H12590

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12590

LOCALITY

State(s):	Alaska
General Locality:	Shumagin Islands, AK
Sub-locality:	5 NM South of Turner Island

2013

CHIEF OF PARTY
Richard T. Brennan, CDR/NOAA

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Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H12590

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):	**Alaska**
General Locality:	**Shumagin Islands, AK**
Sub-Locality:	**5 NM South of Turner Island**
Scale:	**40000**
Dates of Survey:	**08/04/2013 to 09/02/2013**
Instructions Dated:	**05/31/2013**
Project Number:	**OPR-P183-RA-13**
Field Unit:	**NOAA Ship *Rainier***
Chief of Party:	**Richard T. Brennan, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	
Verification by:	**Pacific 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 Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

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Descriptive Report to Accompany Survey H12590

Project: OPR-P183-RA-13

Locality: Shumagin Islands, AK

Sublocality: 5 NM South of Turner Island

Scale: 1:40000

August 2013 - September 2013

NOAA Ship *Rainier*

Chief of Party: Richard T. Brennan, CDR/NOAA

A. Area Surveyed

The survey area is referred to as Sheet 3: "5 NM South of Turner Island" within the Project Instructions (Figure 1). The survey area encompasses the Twins Islands, and meets the southwest edge of Turner Island, otherwise remaining in open water.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
55° 1' 60" N 160° 0' 0" W	54° 55' 0" N 159° 41' 60" W

Table 1: Survey Limits

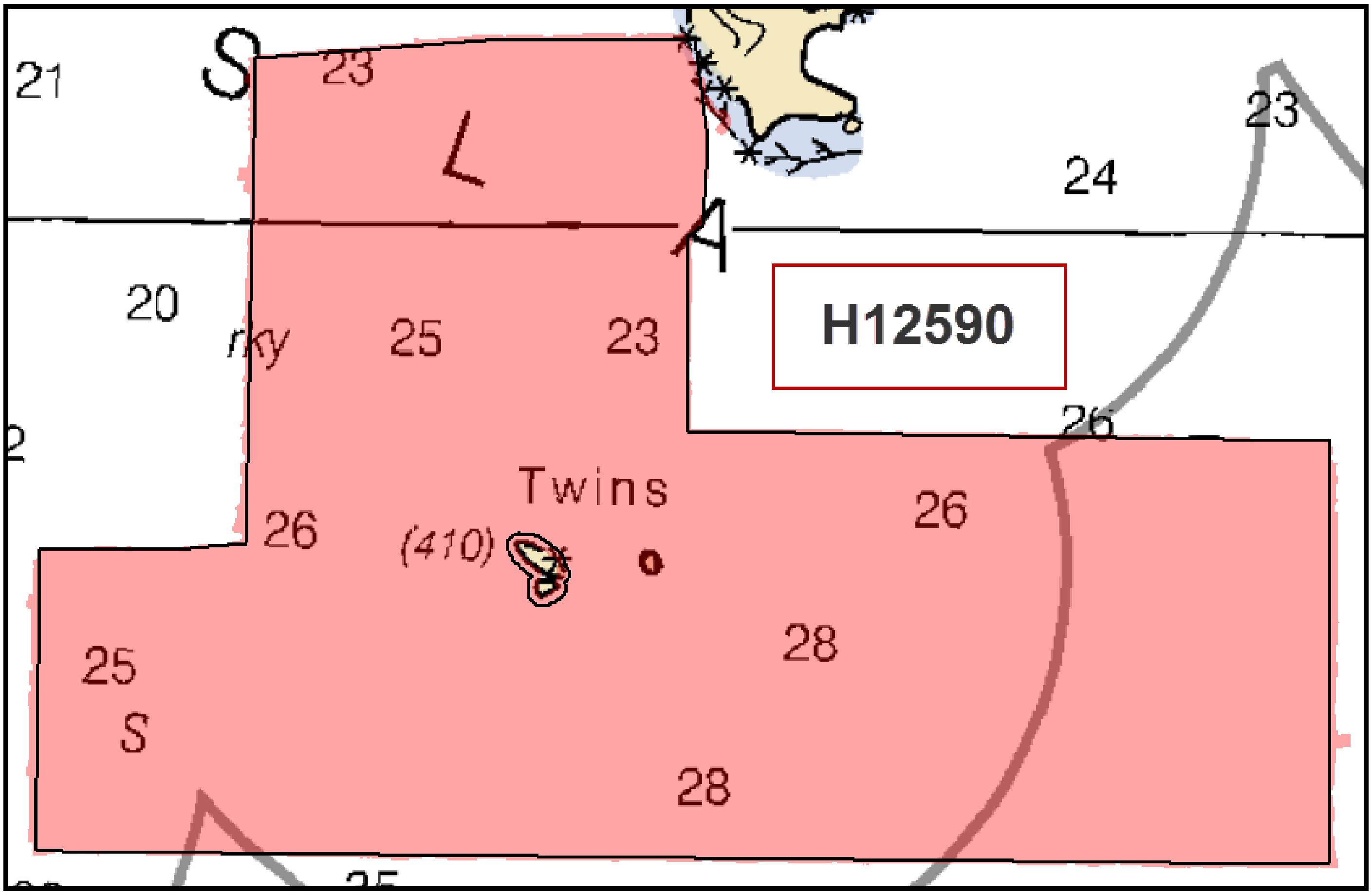


Figure 1: H12590 survey limits.

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

A.2 Survey Purpose

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12590 met complete multibeam echosounder (MBES) coverage requirements, including the 5 soundings per node data density requirement outlined in section 5.2.2.2 of the HSSD (Figure 2). In order to extract some descriptive statistics of the data density achievements, the density layer of each finalized surface was queried within CARIS and then examined in Excel.

The 1-meter surface fell slightly short of density requirements, achieving 82.9% data density. This low density occurred primarily where data was acquired using the tilted (34-degrees) Reson 8125 mounted on Launch 2803 (RA-3). The 8125 produces fewer beams (240 versus 512 beams) and only operates in an equi-angular mode. In an equi-angular paradigm, the further from nadir a beam is directed, the larger the horizontal spacing between its neighbors; an increased beam spacing is only exacerbated by a tilted sonar mount. Although these low density areas exist, they are close to shore, not navigationally significant, and occur almost entirely beyond the assigned sheet limits (Figure 3).

Overall, the required data density was achieved in 99.2% of the nodes, and 99.9% by area (Figure 4).

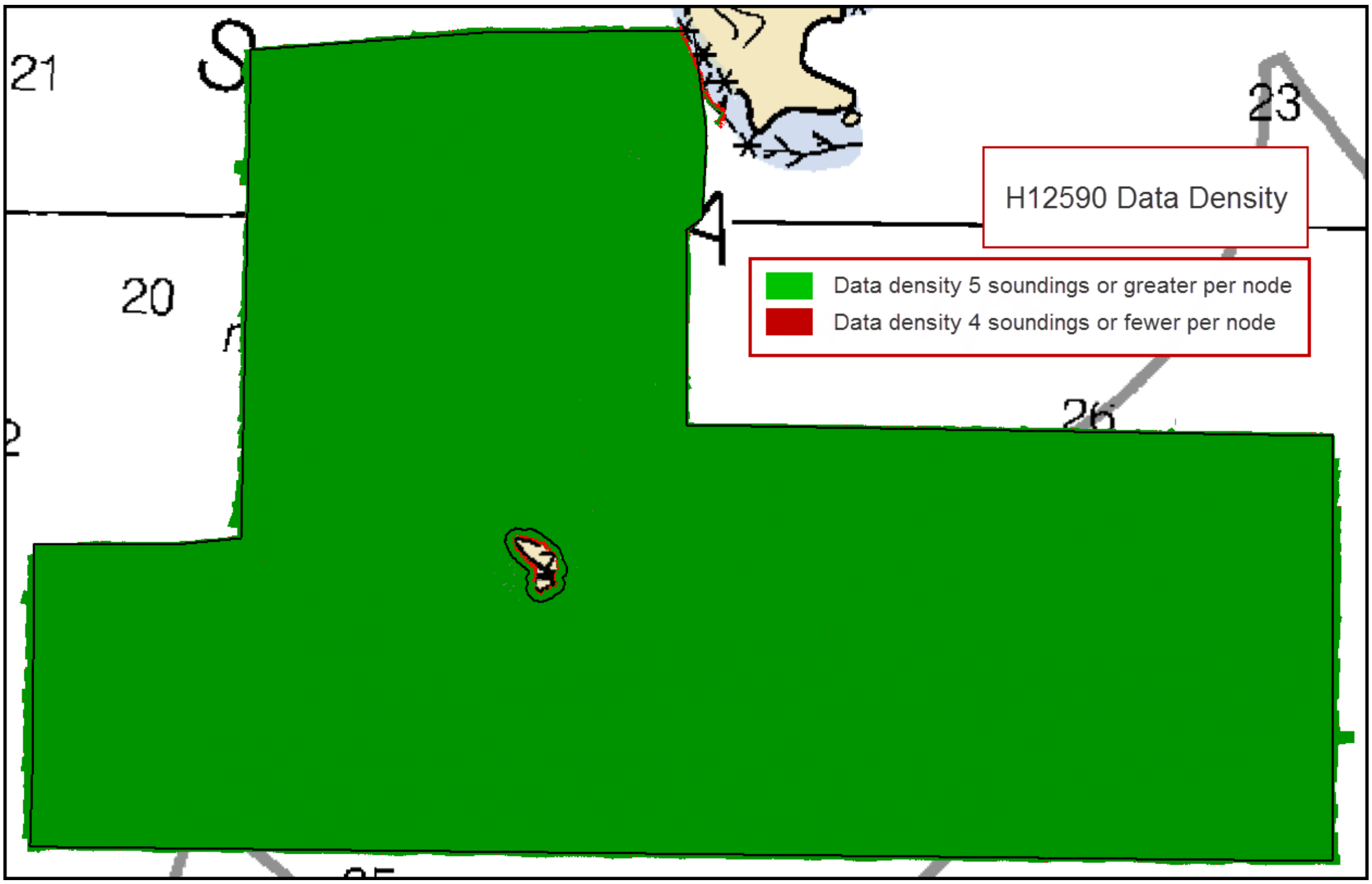


Figure 2: H12590 data density.

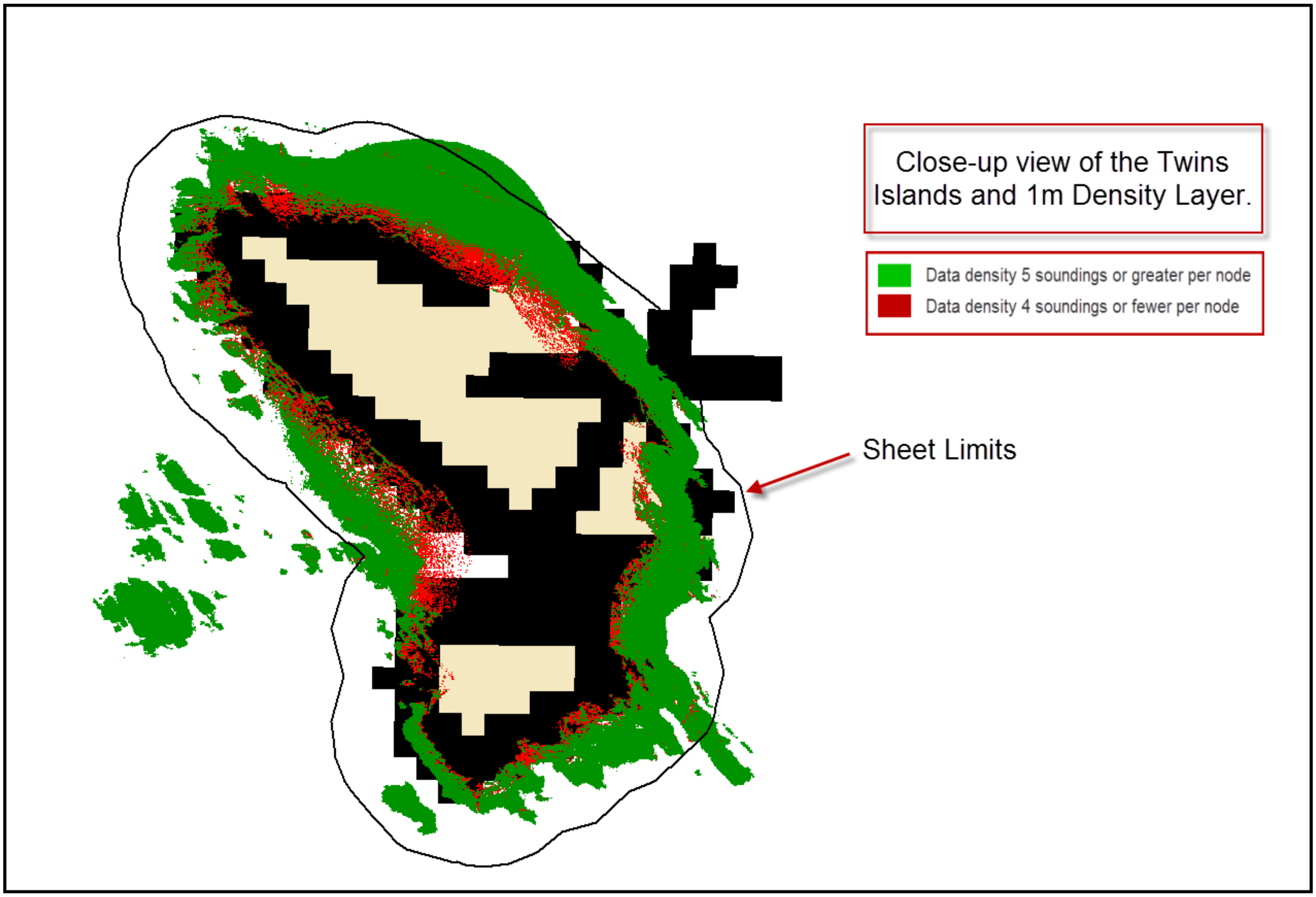


Figure 3: Low density areas in the 1-meter surface were generally caused by the tilted Reson 8125 in nearshore areas.

Resolution	Depth range	Number of nodes	Fewer than five soundings per node	Percent of nodes with greater than five soundings per node
1m	0 - 20m	449,756	76,896	82.9%
2m	18 - 40m	936,429	1,447	99.8%
4m	36 - 80m	8,108,529	2,181	100.0%
	TOTAL:	9,494,714	80,524	99.2%
	TOTAL (by area):	133,931,936	117,580	99.9%

Figure 4: Summary table showing the percentage of nodes satisfying the 5 sounding density requirements, sub-divided by the appropriate depth ranges. Note: The final row has a unit of square meters, and sums the number of different resolution nodes into a common unit of area.

The percentage of nodes with five or more soundings on the 4m surface is 99.99%.

A.4 Survey Coverage

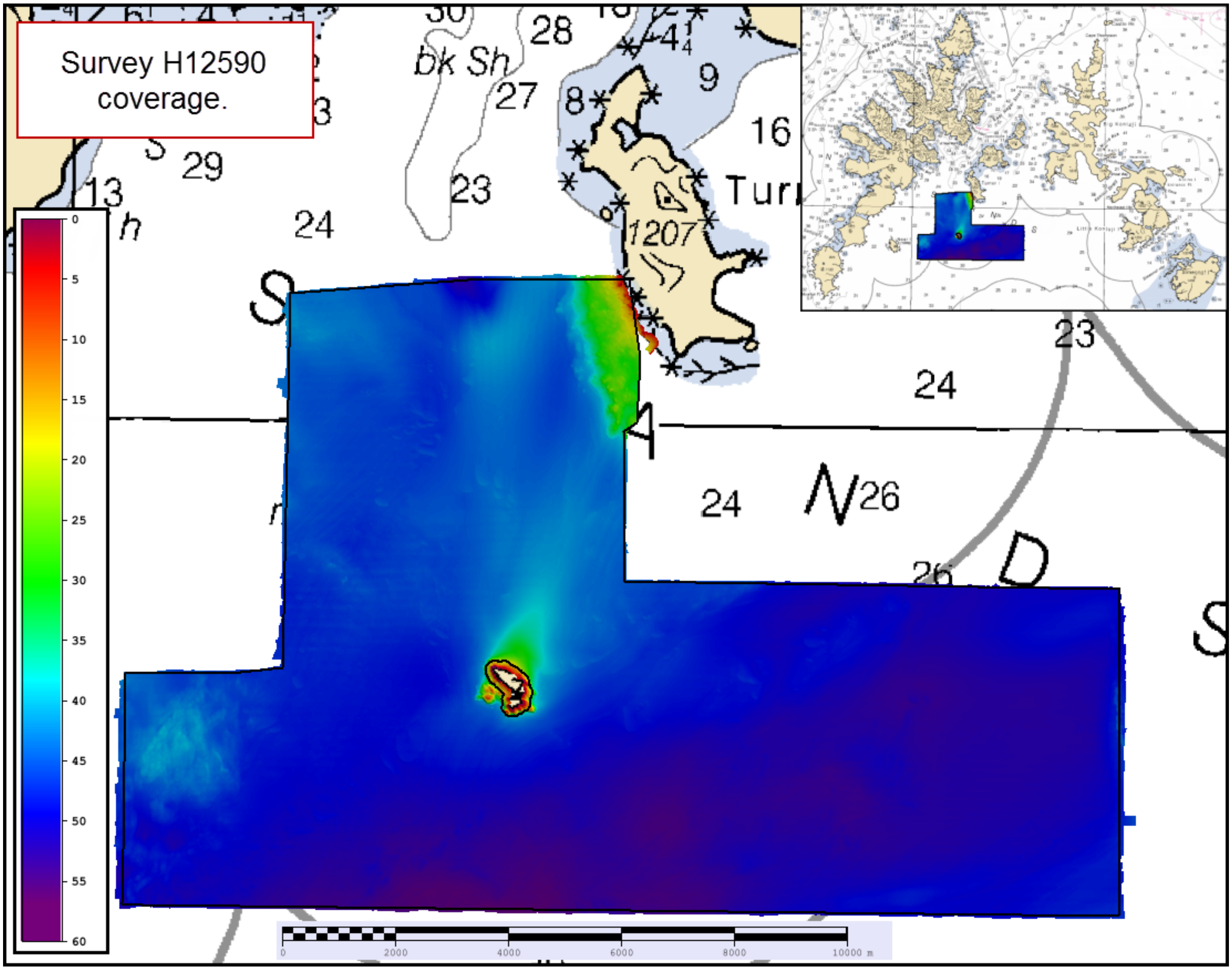


Figure 5: Acquired survey coverage overlaid on Chart 16540. Scales show depth and distance in meters.

Survey coverage was in accordance with the requirements in the Project Instructions and the HSSD with one exception; the sheet limits were not met in the northeast portion of the sheet due to dangerous wave action nearshore. This area is not navigationally significant (Figure 6).

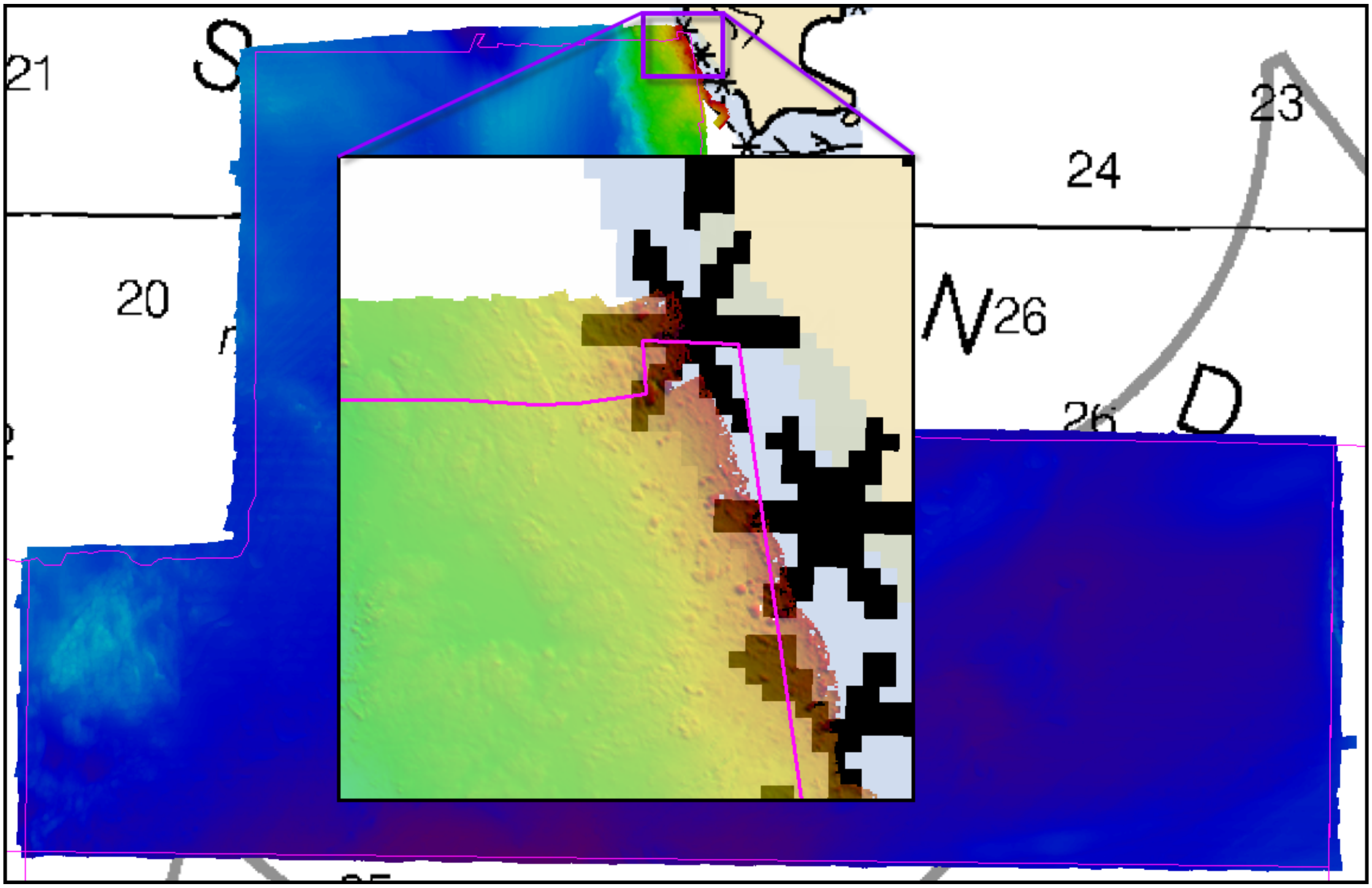


Figure 6: Sheet limits not met.

A.5 Survey Statistics

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

	HULL ID	*S221*	*2801*	*2802*	*2803*	*2804*	*Total*
LNM	SBES Mainscheme	0	0	0	0	0	0
	MBES Mainscheme	196.1	98.2	90.5	12.0	94.7	491.5
	Lidar Mainscheme	0	0	0	0	0	0
	SSS Mainscheme	0	0	0	0	0	0
	SBES/MBES Mainscheme	0	0	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0	0	0
	MBES/SSS Mainscheme	0	0	0	0	0	0
	SBES/MBES Crosslines	0	13.5	0.15	0	11.4	25.05
	Lidar Crosslines	0	0	0	0	0	0
Number of Bottom Samples							6
Number of AWOIS Items Investigated							0
Number Maritime Boundary Points Investigated							0
Number of DPs							0
Number of Items Investigated by Dive Ops							0
Total SNM							38.8

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/04/2013	216
08/05/2013	217
08/27/2013	239
08/28/2013	240
08/30/2013	242
08/31/2013	243
09/02/2013	245

Table 3: Dates of Hydrography

All data for survey H12590 was acquired by NOAA Ship RAINIER and her four survey launches (2801, 2802, 2803, 2804). The survey launches and ship acquired MBES depth soundings, sound speed profiles, and bottom samples. Launch 2803 was also used for shoreline verification.

Table 2 states that zero DPs were taken by the field. Two UWTROCs were DP'ed by the field and included in the Final Feature File.

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	*S221*	*2801*	*2802*	*2803*	*2804*
LOA	231 feet	28 feet	28 feet	28 feet	28 feet
Draft	16.5 feet	3.5 feet	3.5 feet	3.5 feet	3.5 feet

Table 4: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
Reson	7125	MBES
Reson	8125	MBES
Kongsberg	EM710	MBES
ODIM Brooke Ocean (Rolls Royce Group)	MVP30	Conductivity, Temperature, and Depth Sensor
ODIM Brooke Ocean (Rolls Royce Group)	MVP200	Conductivity, Temperature, and Depth Sensor
Applanix	POS-MV V4	Vessel Attitude & Positioning System
Seabird	SBE 19	Conductivity, Temperature, and Depth Sensor
Seabird	SBE 19 Plus	Conductivity, Temperature, and Depth Sensor
Reson	SVP 70	Sound Speed System
Reson	SVP 71	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines, acquired for this survey, totalled 5.1% of mainscheme acquisition.

Multibeam crosslines were acquired using the Reson 7125 on vessels 2801 (RA-4), 2802 (RA-5), and 2804 (RA-6). A 4-meter CUBE surface was created using the mainscheme lines, while a second 4-meter CUBE surface was created using only crosslines, from which a difference surface was generated in CARIS at a 4-meter resolution (Figure 7). Statistics were then derived from the CARIS difference surface and are shown in Figure 8. The average difference between the depths derived from the mainscheme and crosslines was 0.07 meters (mainscheme being shoaler) with a standard deviation of 0.19 meters.

For the respective depths, the difference surface was compared to the allowable IHO accuracy standards (Figure 9). In total, 99.9% of the depth differences between H12590 mainscheme and crossline data are within allowable IHO accuracies (Figure 10).

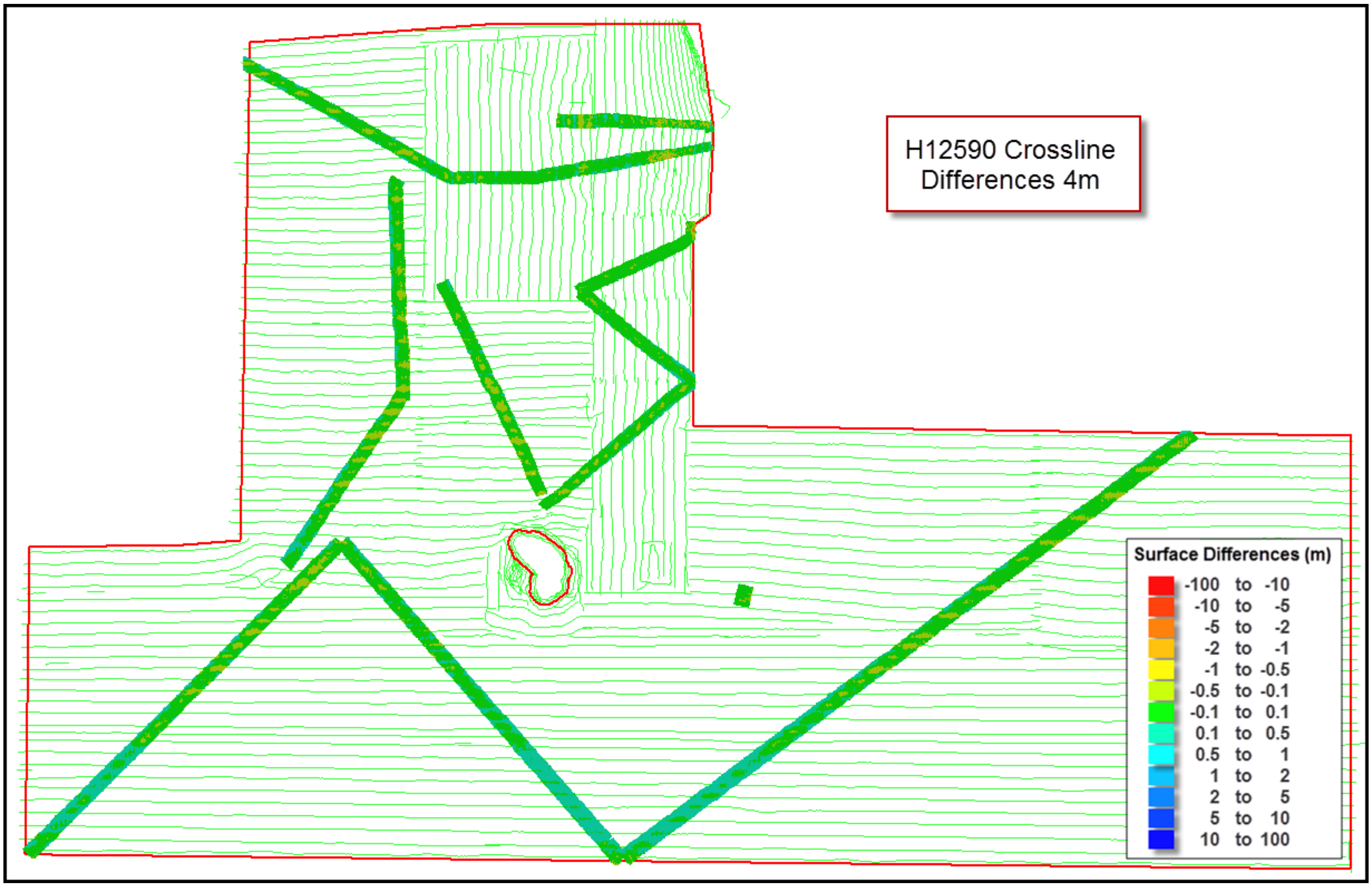


Figure 7: H12590 difference surface between the mainscheme and crosslines.

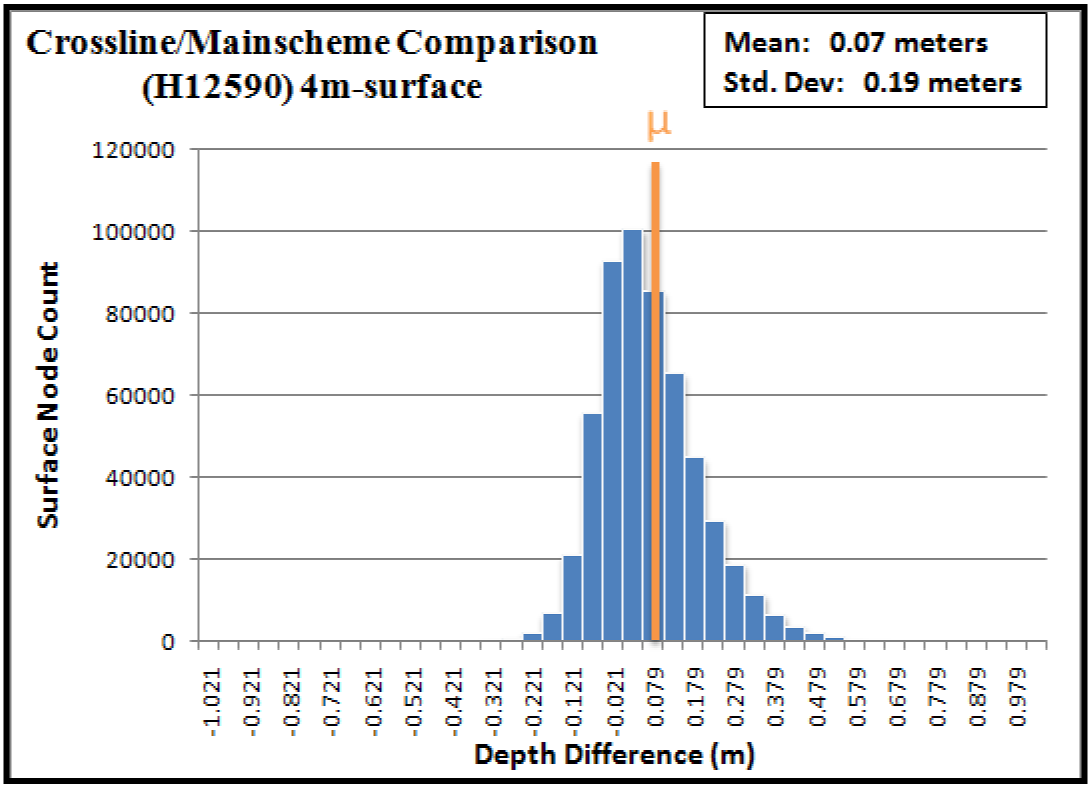


Figure 8: Crossline comparison with mainscheme lines.

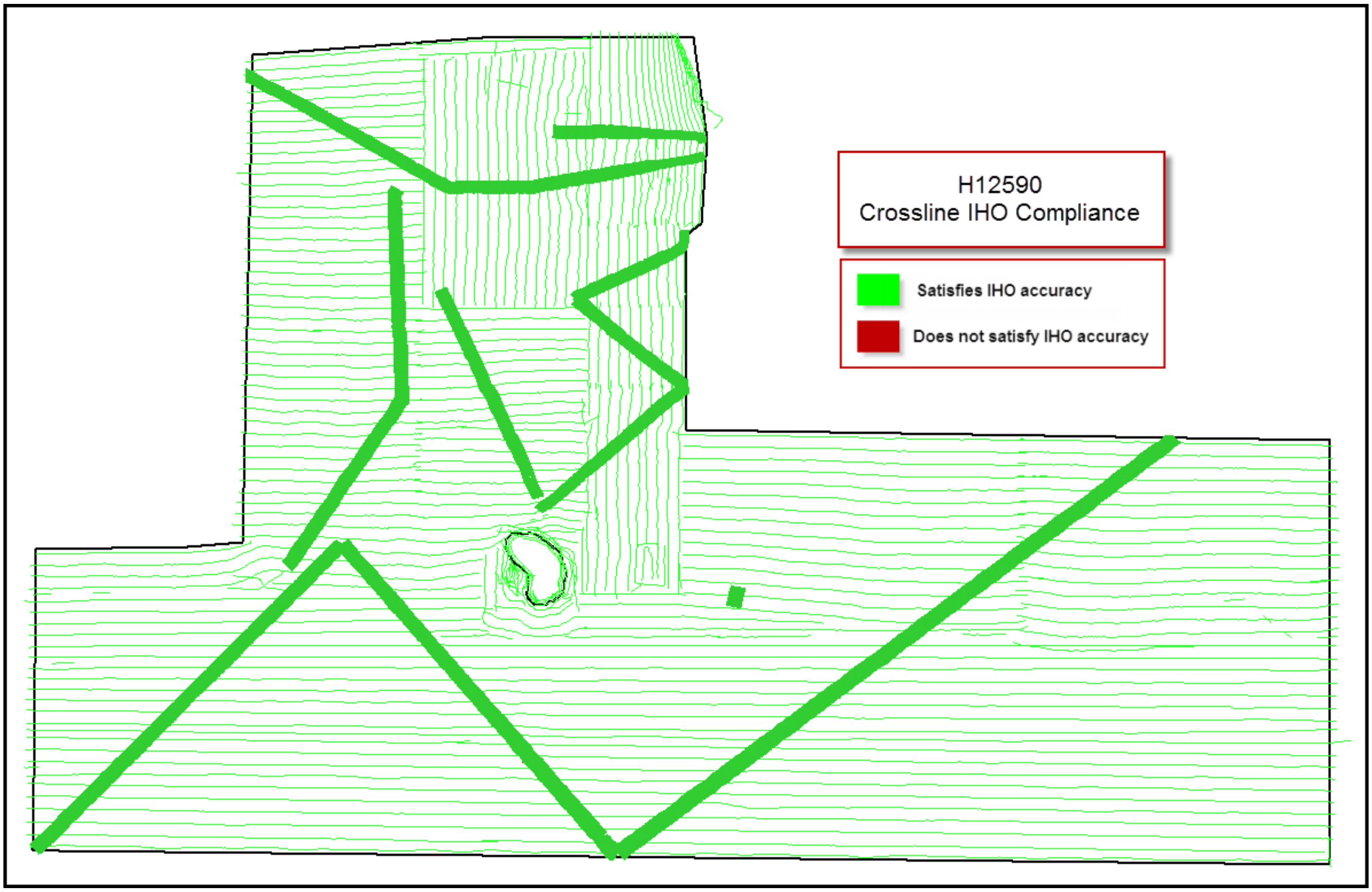


Figure 9: Depth differences between H12590 mainscheme and crossline data as compared to allowable IHO accuracy standards for the associated depths.

Depth range	IHO Order	Number of nodes	Nodes satisfying IHO accuracy	Percent nodes satisfying IHO accuracy
Less than 100m	Order 1	551,491	551,123	99.9%

Figure 10: Summary table showing percentage of difference surface nodes between H12590 mainscheme and crossline data that meet allowable IHO accuracy standards for the respective depths.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0 meters	0.045 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S221		1.0 meters/second	0.05 meters/second
2801	3.0 meters/second		0.15 meters/second
2802	3.0 meters/second		0.15 meters/second
2803	3.0 meters/second		0.15 meters/second
2804	3.0 meters/second		0.15 meters/second

Table 7: Survey Specific Sound Speed TPU Values

Total propagated uncertainty values for survey H12590 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. Tidal uncertainties were provided by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), and were applied to depth soundings.

Uncertainty values of submitted final grids were calculated in CARIS using the "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). To visualize the locations in which accuracy requirements were met, for each finalized surface a custom "predicted IHO compliance" layer was created based on the differences between calculated uncertainty of the nodes and the allowable IHO uncertainty (Figure 11). To quantify the extent to which accuracy requirements were met, the preceeding "predicted IHO compliance" layers were queried within CARIS and then examined in Excel (Figure 12). Overall, 99.5% by node and 100.0% by area of survey H12590 met the accuracy requirements stated in the HSSD.

In addition to the usual a priori estimates of uncertainty, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H12590. Real-time uncertainties from both the EM710 and Reson 7125 were recorded and applied in post-processing. Applanix TrueHeave files are recorded on all survey vessels, which include an estimate of the heave uncertainty, and are applied during post-processing. Finally, the post-processed uncertainties associated with vessel roll, pitch, gyro, and navigation are applied in CARIS HIPS via an SBET RMS file generated in POSPac.

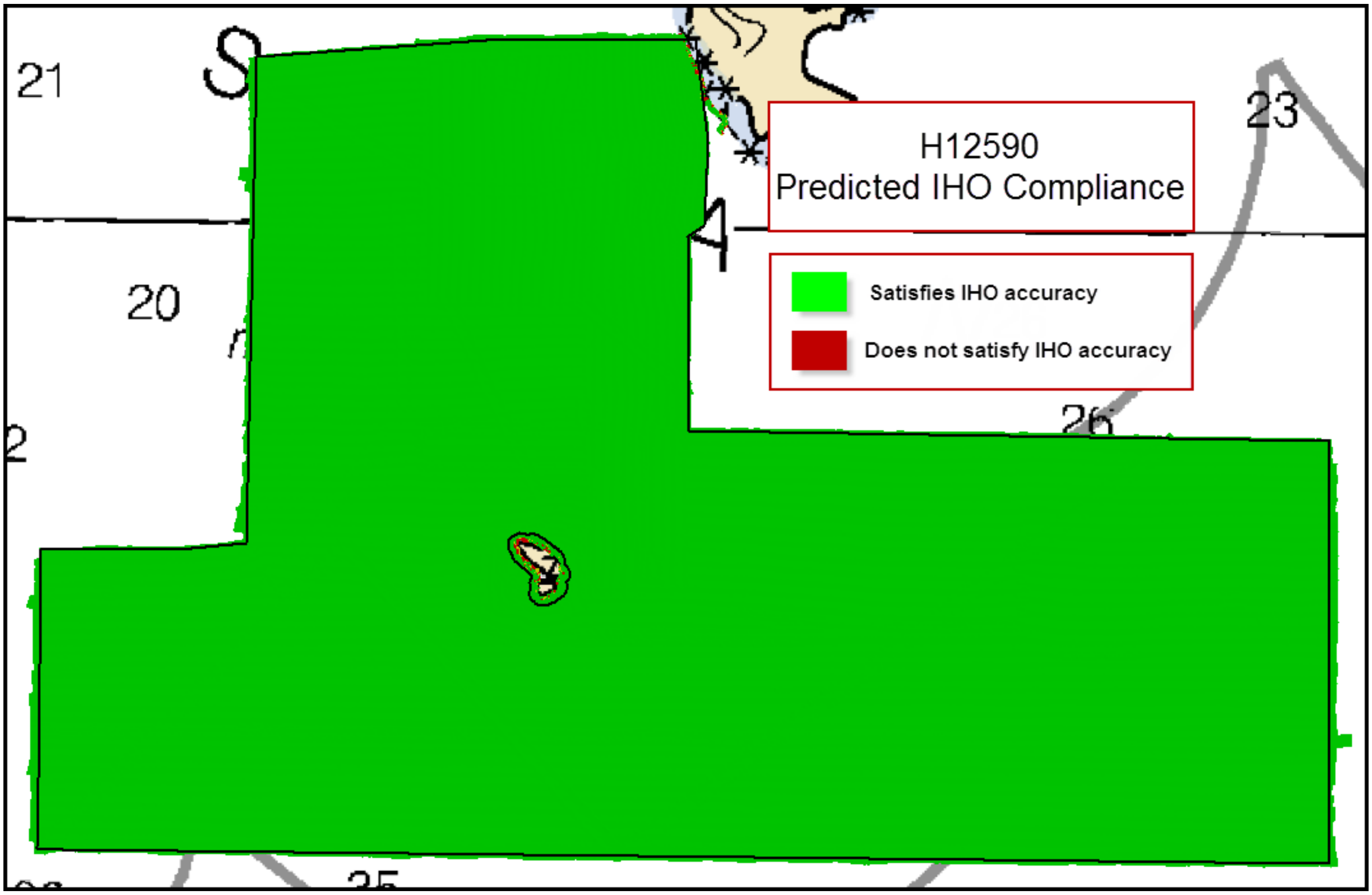


Figure 11: H12590 met IHO accuracy standards for 100.0% of the survey area.

Resolution	Depth range	IHO Order	Number of nodes	Nodes satisfying IHO accuracy	Percent nodes satisfying IHO accuracy
1m	0 - 20m	Order 1	449,756	401,490	89.3%
2m	18 - 40m	Order 1	936,429	936,330	100.0%
4m	36 - 80m	Order 1	8,108,529	8,108,516	100.0%
		TOTAL:	9,494,714	9,446,336	**99.5%**
		TOTAL (by area):	133,931,936	133,883,066	**100.0%**

Figure 12: Summary table showing the percentage of nodes satisfying the indicated IHO accuracy level, sub-divided by the appropriate depth ranges. Note: The final row has a unit of square meters, and sums different resolution nodes into a common unit of area.

The percent of nodes satisfying IHO accuracy on the 2m, 4m, and total by area is 99.99%

B.2.3 Junctions

Eight junction comparisons were completed for H12590. Four of these surveys (H12588, H12589, H12591, H12592) were acquired concurrently with this survey, and four surveys (H11607; 2006-RAINIER, H11682; 2007-FAIRWEATHER, H11848; 2008-FAIRWEATHER, H11923; 2008-FAIRWEATHER) were completed prior to 2013 (Figure 13). Depth comparisons were performed using CARIS difference surfaces and CARIS Subset Editor.

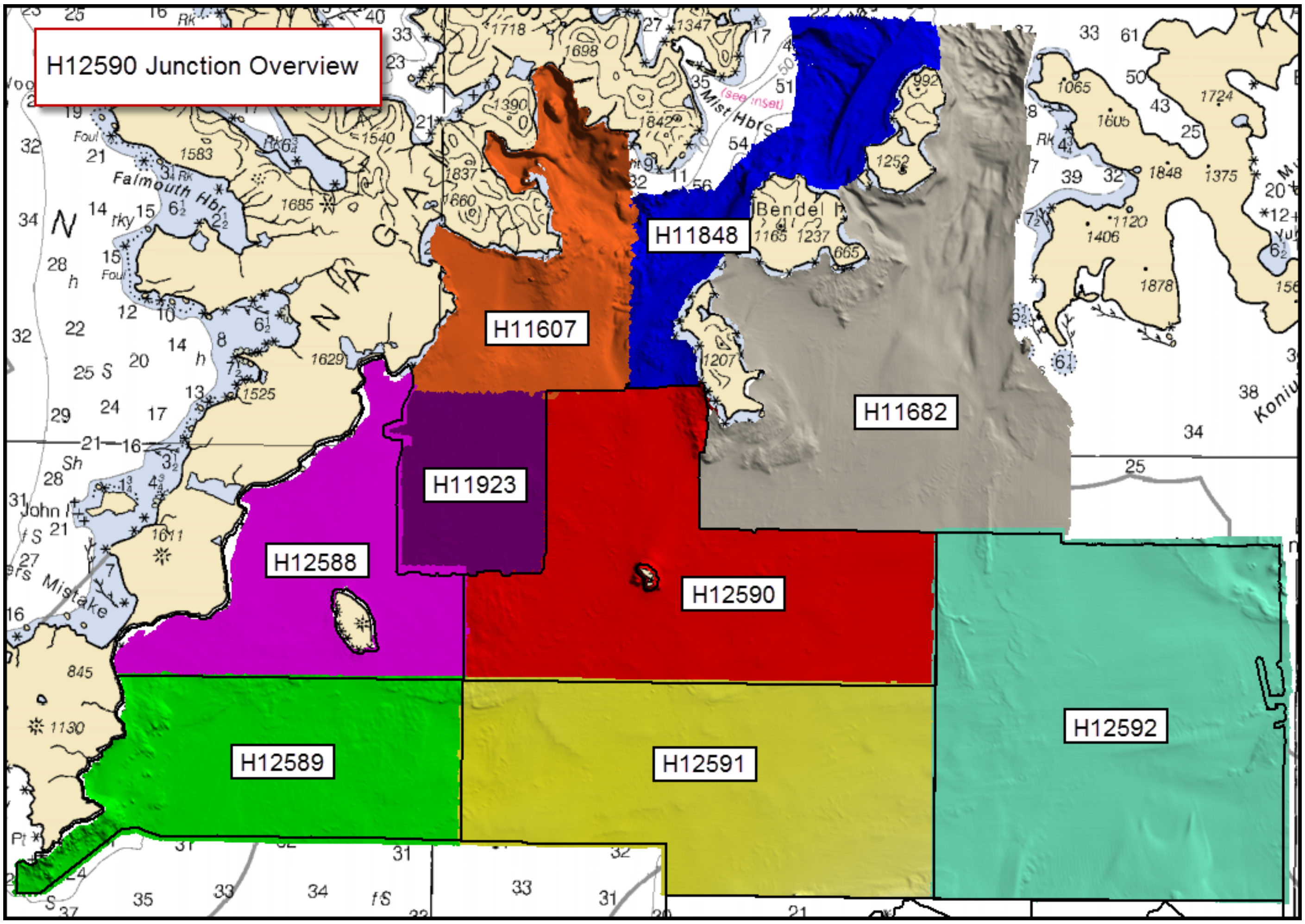


Figure 13: H12590 junction overview.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H11682	1:20000	2007	NOAA Ship FAIRWEATHER	NE
H11848	1:10000	2008	NOAA Ship FAIRWEATHER	N
H11923	1:20000	2008	NOAA Ship FAIRWEATHER	NW
H11607	1:10000	2006	NOAA Ship RAINIER	N
H12588	1:40000	2013	NOAA Ship RAINIER	W
H12589	1:40000	2013	NOAA Ship RAINIER	SW
H12591	1:40000	2013	NOAA Ship RAINIER	S
H12592	1:40000	2013	NOAA Ship RAINIER	E

Table 8: Junctioning Surveys

H11682

Overlap with survey H11682 ranges from 135 meters wide along the northeast boundary to 120 meters wide on the southeast boundary of H12590 (Figure 14). Depths in the junction range from approximately 20 to 51 meters. A difference surface analysis between CUBE depth layers for each survey showed H12590 to be an average of 0.06 meters shoaler than H11682, with a standard deviation of 0.38 meters (Figure 15). Greater differences occurred in areas of high bathymetric relief.

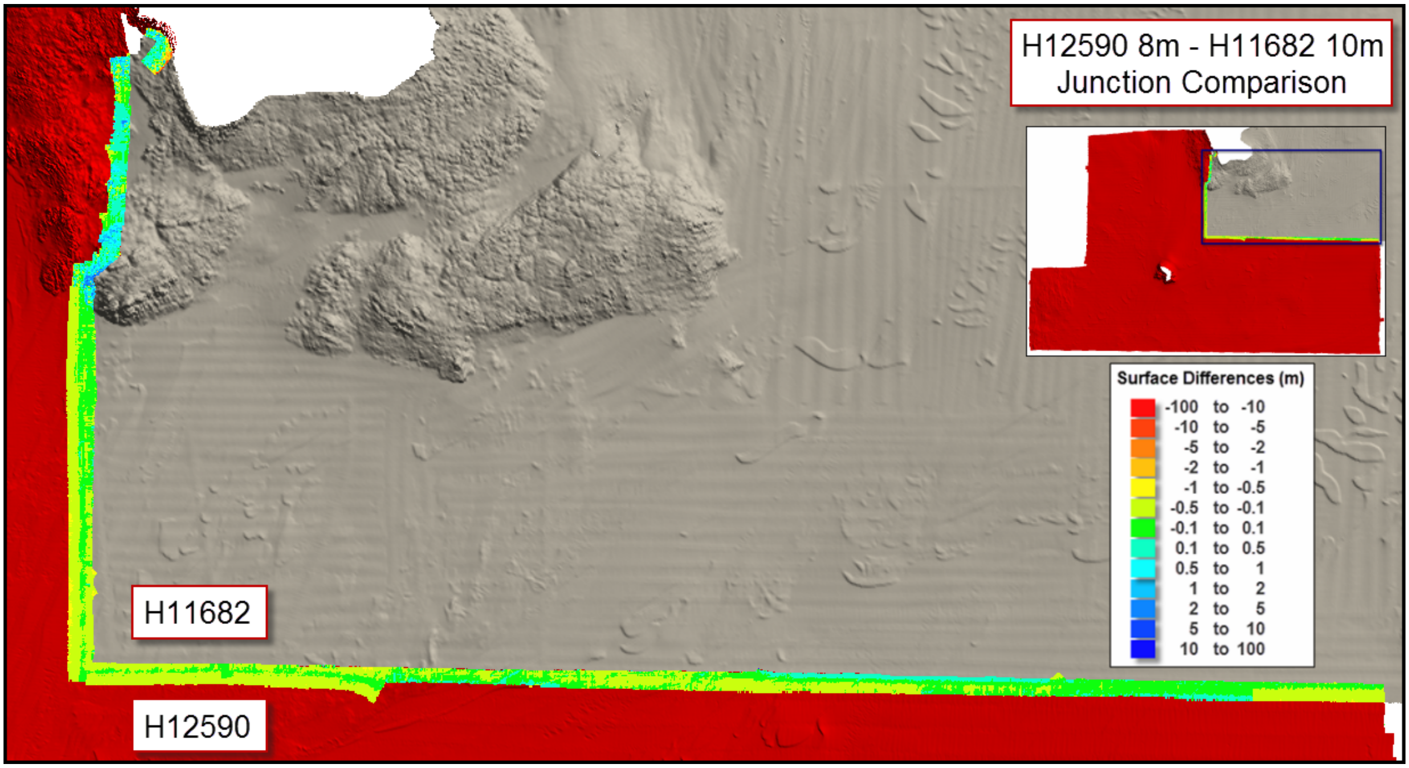


Figure 14: Junction between H12590 and H11682.

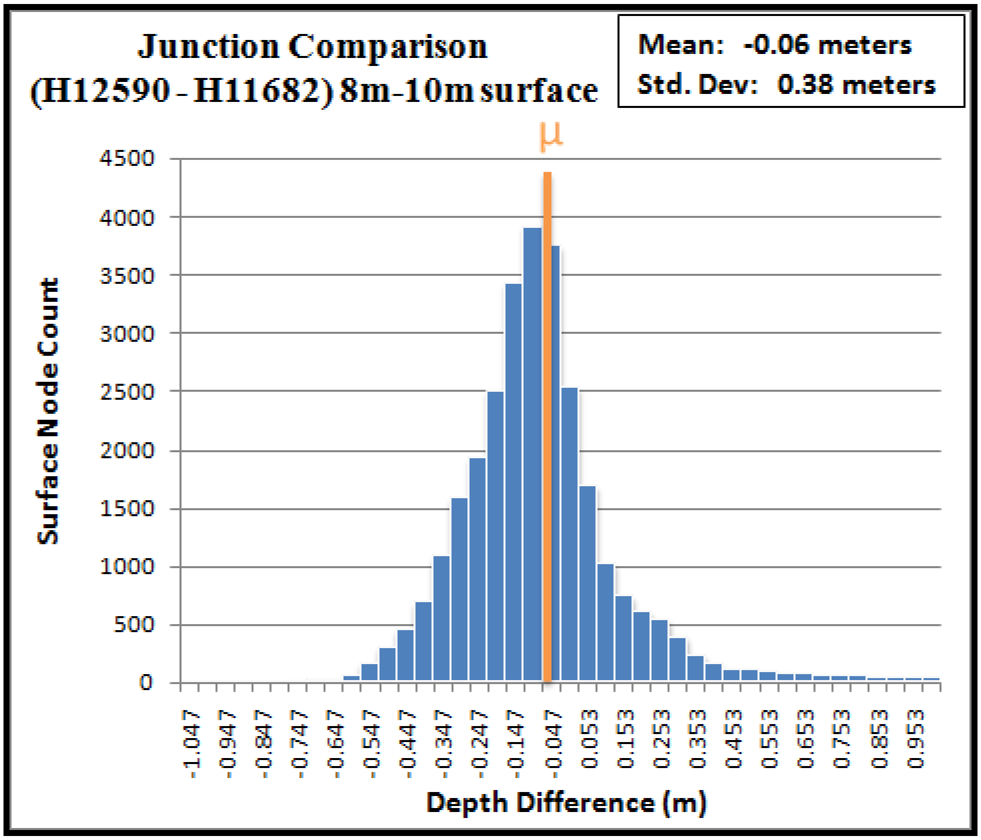
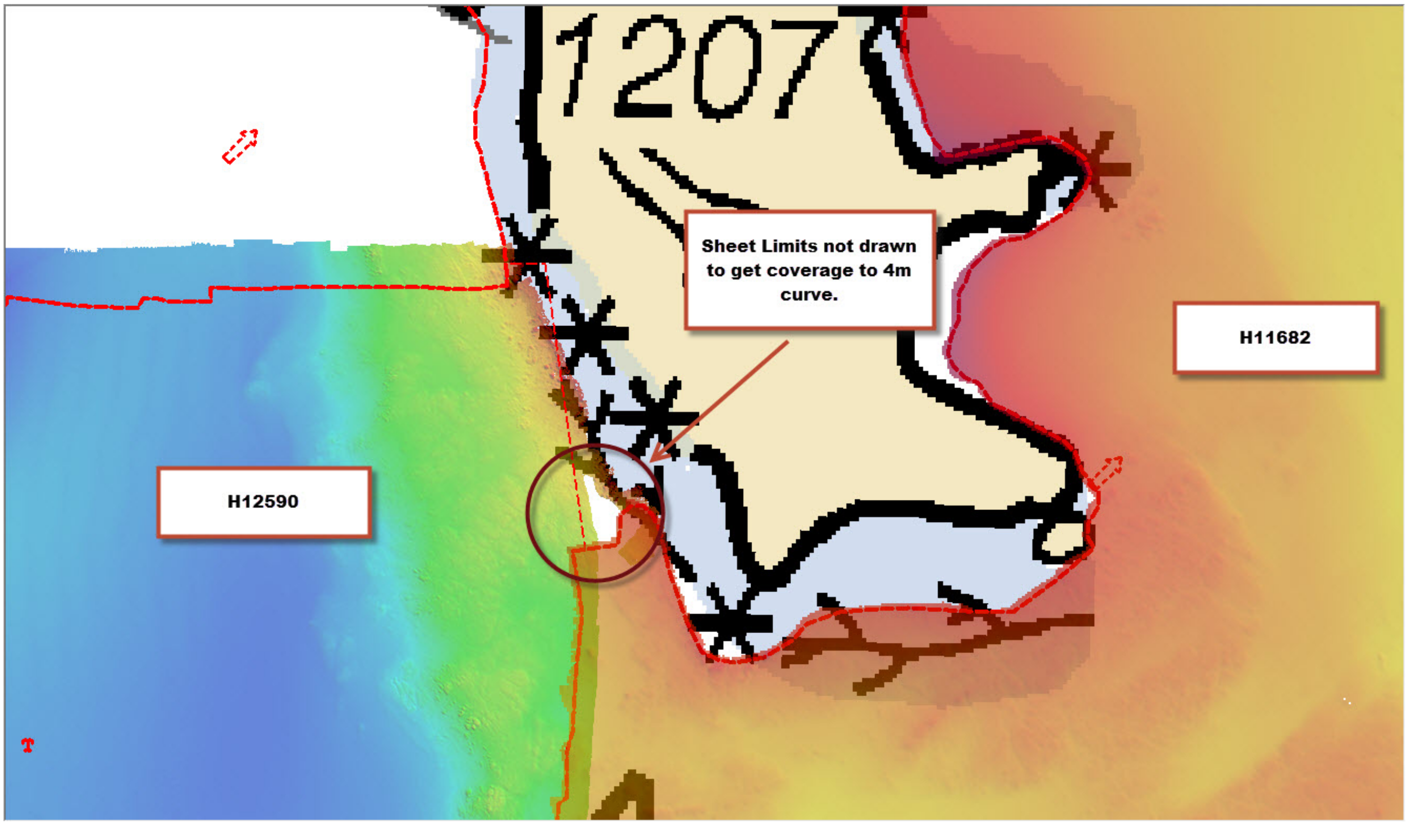


Figure 15: Difference surface statistics between H12590 and H11682 CUBE depth layers (8m & 10m grid size). H12590 is an average of 0.06 meters shoaler.

The sheet limits of both H12590 and H11682 were not drawn such that it was conducive for nearshore hydrography to reach the 4m curve near the shore of Turner Island (NE part of survey). This produced an awkward gap in coverage between the two surveys. The DR mentions being unable to reach the sheet limits of H12590 due to dangerous wave action nearshore, however, this gap in the junctions is not mentioned.



Sheet limits from Project Reference File did not join together flush with Turner Island shoreline.

H11848

Overlap with survey H11848 ranges from 240 meters wide on the western boundary to 205 meters wide along the eastern boundary of H12590 (Figure 16). Depths in the junction range from approximately 5 to 53 meters. A difference surface analysis between CUBE depth layers for each survey showed H11848 to be an average of 0.10 meters shoaler than H12590, with a standard deviation of 0.45 meters (Figure 17). Greater differences occurred in areas of high bathymetric relief.

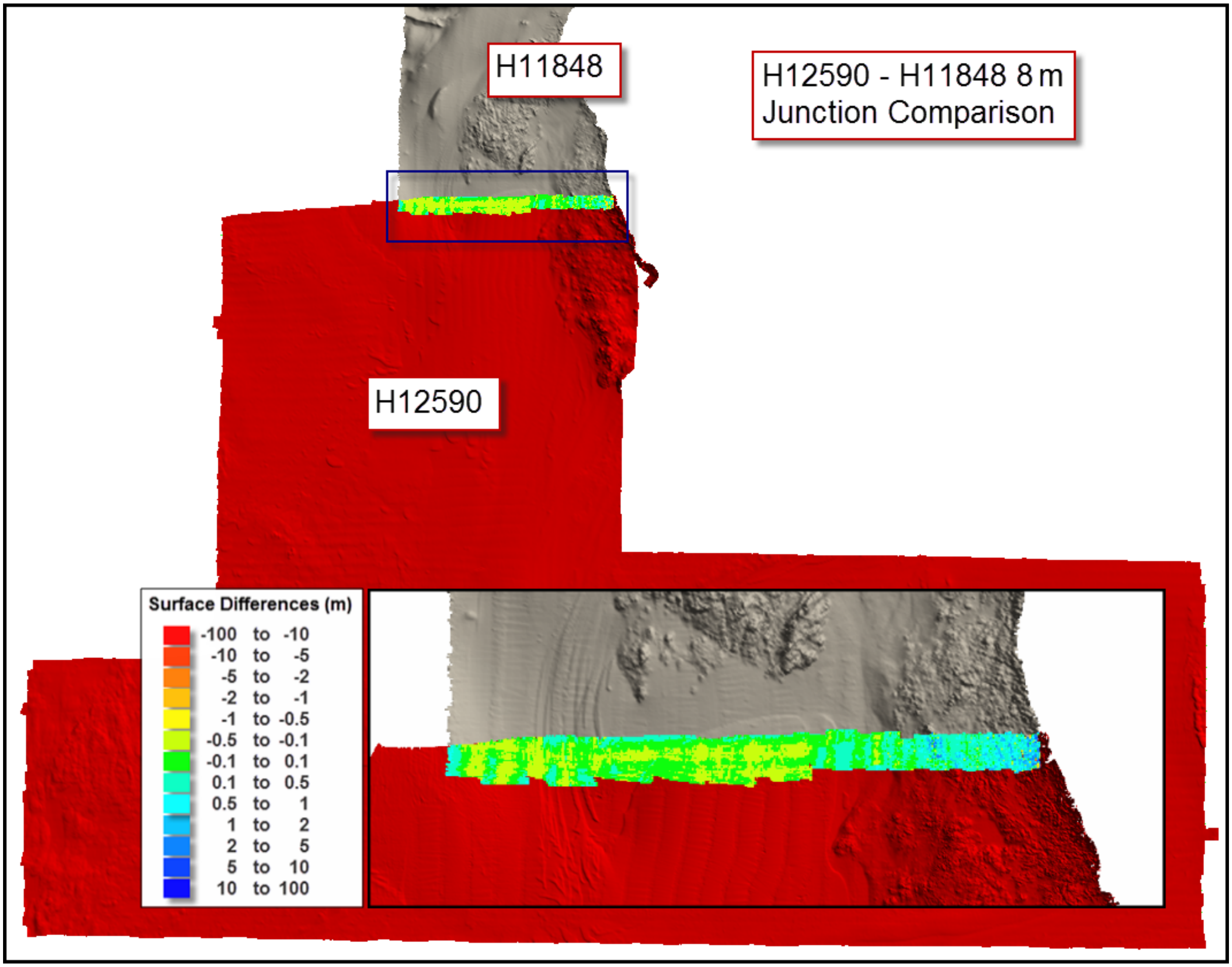


Figure 16: Junction between H12590 and H11848.

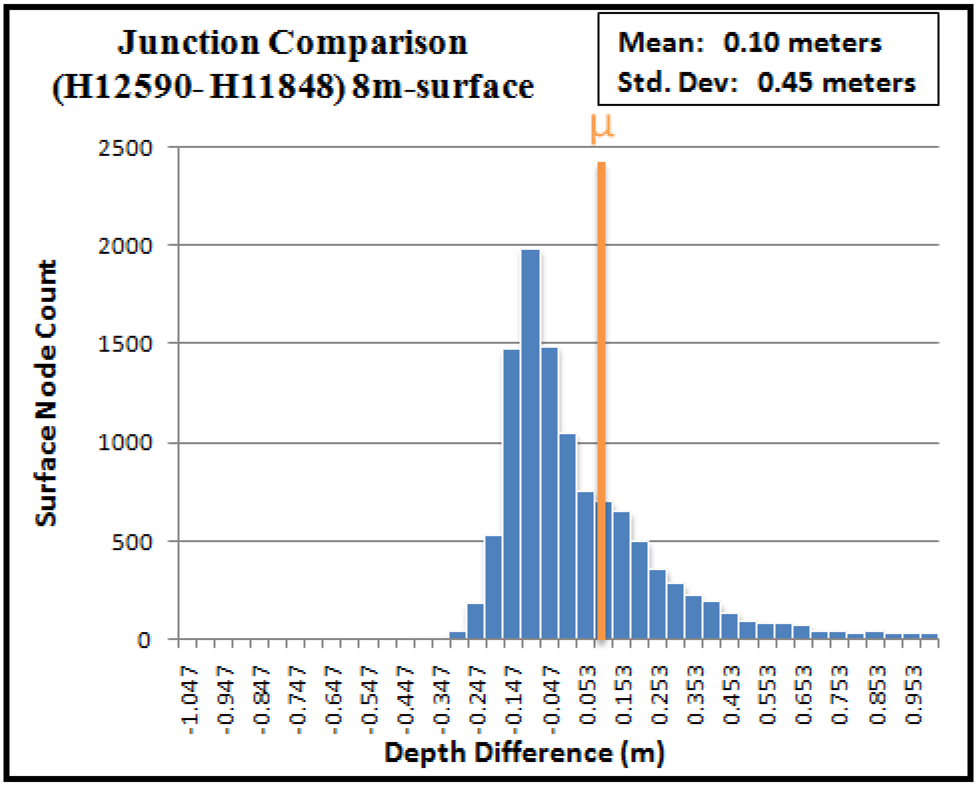


Figure 17: Difference surface statistics between H12590 and H11848 CUBE depth layers (8m grid size). H11848 is an average of 0.10 meters shoaler.

<u>H11923</u>

Overlap with survey H11923 ranges from 125 meters wide along the southwest boundary to 205 meters wide along the northern boundary of H12590 (Figure 18). Depths in the junction range from approximately 42 to 48 meters. A difference surface analysis between CUBE depth layers for each survey showed H12590 to be an average of 0.28 meters shoaler than H11923, with a standard deviation of 0.15 meters (Figure 19).

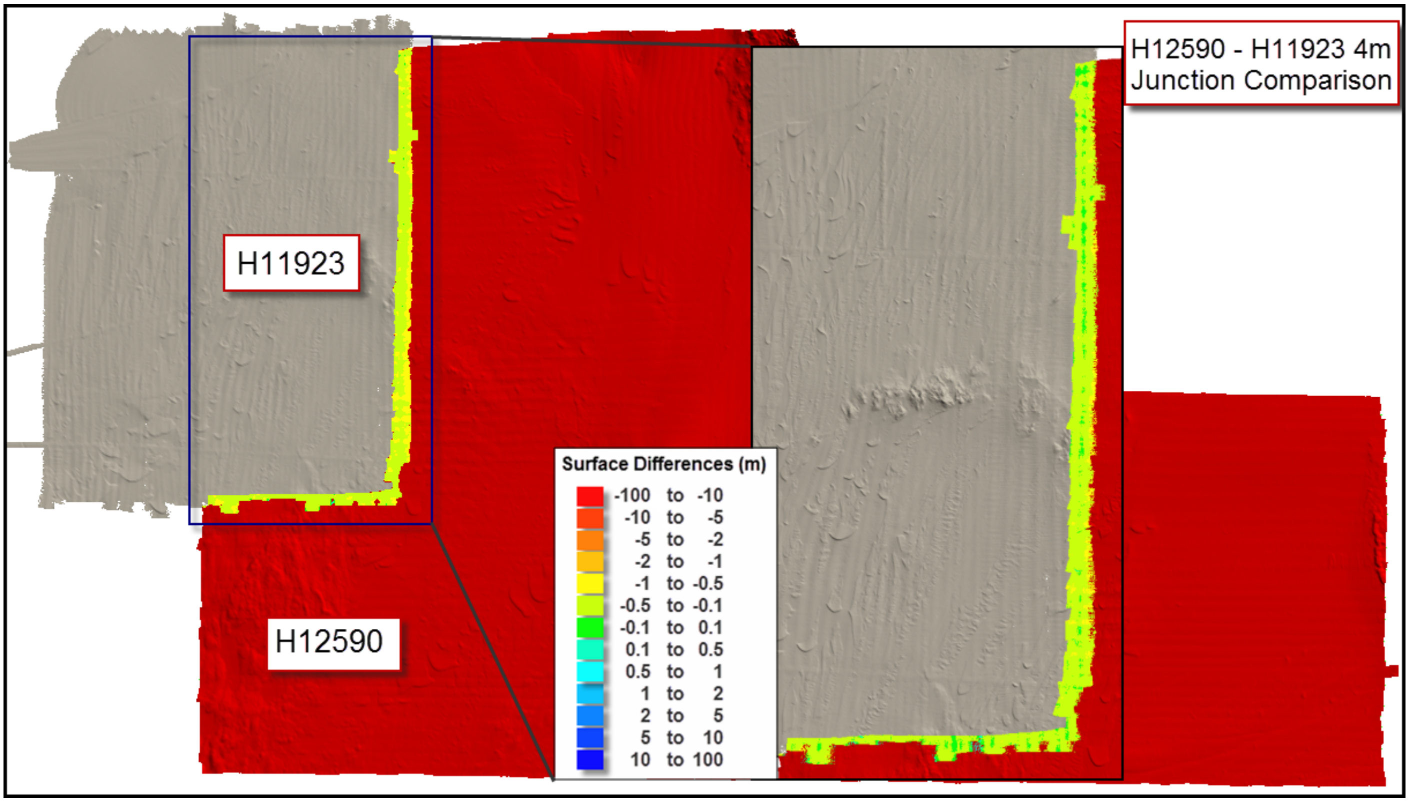


Figure 18: Junction between H12590 and H11923.

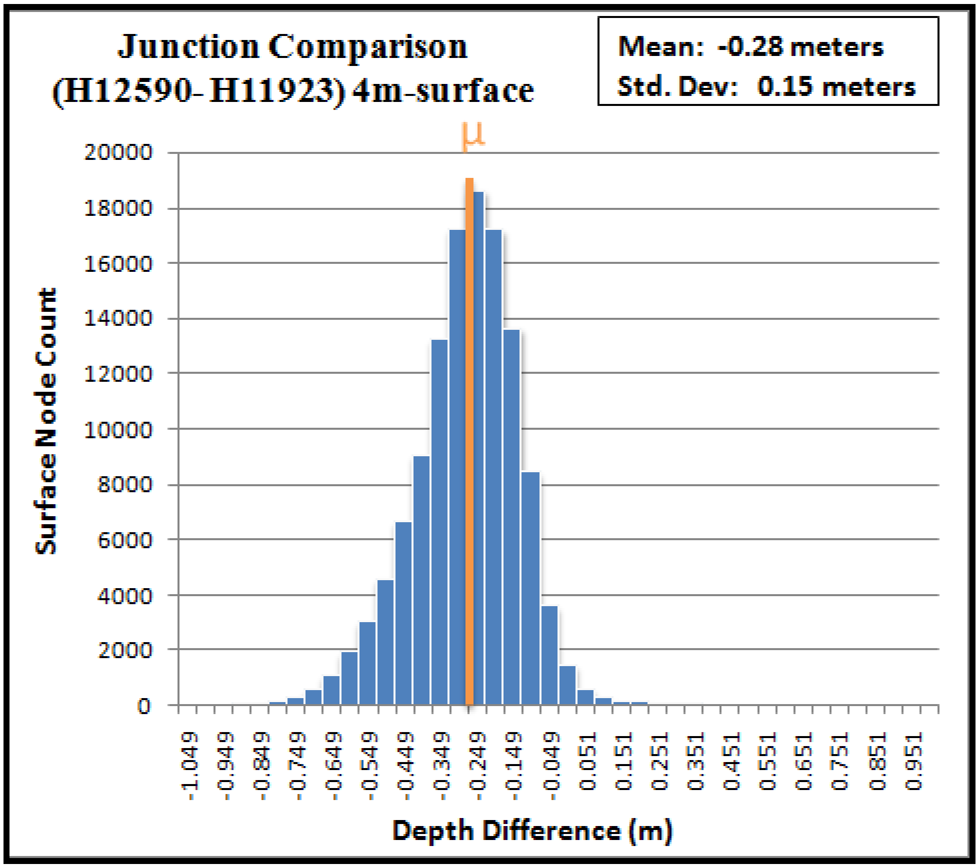


Figure 19: Difference surface statistics between H12590 and H11923 CUBE depth layers (4m grid size). H12590 is an average of 0.28 meters shoaler.

H11607

Overlap with survey H11607 ranges from 170 meters wide along the western boundary to 410 meters wide along the eastern boundary of H12590 (Figure 20). Depths in the junction range from approximately 41 to 52 meters. A difference surface analysis between CUBE depth layers for each survey showed H11607 to be an average of 0.08 meters shoaler than H12590, with a standard deviation of 0.20 meters (Figure 21). This is well within allowable IHO Order 1 accuracy at these depths.

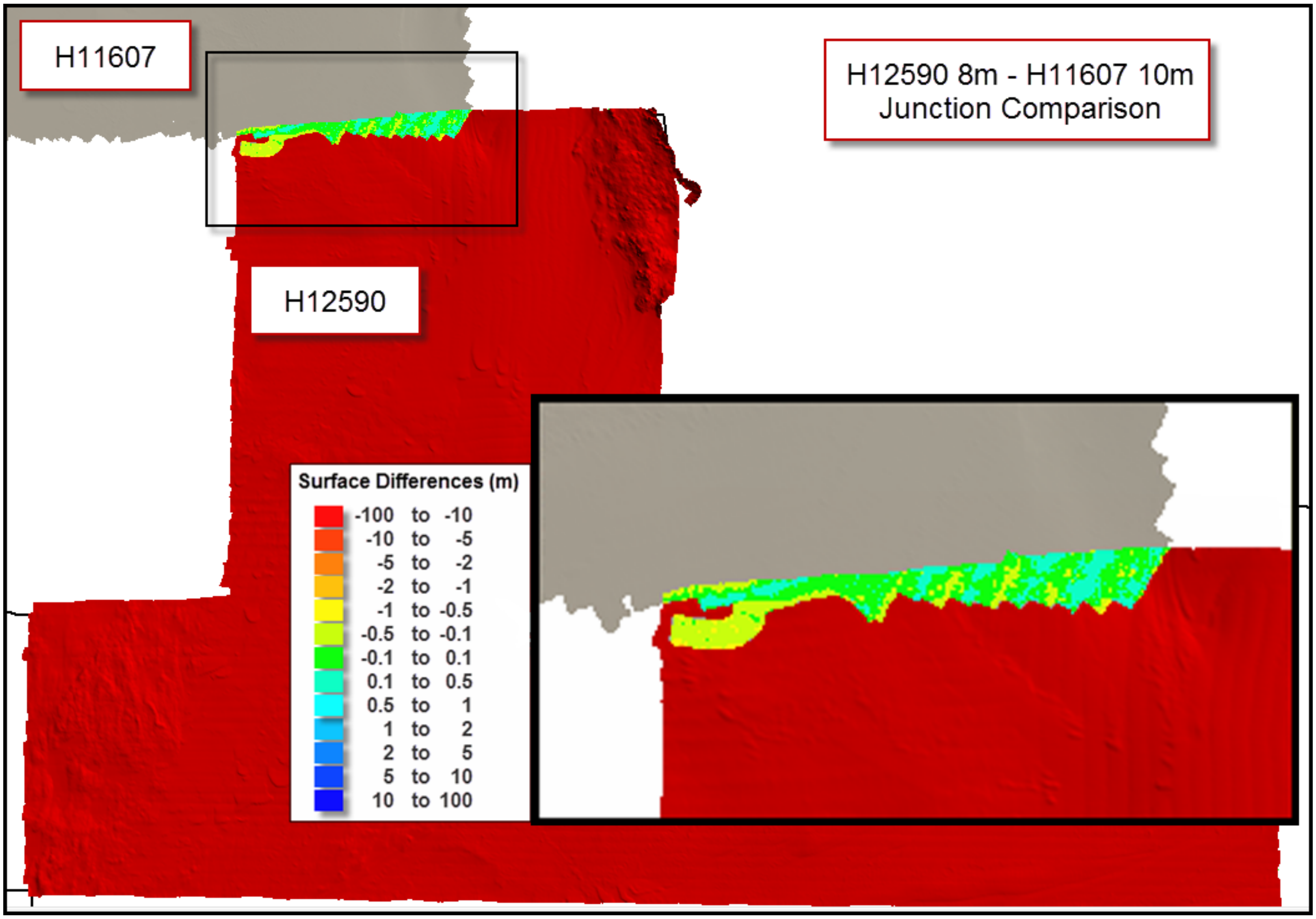


Figure 20: Junction between H12590 and H11607.

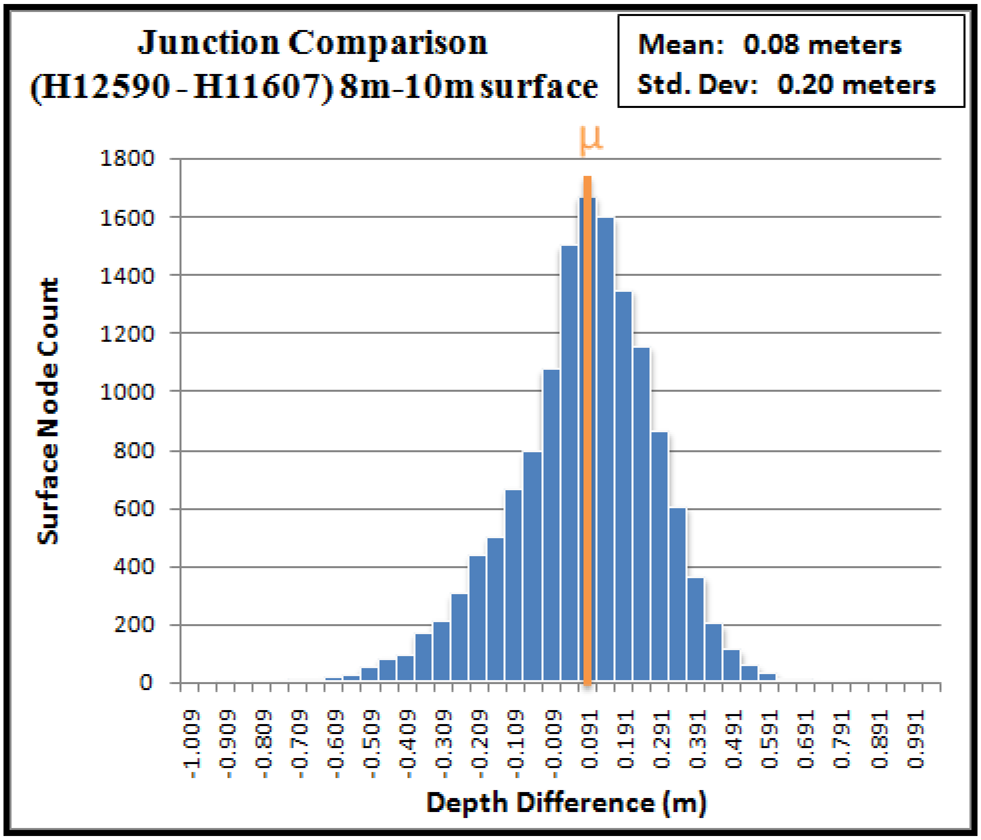


Figure 21: Difference surface statistics between H12590 and H11607 CUBE depth layers (8m & 10m grid size). H11607 is an average of 0.08 meters shoaler.

<u>H12588</u>

Overlap with survey H12588 ranges from 120 meters wide along the northern boundary to 164 meters wide along the southern boundary of H12590 (Figure 22). Depths in the junction range from approximately 43 to 52 meters. A difference surface analysis between CUBE depth layers for each survey showed H12588 to be an average of 0.10 meters shoaler than H12590, with a standard deviation of 0.15 meters (Figure 23). This is well within allowable IHO Order 1 accuracy at these depths.

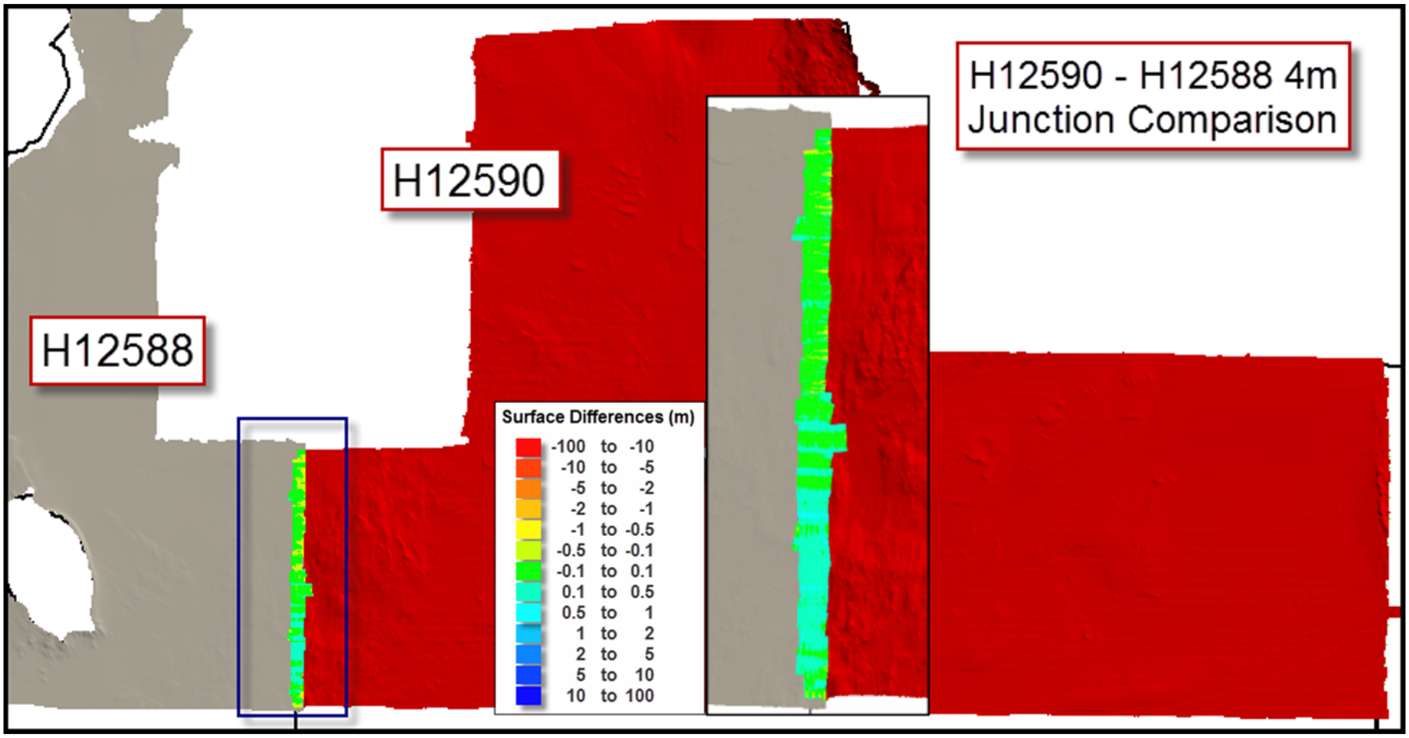


Figure 22: Junction between H12590 and H12588.

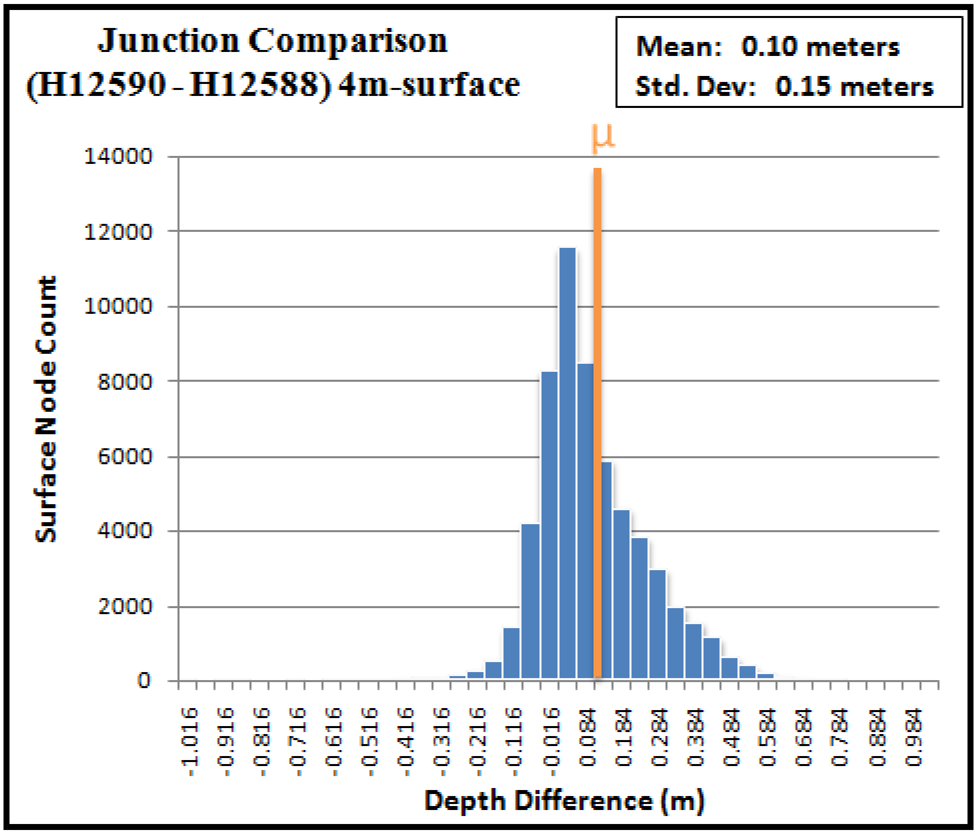


Figure 23: Difference surface statistics between H12590 and H12588 CUBE depth layers (4m grid size). H12588 is an average of 0.10 meters shoaler.

H12589

Overlap with survey H12589 was 197 meters wide along the northern boundary of H12590 (Figure 24). Depths in the junction range from approximately 48 to 52 meters. A difference surface analysis between CUBE depth layers for each survey showed H12590 to be an average of 0.09 meters shoaler than H12589, with a standard deviation of 0.08 meters (Figure 25). This is well within allowable IHO Order 1 accuracy at these depths.

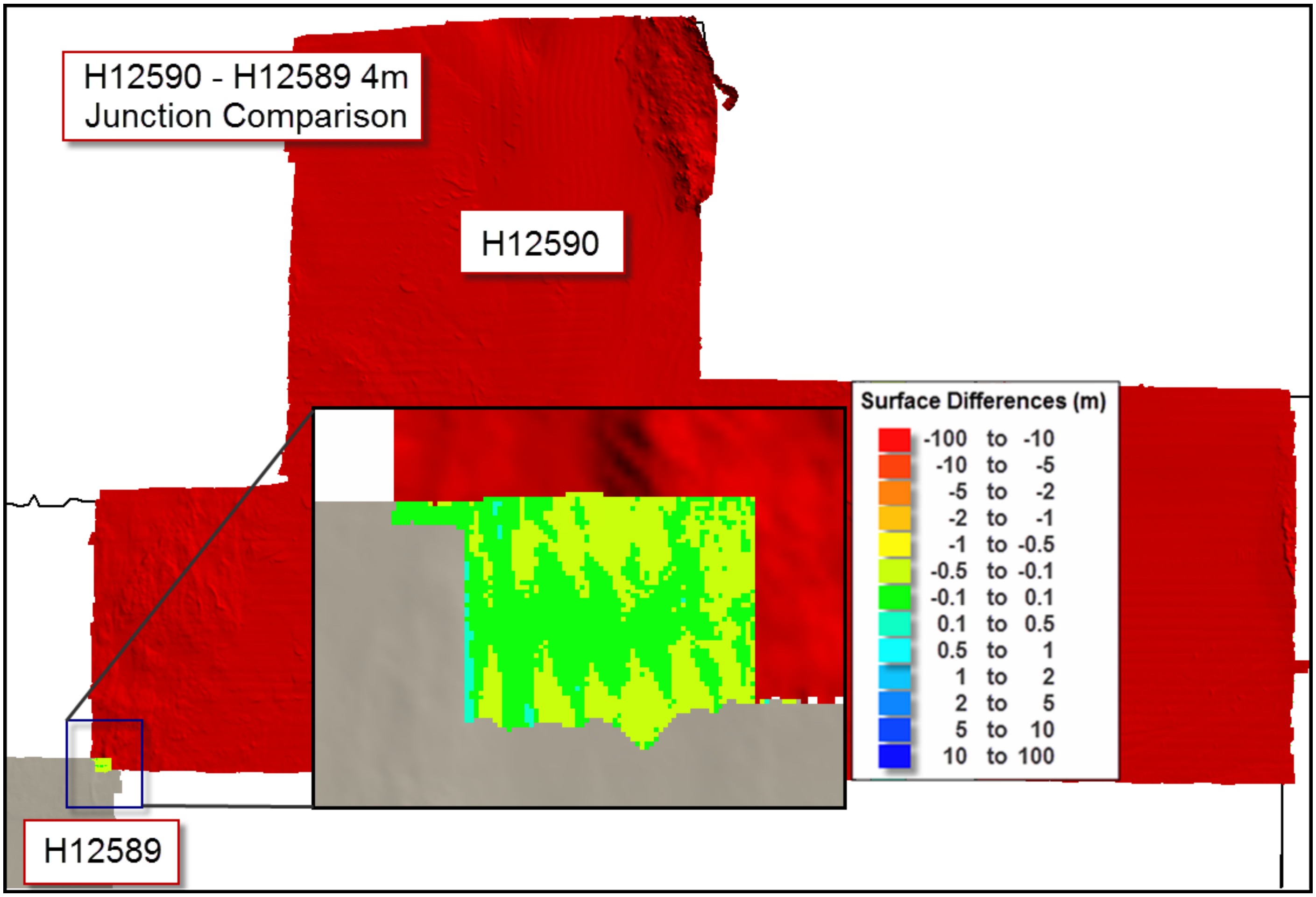


Figure 24: Junction between H12590 and H12589.

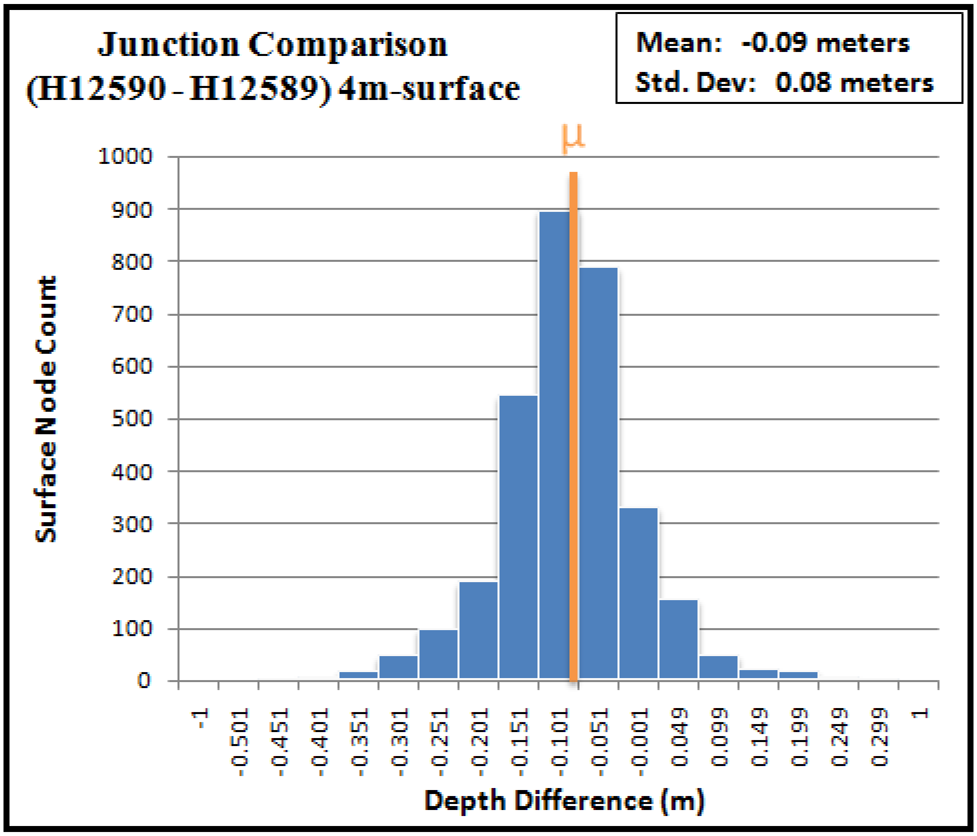


Figure 25: Difference surface statistics between H12590 and H12589 CUBE depth layers (4m grid size). H12590 is an average of 0.09 meters shoaler.

<u>H12591</u>

Overlap with survey H12591 ranges from 180 meters wide along the western boundary to 152 meters wide along the eastern boundary of H12590 (Figure 26). Depths in the junction range from approximately 47 to 57 meters. A difference surface analysis between CUBE depth layers for each survey showed H12590 to be an average of 0.02 meters shoaler than H12591, with a standard deviation of 0.11 meters (Figure 27). This is well within allowable IHO Order 1 accuracy at these depths.

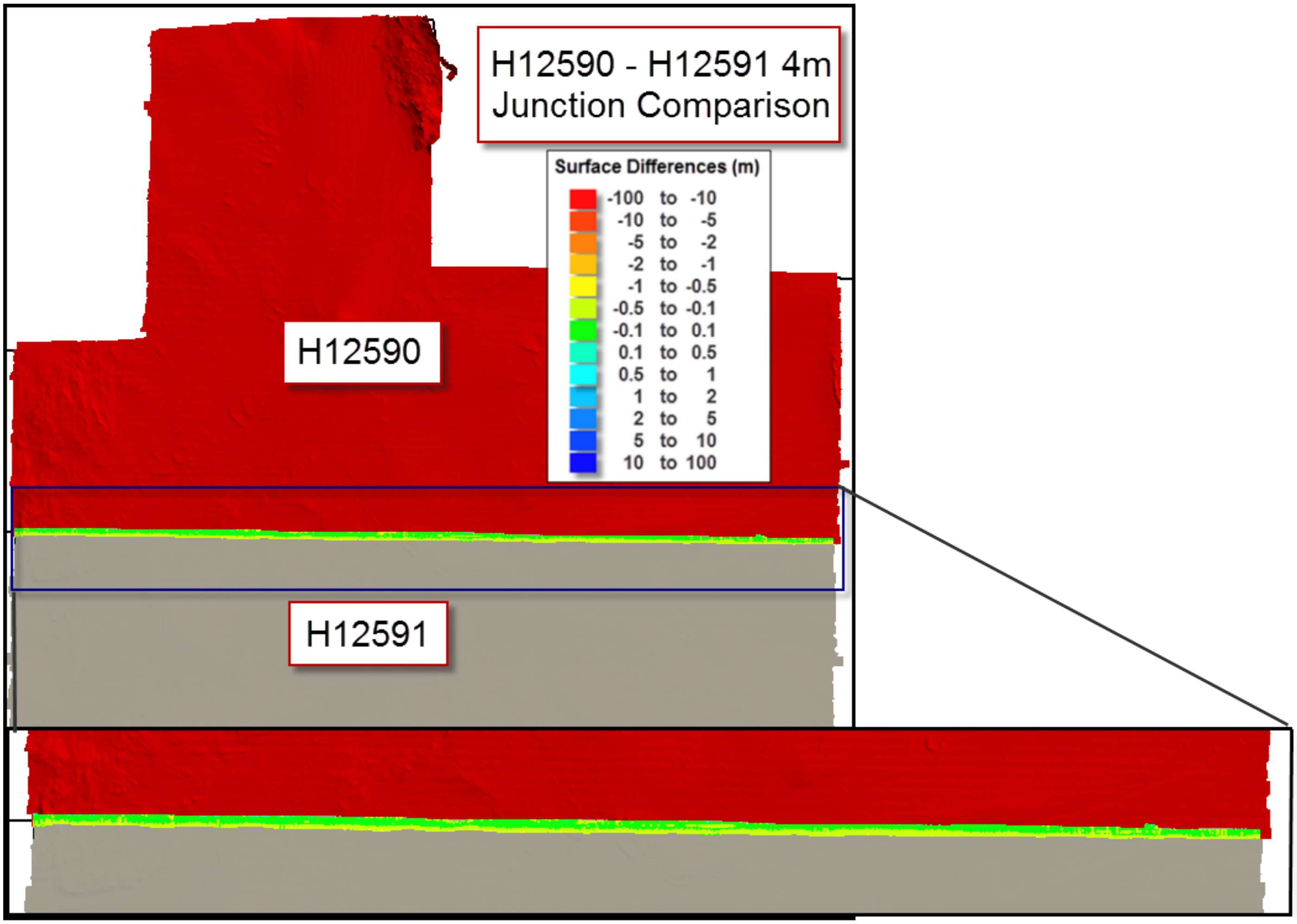


Figure 26: Junction between H12590 and H12591.

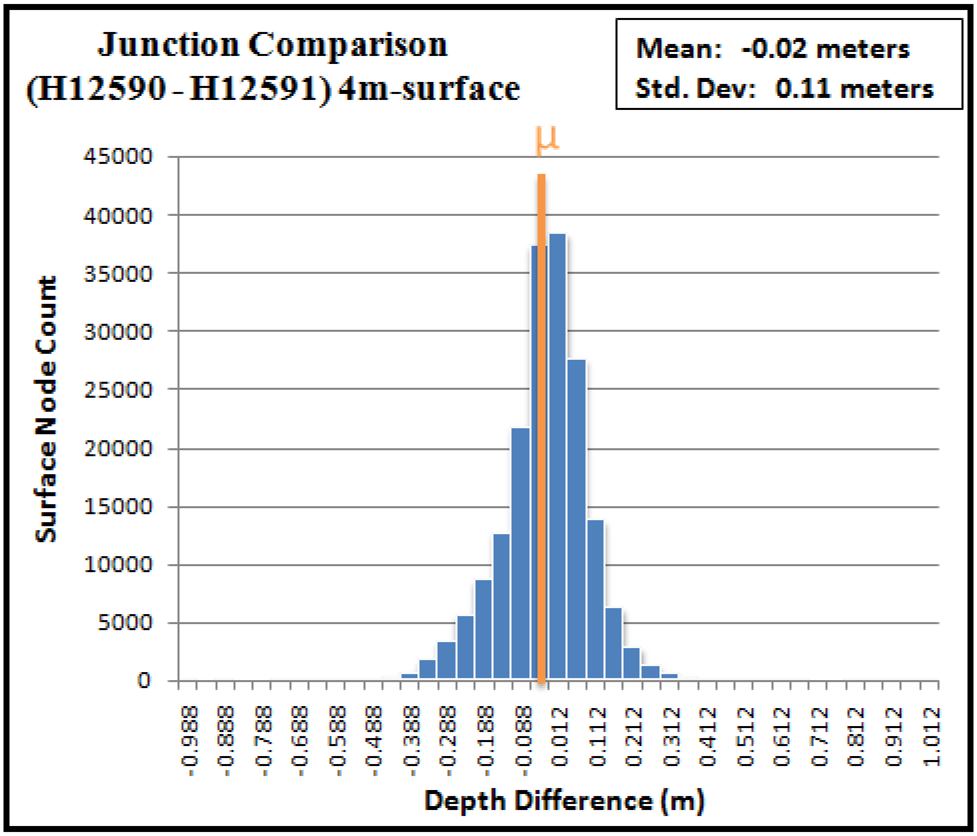


Figure 27: Difference surface statistics between H12590 and H12591 CUBE depth layers (4m grid size). H12590 is an average of 0.02 meters shoaler.

<u>H12592</u>

Overlap with survey H12592 ranges from 362 meters wide along the southern boundary to 175 meters wide along the northern boundary of H12590 (Figure 28). Depths in the junction range from approximately 45 to 51 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.02 meters shoaler than H12590, with a standard deviation of 0.12 meters (Figure 29). This is well within allowable IHO Order 1 accuracy at these depths.

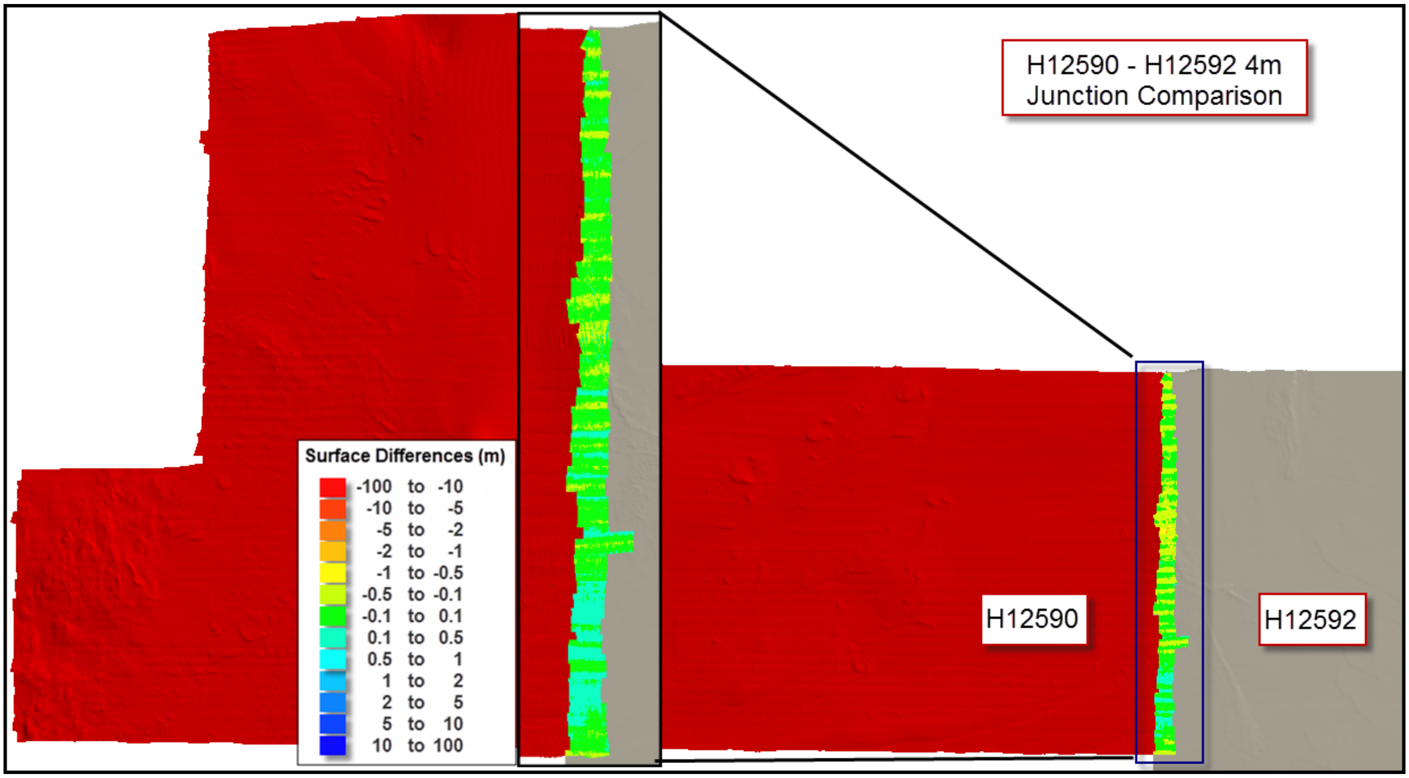


Figure 28: Junction between H12590 and H12592.

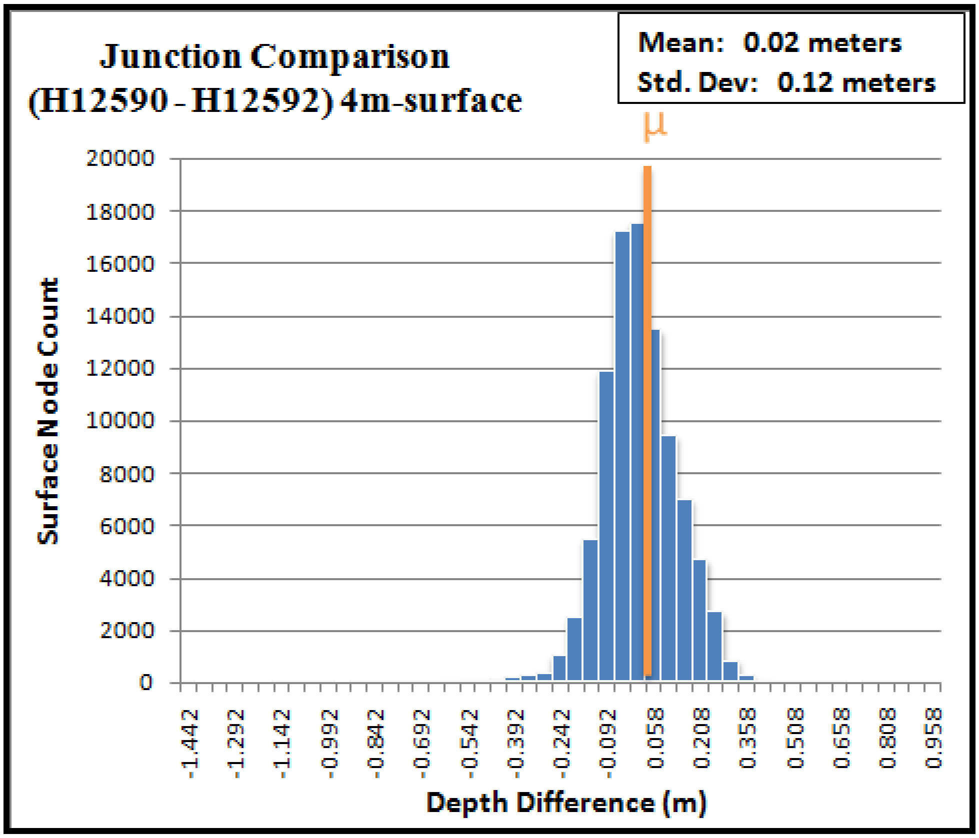


Figure 29: Difference surface statistics between H12590 and H12592 CUBE depth layers (4m grid size). H12592 is an average of 0.02 meters shoaler.

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

<u>Ellipsoidal-to-Tidal Surface Comparison</u>

Using the GPS height determined from the SBET file, data from H12590 was referenced to the ellipse and gridded. As a QC tool an ERS to MLLW difference surface was created to identify artifacts. By differencing this ellipsoidally-referenced surface (ERS) from the traditional tidally-referenced surface, one should only see the ellipsoidal slope across the length of the survey. Any deviations from this slope would therefore be the result of an error intrinsic to either the ERS or tidal processing work flow. Misprojected SBETs, current induced dynamic draft, incorrect waterline measurements, corrupt True Heave files, or poorly-modeled water levels are all examples of artifacts that can be identified through the difference of the ERS and tidally-referenced surfaces.

Upon review of this surface, vertical offsets were found in the data when referenced to the ellipse for Launch 2804 on DN239. These offsets at times exceeded 1.0 meter vertically when compared to surrounding data. Out of an abundance of caution, GPS heights were removed from this data. Since no horizontal offsets were seen at MLLW or the ellipse, the rest of the correctors within the SBETs were retained (see C.3 Additional Horizontal or Vertical Control Issues).

The depth gradient between the MLLW and the ERS surfaces is expected to be similar in magnitude and position as the EGM2008-WGS84 geoid-ellipsoid separation model published by the National Geospatial Intelligence Agency (NGA). In review it was found that the two models compare well - exhibiting a signature NW-to-SE gradient of depth differences across the survey area - particularly considering the 2.5' resolution of the NGA surface and the expected differences between the geoid and MLLW (Figure 30). Data from Launch 2804 on DN239 was removed from this comparison.

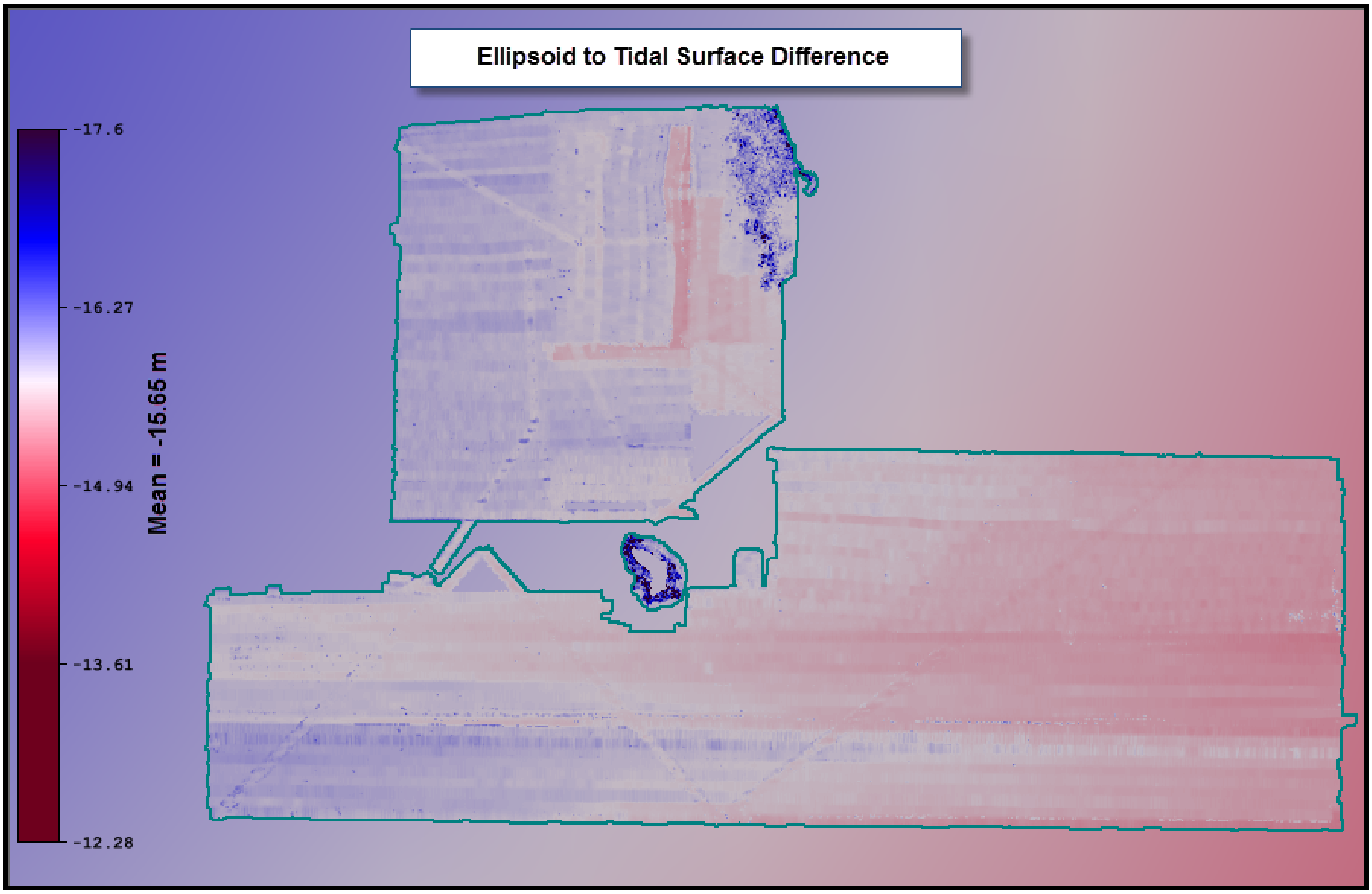


Figure 30: Difference surface between the ellipsoidally-referenced and tidally-referenced surfaces. Difference surface is overlaid on the EGM2008-WGS84 geoid-ellipsoid separation model. This figure excludes data from Launch 2804 on DN239, which displayed significant vertical offsets when referenced to the ellipse.

Sound Speed Artifacts

Despite casts being taken as frequently as every 15 minutes, with consideration to spatial distribution, sound speed artifacts were seen within the data. These artifacts occurred as "frowns" due to inadequately modeled refraction. In these areas, the outer beams were flagged as rejected to assist the gridding algorithm in bringing the surface back to better represent the true seafloor. Although this artifact exists within the data, it is within uncertainty standards specifications as stated within Section 5.1.3 of the HSSD. The Hydrographer finds that the data is adequate to supersede charted data (Figure 31).

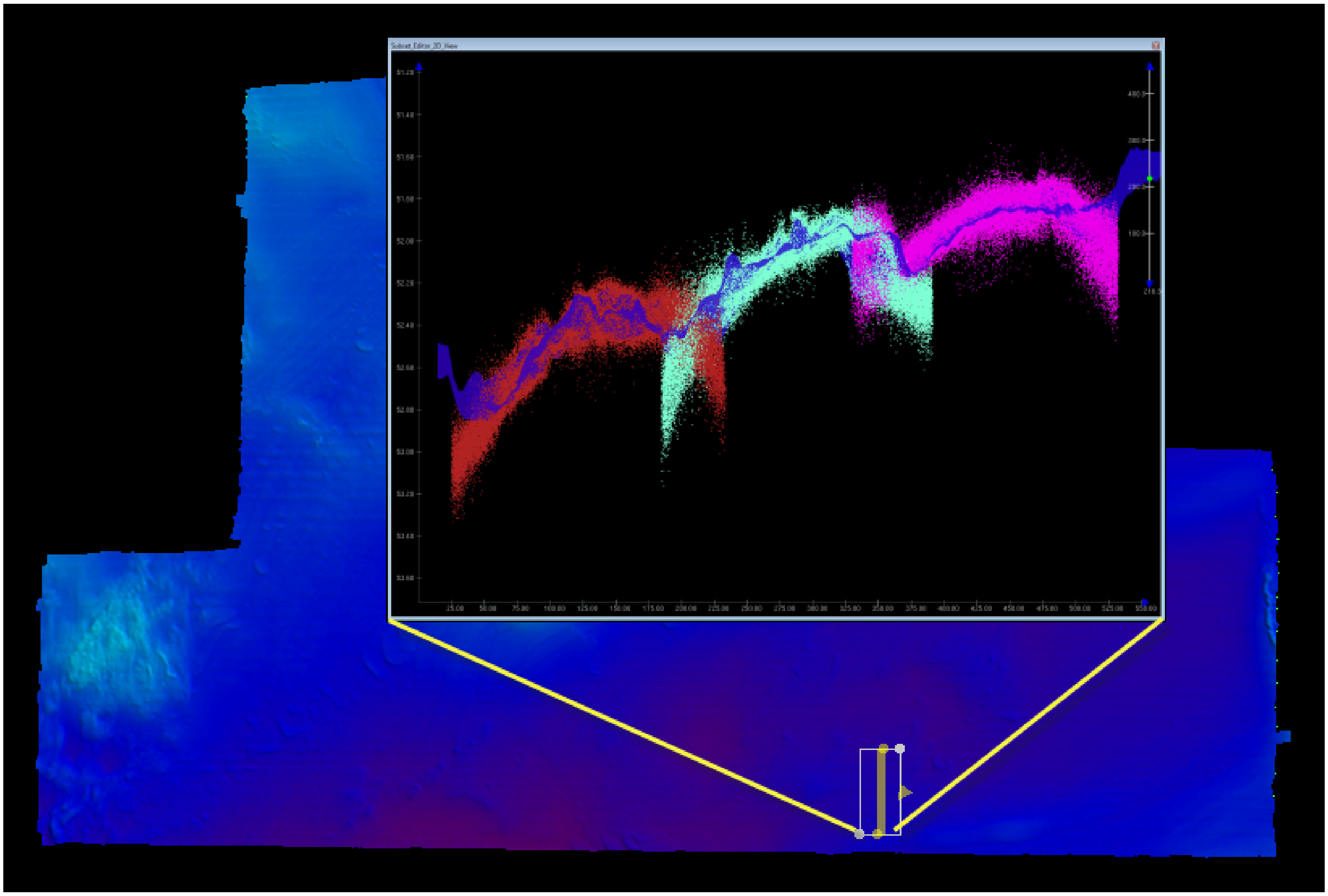


Figure 31: Example of sound speed artifacts seen within H12590.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: For casts collected on S221, profiles were acquired using the Rolls Royce MVP200 approximately every 15 minutes or when recommended by "CastTime", a cast frequency program developed at the University of New Hampshire. All launch sound speed profiles were acquired using the SBE-19 and SBE-19 plus CTDs at discrete locations at least once every four hours. A concatenated CTD file was created for each vessel and applied to all H12590 survey lines using the "Nearest in Distance within (4 hours) Time" profile selection method. A total of 80 CTD casts were used (Figure 32).

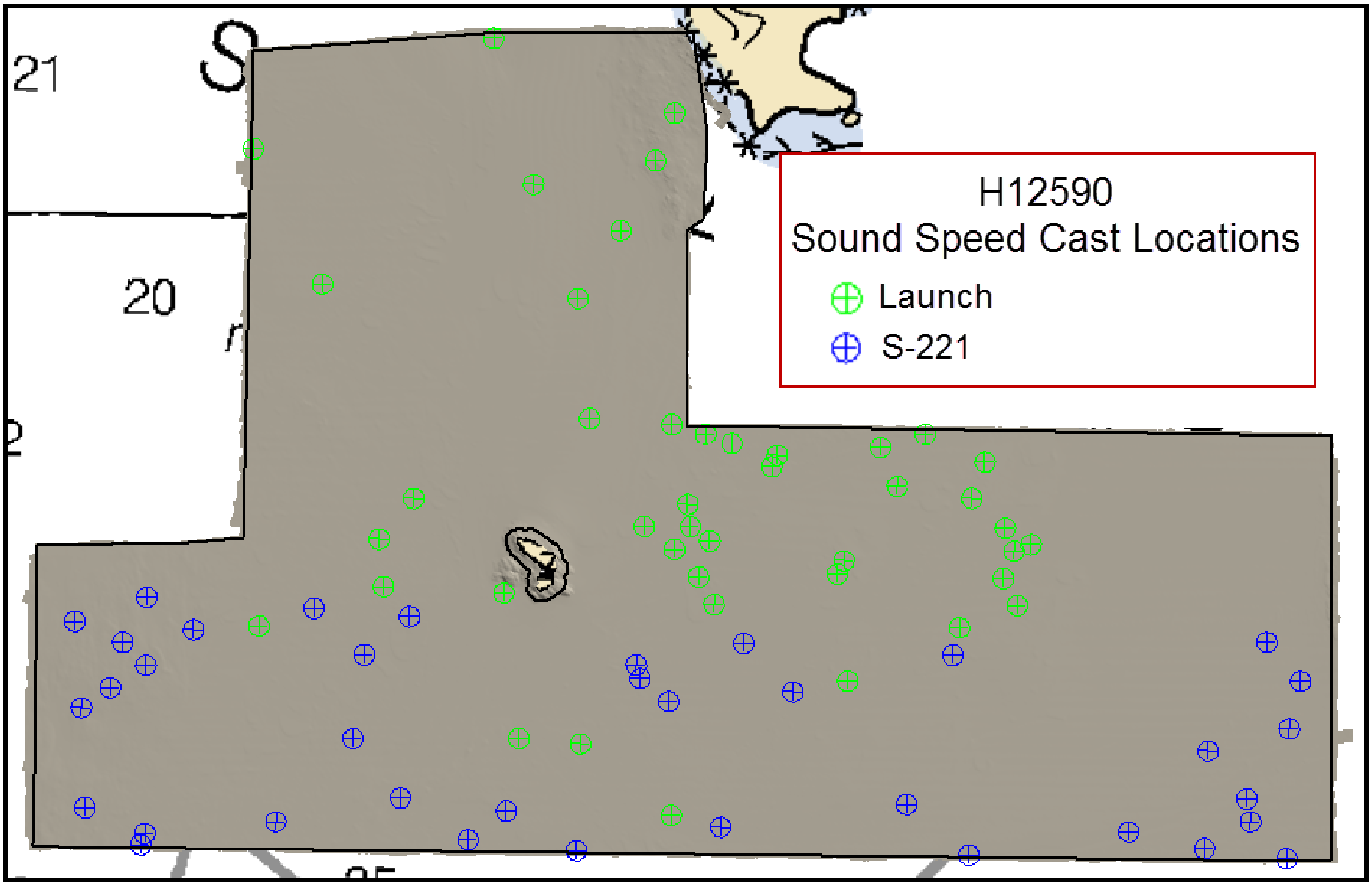


Figure 32: H12590 sound speed cast locations.

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.

The HVF was changed for the 8125 on Launch 2803 on DN 216 and 217. This was done to fix a "zeroing out" of the Hypack system (according to the note in the HVF). Before acquisition on the survey began, the IMU was replaced and a new patch test was performed on DN 195. At the end of the day of acquisition an HVF entry with a -33 degree roll offset was added. The Branch assumes the Field noticed that the offset was not included during acquisition for the side mounted 8125 and was added during evening processing (though not mentioned in processing log). The HVF was again changed back to previous values for DN 217 and on.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter data was acquired, but not formally processed by RAINIER personnel. However, periodic spot checks were performed to ensure backscatter quality. Backscatter was logged as .7k or .ALL files and submitted to NGDC, but is not included with the data submitted to the Branch.

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAA Profile V_5_3_2.

All final data processing was performed using CARIS HIPS 8.1. It should be noted that all Kongsberg EM710 data was intentionally processed without the Simrad Sound Velocity Correction (SVC) module. This was done in order to avoid a known error in the SVC module associated with reverse-mounted transducers. To accomplish this, a custom CARIS license file was used, which excluded the licensing for the Simrad SVC. For further details, refer to the DAPR.

B.5.2 Surfaces

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

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12590_1m	CUBE	1 meters	-1 meters - 57 meters	NOAA_1m	Complete MBES
H12590_2m	CUBE	2 meters	-1 meters - 57 meters	NOAA_2m	Complete MBES
H12590_4m	CUBE	4 meters	-1 meters - 57 meters	NOAA_4m	Complete MBES
H12590_1m_Final	CUBE	1 meters	-1 meters - 20 meters	NOAA_1m	Complete MBES
H12590_2m_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12590_4m_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
Combined_4m_Final	CUBE	4 meters	-1 meters - 57 meters	NOAA_4m	Complete MBES

Table 9: Submitted Surfaces

A 4 meter base surface was created during SAR review. H12590_4m_Combined_Office2 base surface was used for final compilation.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

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

Standard Vertical Control Methods Used:

Discrete Zoning

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

Station Name	Station ID
Sand Point	945-9450

Table 10: NWLON Tide Stations

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

Station Name	Station ID
Bird Island	945-9251

Table 11: Subordinate Tide Stations

File Name	Status
9459450.tid	Final Approved
9459251.tid	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
H12590CORF.zdf	Final

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

A request for final approved tides was sent to N/OPS1 on 09/13/2013. The final tide note was received on 11/18/2013.

The tide station installed by RAINIER personnel on Bird Island, AK (945-9251) was used as the primary control for datum determination and as a source for water level reducers from 2348 UTC on 13 July (DN194) through 0436 UTC on 18 August (DN230). The National Water Level Observation Network (NWLON) tide station in Sand Point, AK (945-9450) served as a subordinate gauge during this time. During the time of acquisition when the Bird Island gauge was not operational, the NWLON tide station in Sand Point served as the primary gauge. A complete description of the vertical and horizontal control for this survey can be found in the accompanying Horizontal and Vertical Control Report (HVCR), submitted under separate cover.

Tide note is appended to this report.

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 04N.

The following PPK methods were used for horizontal control:

Single Base

In conjunction with this project, a GPS base station was established by RAINIER personnel on Bird Island, AK; the station was operational from DN192 through DN207 and from DN222 through DN245. During the times when the Bird Island base station was not operational (DN208 through DN221 and DN246 through DN254), a Plate Boundary Observatory station on Chernabura Island (ChernaburaAK2008, AC12) was used for post-processing. There was one exception: Data from S221 on DN245 was acquired while the Bird Island base station was operational, but due to processing problems, this data was corrected using the Chernabura Island base station.

Vessel kinematic data was post-processed with Applanix POSPac and POSGNSS software using Single Base processing methods described in the DAPR.

One line used DGPS correctors for horizontal control because the post-processing methods stated above were not possible (see C.3 Additional Horizontal or Vertical Control Issues).

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
ChernaburaAK2008	AC12

Table 14: CORS Base Stations

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Bird Island	N/A

Table 15: User Installed Base Stations

The following DGPS Stations were used for horizontal control:

DGPS Stations
Kodiak, AK (313 kHz)
Cold Bay, AK (289 kHz)

Table 16: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 Lines without GPS height

GPS heights were removed from data for Launch 2804 on DN239 due to vertical offsets of over one meter found in the data when referenced to the ellipse.

3.3.2 Line without SBET

SBETs could not be applied to Line 2804_2013RA2162351 due to time extents not overlapping with the line. DGPS was retained for this line.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was made between survey H12590 and Chart 16540 using CARIS CUBE surfaces and a sounding layer. All data from H12590 should supersede charted data.

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
16540	1:300000	13	10/2010	10/12/2010	10/30/2010

Table 17: Largest Scale Raster Charts

<u>16540</u>

Comparison was performed with Chart 16540 (1:300000) using a CARIS sounding layer based on the combined 4-meter CUBE surface from H12590 (Figure 33).

The eastern Twins Island does not exist; depths in that area were found to be approximately 25 fathoms. All charted depths agreed to within 2 fathoms of surveyed soundings. All data from H12590 should supersede the chart.

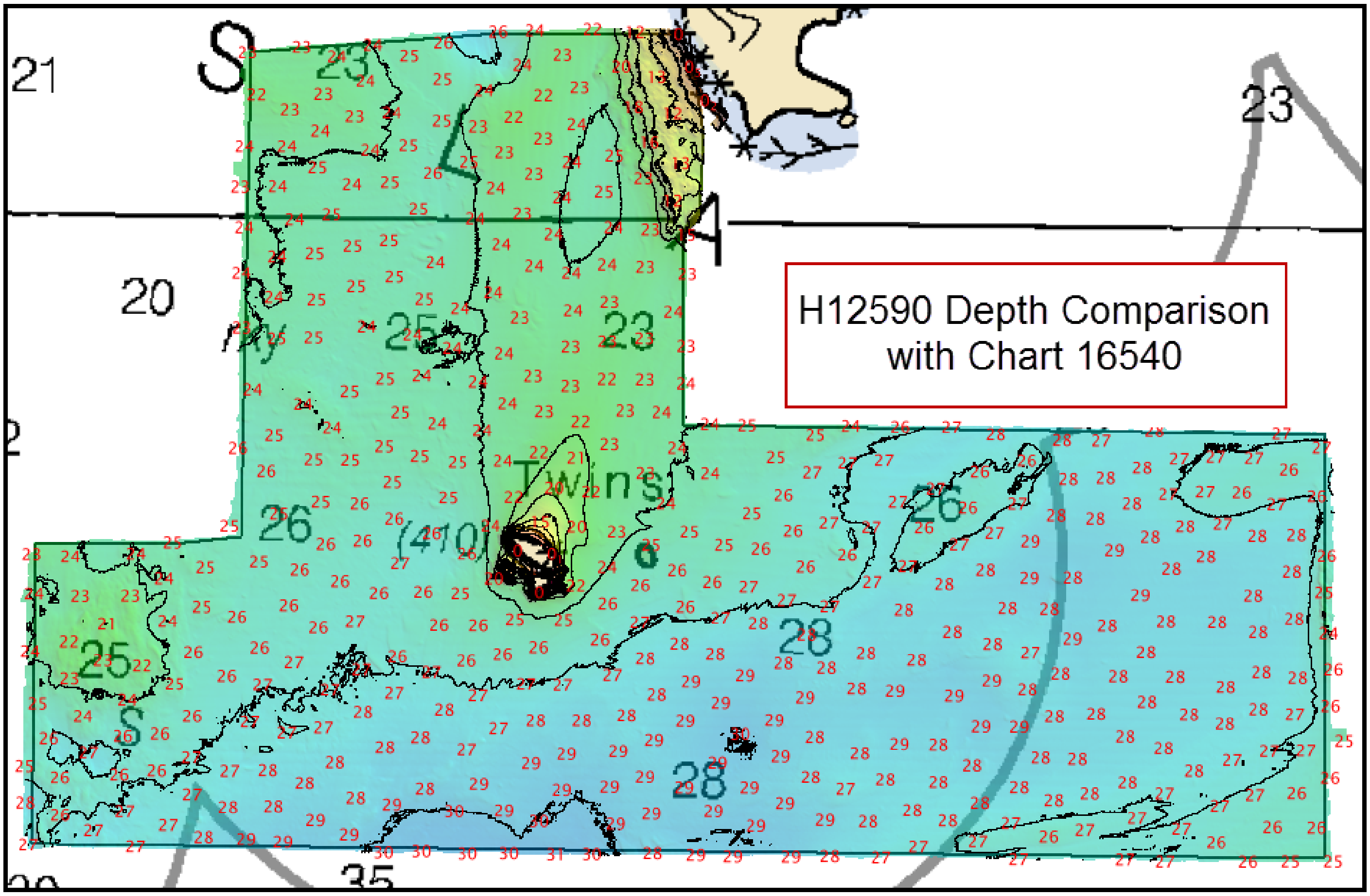


Figure 33: Chart 16540 depth comparison in fathoms.

Local Notice to Mariners (LNM) and Notice to Mariners (NM) appear to be outdated as indicated in Table 17. Additional comparisons were performed at PHB with the most recent updates at the time of review and no new discrepancies were found.

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?
US3AK50M	1:300000	17	06/29/2011	06/29/2011	NO

Table 18: Largest Scale ENCs

US3AK50M

There is a 150-meter southwesterly offset of the western Twins Island shoreline and rock feature (Figure 34). The eastern Twins Island does not exist. All soundings agree to within 2 fathoms. The Hydrographer recommends that the ENC be updated with data from survey H12590.

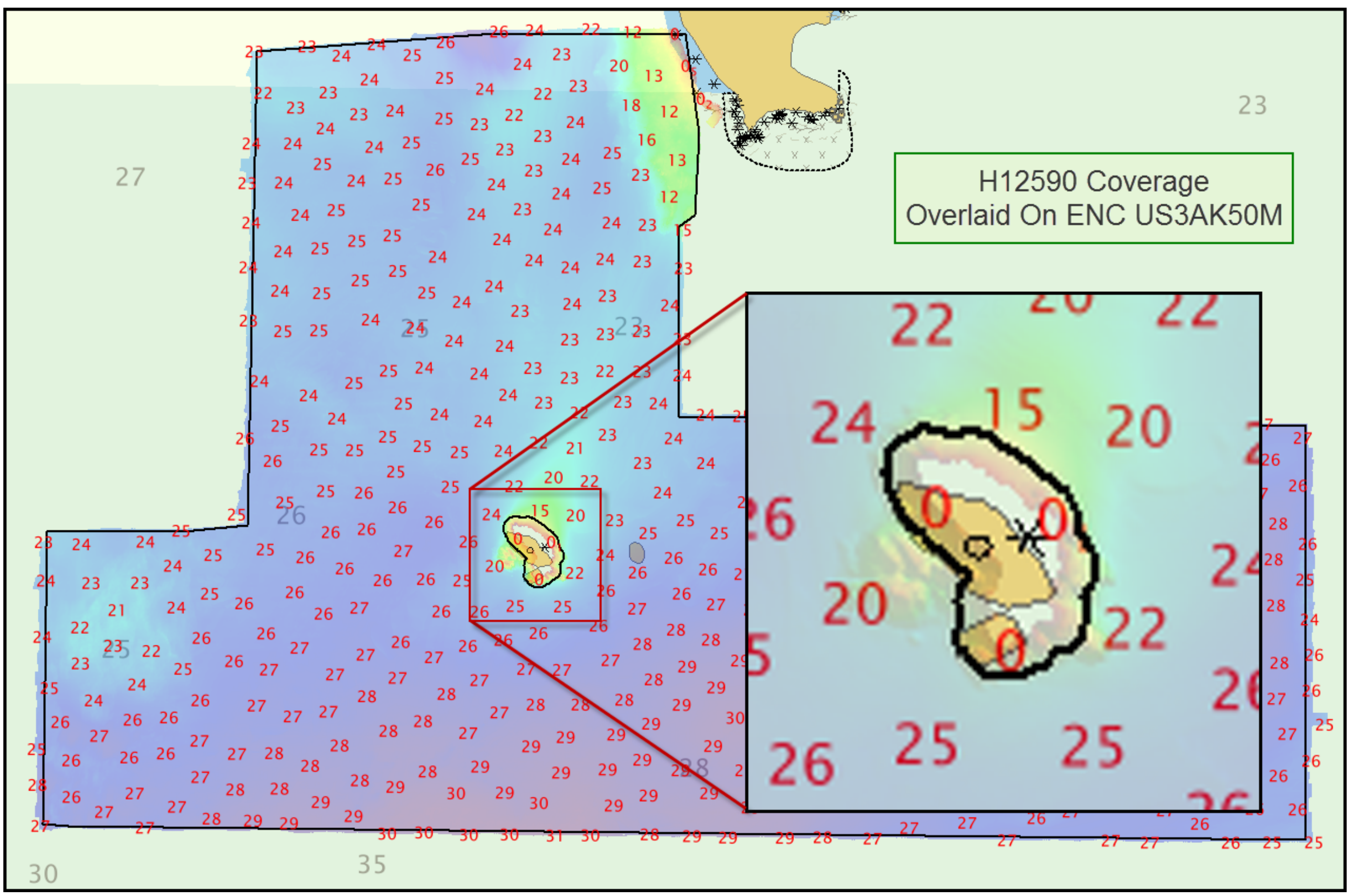


Figure 34: H12590 survey coverage overlaid on ENC US3AK50M.

D.1.3 AWOIS Items

No AWOIS items were assigned for this survey.

D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.5 Charted Features

No charted features exist for this survey.

D.1.6 Uncharted Features

No uncharted features exist for this survey.

D.1.7 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.8 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.9 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.1.10 Bottom Samples

Bottom samples were acquired in accordance with the Project Instructions and the HSSD. Six proposed bottom sample locations were included in the Project Reference File and five sites returned adequate samples; the remaining site produced no sample after three attempts and was labeled "unknown". All samples were labeled in accordance with the HSSD with S-57 attribution and can be found in the Final Feature File (Figure 35).

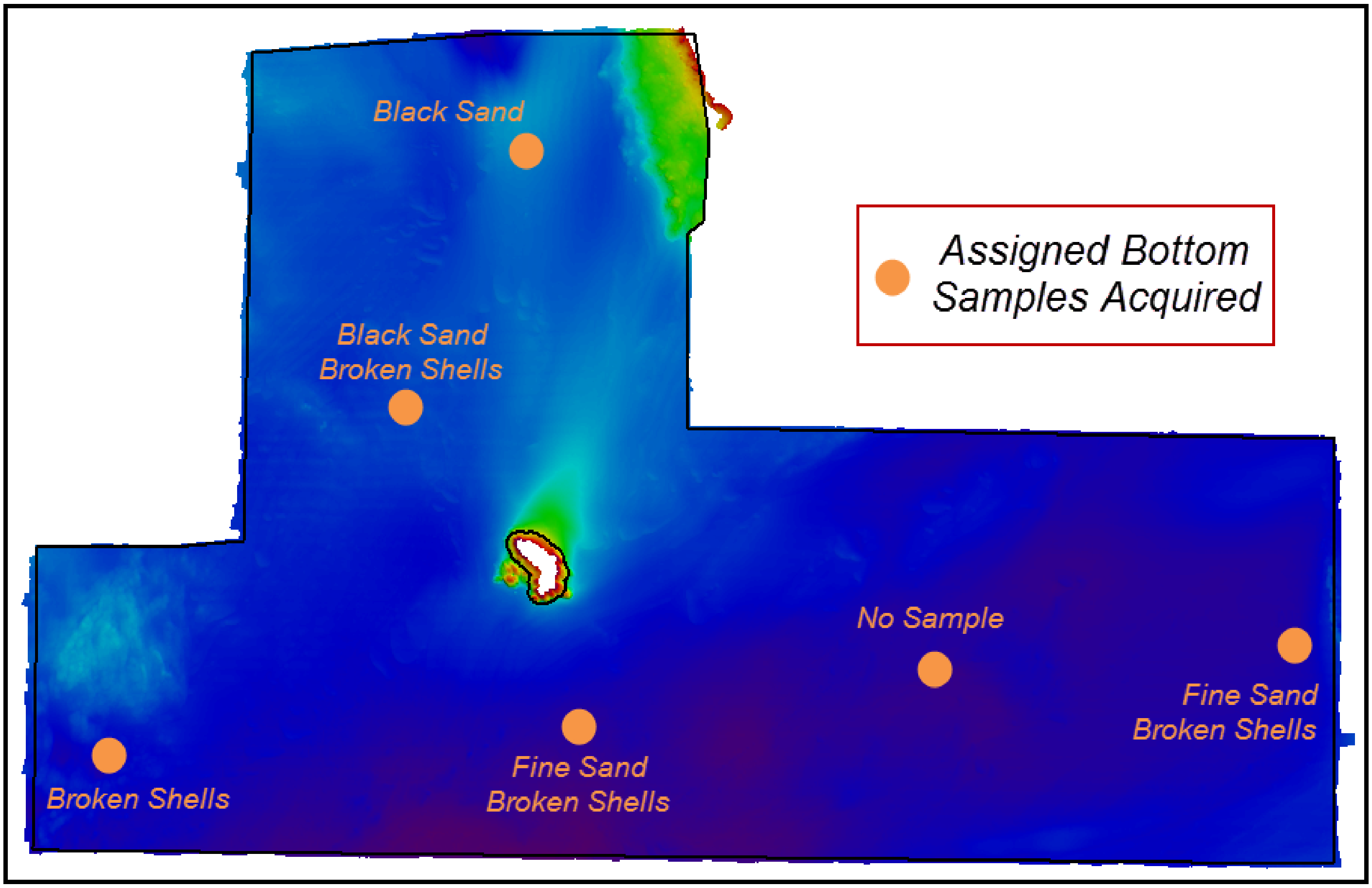


Figure 35: Bottom sample locations.

D.2 Additional Results

D.2.1 Shoreline

Shoreline verification was conducted near predicted low water in accordance with the applicable sections of NOAA HSSDM and FPM. There was one assigned feature for this survey; the rock was found to be awash at MLLW and is attributed as such in the H12590 Final Feature File.

The provided shoreline from the Composite Source File (CSF) around the Twins Islands deviated significantly from the true coastline as well as from the acquired bathymetry. It was determined that the CSF was sourced from ENC US3AK50M (1:300,000), which had sections of outdated shoreline and features. The Hydrographer downloaded the more accurate geographic cell shoreline data, which matched the hydrography and raster chart of the area.

The shoreline from GC10588 is included in the Final Feature File as an 'Update' feature. The incorrect shoreline is marked as 'Delete'. The Hydrographer recommends that the ENC be updated with the correct GC shoreline.

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
Richard T. Brennan, CDR/NOAA	Commanding Officer, NOAA Ship RAINIER	12/13/2013	
Meghan McGovern, LT/NOAA	Field Operations Officer, NOAA Ship RAINIER	12/13/2013	Date: 2013.12.14 15:12:40 -08'00'
James B. Jacobson	Chief Survey Technician, NOAA Ship RAINIER	12/13/2013	James Jacobson I have reviewed this document 2013.12.19 07:39:45 -08'00'
C.D. McBride	Assistant Survey Technician, NOAA Ship RAINIER	12/13/2013	Date: 2013.12.14 15:12:16 -08'00'

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

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : November 18, 2013

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-P183-RA-13
HYDROGRAPHIC SHEET: H12590

LOCALITY: 5NM South of Turner Island, Shumagin Islands, AK
TIME PERIOD: July 16, 2013 - September 2, 2013

TIDE STATION USED: 945-9450 Sand Point, AK
Lat. 55° 19.9'N Long. 160° 30.3' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.988 meters

TIDE STATION USED: 945-9251 Bird Island, AK
Lat. 54° 50.1' N Long. 159° 45.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.928 meters

REMARKS: RECOMMENDED ZONING
Use zone(s) identified as: SWA204A, SWA205

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: Use tide data from the appropriate station with applicable zoning correctors for each zone according to the order in which they are listed in the Tidezone corrector file (*.ZDF). For example, tide station one (TS1) would be the first choice for an applicable zone followed by TS2, etc. when data are not available.

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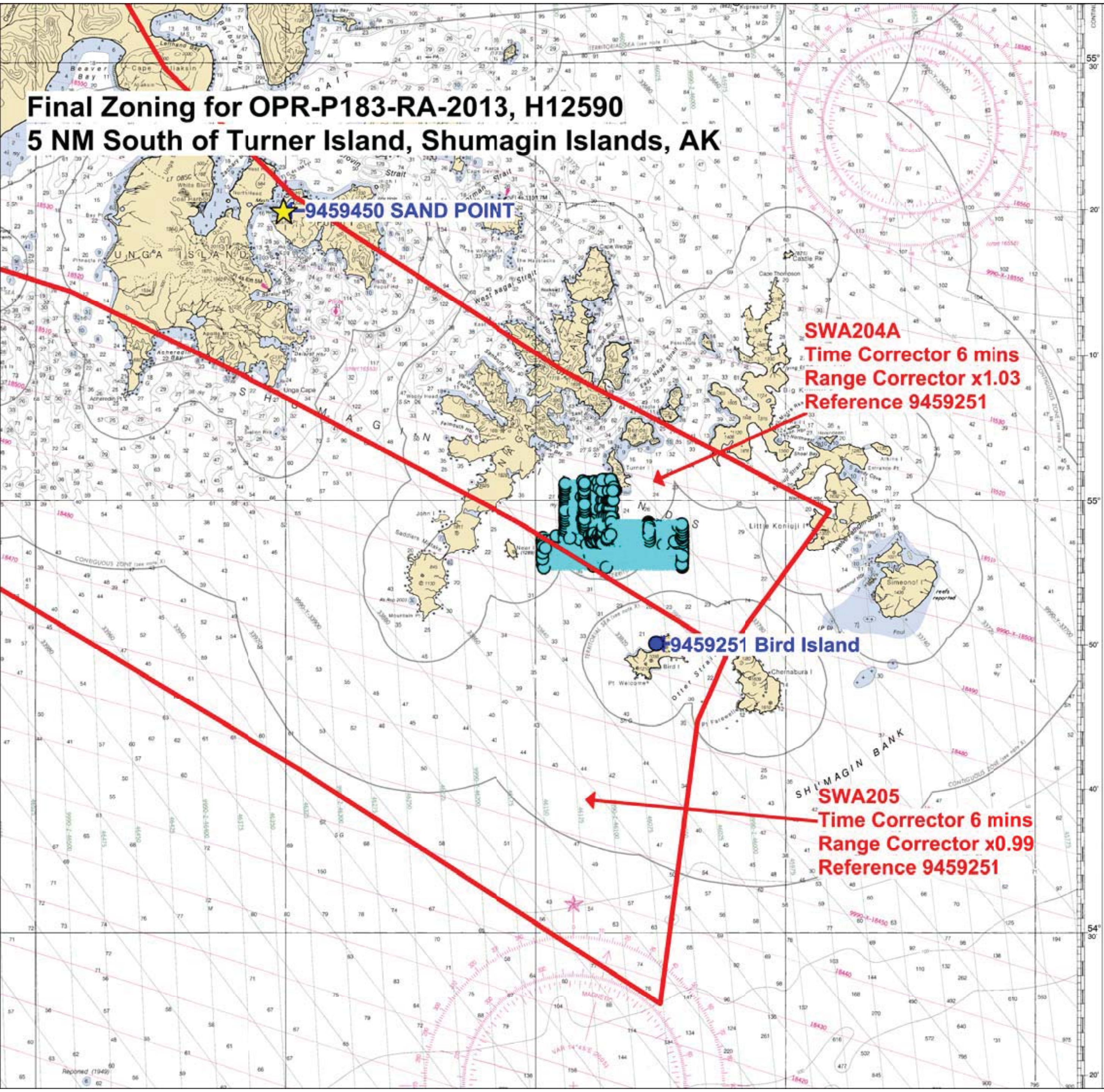
CHIEF, PRODUCTS AND SERVICES BRANCH



Final Zoning for OPR-P183-RA-2013, H12590
5 NM South of Turner Island, Shumagin Islands, AK
9459450 SAND POINT
SWA204A
Time Corrector 6 mins
Range Corrector x1.03
Reference 9459251
9459251 Bird Island
SWA205
Time Corrector 6 mins
Range Corrector x0.99
Reference 9459251

APPROVAL PAGE

H12590

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 NGDC for archive

- H12590_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12590_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.

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Date: 2014.11.18 10:28:39 -08'00'

Approved:____

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

The survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

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Approved:____

CDR, Benjamin K. Evans, NOAA
Chief, Pacific Hydrographic Branch