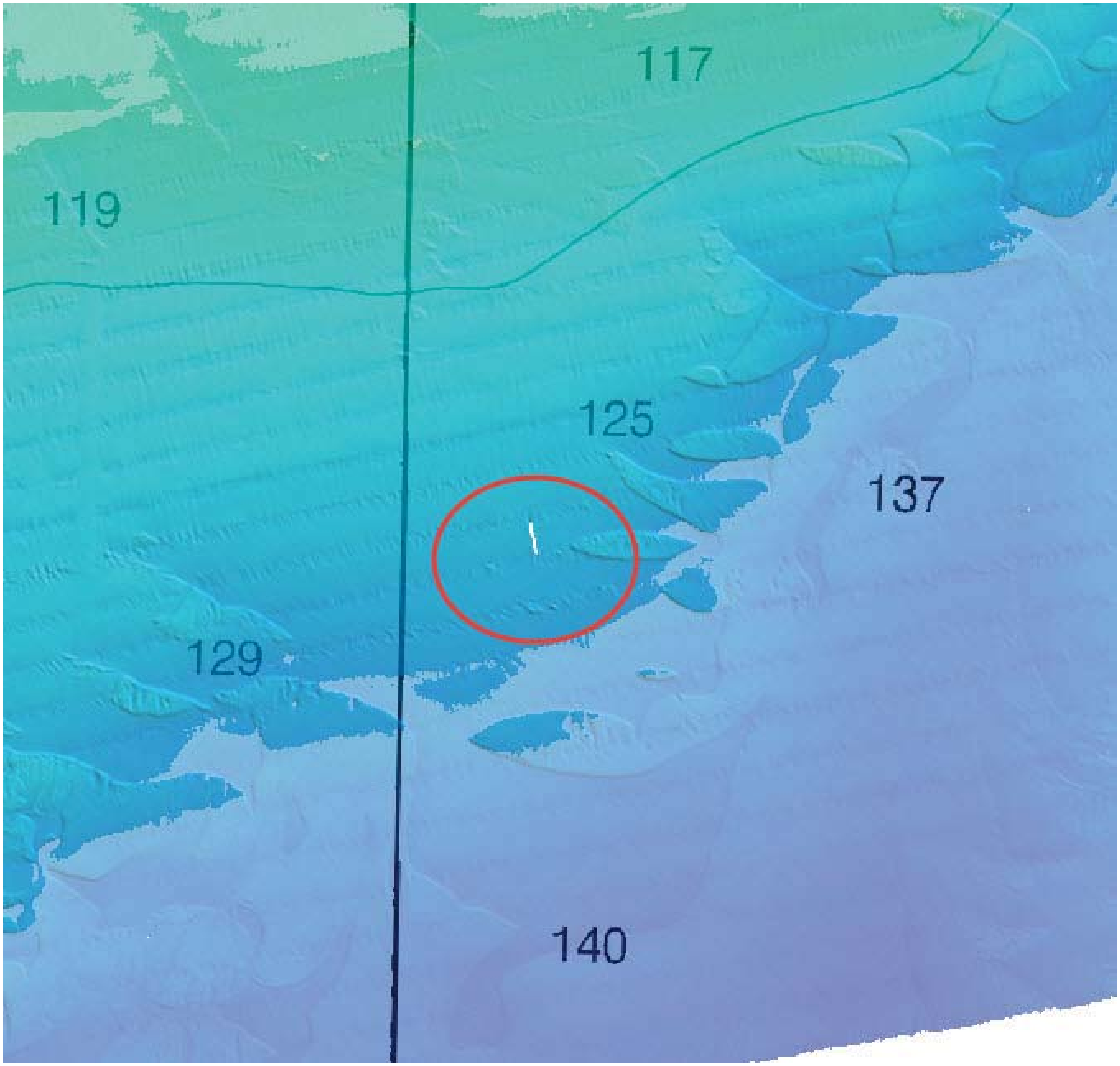


Figure 12: Surface sound speed holiday overview

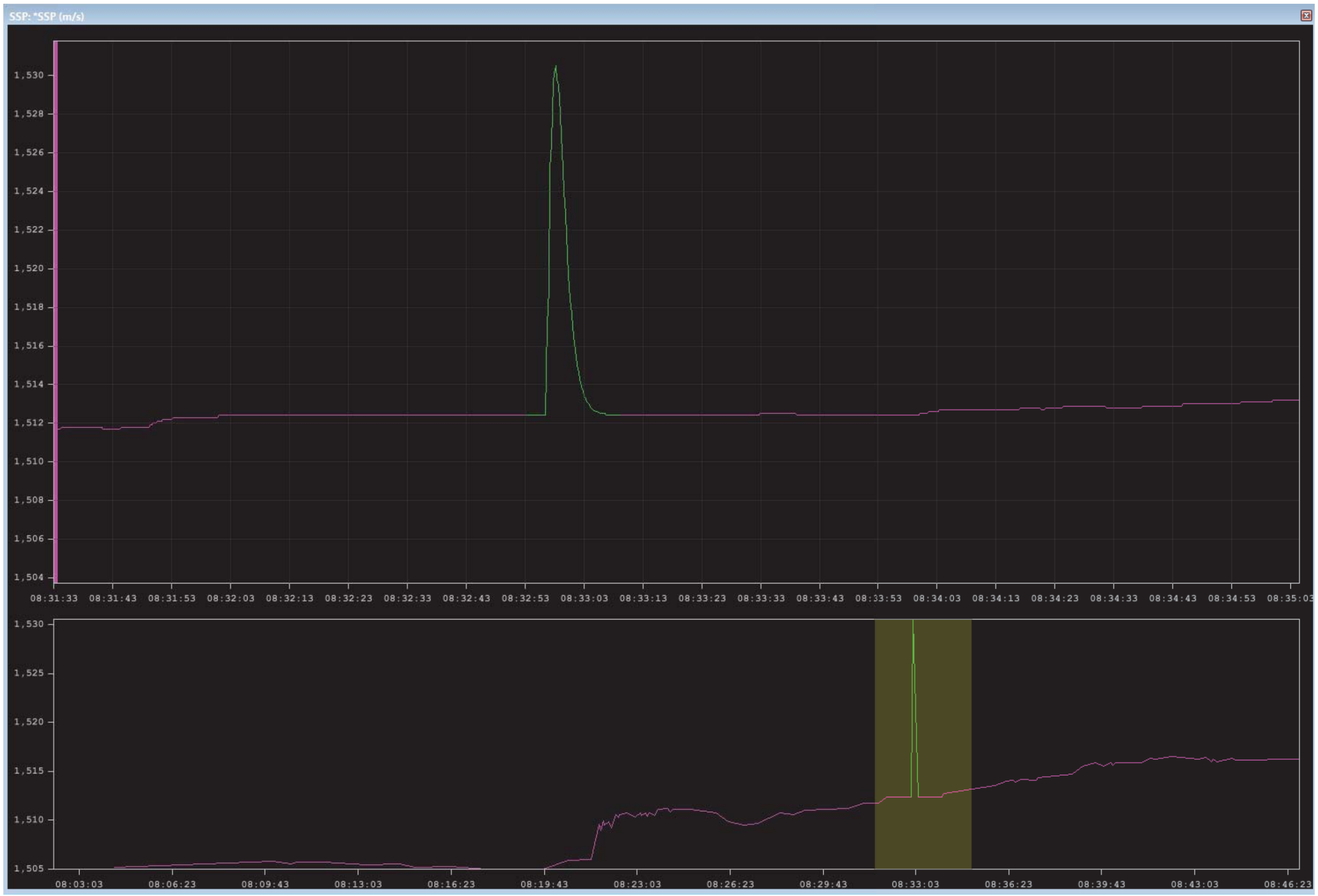


Figure 13: Example of surface sound speed spike from DN198 on port line 000_0804.HSX.

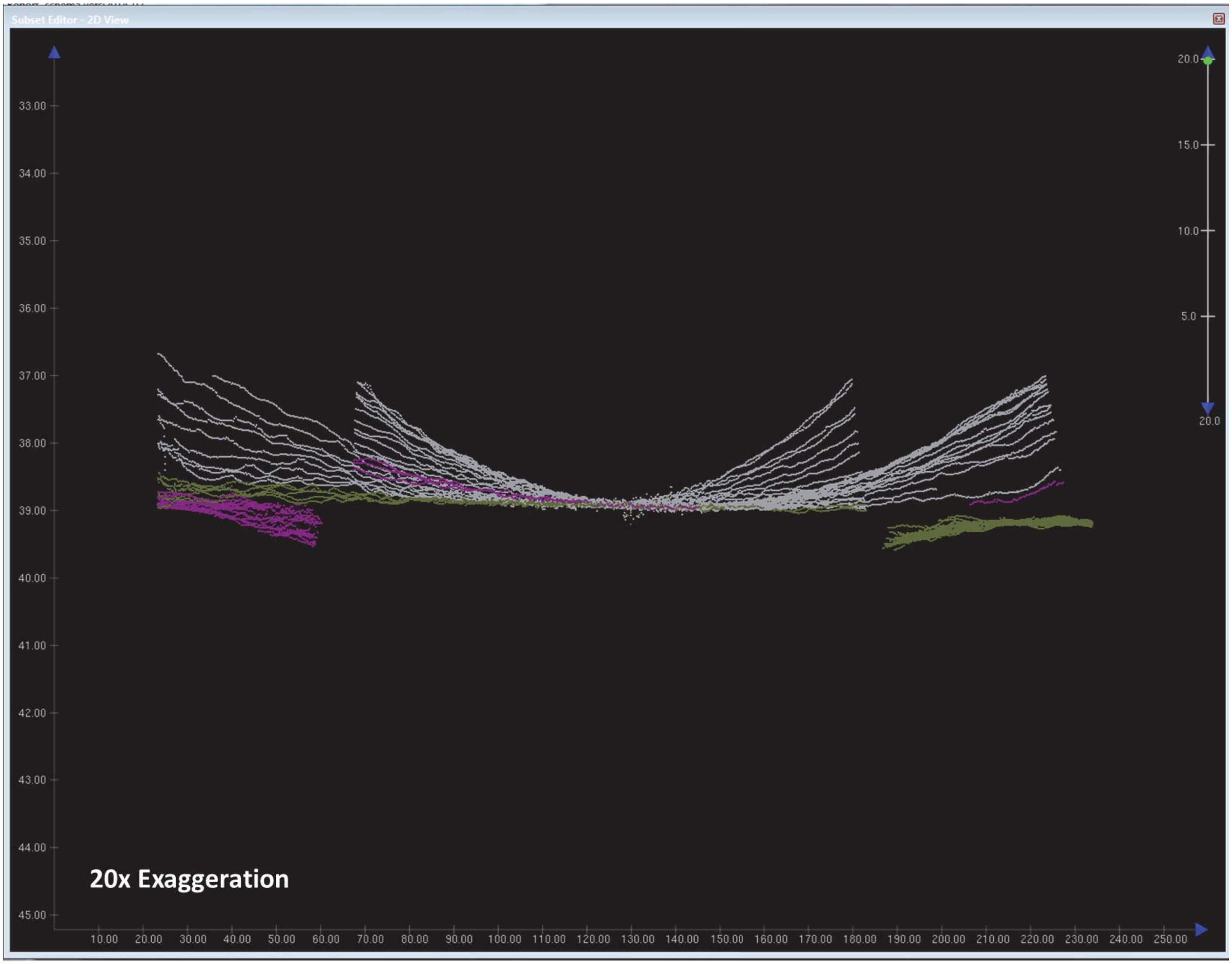


Figure 14: Rejected data represented in CARIS Subset Editor.

<u>Sound Speed Variability</u>

DN 198 and 199 provided very challenging environmental conditions in terms of sound speed. On average casts were taken at an interval of 15-20 minutes which was not frequent enough to account for the variability. Figures 15 and 16 show the sound speed profiles from these days. As a result, refraction artifacts do exist in H12811. The hydrographer has rejected refraction data which does not meet TVU specifications. Some of the rejected data resulted in small holidays but hydrographer analysis of the holiday areas indicates no existence of navigationally significant features.

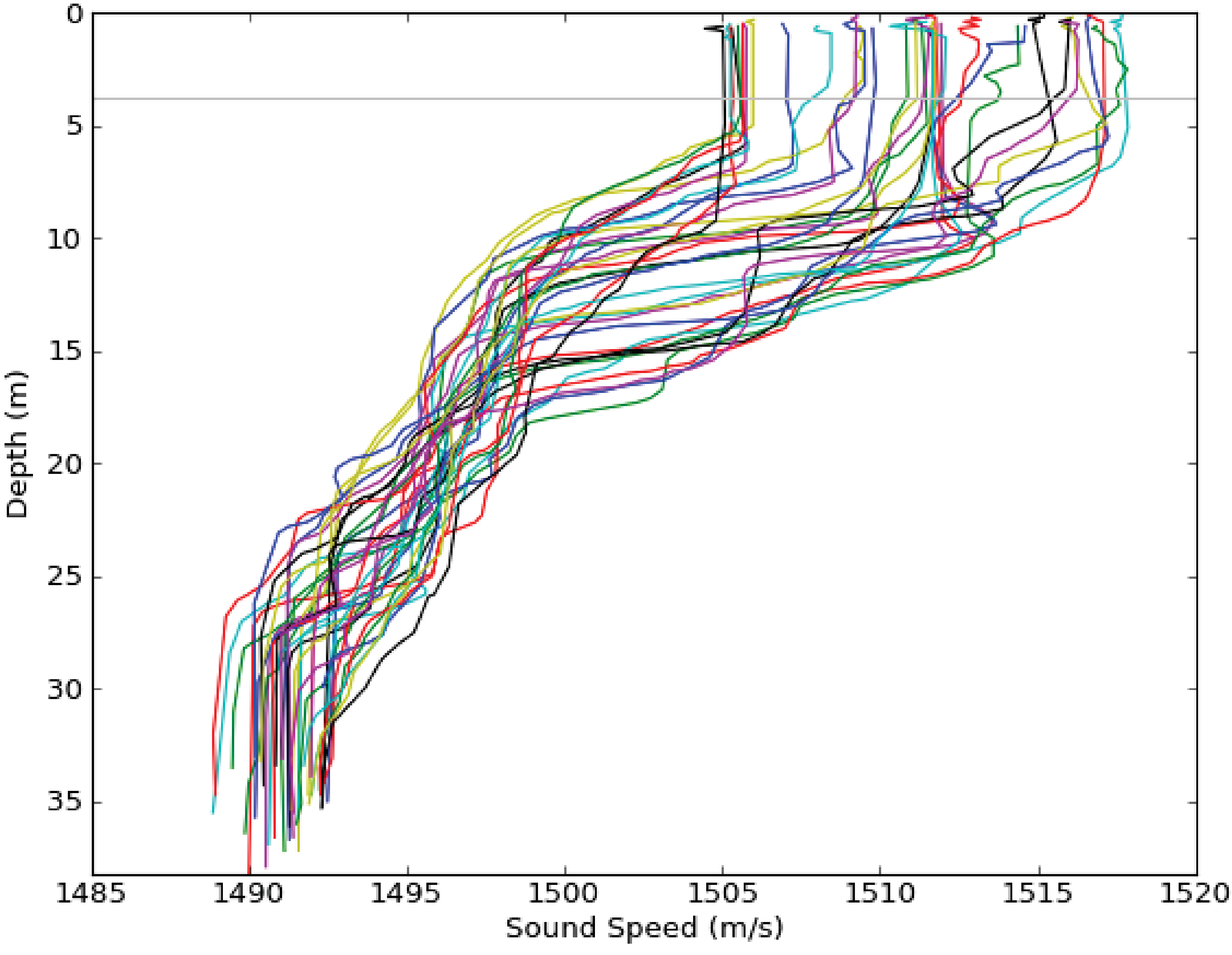


Figure 15: DN198 Sound Speed Profiles.

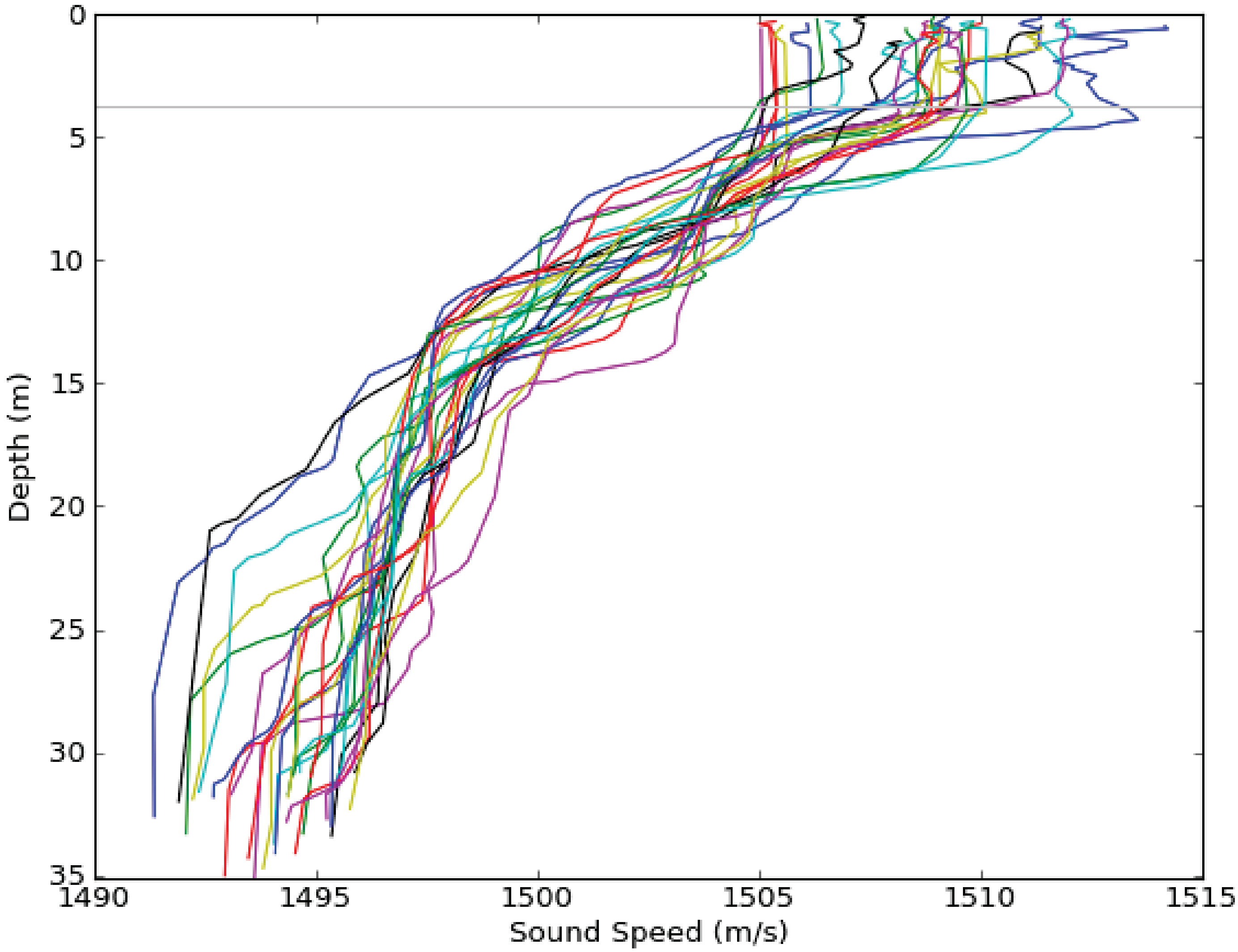


Figure 16: DN199 Sound Speed Profiles.

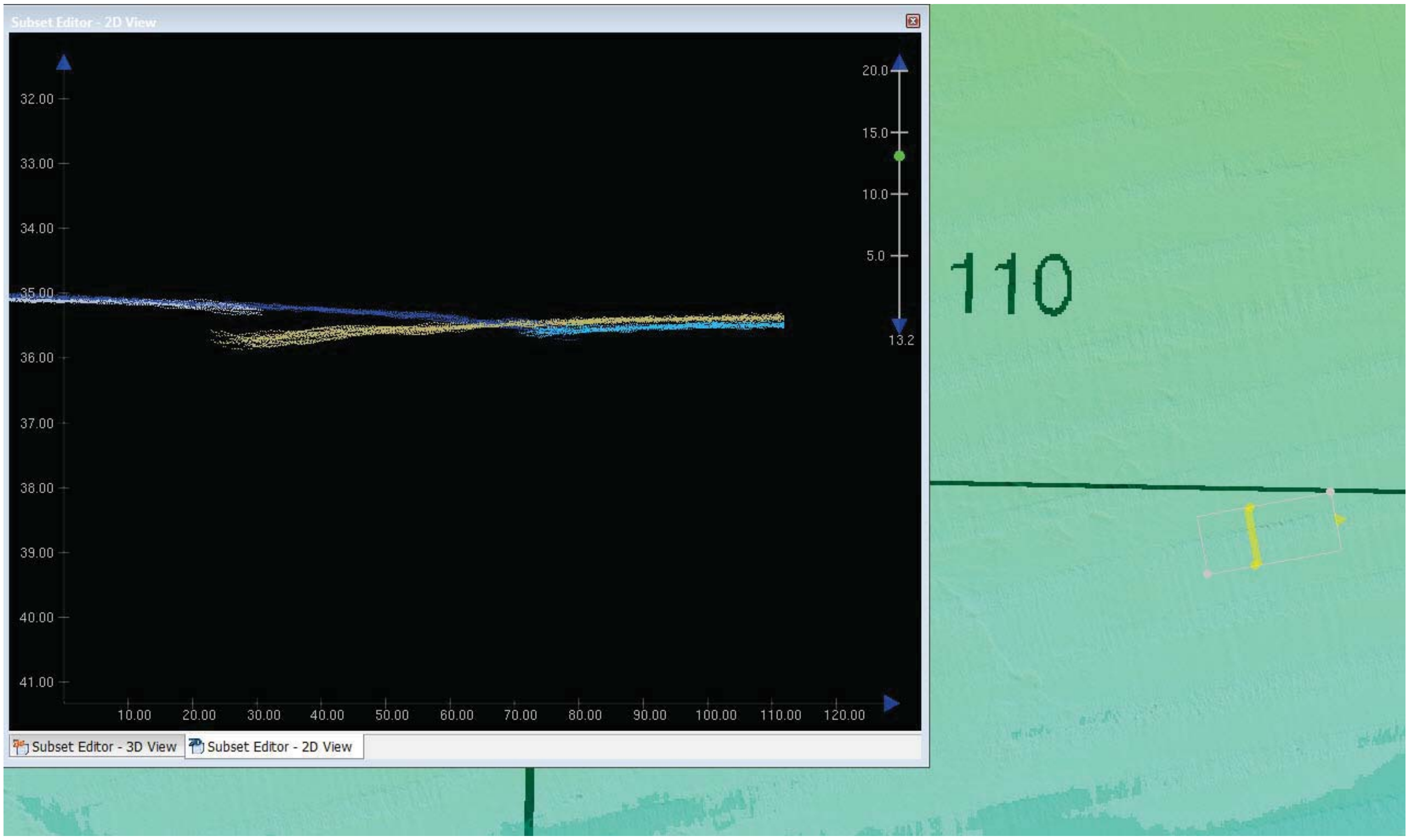


Figure 17: Increased overlap to compensate for sound speed artifacts

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: A total of 349 sound speed measurements were taken within the boundaries of survey H12811. Due to the stratification of the water column and variance between consecutive sound speed profiles, casts were taken at a variety of intervals, ranging from 5 minutes to 30 minutes using the MVP 200. In general sound speed corrections were applied in CARIS using Nearest in Distance Within Time (NDWIT) of 1 hour for the entire survey.

Sound speed artifacts exist throughout the survey, with most being outside of the IHO total vertical uncertainty limits for the corresponding water depth. This was compensated for by increasing coverage overlap. Examples of this can be seen in the Factors Affecting Soundings section.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Holidays and data gaps

Four holidays were identified in survey H12811 as defined by 2015 HSSD in Section 5.2.2.2. For a complete coverage survey, a holiday is defined as at least three nodes by three nodes. The holidays shown in Figures 18 and 19 are due to poor overlap in the outer beams. The holidays shown in Figures 20 and 21are due to sound speed variability and surface sound speed spikes, respectively (see Section B.2.6 of this report in this report for more information). These holidays do not exist in areas where significant shoals or features are present.

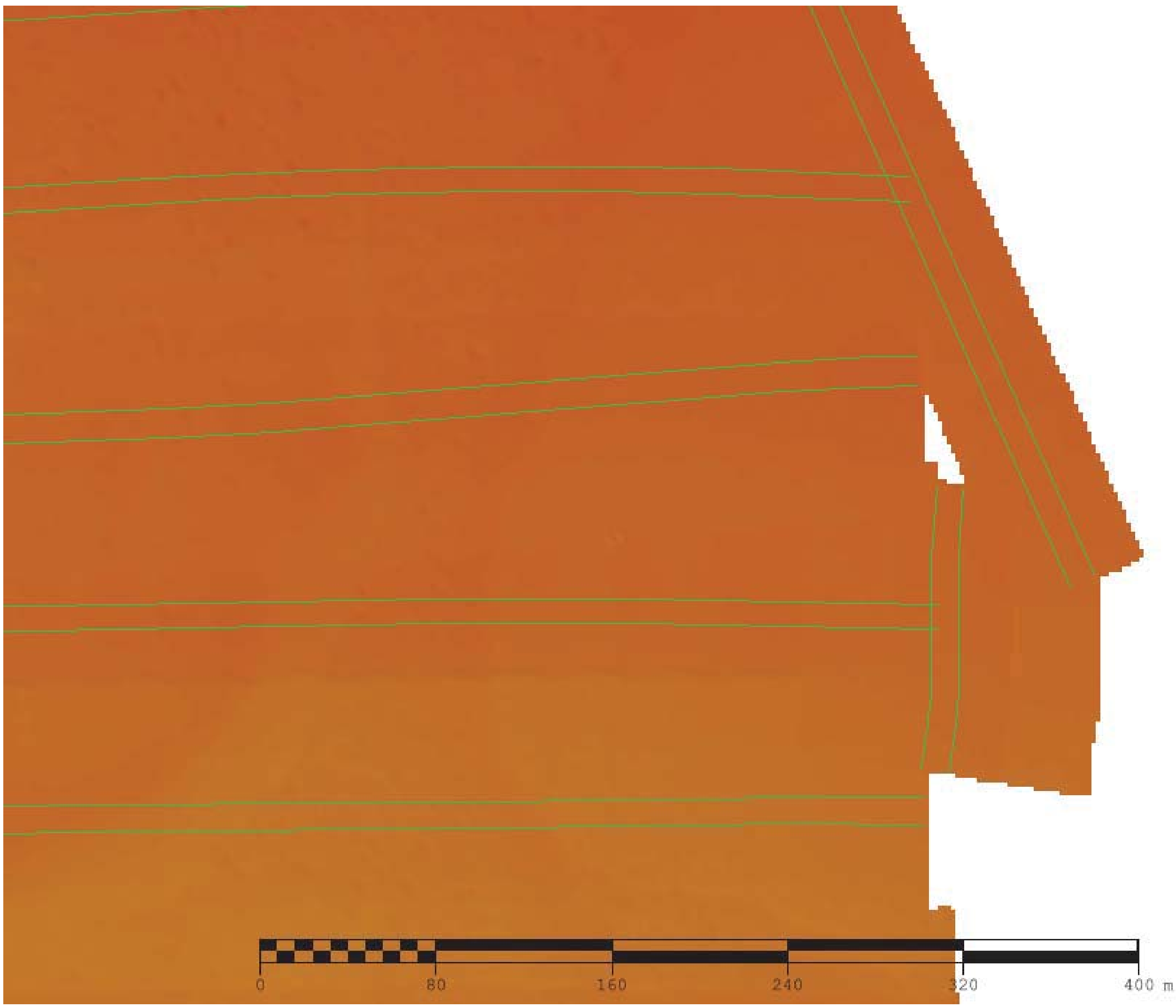


Figure 18: Holiday in 1m surface located at 41-18-13.58N, 70-36-44.12W.

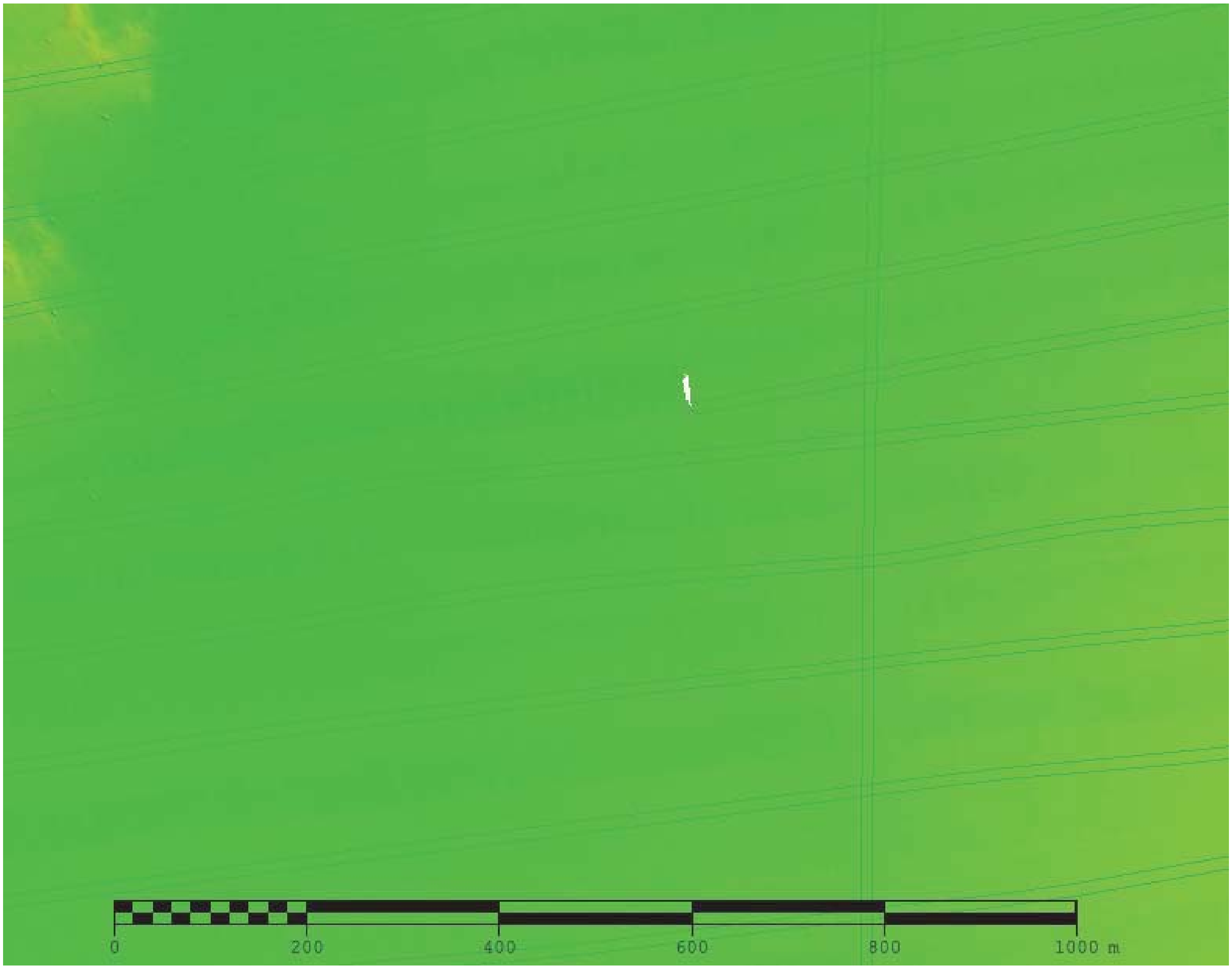


Figure 19: Holiday in 1m surface located at 41-13-29.72N, 70-37-33.96W.

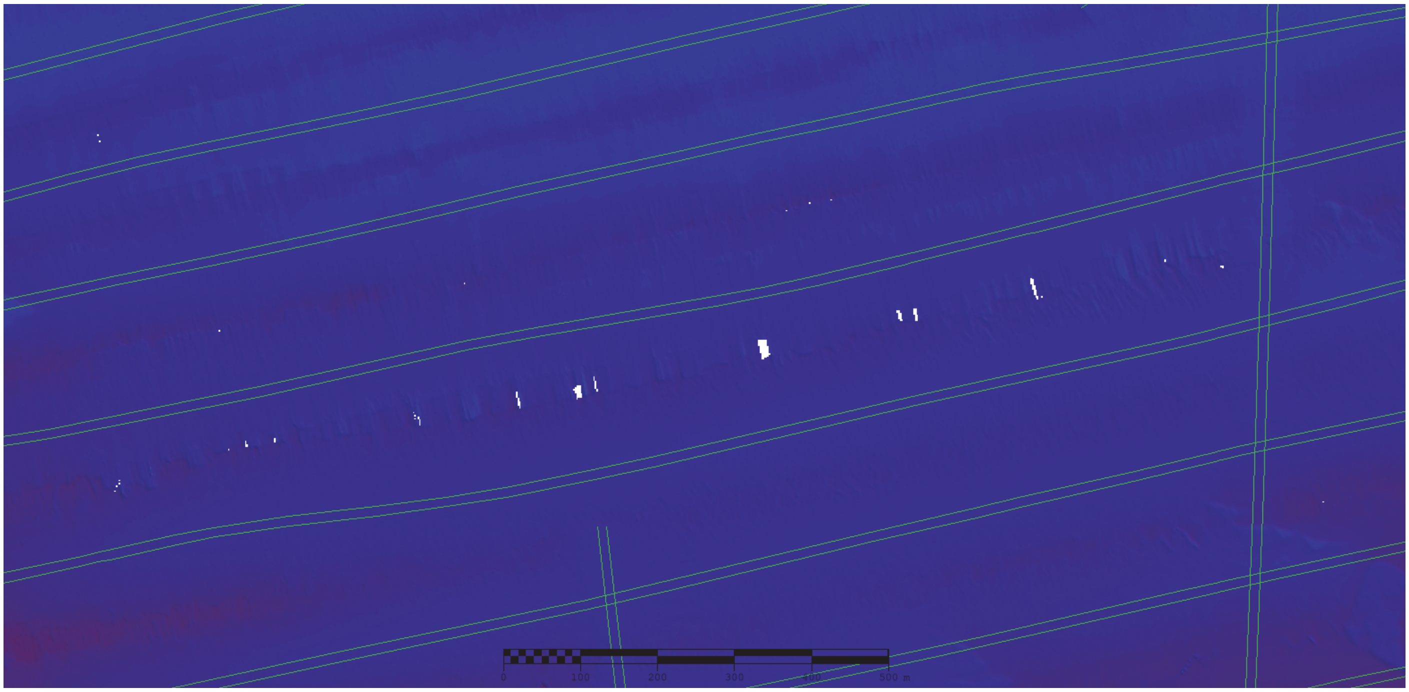


Figure 20: Holidays in 2m surface located approximately 41-08-19.87N, 70-41-20.84W.

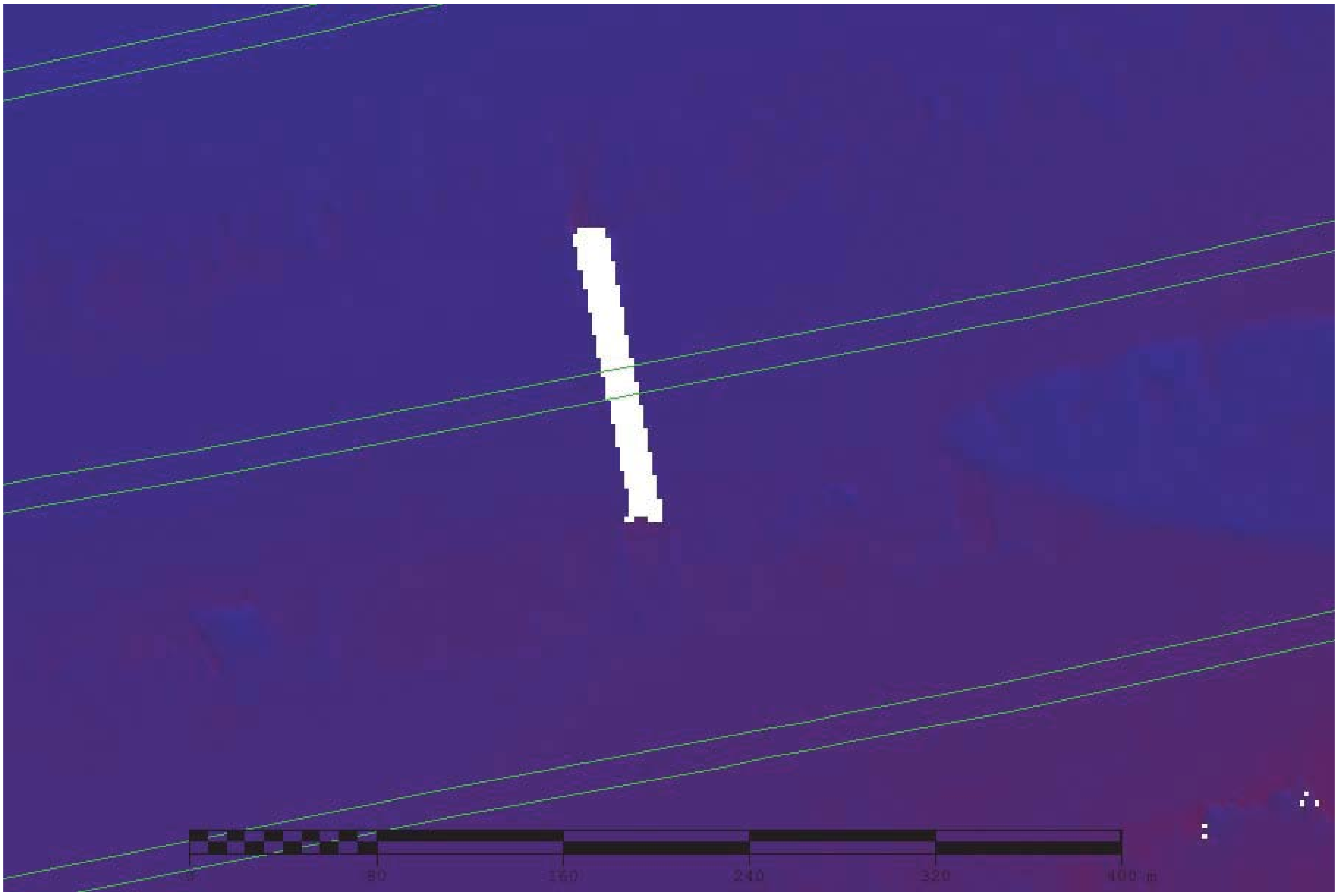


Figure 21: Holiday in 2m surface located at 41-08-28.74N, 70-39-38.62W.

B.2.10 Data Density Analysis

A density analysis was run to calculate the number of soundings per surface node. The results determined that over 99% of all nodes in each finalized surface contain five or more soundings. The density analysis was executed on nodes which are populated by at least one sounding and did not account of holidays located within the surface.

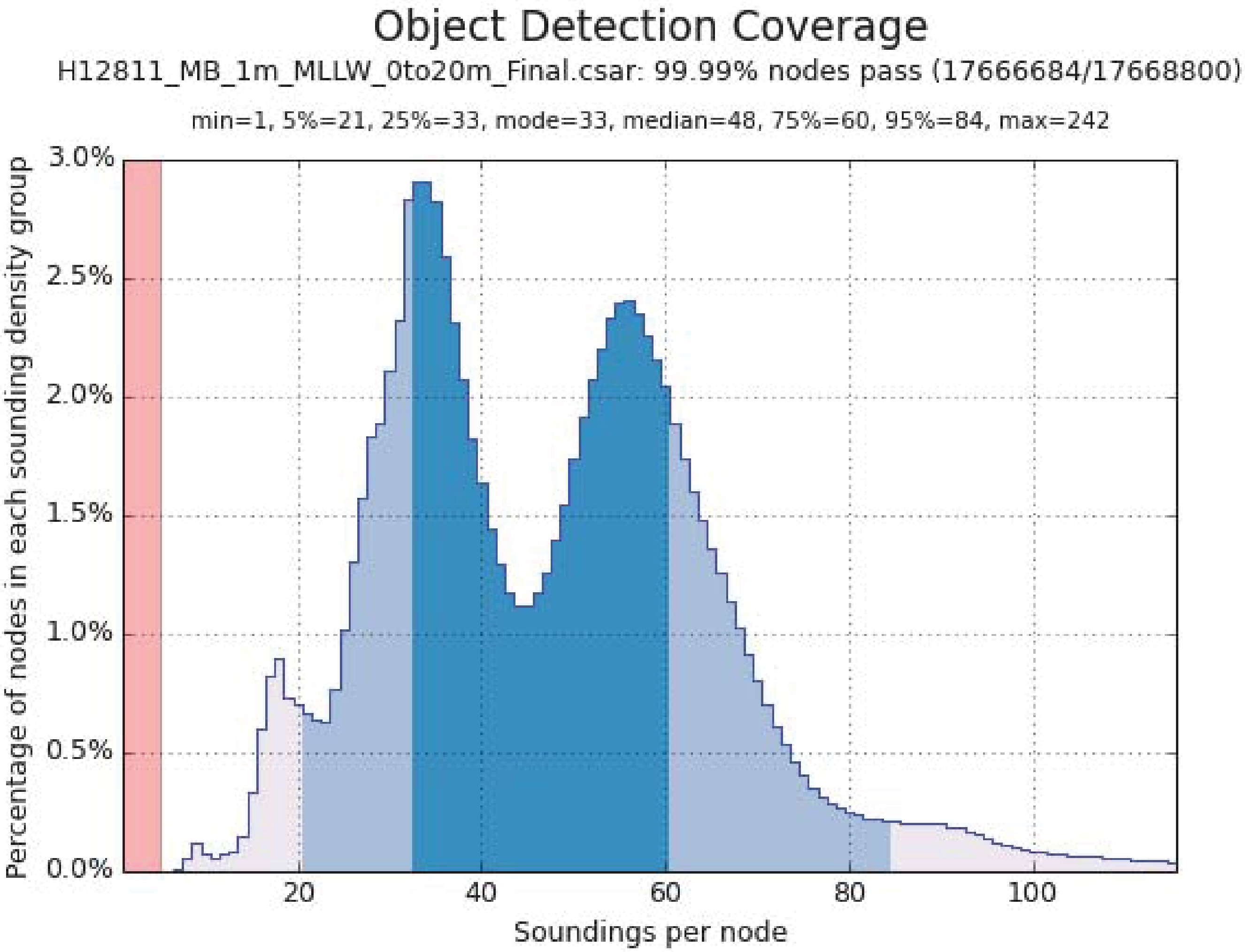


Figure 22: Data density analysis for 1-meter finalized surface.

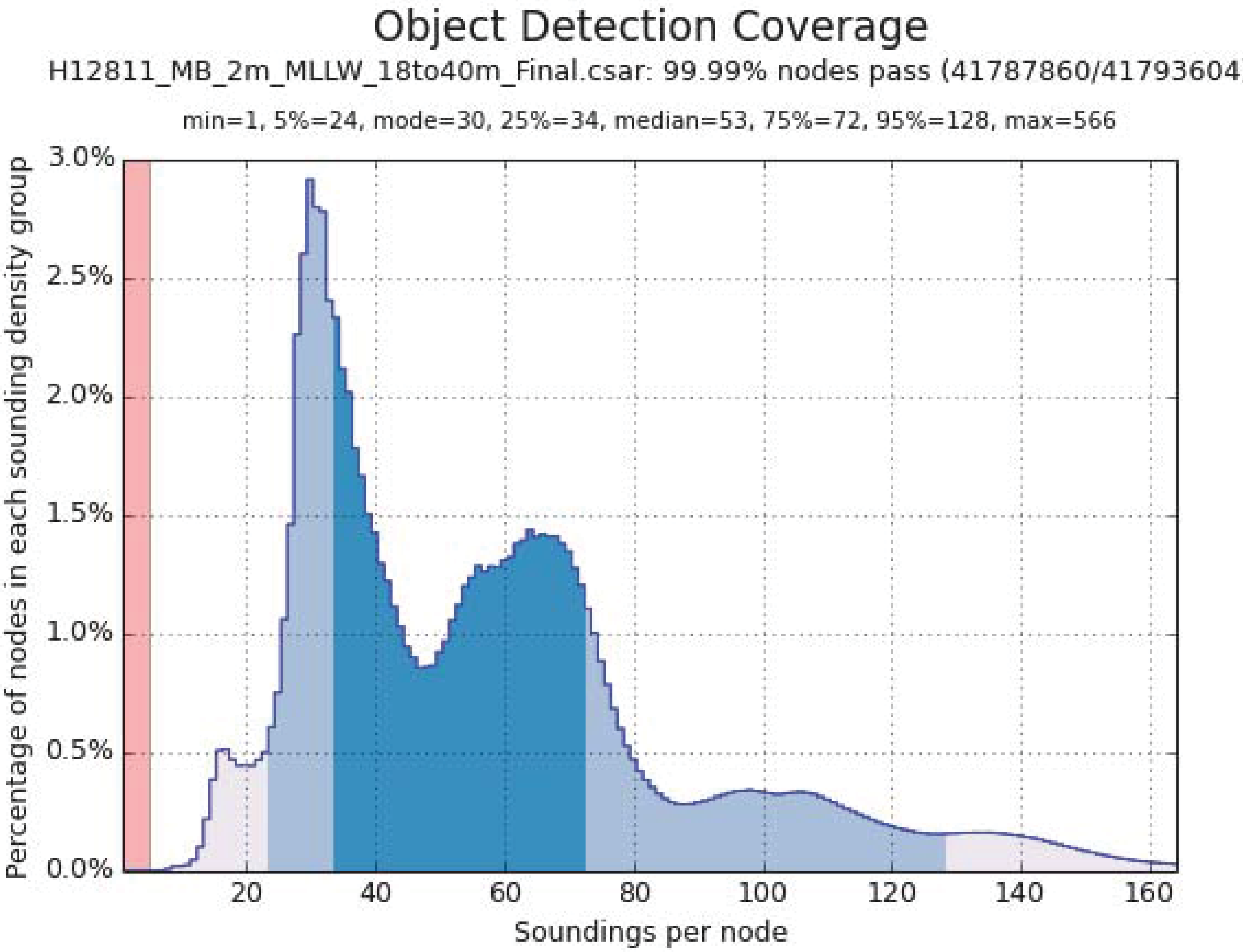


Figure 23: Data density analysis for 2-meter finalized surface.

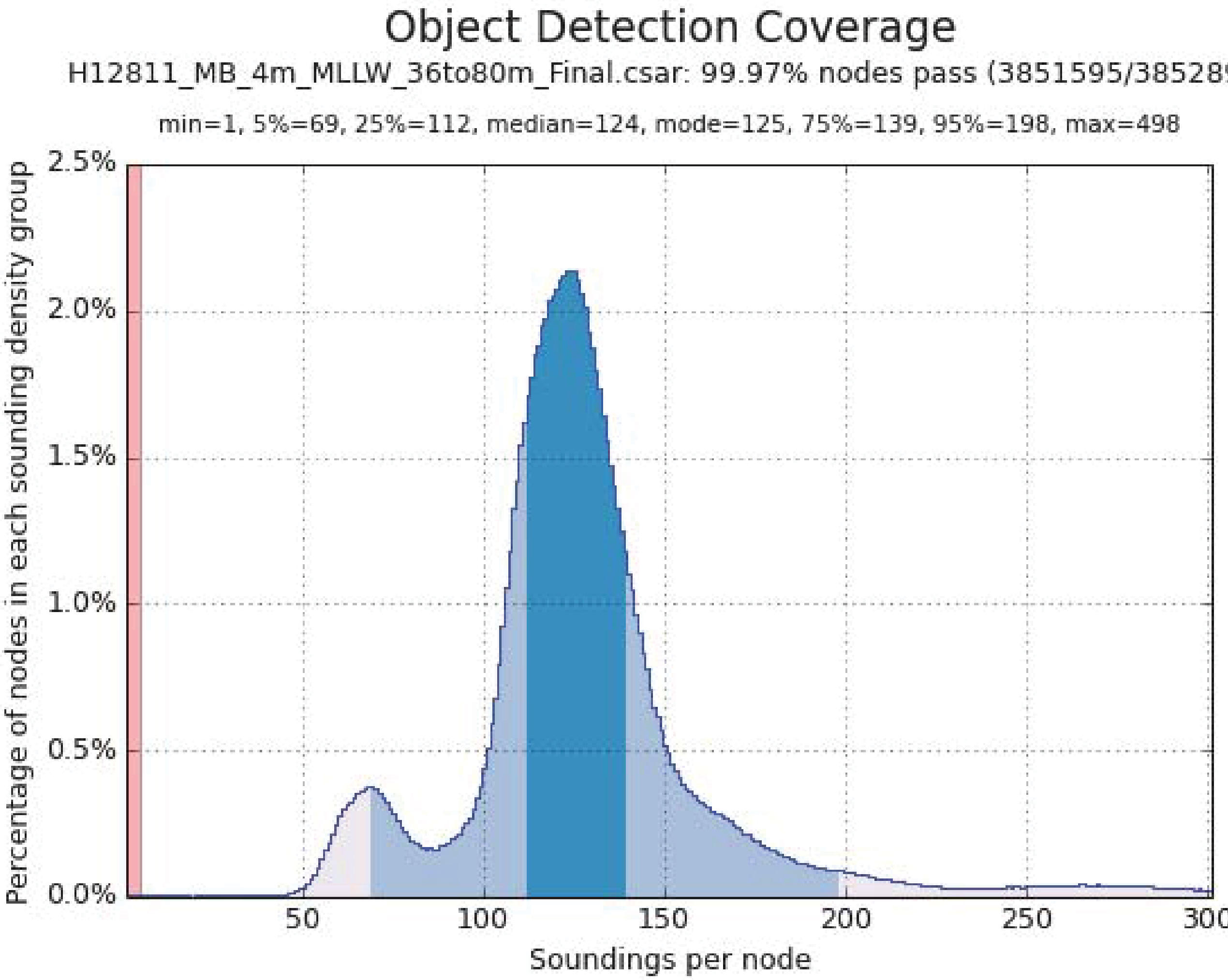


Figure 24: Data density analysis for 4-meter finalized surface.

B.2.11 Total Vertical Uncertainty Analysis

Total vertical uncertainty analysis was performed using the Finalized CSAR QA tool within Pydro. The resulting statistical analysis found that 100% of nodes within survey H12811 meet the vertical uncertainty standards.

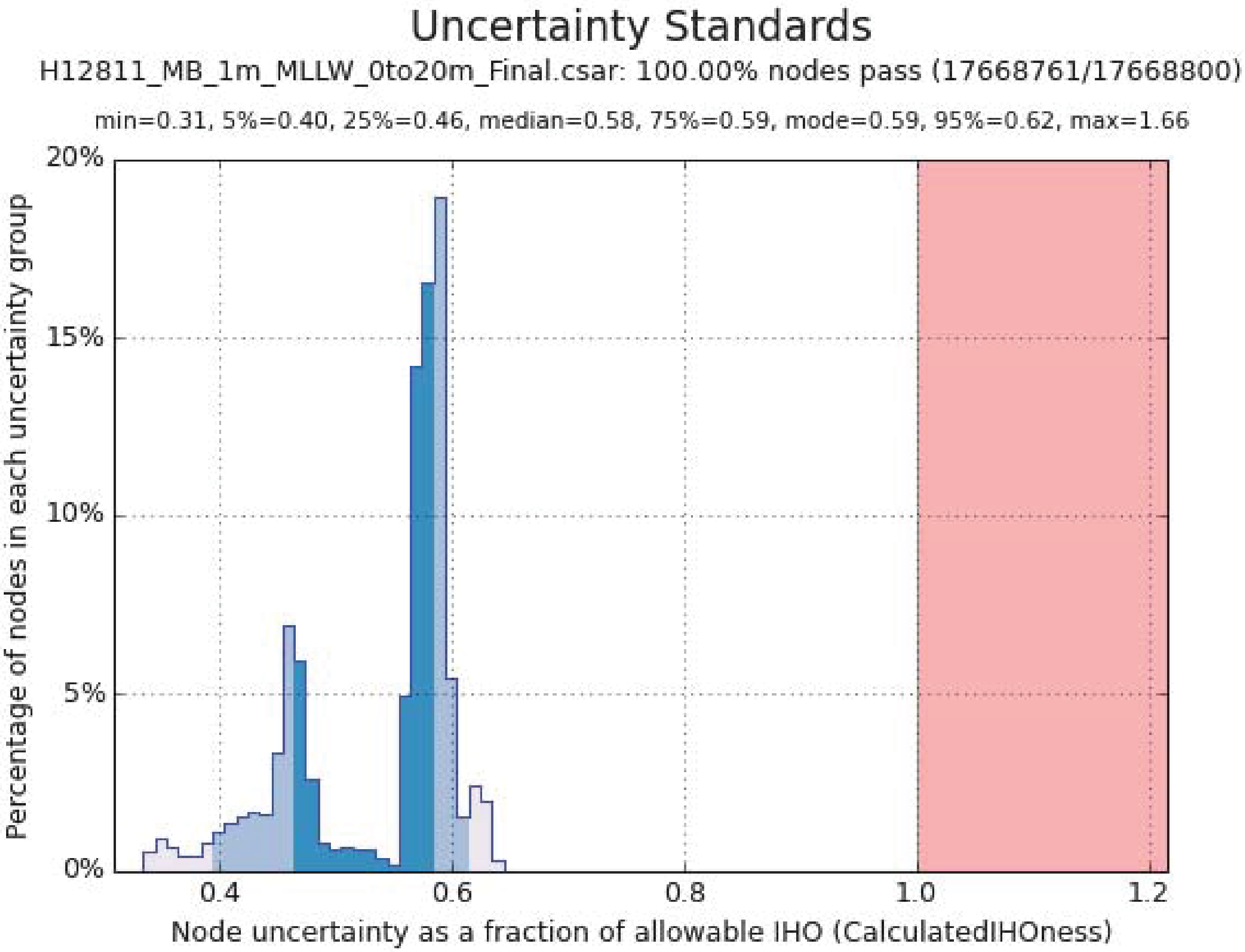


Figure 25: Total vertical uncertainty analysis for 1-meter finalized surface.

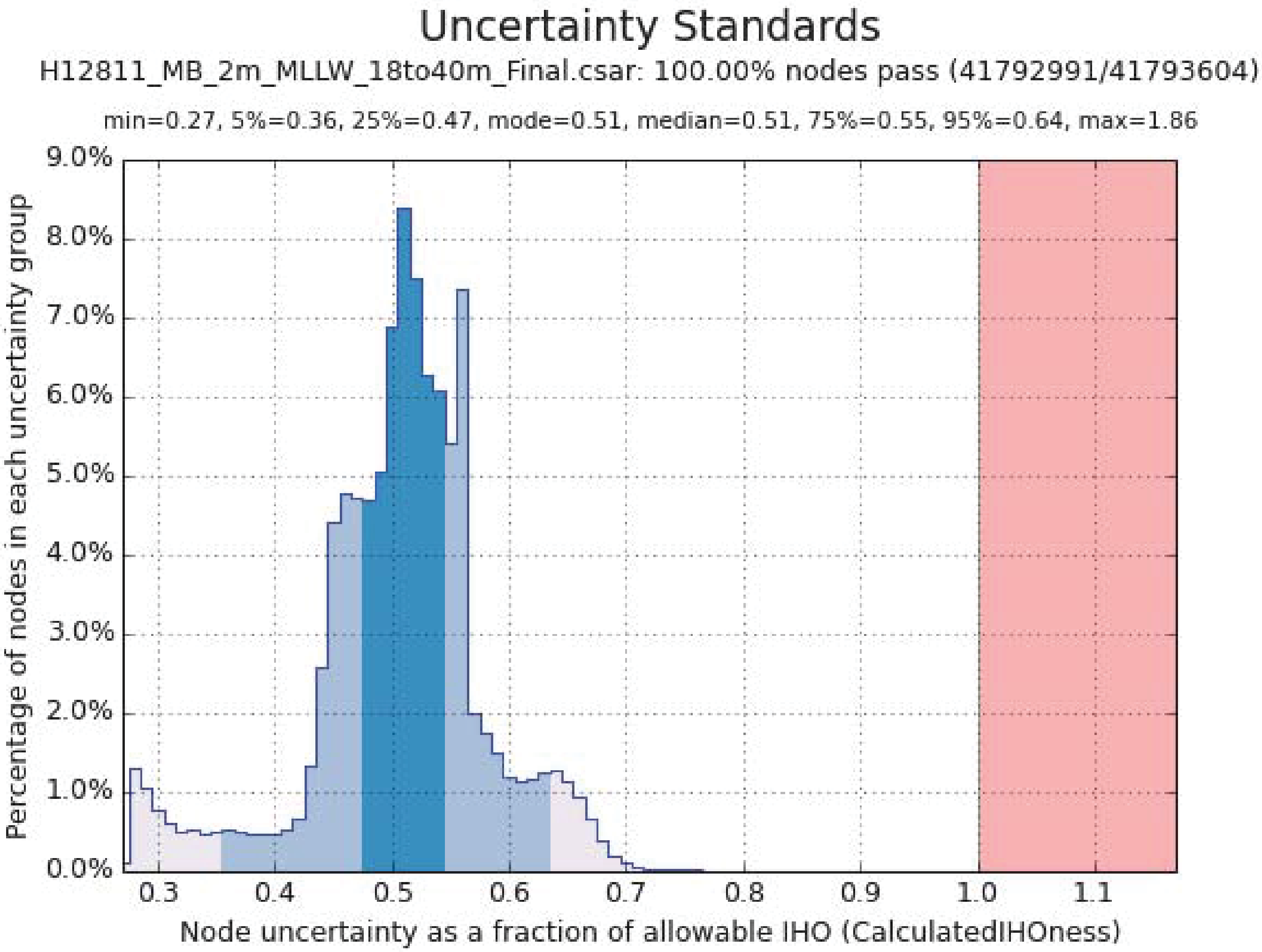


Figure 26: Total vertical uncertainty analysis for 2-meter finalized surface.

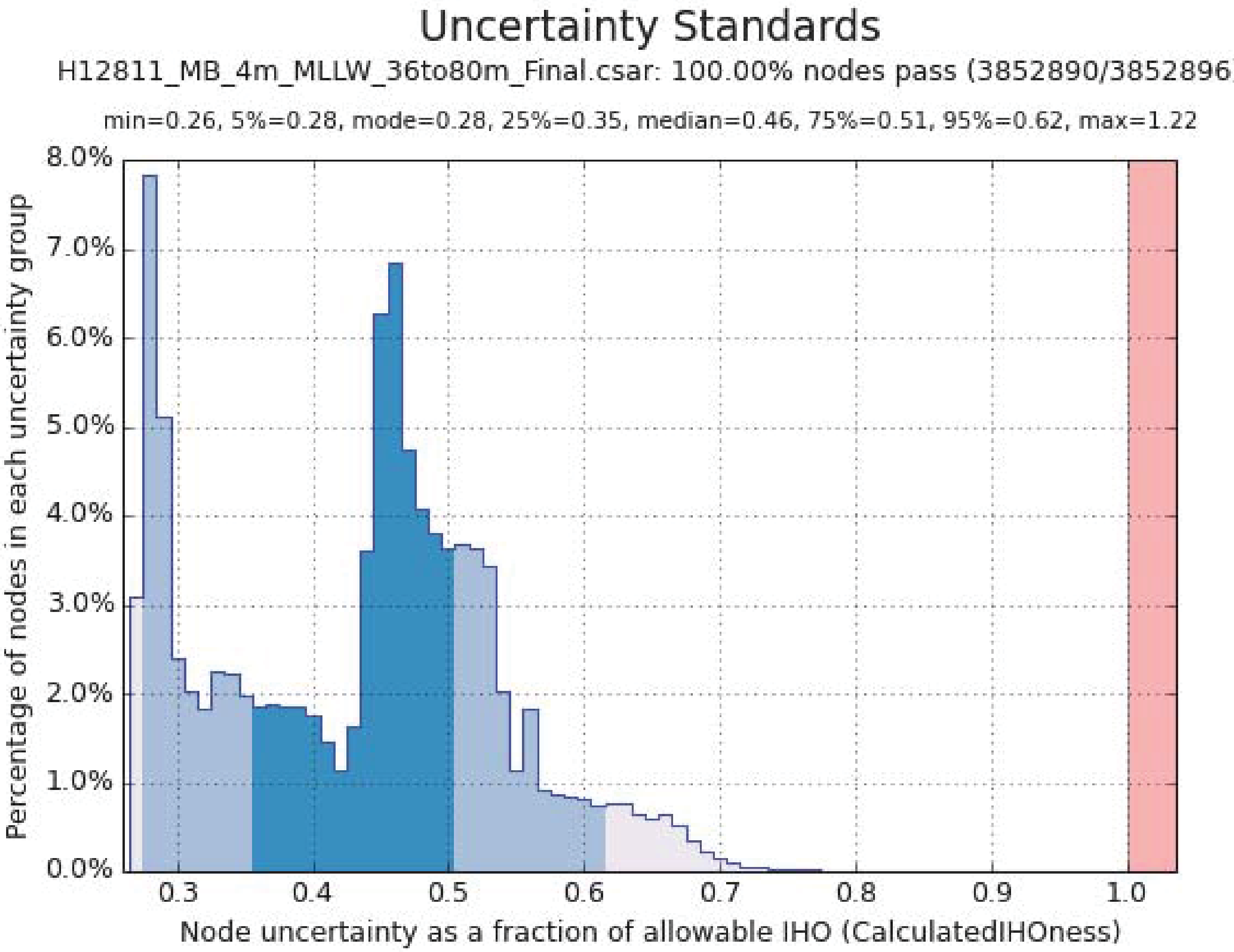


Figure 27: Total vertical uncertainty analysis for 4-meter finalized surface.

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 H12811. The files were paired with the CARIS HDCS data, imported, and processed using Fledermaus Geocoder Toolbox (FMGT). The FMGT project and backscatter mosaic is included in the field submission. The processed mosaic is formatted as a geo-tiff image per specifications.

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
H12811_MB_1m_MLLW	CUBE	1 meters	11.79 meters - 24.71 meters	NOAA_1m	Complete MBES
H12811_MB_2m_MLLW	CUBE	2 meters	11.79 meters - 83.20 meters	NOAA_2m	Complete MBES
H12811_MB_4m_MLLW	CUBE	4 meters	11.80 meters - 43.97 meters	NOAA_4m	Complete MBES
H12811_MB_1m_MLLW_0to20m_Final	CUBE	1 meters	11.79 meters - 20 meters	NOAA_1m	Complete MBES
H12811_MB_2m_MLLW_18to40m_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12811_MB_4m_MLLW_36to80m_Final	CUBE	4 meters	36 meters - 43.97 meters	NOAA_4m	Complete MBES
H12811_MB_4m_MLLW_Combined	CUBE	4 meters	11.79 meters -	NOAA_4m	Complete MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
			43.97 meters		

Table 9: Submitted Surfaces

CARIS CUBE Surfaces Not Honoring Features

During processing it was noticed that least depths on rocks and boulders were not being reflected in the CUBE surfaces generated by CARIS. For example a 1.68 meter rock is not being honored at a depth of 27 meters. While this resulted in many designated soundings, the 40000 meter chart scales made the horizontal component of the designation threshold 80 meters (2mm at survey scale) decreasing the potential number of designated soundings. The hydrographer felt it was unnecessary to adjust finalized surface ranges to mitigate the issue, but resulted in 509 designated soundings. An example of this is shown in Figure 28.

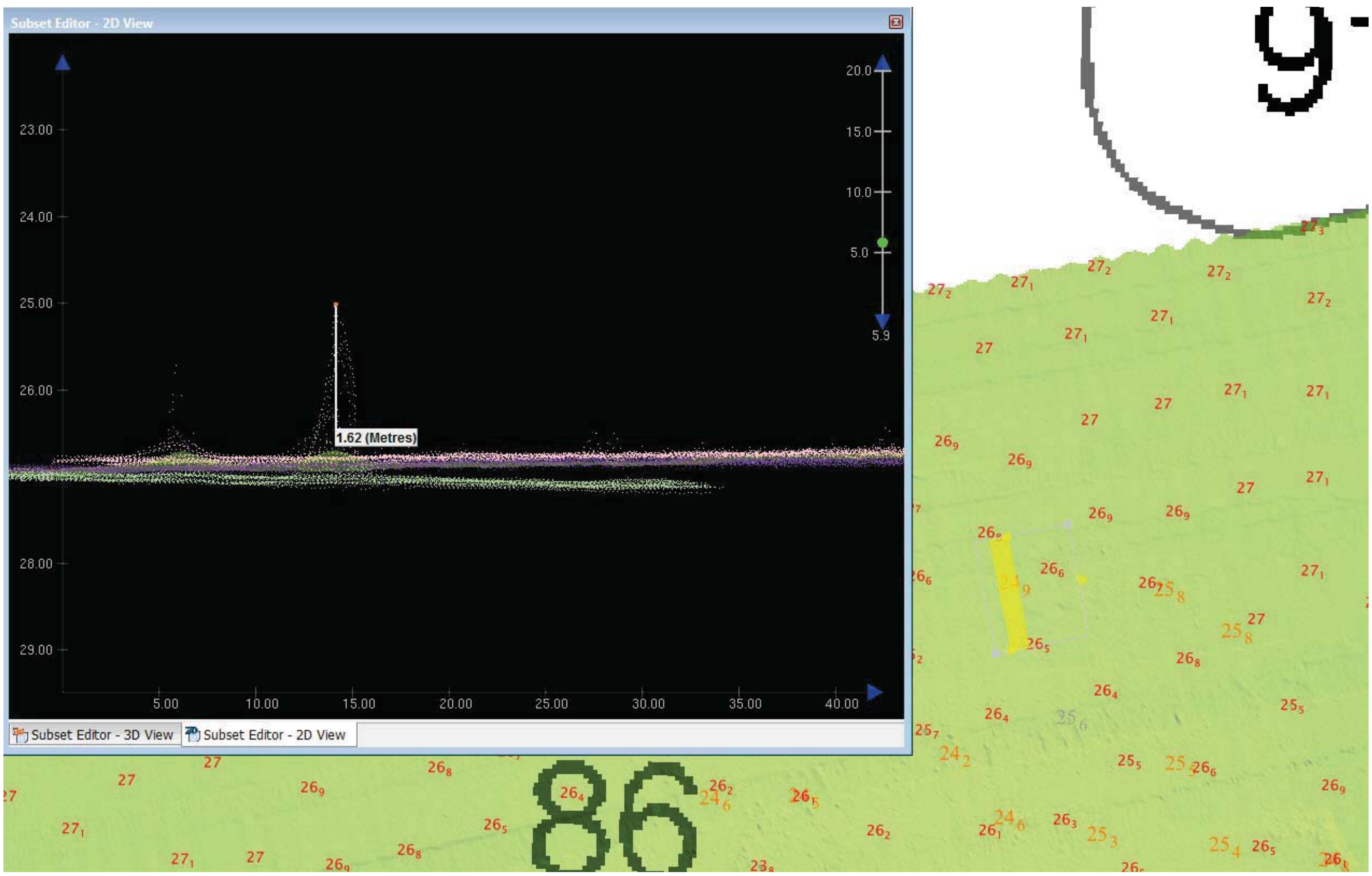


Figure 28: H12811 Features not being honored by Cube surface

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HSTB base station report.

C.1 Vertical Control

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

Standard Vertical Control Methods Used:

TCARI

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Newport, RI	8452660

Table 10: NWLON Tide Stations

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Martha's Vineyard GPS Buoy, MA	8448875

Table 11: Subordinate Tide Stations

File Name	Status
8452660.tid	Verified Observed

Table 12: Water Level Files (.tid)

File Name	Status
B307FH2015CORP_rev.zdf	Preliminary
B307FH2015_Final.tc	Final

Table 13: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 07/30/2015. The final tide note was received on 09/23/2015.

A final TCARI grid was received for project OPR-B307-FH-15, H12811, during the time period between July 16 and July 26, 2015. The final TCARI grid included data from HSTB's water level buoy that was used during the project.

<u>Non-Standard Vertical Control Methods Used:</u>

VDatum

<u>Ellipsoid to Chart Datum Separation File:</u>

2015_OPR-B307-FH-15_VDatum_NAD83_MLLW_revised.csar
2015_OPR-B307-FH-15_VDatum_MLLW_to_NAD83_ReverseSEP.csar

All soundings submitted are reduced to Mean Lower Low Water (MLLW) using a VDatum separation model provided by HSD Ops. A VDatum model evaluation was conducted after acquisition was completed comparing a 100m resolution Ellipsoidally Referenced Zone Tide model derived from acquired soundings to the VDatum separation model provided. The results can be seen in Appendix IV.

A reverse separation model was provided to assist in the trouble shooting of some SBET issues. The SBET issues were corrected by either reprocessing the SBET or the interpolation of SBET altitude spikes. This separation model was not used to reduce any data from H12811 to MLLW.

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 19N.

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

Single Base

Single Base processing was the primary method used for 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 H12811 and are used to reduce acquired soundings to MLLW via HSD OPs provided separation model.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Martha's Vineyard 1, Martha's Vineyard, MA	WMVY1
Martha's Vineyard 2, Martha's Vineyard, MA	WMVY2

Table 14: User Installed Base Stations

HSTB installed two base stations on Martha's Vineyard, MA, that were feeding real time correctors to the FERDINAND HASSLER throughout the acquisition process via 4G internet service. More details have been provided through a supplemental HSTB field report about the base station.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Achushnet, MA (306 kHz)

Table 15: 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 29 for an example). The interpolated SBET was exported out of 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 H12811: interpolated_2015_201_S250P, interpolated_2015_202_S250P_b, interpolated_2015_203_S250P_b, interpolated_2015_203_S250S_b.

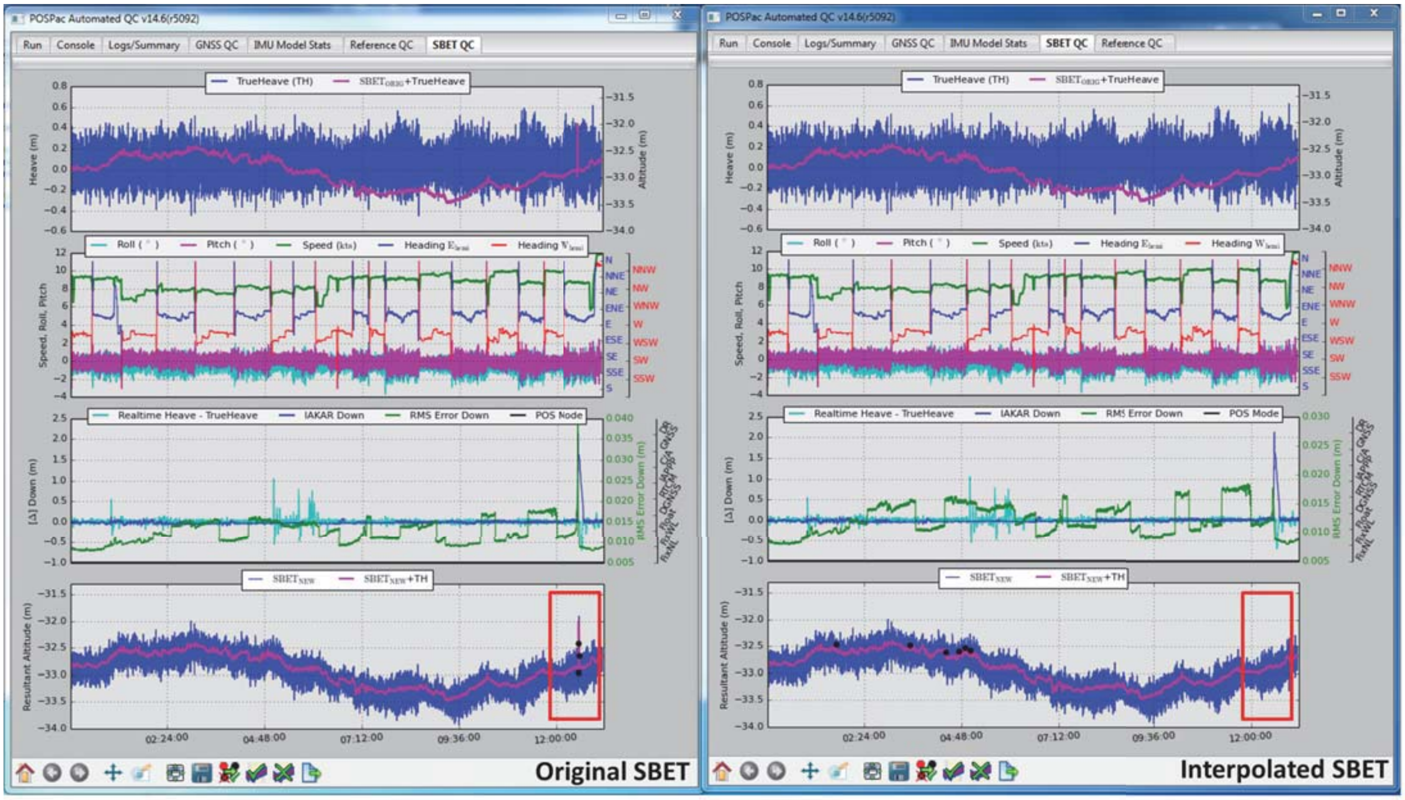


Figure 29: The original SBET for 2015_201_S250P is shown on the left with the highlighted spike in the altitude. On the right the red box shows that the interpolated SBET does not have such spike.

3.3.2 Altitude Issues

The SBET created for 2015_203_S250P has poor altitude due to "Continuous primary GNSS position measurement rejections" (See Figure 30). The erroneous altitude occurs from approximately 10:30-13:19 (about 2 hours 50 minutes in duration). The poor altitude solution impacts 9 lines from the port transducer on DN203 (listed below). In an effort to produce a survey fully surveyed to the ellipse, these port transducer lines were removed from the project as the altitude issues could not be resolved. The hydrographer ensured that the removal of this data did not impact the survey's ability to meet density requirements and no holidays were created due to the removal of these lines.

Lines Removed:
000_1048.HSX.s7k
000_1057.HSX.s7k
000_1100.HSX.s7k
000_1128.HSX.s7k
000_1155.HSX.s7k
000_1217.HSX.s7k

000_2141.HSX.s7k
000_1306.HSX.s7k
000_1309.HSX.s7k

Some altitude issues remain in the survey, but meet total vertical uncertainty limits for the water depth where they are located. The example below (Figure 31) shows a 0.49 meter offset in 27 meters of water where the maximum vertical uncertainty is 0.61 meters.

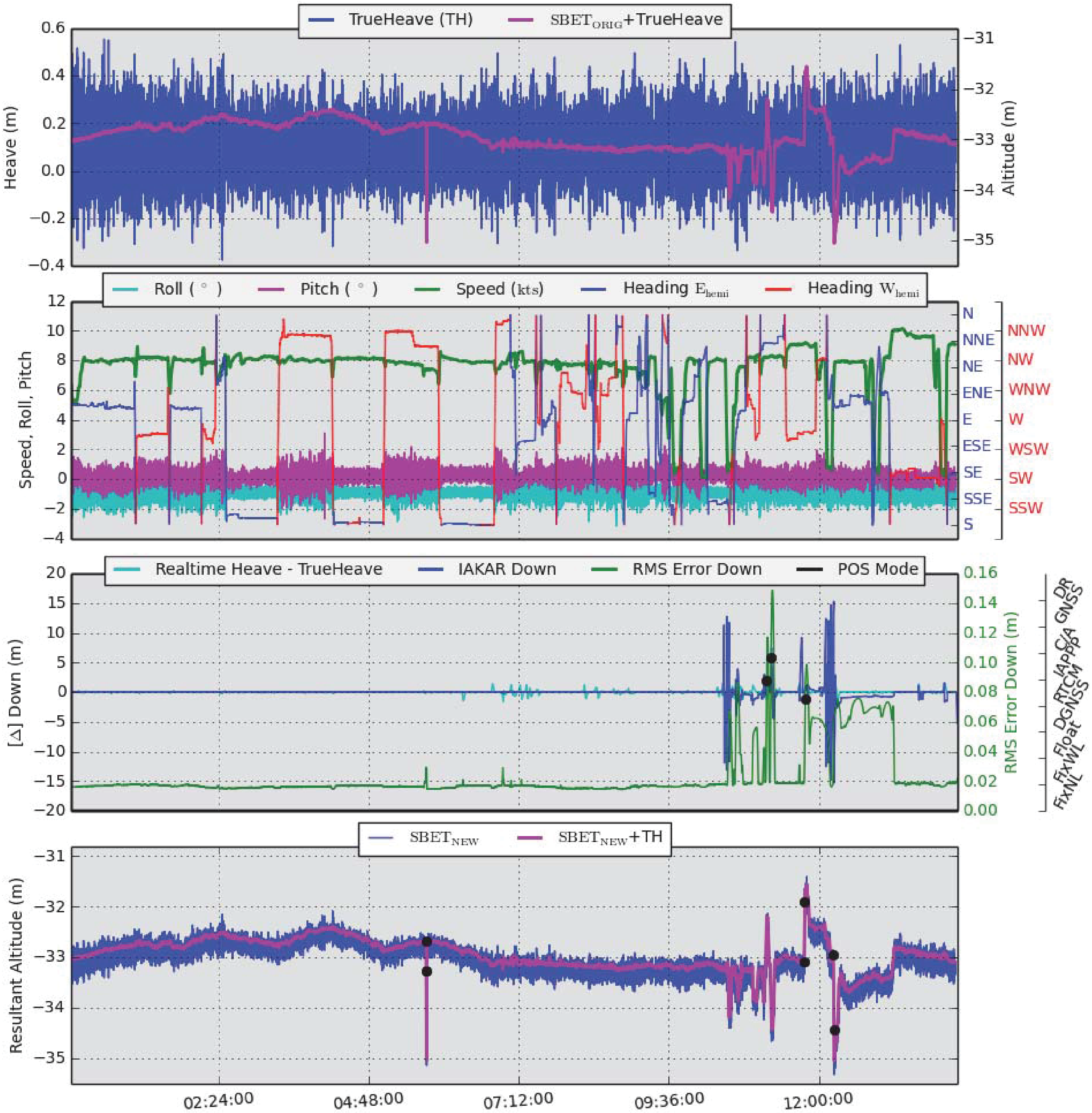


Figure 30: Altitude for SBET 2015_203_S250P

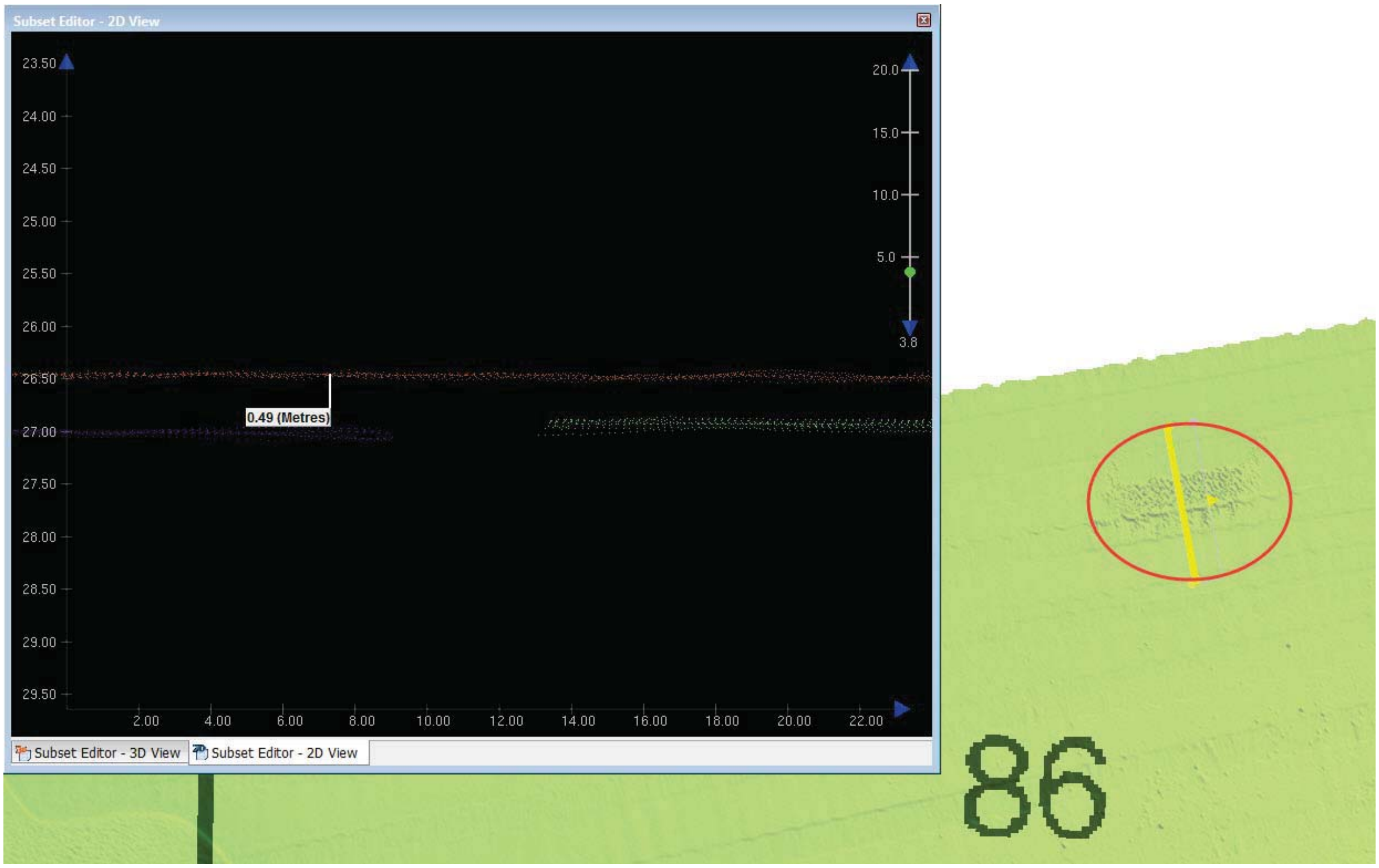


Figure 31: Altitude spike example that was left in the survey

D. Results and Recommendations

D.1 Chart Comparison

The hydrographer has compared a sounding plot and derived depth contours from the surveyed area to the charted soundings and contours. In general, the depth derived contours line up with the previously charted contours with only a few exceptions.

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
13233	1:40000	19	01/2011	03/31/2015	04/11/2015
13218	1:80000	42	07/2013	03/31/2015	04/11/2015
13237	1:80000	42	05/2013	05/05/2015	05/16/2015

Table 16: Largest Scale Raster Charts

<u>13233</u>

Surveyed soundings generally agree within 1 to 2 feet of charted soundings, with the charted soundings being shoaler then depth derived soundings. The one sixty foot contour the chart shares with the surveyed area generally agrees with some minor changes due to surveyed soundings being slightly deeper then charted soundings.

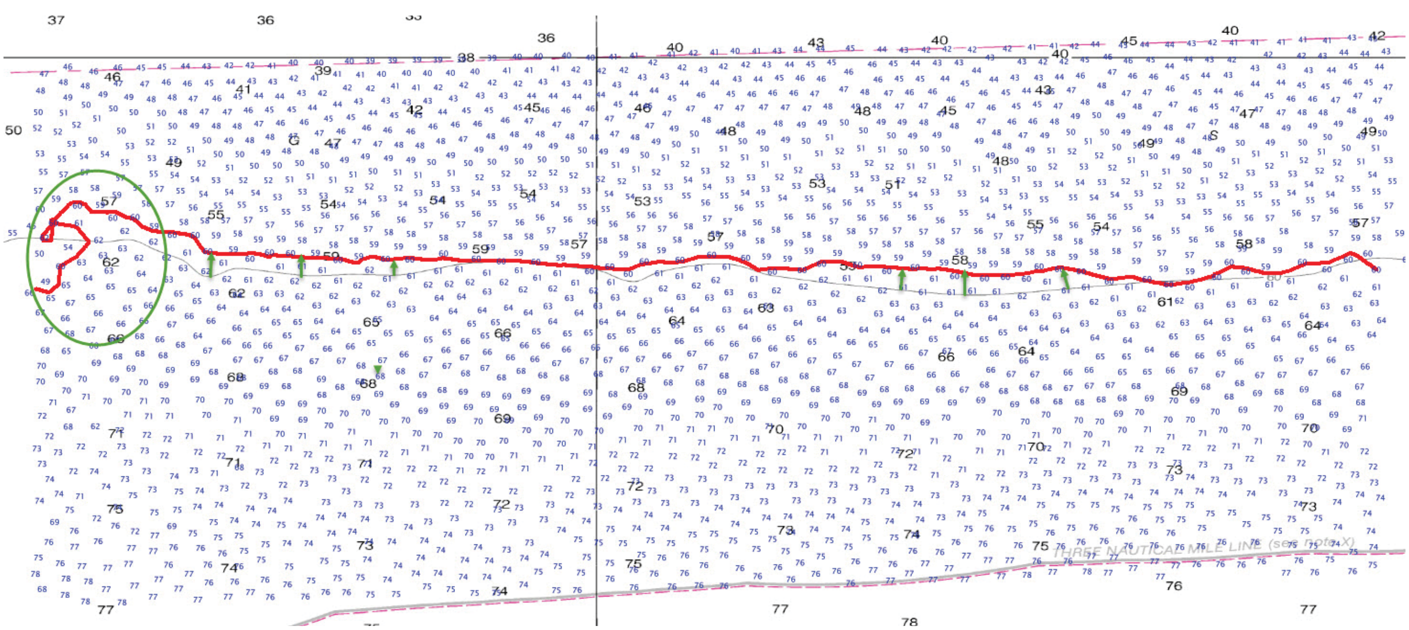


Figure 32: H12811 RNC 13233 60 Foot contour disagreement

<u>13218</u>

Surveyed soundings generally agree within 1 to 2 feet of charted soundings, with the charted soundings being shoaler than depth derived soundings. The sixty foot and ninety foot contours the chart shares with the surveyed area generally agree with some minor changes due to surveyed soundings being slightly deeper then charted soundings.

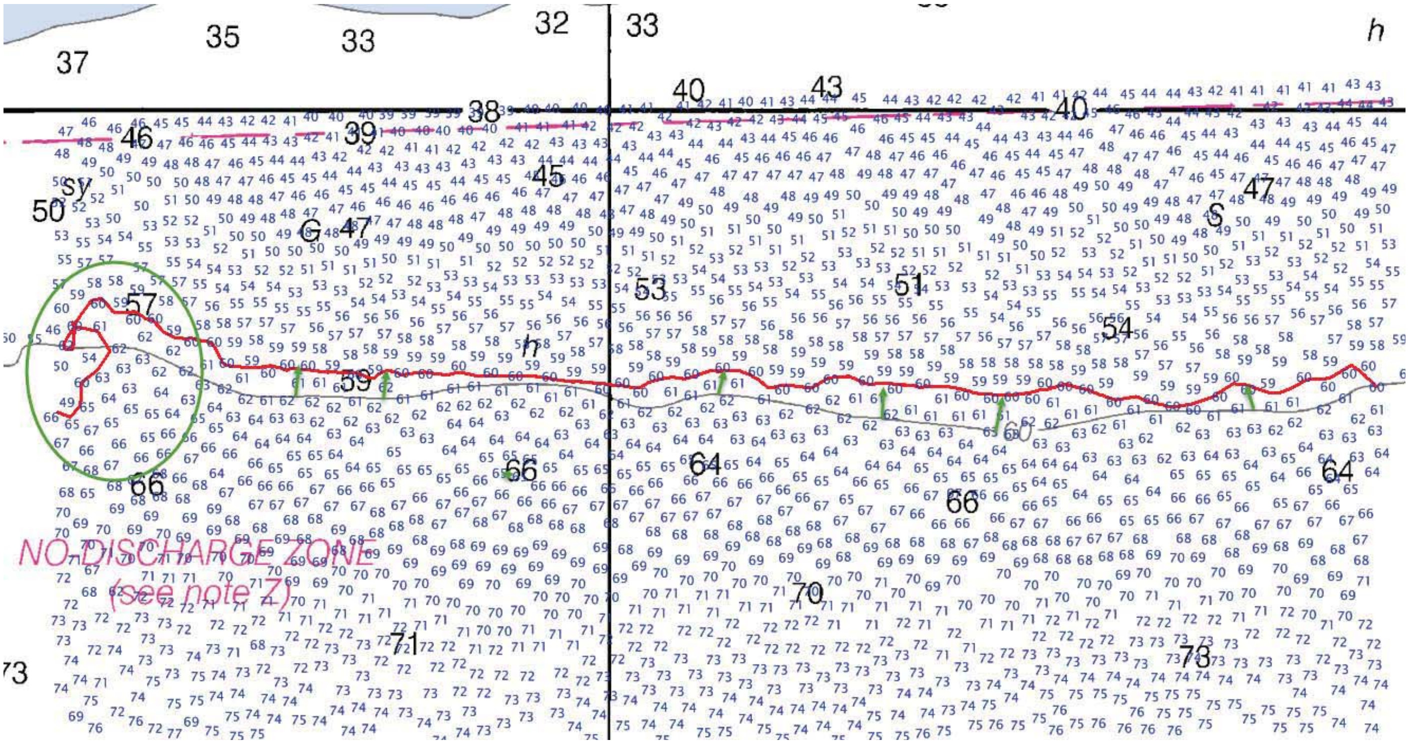


Figure 33: H12811 RNC 13218 60 Foot contour disagreement

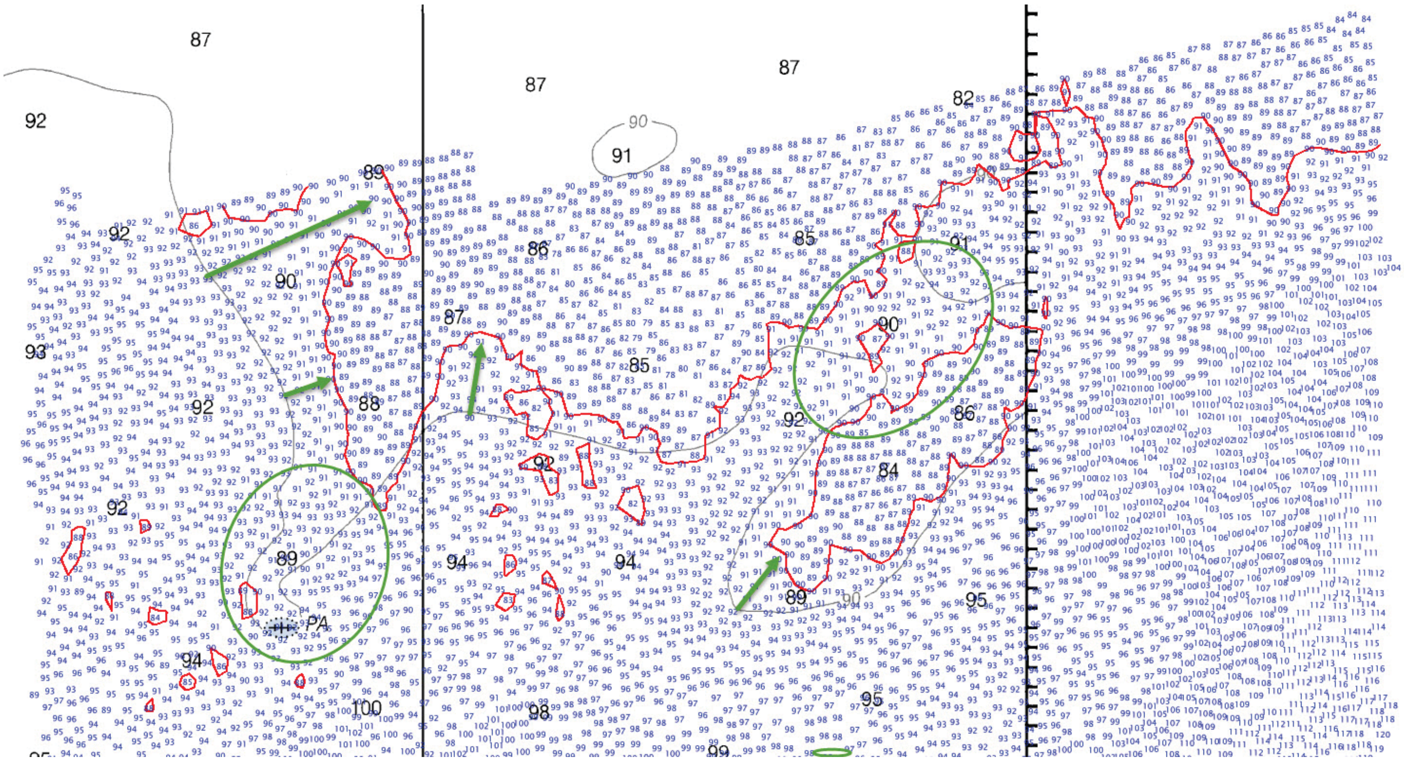


Figure 34: H12811 RNC 13218 90 Foot contour disagreement

13237

Surveyed soundings generally agree within 1 to 2 feet of charted soundings, with the charted soundings being shoaler then depth derived soundings. The ninety foot contour the chart shares with the surveyed area generally agrees with some minor changes due to surveyed soundings being slightly deeper then charted soundings.

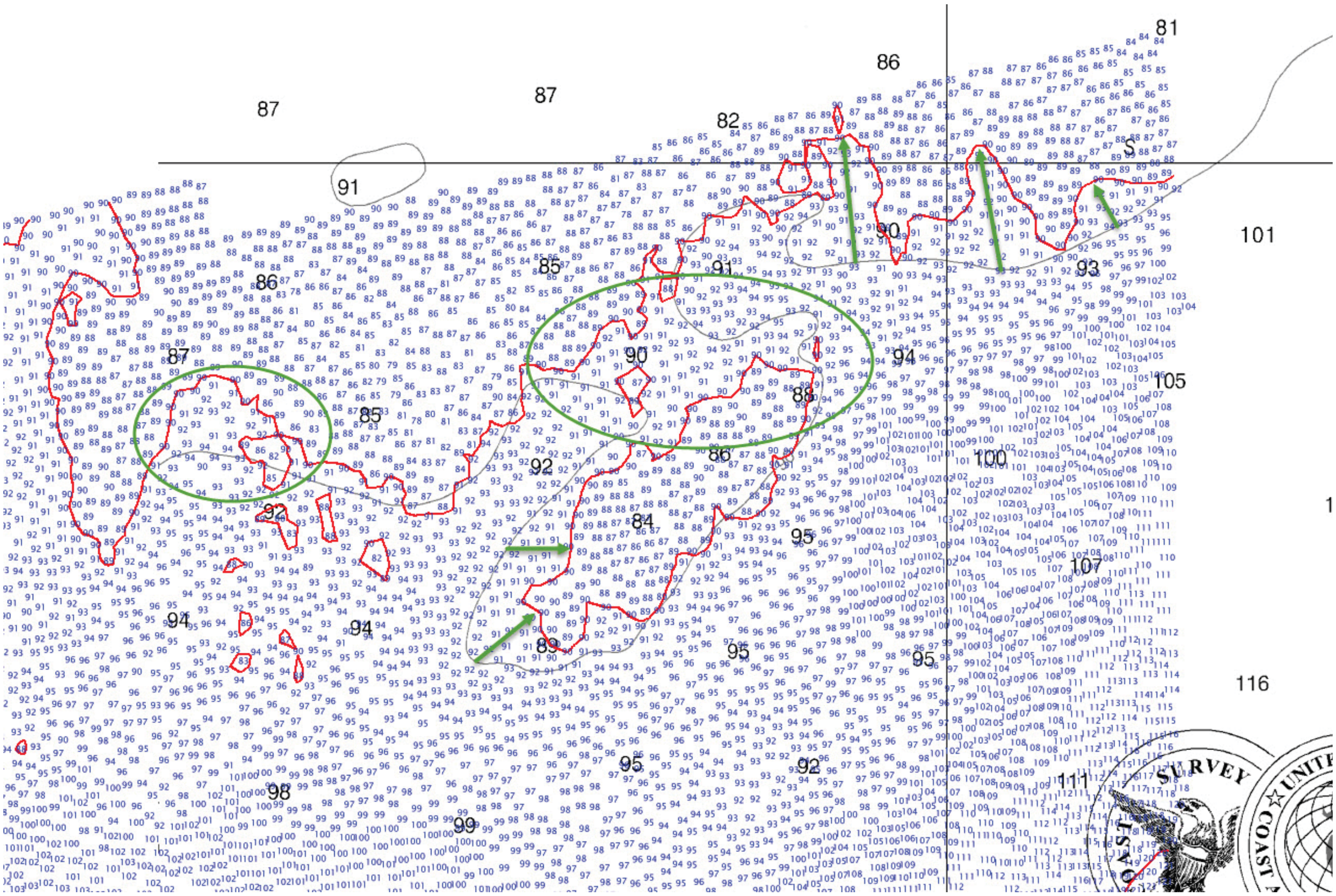


Figure 35: H12811 RNC 13218 90 Foot contour disagreement

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?
US4MA23M US4MA43M US5MA29M	1:80000	27	03/31/2015	04/27/2015	NO

Table 17: Largest Scale ENCs

<u>US4MA23M US4MA43M US5MA29M</u>

ENC soundings were extracted from the S-57 files and differenced from the 4-meter combined surface from H12811. This difference surface was then used to create an interpolated surface. The depth differences ranged from -4.45 to 2.23 feet. On average surveyed soundings were 1.4 deeper then charted soundings with a standard deviation of 0.3 feet. ENC contours correspond with RNC contours, see RNC comparison above for ENC contour comparison.

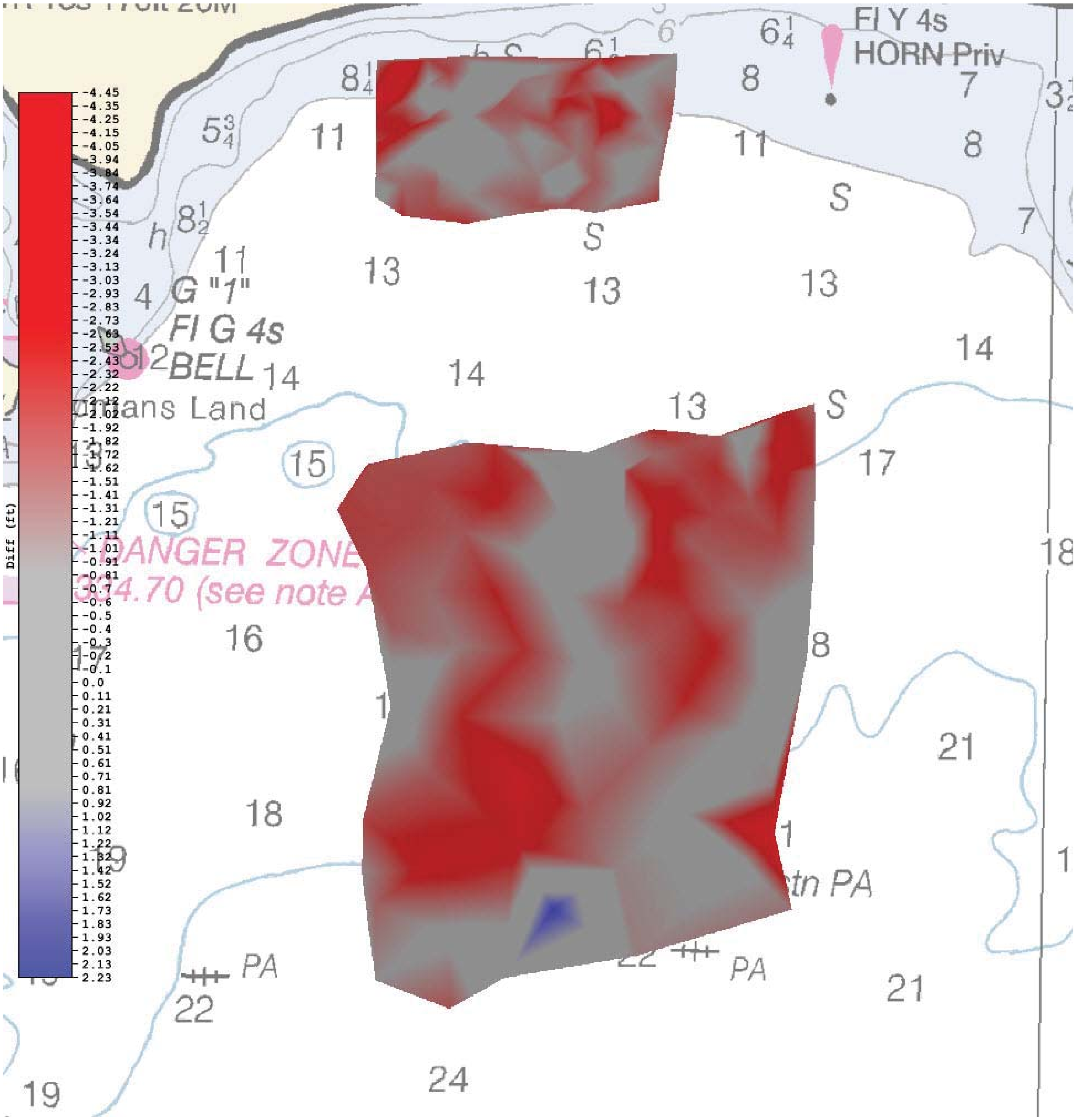
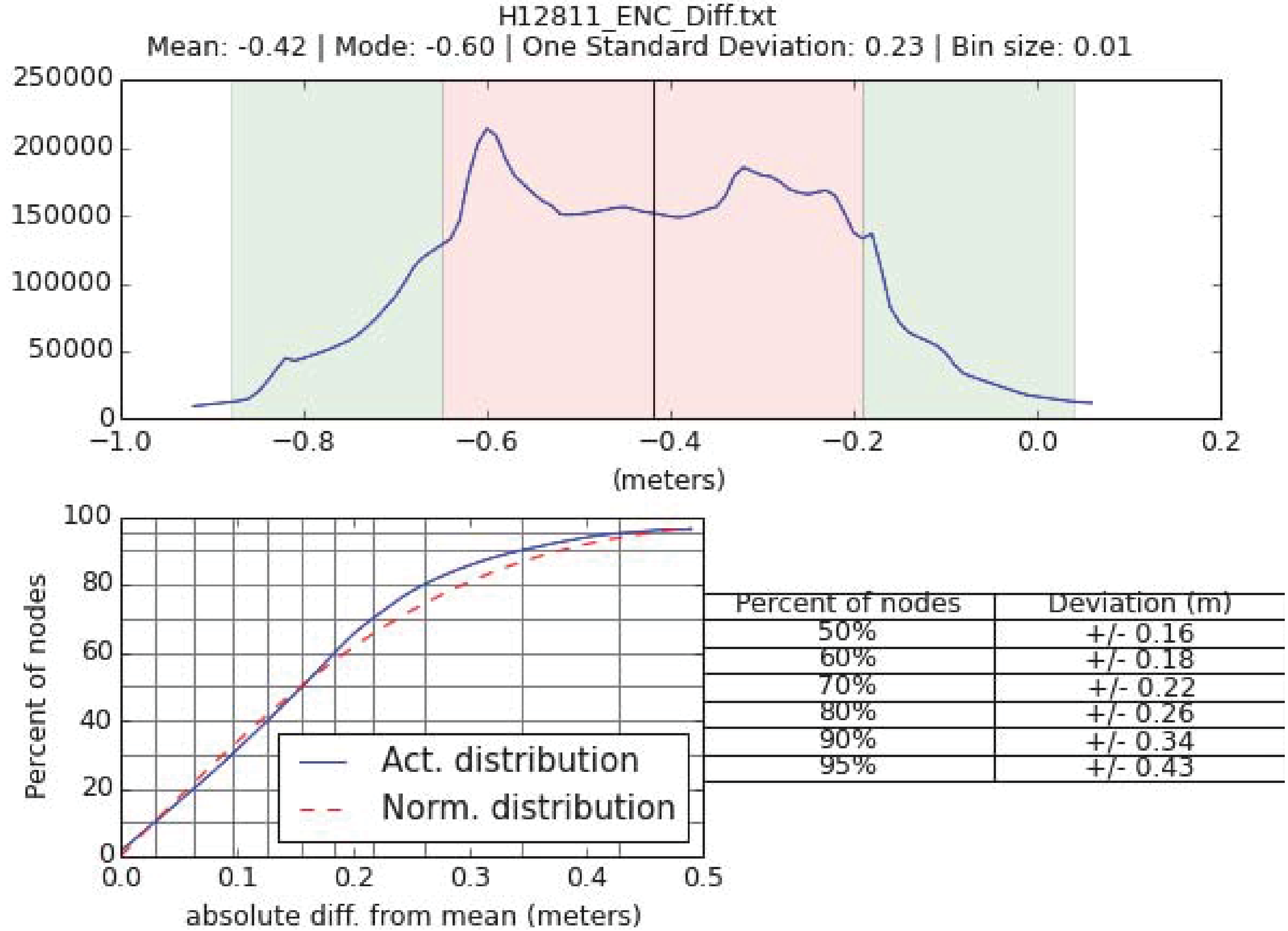


Figure 36: H12811 ENC sounding comparison



Percent of nodes	Deviation (m)
50%	+/- 0.16
60%	+/- 0.18
70%	+/- 0.22
80%	+/- 0.26
90%	+/- 0.34
95%	+/- 0.43

Figure 37: H12811 ENC sounding comparison statistics

D.1.3 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.4 Charted Features

Two charted features exist within the coverage of sheet H12811. The charted features were examined in CARIS subset editor and were not found. The charted wreck PA near the 89 and 94 foot sounding on RNC 13218 was covered with 100% multibeam and did not appear in the surface or when examined in CARIS subset editor. The charted obstruction PA near the southeast corner of RNC 13218 was covered with 100% multibeam and did not appear in the surface or when examined in CARIS subset editor.

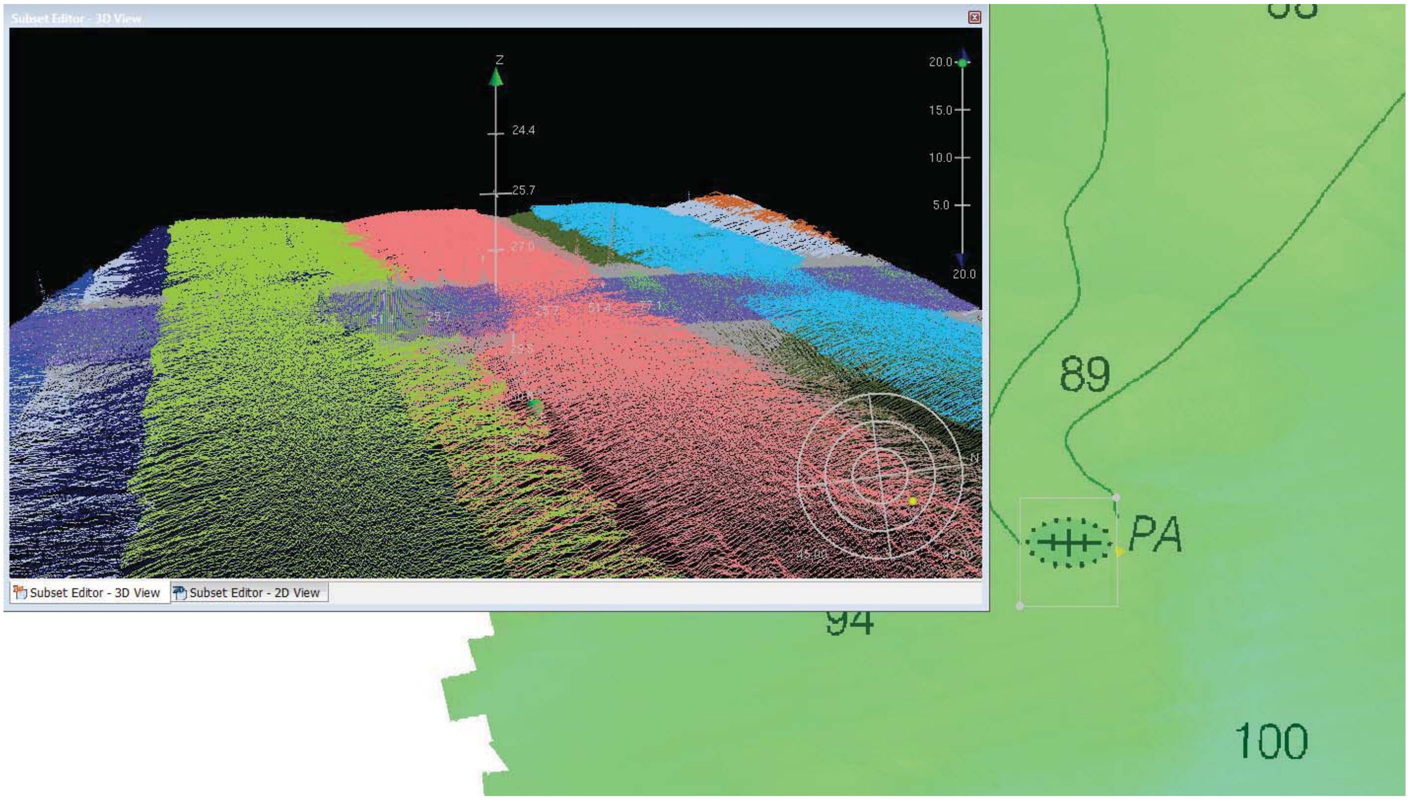


Figure 38: Wreck disproval located near north east 90 foot contour

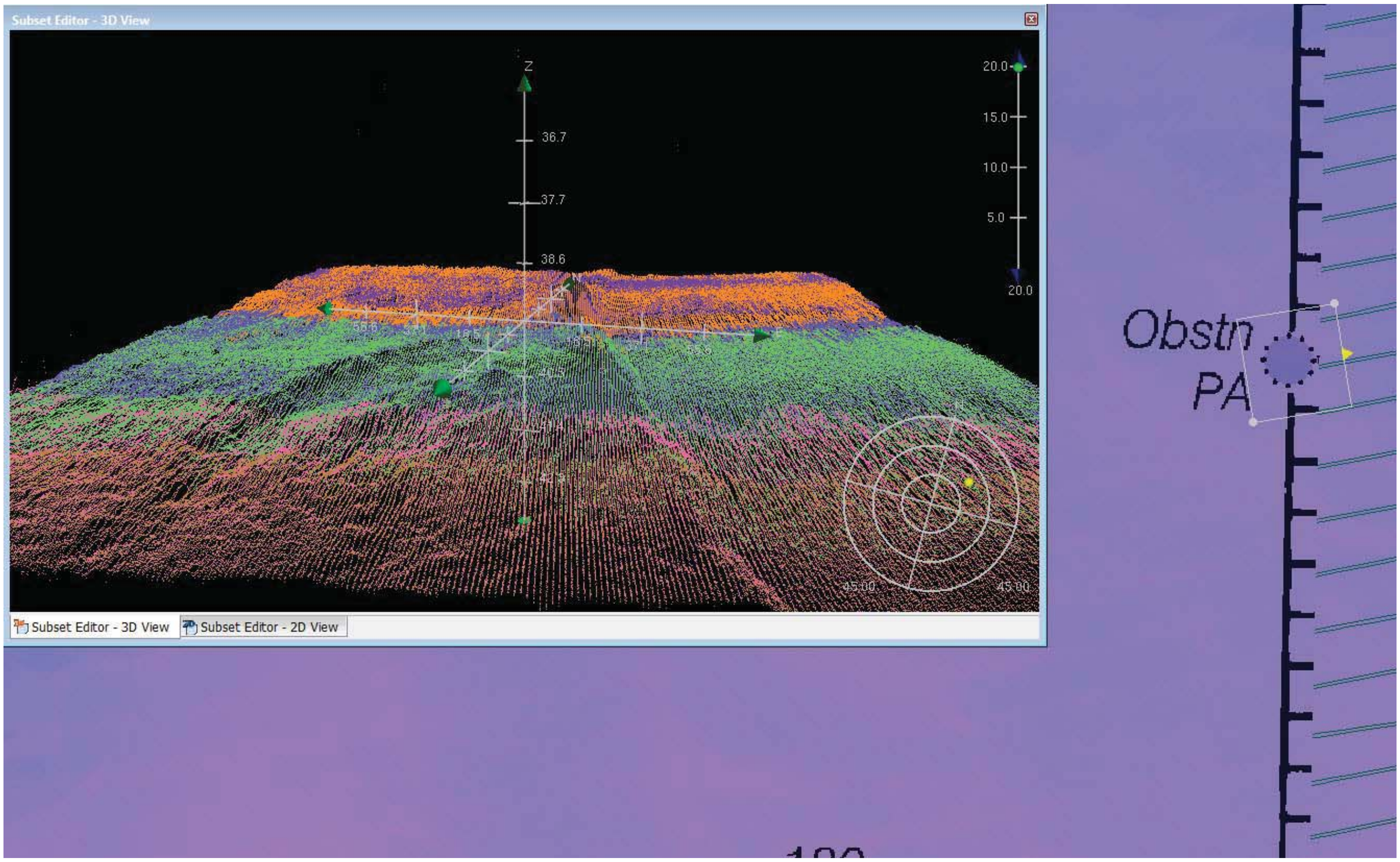


Figure 39: Obstruction disproval located on south east corner of chart 13218

D.1.5 Uncharted Features

Five uncharted rocks were added to the final feature file. The rocks were located in the north west portion of the sheet. An example of the rocks, as well as an overview of there location can be seen below. For position and depth of the rocks refer to the final feature file.

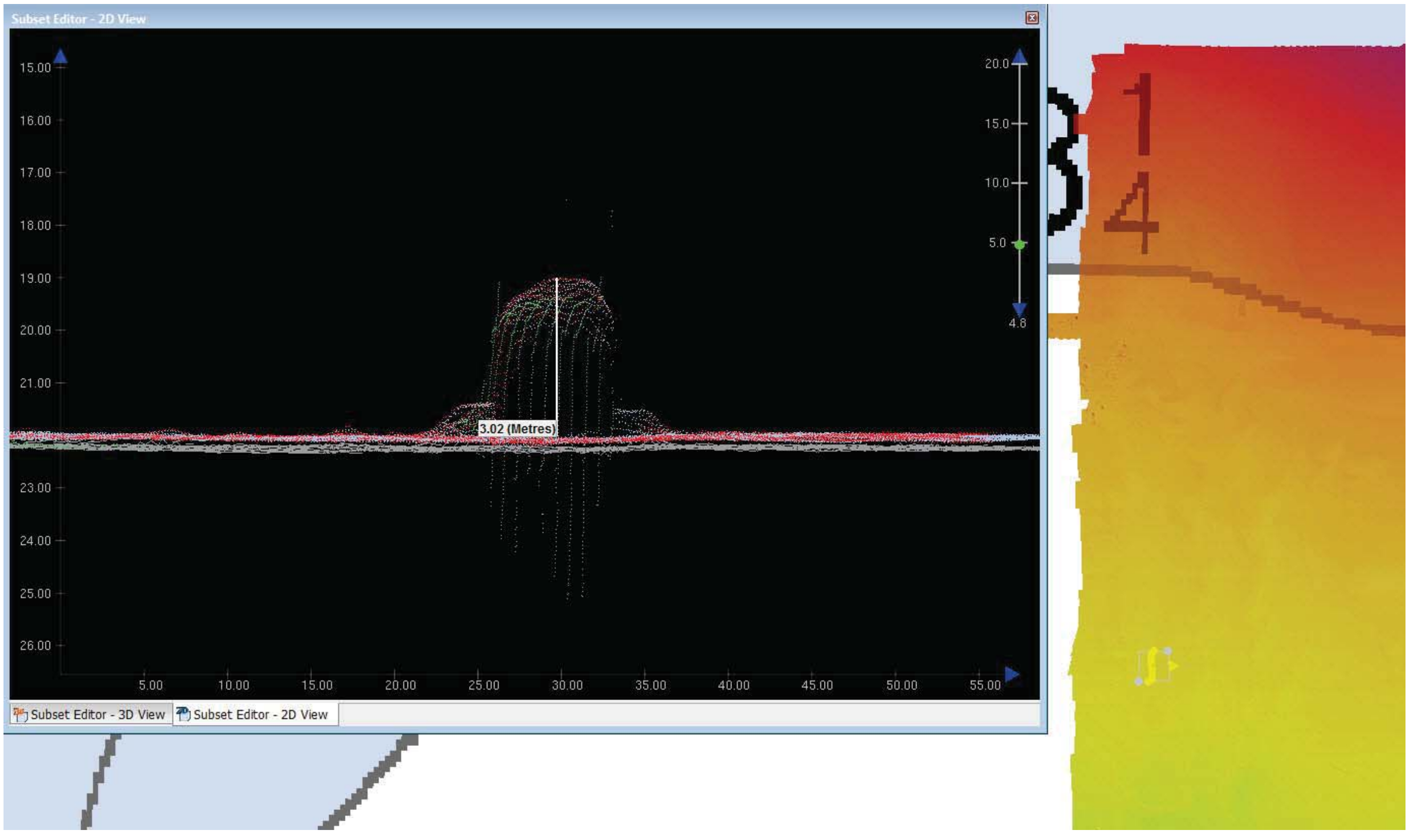


Figure 40: H12811 Uncharted rock example

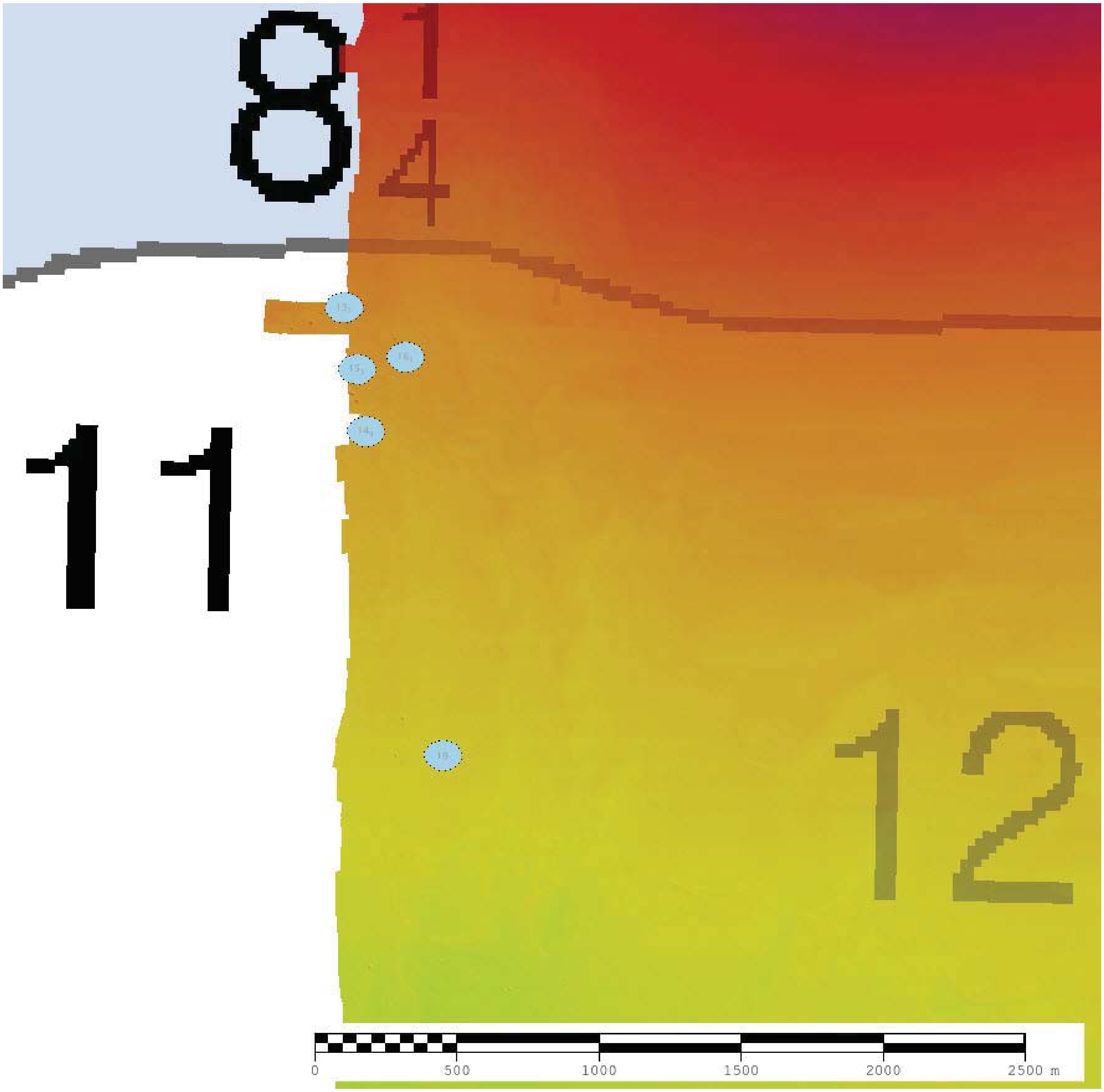


Figure 41: H12811 Uncharted rock overview

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

Six bottom samples, chosen from HSD OPS suggestions and acquired backscatter, were taken within the limits of H12811 and are submitted with the final feature file, as shown below in Figure 40. Bottom samples consisted mostly of coarse to fine sand.

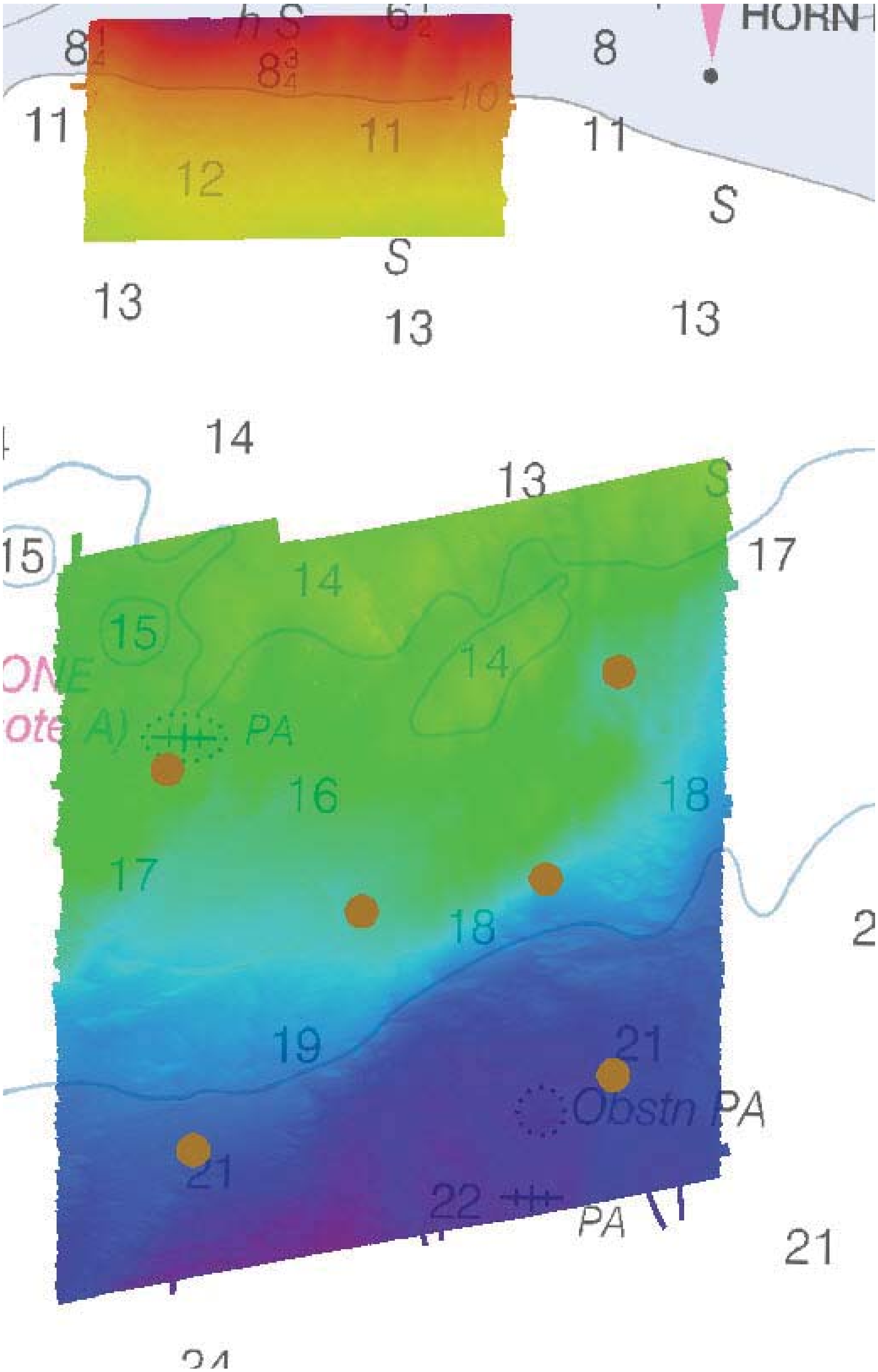


Figure 42: H12811 bottom sample locations

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

D.2.2 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

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

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

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 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	03/06/2016	WELTON.BRIANA.JANE.1267667531 2016.03.09 17:07:45 -05'00'
LT Jon Andvick, NOAA	Field Operations Officer	03/06/2016	ANDVICK.JON.DOUGLAS.1369596434 2016.03.09 13:03:43 -05'00'
Patrick Berube	Senior Survey Technician	03/06/2016	2016.03.09 12:00:43 -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	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

APPENDIX I

TIDE NOTE AND GRAPHICS

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

PROVISIONAL TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : September 18, 2015

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-B307-FH-2015
HYDROGRAPHIC SHEET: H12811
LOCALITY: 10 NM Southeast of Nomans Land, Rhode Island Sound, RI
TIME PERIOD: July 16 - July 26, 2015

TIDE STATION USED: 8452660 Newport
Lat. 41° 30.3'N Long. 71° 19.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.099 meters

TIDE STATION USED: 8448875 Martha's Vineyard GPS Buoy
Lat. 41° 19.6'N Long. 70° 35.4' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 0.883 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "B307FH2015_Final.tc" as the final grid for project OPR-B307-FH-2015, H12802, during the period between July 16 and July 26, 2015.

Refer to attachments for zoning information.

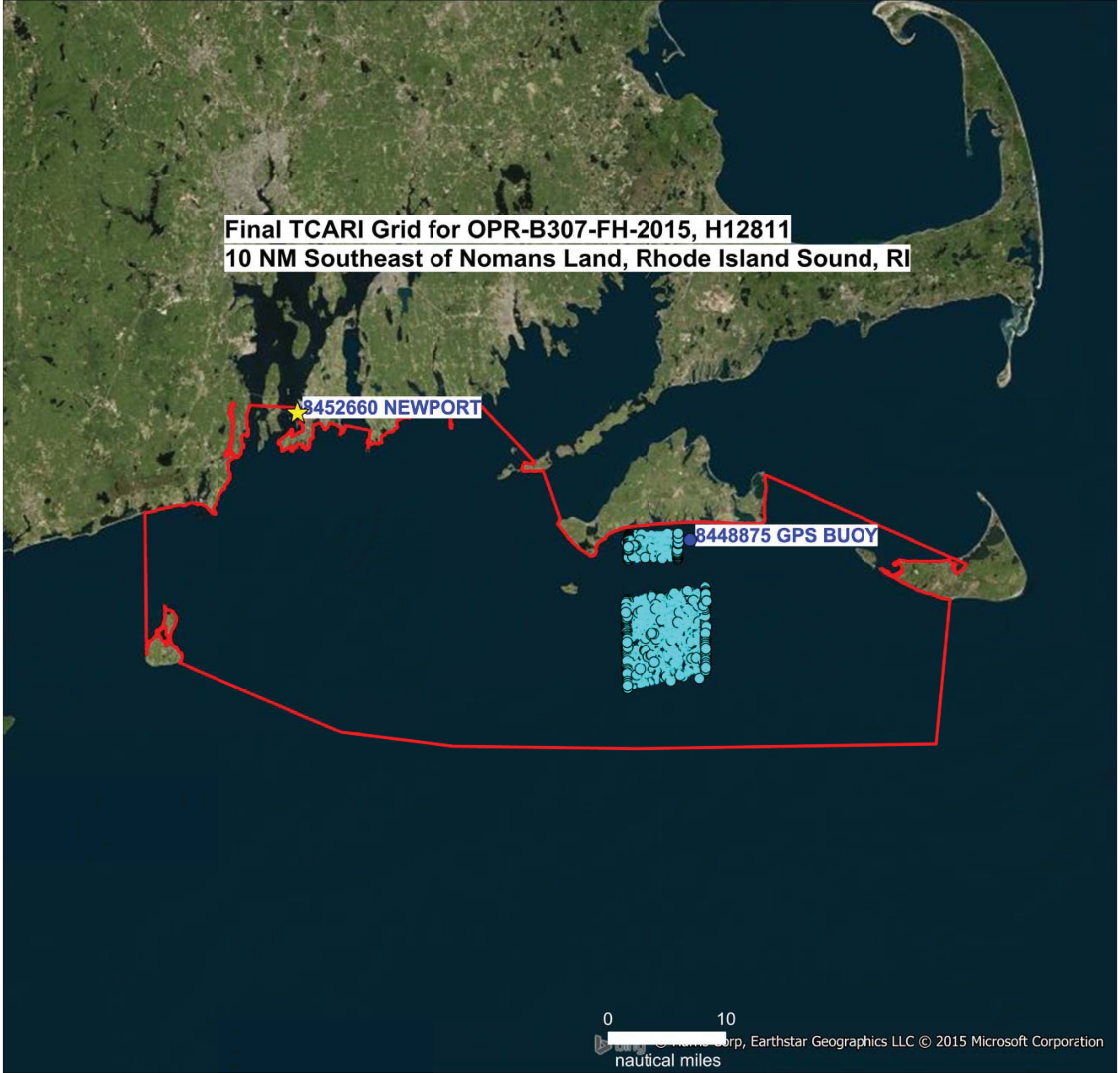
Note 1: Provided time series data are tabulated in metric units(meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Note 2: Annual leveling for Newport, RI (8452660) was not completed in FY15. A review of the water level data collected during the survey period for this sheet indicates good data quality, however the sensor stability cannot be verified until the most recent set of levels are reviewed. This provisional tide note should be used as the final tide for this sheet and after the leveling information has been received and reviewed, a follow-up memo to OCS will validate the stability of the data. Should the most recent set of levels indicate that the sensor was not stable during the period of survey operations, CO-OPS will immediately provide a revised Tide Note with updated water level reference information.

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: 2015.09.23 12:11:46 -04'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


Final TCARI Grid for OPR-B307-FH-2015, H12811
10 NM Southeast of Nomans Land, Rhode Island Sound, RI
8452660 NEWPORT
8448875 GPS BUOY
0
10
nautical miles
Earthstar Geographics LLC © 2015 Microsoft Corporation

APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

OPR-B307-FH-15 Rhode Island Sound

Sheet H12811 ERS Evaluation

ERS checklines were run, but were not processed before acquisition was completed. In lieu of processing checklines, an ERZT separation model was created and a difference surface was created using the datum height of the sparation model and VDatum model. A final TCARI grid was used in the creating of the ERZT separation model.

The SBETs that were created from the data that was furthest away from the base station (WMVY) were colored by RMS position error and the highest RMS position error was less than or equal to 0.05 meters. This is lower than our zoned tide uncertainty value of 0.5 meters, bringing us to the conclusion GPS tides would be more accurate than using traditional zoned tides. The ERZT model compared to the VDatum separation model showed a mean difference of 0.06 meters with 95% of nodes within 0.10 meters of the mean difference.

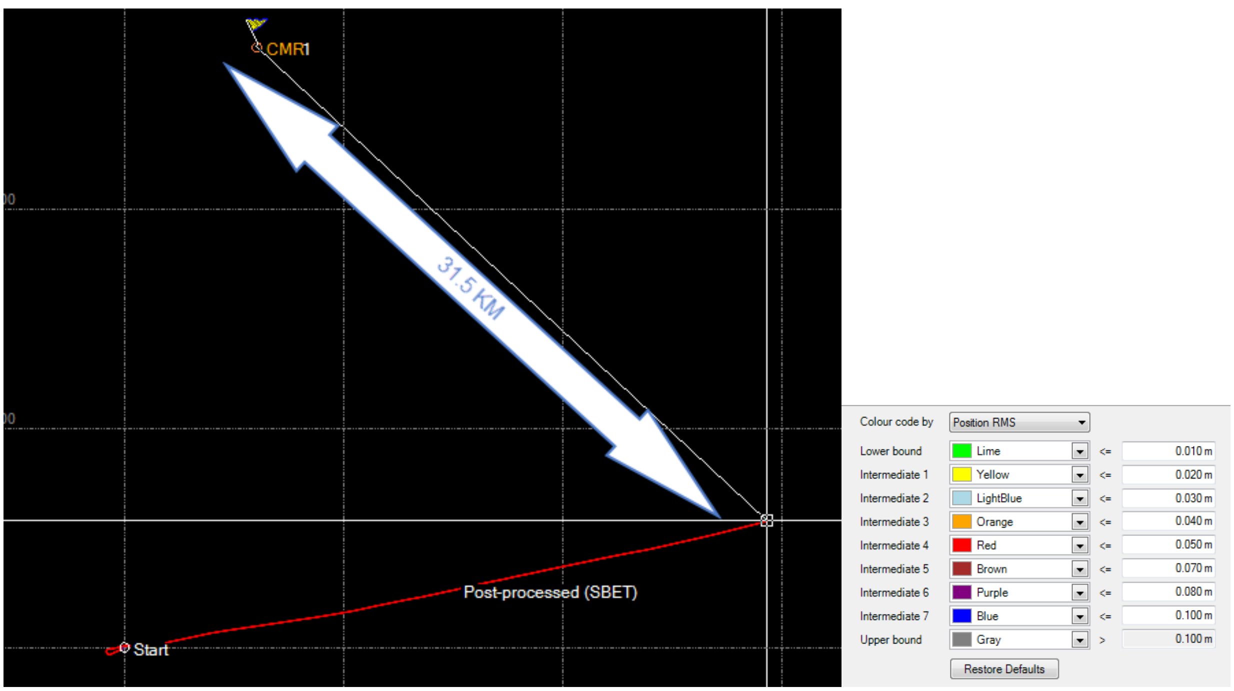


Figure 1: H12811 DN 197 position RMS

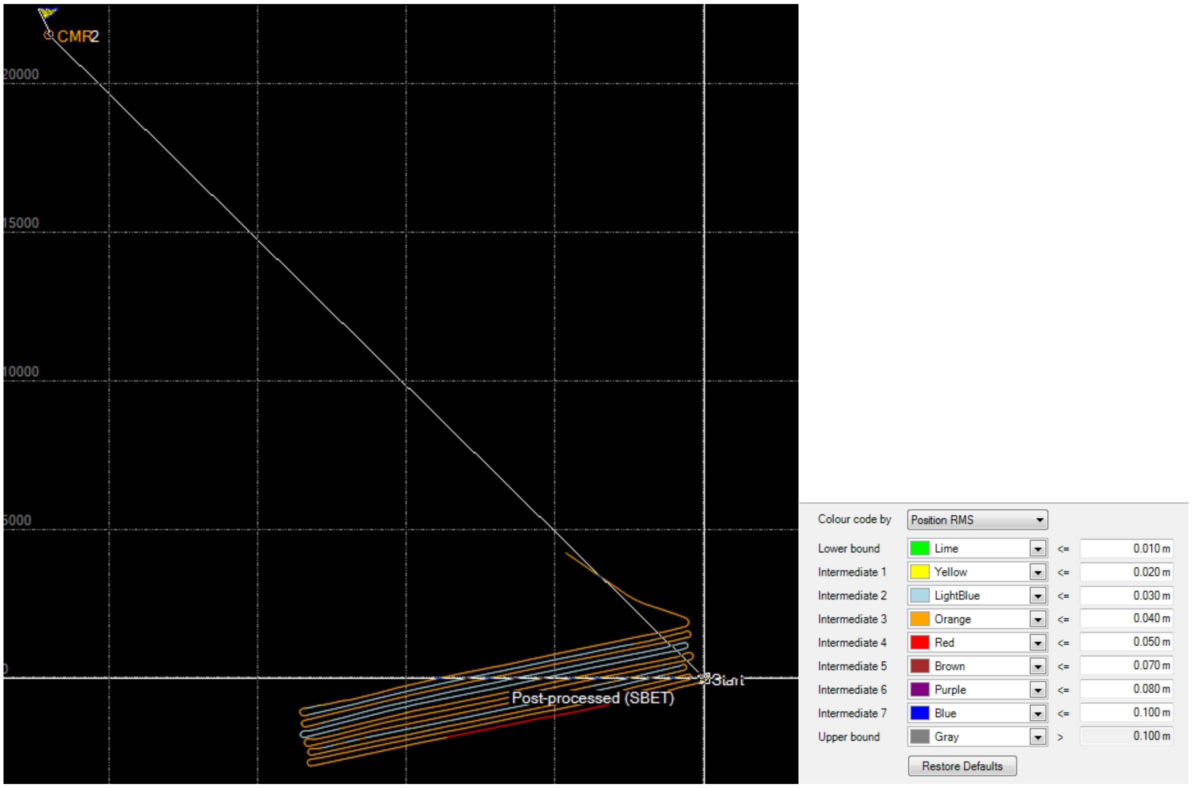


Figure 2: H12811 DN 198 position RMS

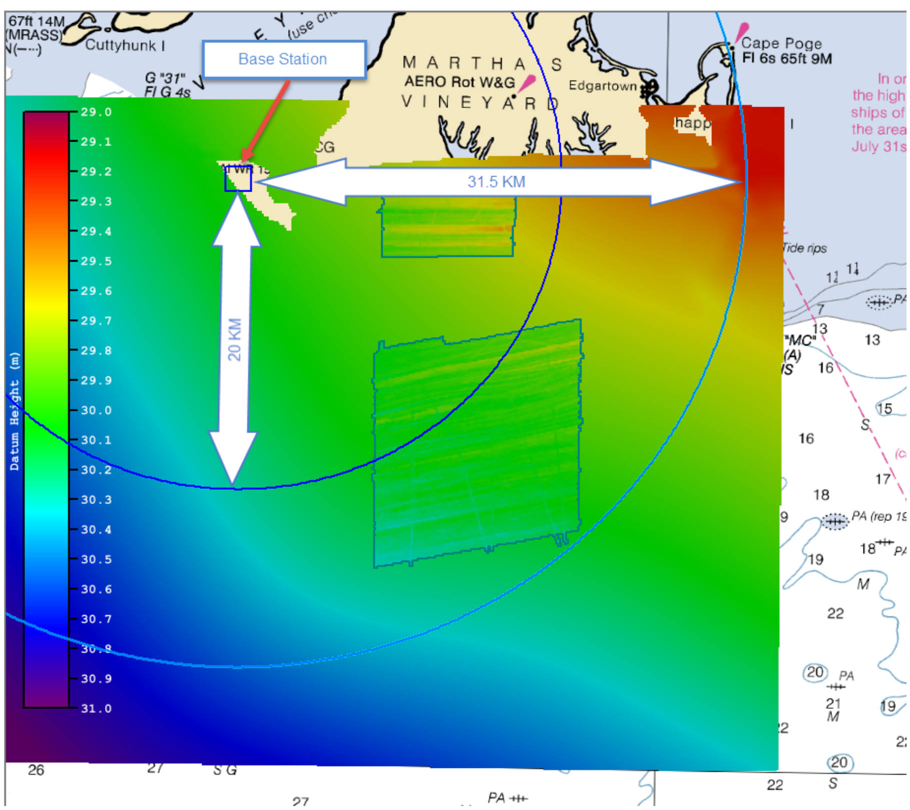


Figure 3: H12811 ERZT model overview with VDatum separation model

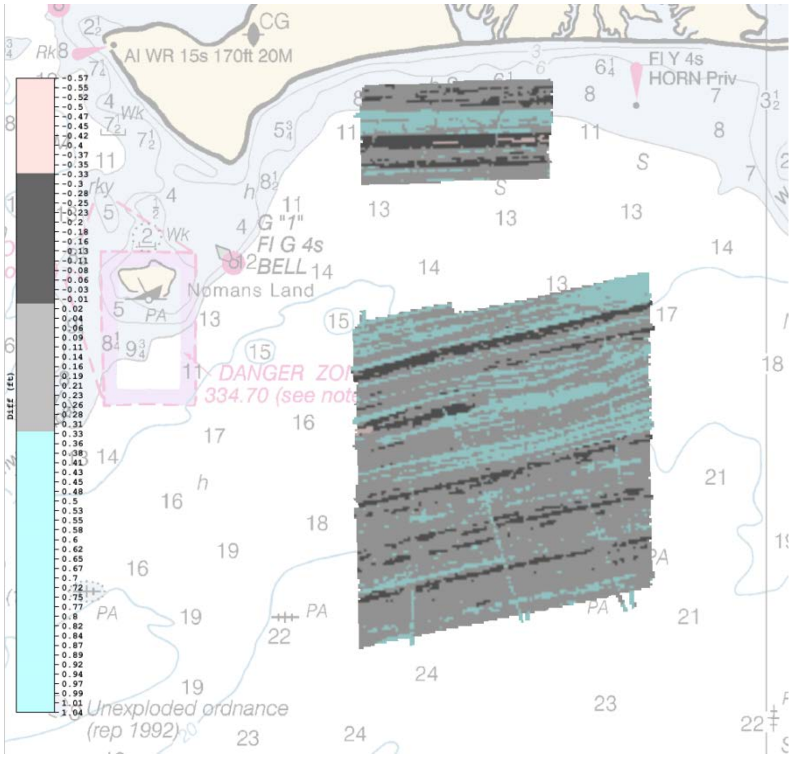


Figure 4: ERZT VDatum separation model difference

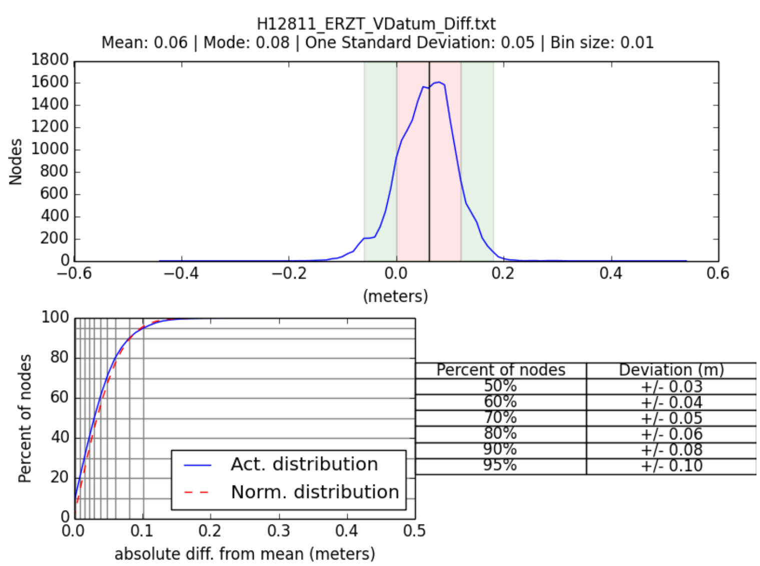


Figure 5: ERZT VDatum difference statistics

APPROVAL PAGE

H12811

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

- H12811_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12801_H12802_H12811_GeoImage.pdf

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

Digitally signed by
HILLSTROM.BRIANA.WELTON.1267667531
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=HILLSTROM.BRIANA.WELTON.1267667531
Date: 2017.08.04 13:25:22 -04'00'

Approved: ______________________________

Lieutenant Commander Briana Hillstrom, NOAA
Chief, Atlantic Hydrographic Branch