

H13851

Southern Approach to Tybee Roads

OPR-G322-TJ-24
Offshore Savannah
Georgia

Responsible Party
DOC/NOAA/NOS/OCS -- Office of Coast Survey
Contact Information
hsd.chief@noaa.gov
Field Unit
NOAA Ship Thomas Jefferson (S222)
Survey Dates
April 22, 2024 - May 12, 2024
License Information
CC0-1.0
Approver
CDR Megan R. Guberski

Platform and Sonar Equipment	
S222 (369958000)	
<i>Kongsberg Maritime EM 2040</i>	
2904 (368926109)	
<i>Kongsberg Maritime EM 2040</i>	
DriX-12 (366991449)	
<i>Kongsberg Maritime EM 2040</i>	

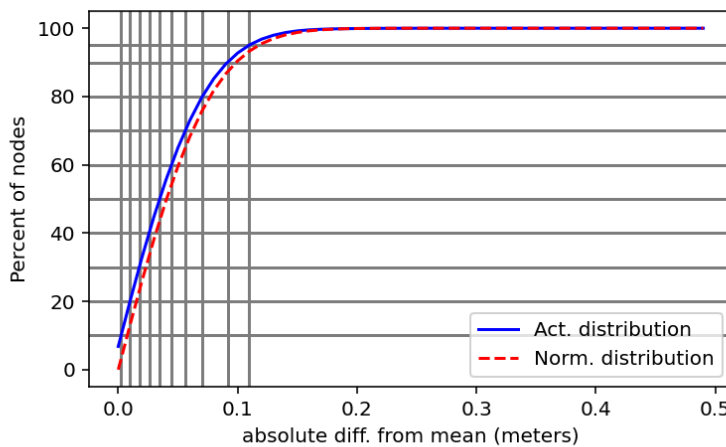
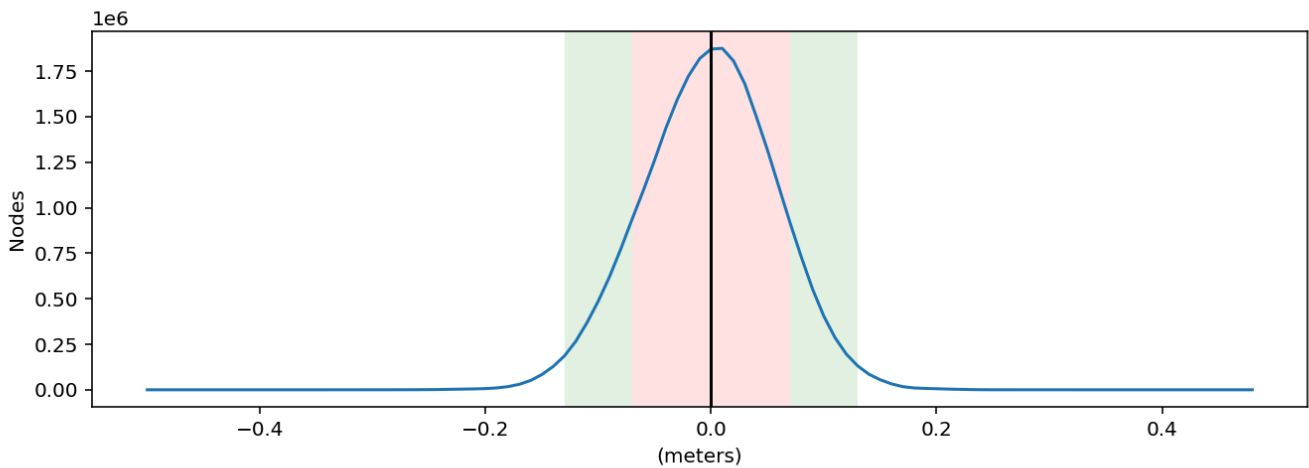
Bathymetry Grid				
H13851_MB_50cm_MLLW_1of1 (North American Datum 1983 (2011), Mean Lower Low Water, Projected UTM 17)				
			Fixed	Variable
Sounding Technique:	Multibeam	Full Seafloor Coverage:	Yes	Feature Detection Size: 1.0m N/A
Features Detected:	Yes	Bathymetric Coverage:	Yes	Uncertainty Horizontal: 1m N/A
Least Depth Detected:	Yes	Interpolated:	No	Uncertainty Vertical: 0.15m 0.75%

Quality Control Procedure

Crosslines

Pydro 22, a suite of software maintained by NOAA's Hydrographic Systems and Technology Branch (HSTB), contains various tools that aid in the analysis and quality control of hydrographic data. A Single Resolution (SR) 50 cm Combined Uncertainty and Bathymetry Estimator (CUBE) surface of this survey's mainscheme data and a SR 50 cm CUBE surface of this survey's crossline data were differenced with the Pydro 22 tool "Compare Grids." Vessels S222, 2904, and DriX-12 collected a combined total of approximately 92.74 linear nautical miles of MBES crosslines, a figure which constitutes about 4.00% of mainscheme mileage. A Single Resolution (SR) 50 cm Combined Uncertainty and Bathymetry Estimator (CUBE) surface of mainscheme data and a SR 50 cm CUBE surface of crossline data were differenced with the Pydro tool Compare Grids. The results of this comparison indicate that over 99.99% of grid-node comparisons between the two surfaces are within the Fraction of Allowable Error for depth/height, exceeding the specification of 95% stipulated by NOAA's 2024 Hydrographic Surveys Specifications and Deliverables (HSSD). The resulting mean of this comparison was a 0.00m difference, with a standard deviation of 0.06m, verifying the consistency of the data.

H13581_MB_50cm_MLLW_MS-H13851_MB_50cm_MLLW_XL
 Mean: 0.00 | Mode: 0.01 | One Standard Deviation: 0.06 | Bin size: 0.01



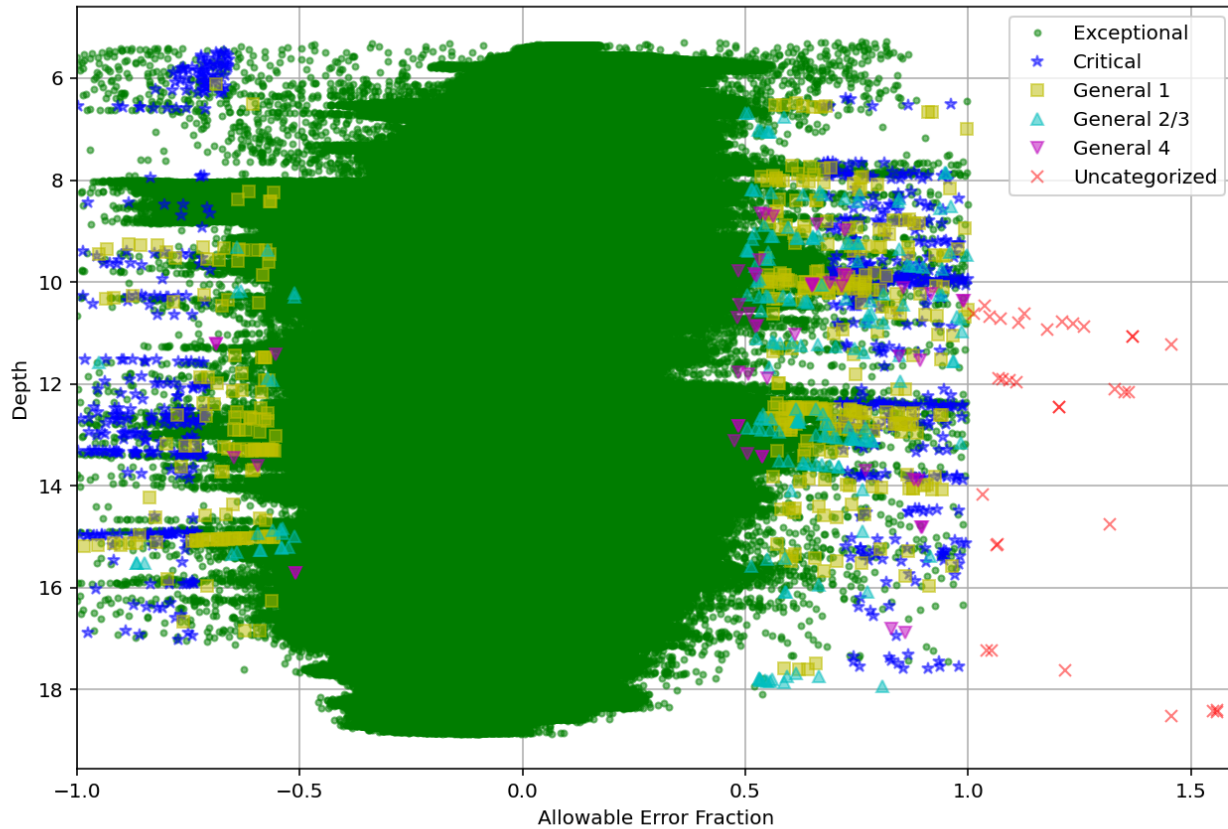
Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.09
95%	+/- 0.11

A statistical summary of the comparison between H13851 crossline and mainscheme data.

Node Depth vs. Allowable Error Fraction

Total comparisons 27530921

Passed States: Exceptional=99.99%, Critical=100.00%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%, Uncategorized=0.00%



A statistical summary of the comparison between H13851 crossline and maincheme data.

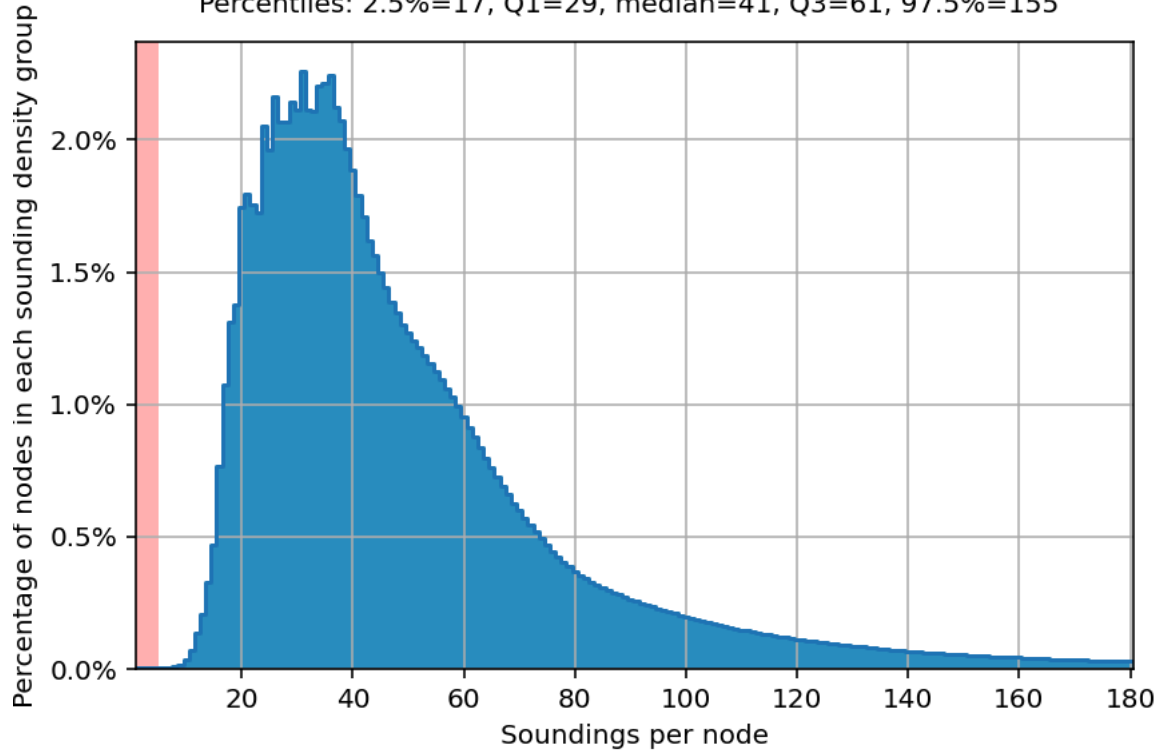
Statistical Analysis

Statistical analysis of grid layers was conducted to assess the quality of the bathymetry. The "Grid QC" program contained within NOAA's Pydro 22 QC Tools was used to assess grid density, resolution, and uncertainty against allowable standards specified in the most recent edition of the HSSD. This survey was assigned quality metrics of General 1 and the delivered grids exceed the assigned quality metrics. The uncertainty metrics reported in the Metadata section reflect the highest Quality Metric that was achieved for each grid.

Data Density

Grid source: H13851_MB_50cm_MLLW_Final

99.5+% pass (455,707,836 of 455,761,935 nodes), min=1.0, mode=31, max=5661.0
Percentiles: 2.5%=17, Q1=29, median=41, Q3=61, 97.5%=155



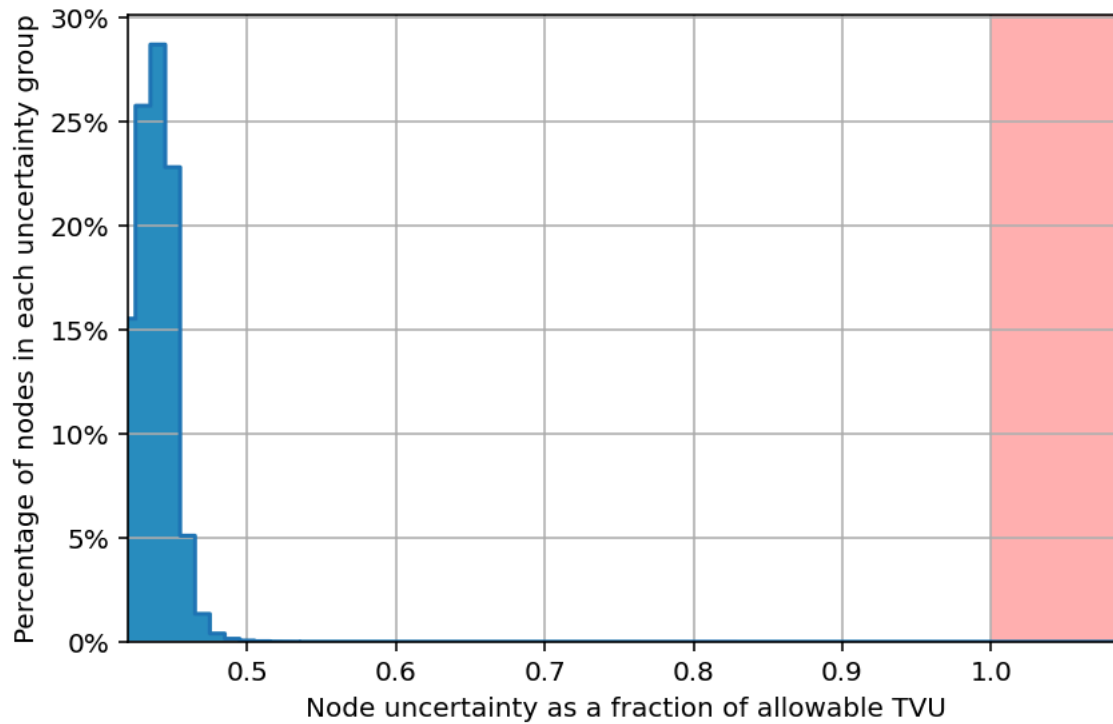
Statistical analysis of grid layers

Uncertainty Standards - NOAA General 1

Grid source: H13851_MB_50cm_MLLW_1of1

99.5+% pass (455,753,384 of 455,761,935 nodes), min=0.42, mode=0.44, max=31.94

Percentiles: 2.5%=0.42, Q1=0.43, median=0.44, Q3=0.45, 97.5%=0.46



Statistical analysis of grid layers

Directed Editing

After initial collection, MBES data underwent a thorough process of editing and inspection to clean gridded surfaces of erroneous fliers that inaccurately affected seabed measurements, and to ensure that no systematic errors were present. Teledyne's CARIS software was used to generate and examine a 50 cm CUBE surface as well as its uncertainty and standard deviation layers, which guided visual inspection for fliers.

Designated soundings were selected to ensure that gridded surfaces honor the true depth of the seafloor specifically with regard to the least depths of new and existing charted features.

Holiday Identification

Survey coverage was assessed daily by the field unit as part of night processing to identify data gaps to be addressed. Gaps in coverage that are larger than HSSD specifications are known as holidays. Various methods were utilized to aid in holiday identification including visual inspection and NOAA's Pydro 22 QC Tools "Holiday Finder". "Holiday Finder" is most commonly used for holiday identification in areas of 100% bathymetric (MBES) coverage. The hydrographer inputs a CUBE surface and the tool returns a number of files which can be used in Caris HIPS & SIPS for holiday analysis and acquisition planning.

Multiple small holidays exist around the sheet edges due to operational time constraints.

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Survey Adequacy

This entire survey is adequate to supersede previous data. The data in this survey was acquired in accordance with requirements set forth in the 2024 HSSD.

Imagery Coverage

N/A

Data Interpolation

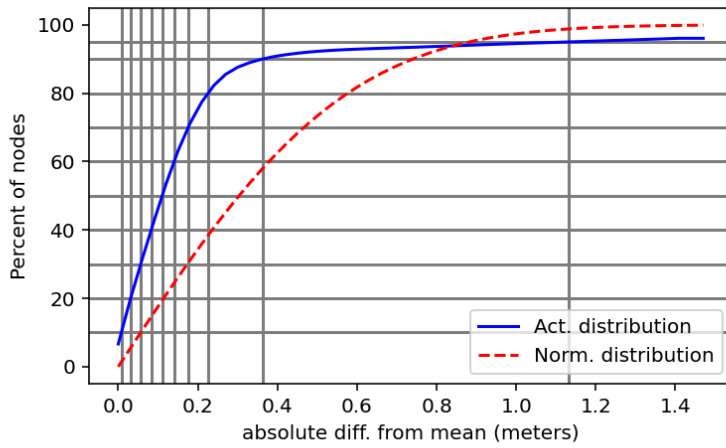
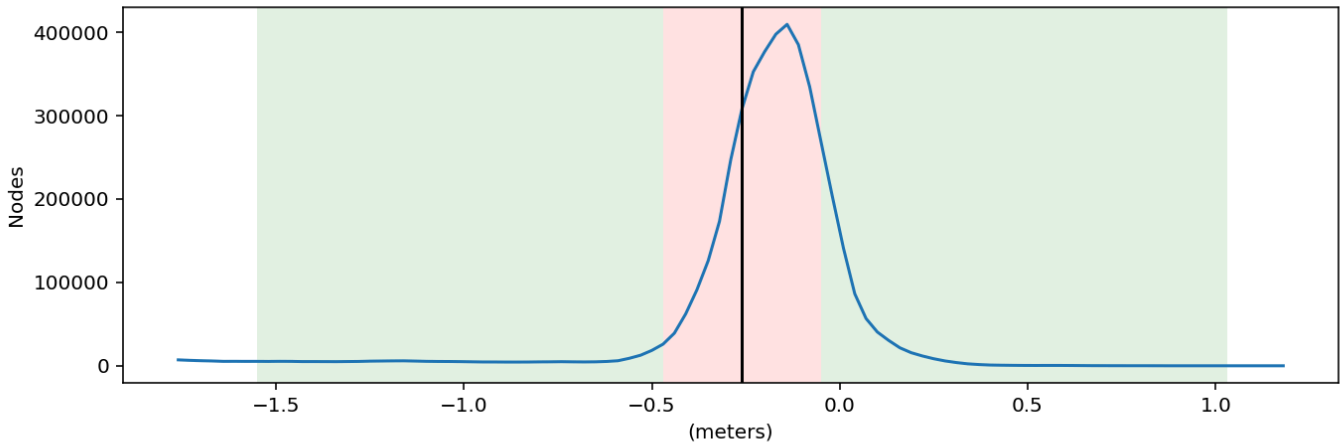
N/A

Junction Overlap

Survey H13851 junctions with four surveys, H12961, H13853, D00279, and D00282. The Pydro 22 tool "Compare Grids" was utilized to assess the overlap of these junctions. The results of these junctions are shown in the statistics below.

The results between H13851 and H12961 indicate that 91.23% of grid-node comparisons are within Fraction of Allowable Error standards for depth/height, thus failing to exceed the specification of 95% stipulated by NOAA's 2024 HSSD. However, the results of this comparison are likely skewed in relation to the 2017 H12961 survey due to the presence of annual dredging at the overlapping channel area - most recently in February, 2024. The resulting mean of this comparison was a -0.26m difference, with a standard deviation of 0.45m - falling outside the allowable TVU for the area. Yet, as shown below, once accounting for/removing the dredged area, 99.13% of grid-node comparisons are within the Fraction of Allowable Error standards for depth/height - thus passing the specification of 95% stipulated by NOAA's 2024 HSSD. The resulting mean of the adjusted comparison was a -0.15m difference, with a standard deviation of 0.13m which is within allowable TVU for the area.

H13851_MB_50cm_MLLW_1of1-H12961_MB_50cm_MLLW_1of1
 Mean: -0.26 | Mode: -0.14 | One Standard Deviation: 0.45 | Bin size: 0.03



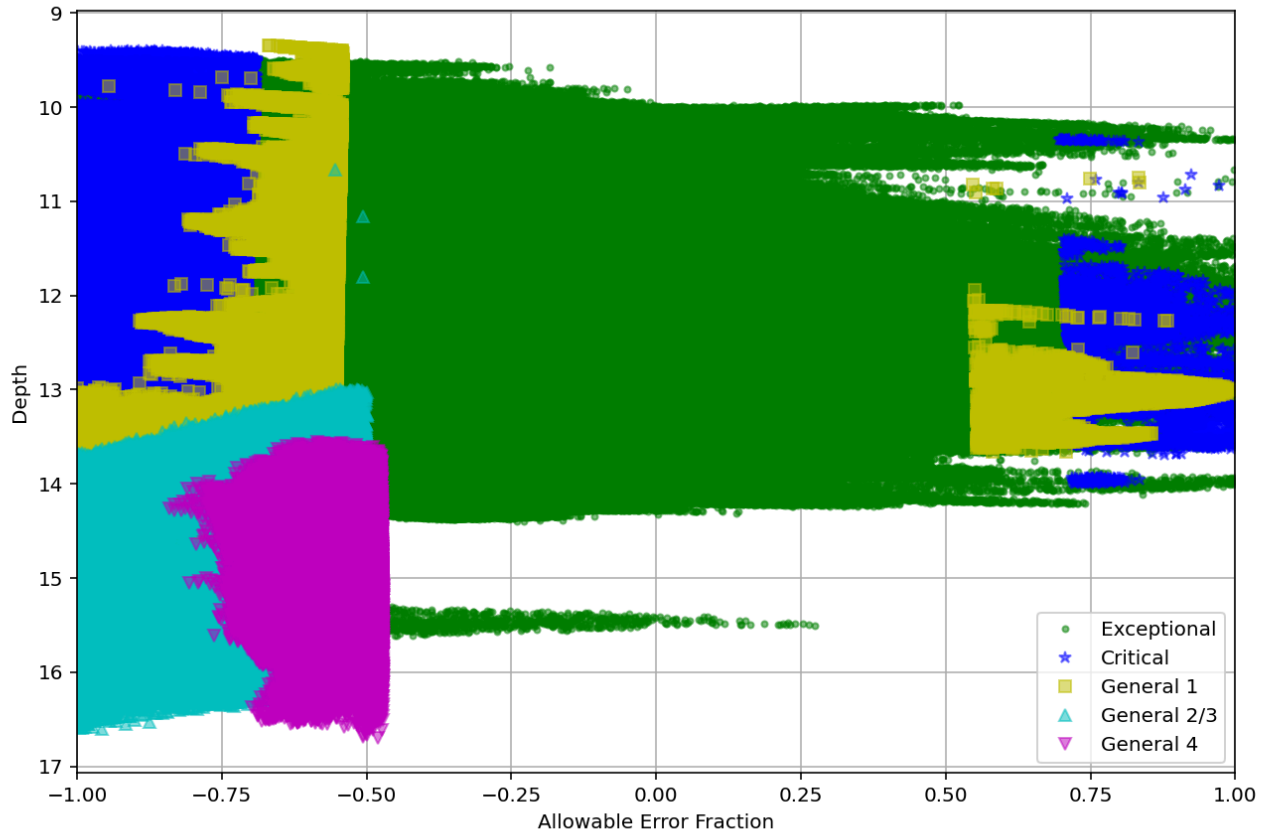
Percent of nodes	Deviation (m)
50%	+/- 0.11
60%	+/- 0.14
70%	+/- 0.18
80%	+/- 0.23
90%	+/- 0.36
95%	+/- 1.13

H13851 and H12961 junction statistics

Node Depth vs. Allowable Error Fraction

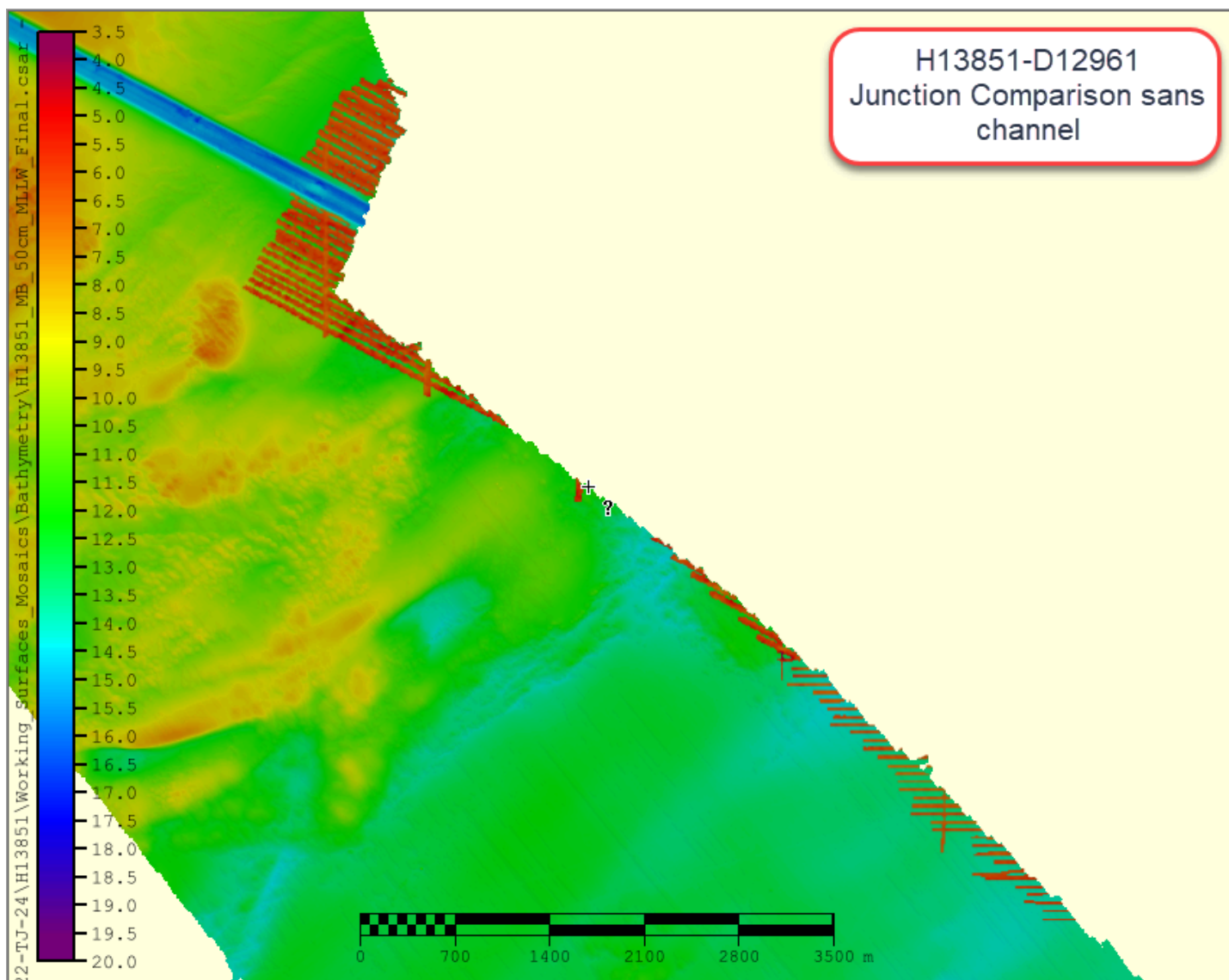
Total comparisons 4644479

Passed States: Exceptional=85.33%, Critical=91.23%, General 1=93.23%, General 2/3=96.92%, General 4=100.00%,



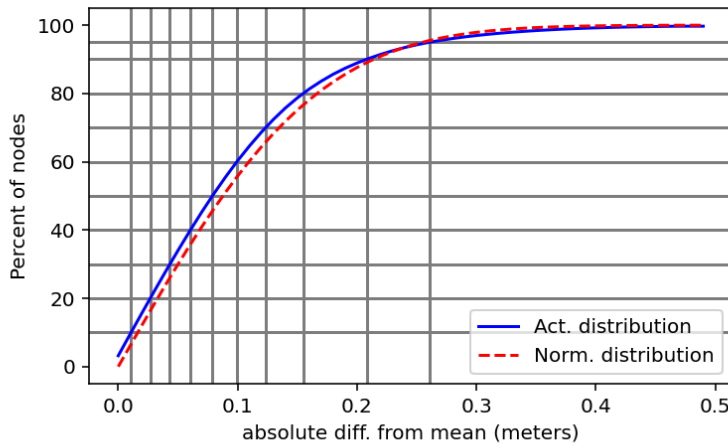
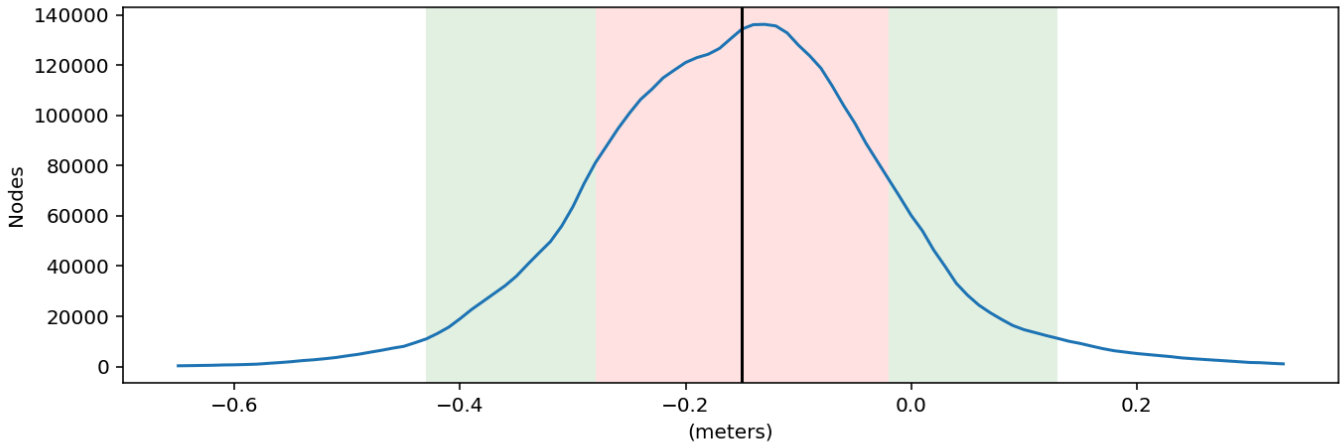
H13851 and H12961 junction statistics

H13851



H13851 (no channel) and H12961 overview

H13851_MB_0.5_NoChannel-H12961_MB_50cm_MLLW_1of1
 Mean: -0.15 | Mode: -0.13 | One Standard Deviation: 0.13 | Bin size: 0.01



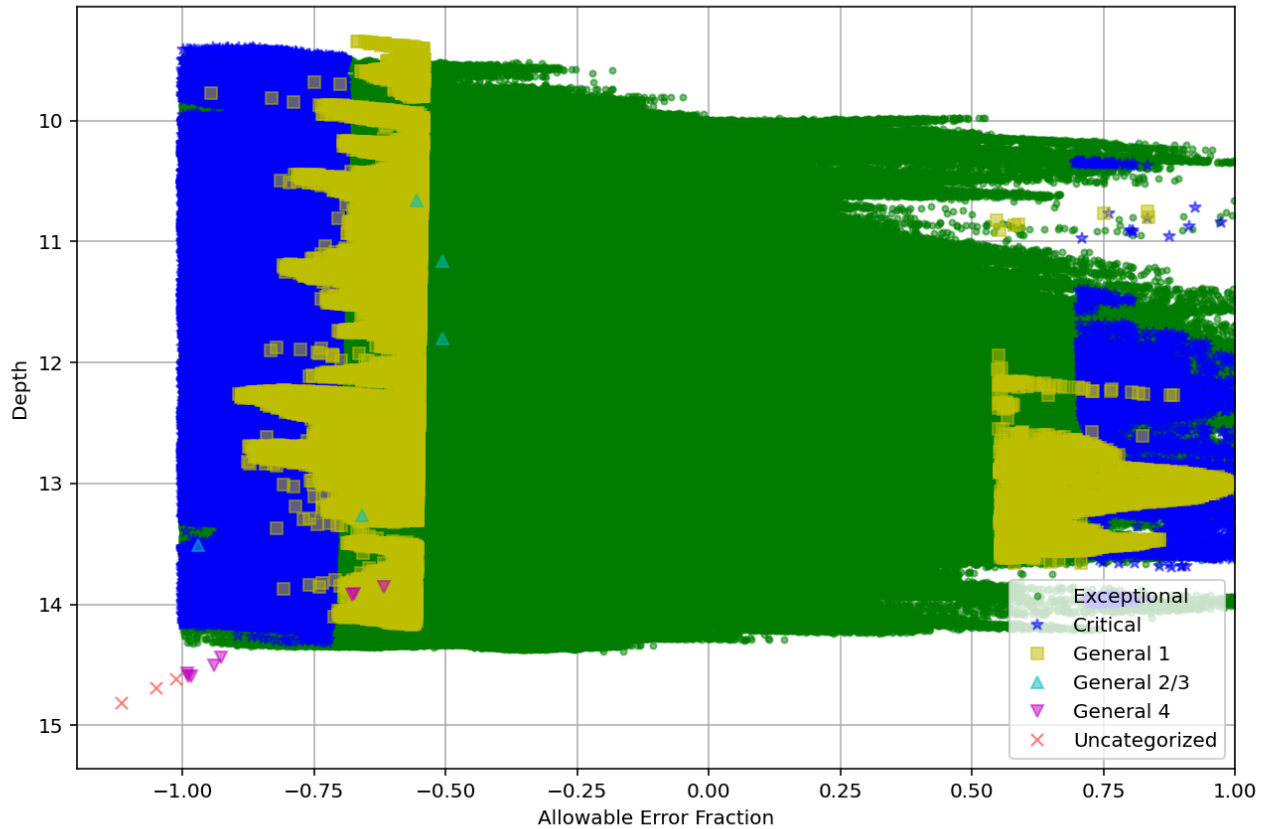
Percent of nodes	Deviation (m)
50%	+/- 0.08
60%	+/- 0.10
70%	+/- 0.12
80%	+/- 0.15
90%	+/- 0.21
95%	+/- 0.26

H13851 (no channel) and H12961 junction statistics

Node Depth vs. Allowable Error Fraction

Total comparisons 4202345

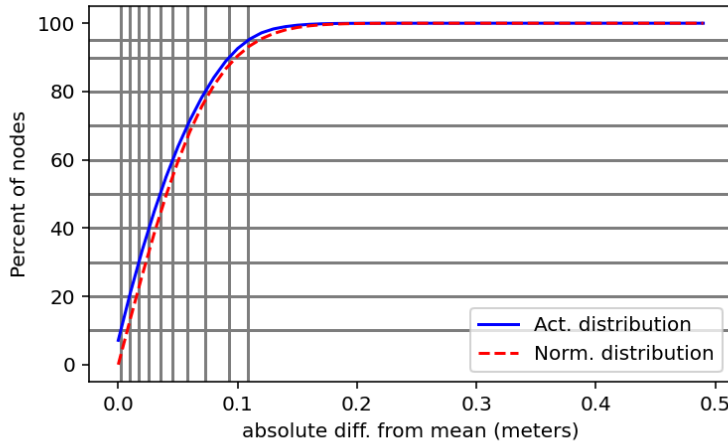
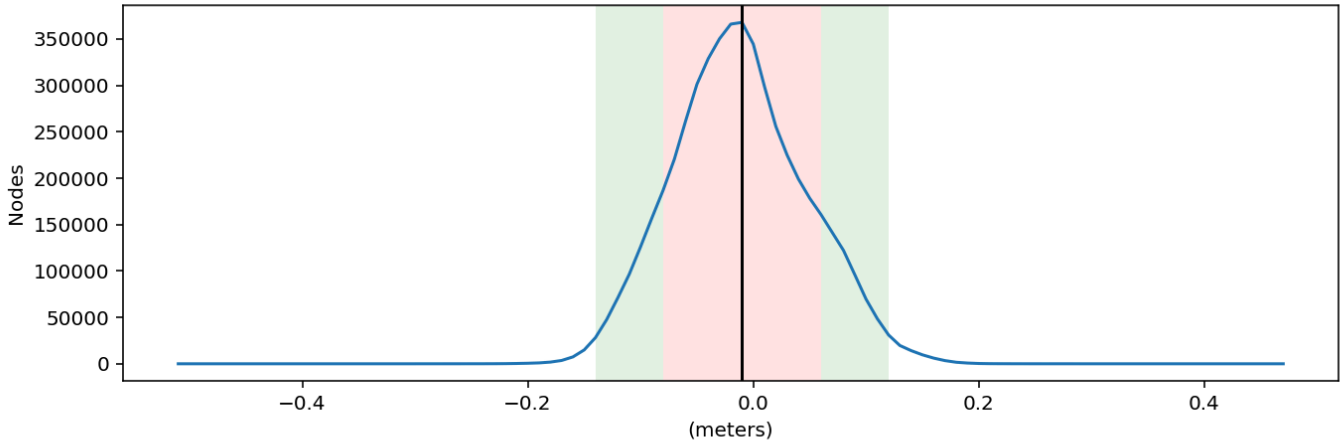
Passed States: Exceptional=93.11%, Critical=99.13%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%, Uncategorized=0.00%



H13851 (no channel) and H12961 junction statistics

The results between H13851 and H13853 indicate that 100% of grid-node comparisons are within Fraction of Allowable Error standards for depth/height, exceeding the specification of 95% stipulated by NOAA's 2024 HSSD. The resulting mean of this comparison was a -0.01m difference, with a standard deviation of 0.06m which is within allowable TVU for the area.

H13851_MB_50cm_MLLW_1of1-H13853_MB_1m_MLLW_1of1
 Mean: -0.01 | Mode: -0.01 | One Standard Deviation: 0.06 | Bin size: 0.01



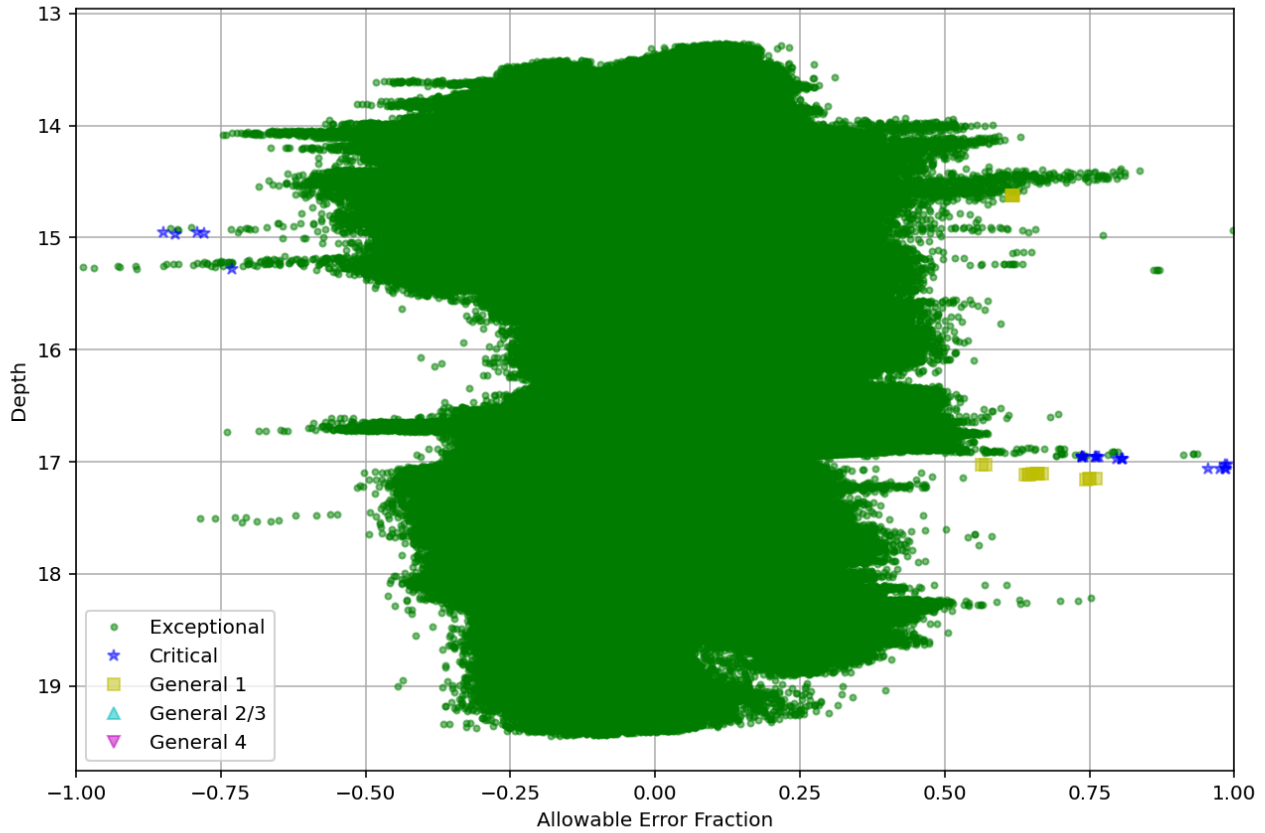
Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.09
95%	+/- 0.11

H13851 and H13853 junction statistics

Node Depth vs. Allowable Error Fraction

Total comparisons 5168047

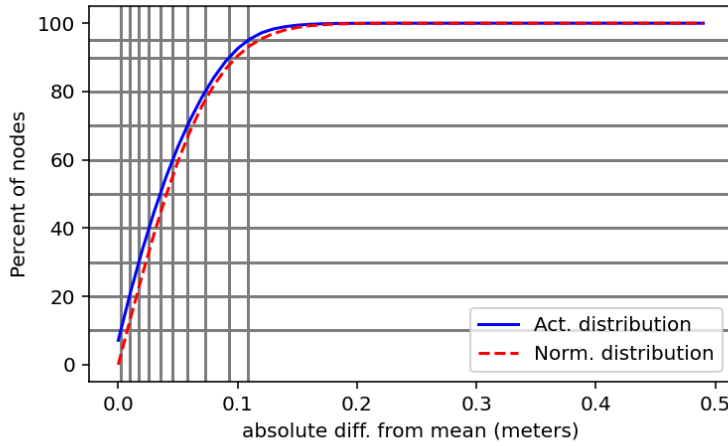
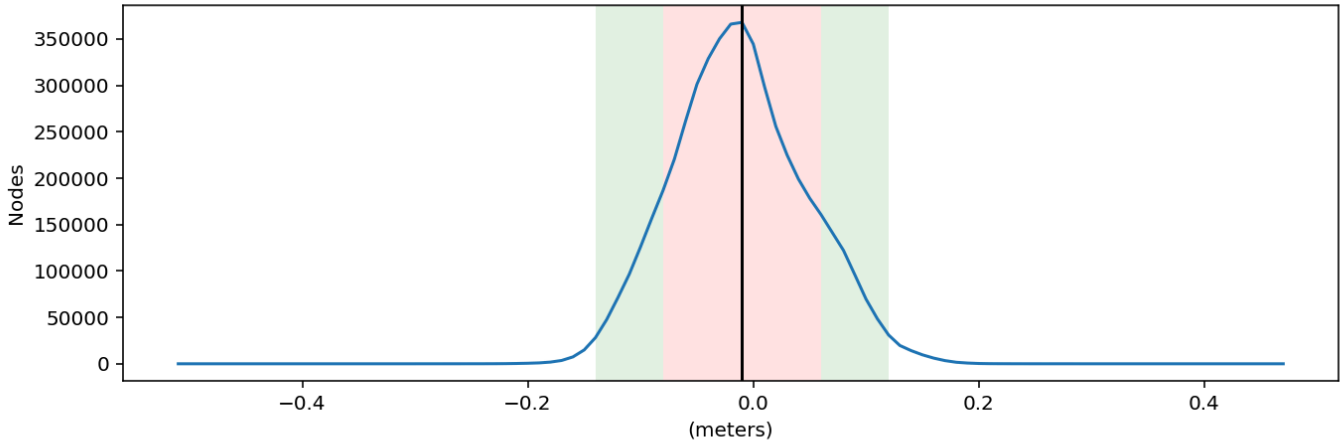
Passed States: Exceptional=100.00%, Critical=100.00%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%,



H13851 and H13853 junction statistics

The results between H13851 and D00279 indicate that 99.98% of grid-node comparisons are within Fraction of Allowable Error standards for depth/height, exceeding the specification of 95% stipulated by NOAA's 2024 HSSD. The resulting mean of this comparison was a -0.07m difference, with a standard deviation of 0.05m which is within allowable TVU for the area.

H13851_MB_50cm_MLLW_1of1-H13853_MB_1m_MLLW_1of1
 Mean: -0.01 | Mode: -0.01 | One Standard Deviation: 0.06 | Bin size: 0.01



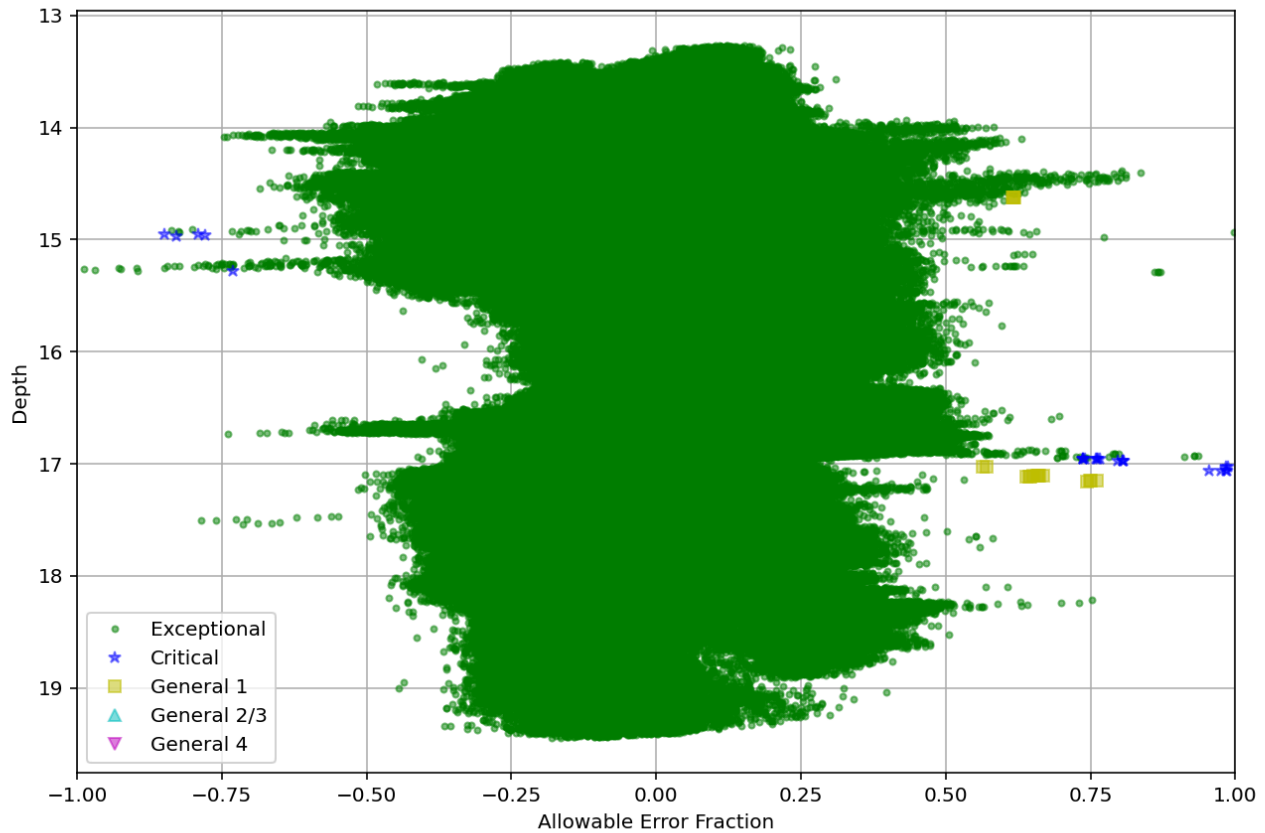
Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.09
95%	+/- 0.11

H13851 and D00279 junction statistics

Node Depth vs. Allowable Error Fraction

Total comparisons 5168047

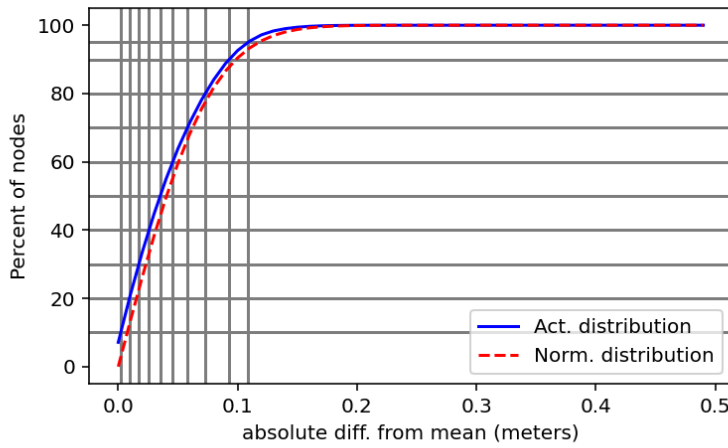
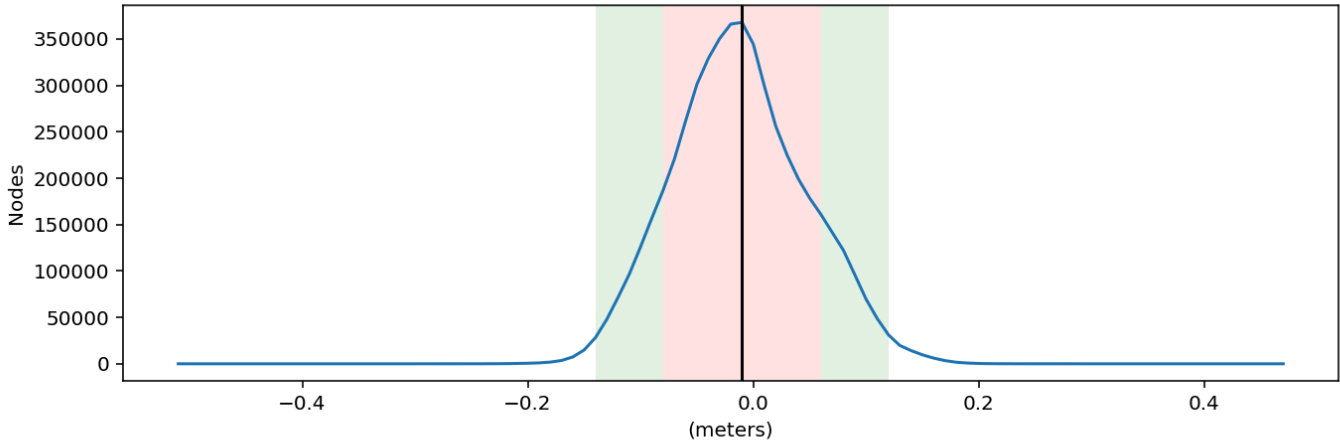
Passed States: Exceptional=100.00%, Critical=100.00%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%,



H13851 and D00279 junction statistics

The results between H13851 and D00282 indicate that 100% of grid-node comparisons are within Fraction of Allowable Error standards for depth/height, exceeding the specification of 95% stipulated by NOAA's 2024 HSSD. The resulting mean of this comparison was a -0.01m difference, with a standard deviation of 0.06m which is within allowable TVU for the area.

H13851_MB_50cm_MLLW_1of1-H13853_MB_1m_MLLW_1of1
 Mean: -0.01 | Mode: -0.01 | One Standard Deviation: 0.06 | Bin size: 0.01



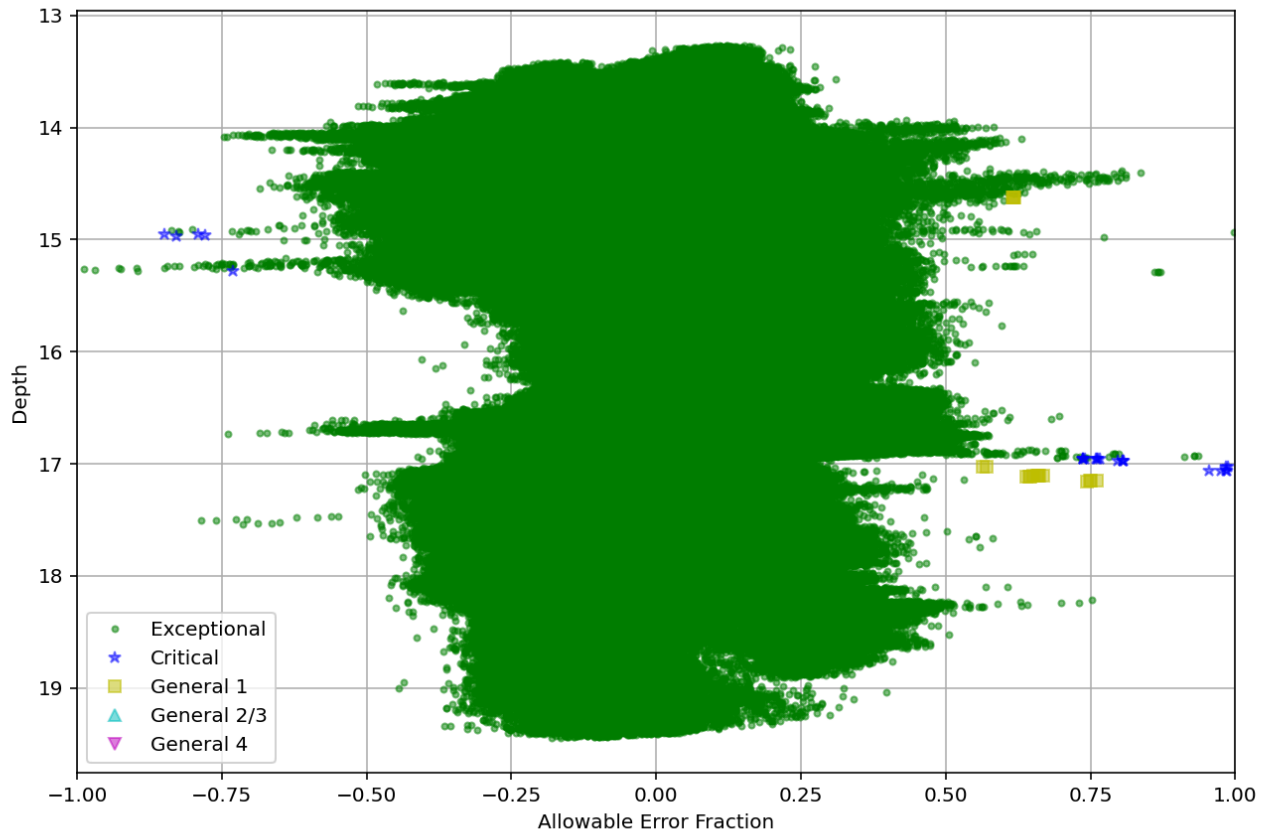
Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.09
95%	+/- 0.11

H13851 and D00282 junction statistics

Node Depth vs. Allowable Error Fraction

Total comparisons 5168047

Passed States: Exceptional=100.00%, Critical=100.00%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%,

*H13851 and D00282 junction statistics***Backscatter****Calibration Method**

N/A

Dynamic Range

The system echo sounders have the dynamic range to accommodate the relatively homogeneous survey area. The frequency was held constant at 300 kHz while the system automatically controlled pulse type.

Acquisition Configuration

No special techniques were used outside of normal considerations for quality data acquisition for a bathymetric survey.

Environmental Variable

Sound speed profiles were collected at the start of acquisition each day and at a minimum of once every four hours in order to apply appropriate absorption coefficients during acquisition.

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Acquisition Output

Please refer to Section 4.3.2.1.2 Acoustic Backscatter Imagery of the Field Procedures Manual 2020 for the backscatter post processing workflow.

Report of Survey**Uncertainty Source**

Information about uncertainty values used for data processing can be found within the Caris HIPS & SIPS processing project and in the associated Hydrographic Vessel Files (HVF) for each survey platform. Uncertainty results for H13851 can be found in the Statistical Analysis section of Quality Control Procedures in this document.

Error Source

Pydro 22, a suite of software maintained by NOAA's Hydrographic Systems and Technology Branch (HSTB), contains the HDR Boost tool that aids in the creation and analysis of BAG files of the bathymetric data collected. The subsequent analysis report returned no warnings/sources of error.

Supplementals

- **Trained Marine Mammal Observers list** (*Mar 05, 2024*)
- **Coast Pilot Report** (*Jul 05, 2024*)
- **Final Survey Outline** (*Jun 04, 2024*)
- **NCEI Sound Speed Data** (*May 17, 2024*)

Approval Statement

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 and approved all data and metadata. The survey meets or exceeds requirements as set forth in the Project Instructions and NOS Hydrographic Surveys Specifications and Deliverables. The survey is complete and no additional work is required with the exception of any deficiencies noted in the Report of Survey.

Approver Name	Approver Title	Approver Certification
CDR Megan R. Guberski	Chief of Party	

Personnel

Name	Title	Certification
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Full Equipment List						
Equipment Type	Manufacturer and System	Model Number	Serial Number	Calibration Date	Frequency	Accuracy Check Date
S222 (369958000)						
Positioning and Attitude System	Applanix POS MV 320 v5	POS MV 320 V5	6497	2024-04-01	NA	NA
Multibeam	Kongsberg Maritime EM 2040	EM2040	40260	2024-04-02	200-400 kHz	2024-04-03
CTD	Sea-Bird Scientific SBE 19plus V2	SBE 19plus V2	19P60744-6667	2024-01-23	n/a	2024-04-01
CTD	Sea-Bird Scientific SBE 19plus	SBE 19plus	19P36399-4630	2024-01-17	n/a	2024-04-01
CTD	AML Oceanographic MVP200	MVP-200	M12981	1901-01-01	n/a	1901-01-01
CTD	AML Oceanographic MVP-X	MVP-X CTD	9006	2022-02-08	n/a	2024-04-01
Sound Speed System	Teledyne RESON SVP 70	SVP 70	0614179	2021-10-03	n/a	1901-01-01
Sound Speed System	Teledyne RESON SVP 70	SVP 70	1013077	2024-01-09	n/a	1901-01-01
2904 (368926109)						
Positioning and Attitude System	Applanix POS MV 320 v5	POS MV 320 v5	8959	2024-03-26	NA	NA
Multibeam	Kongsberg Maritime EM 2040	EM 2040	40122	2024-03-27	200-400 kHz	2024-04-04
Sound Speed System	Teledyne RESON SVP 70	SVP 70	1921072	2024-01-10	n/a	1901-01-01
CTD	Sea-Bird Scientific SBE 19plus	SBE 19plus	19P33072-4472	2024-01-24	n/a	2024-04-01
CTD	Sea-Bird Scientific SBE 19plus	SBE 19plus	19P33589-4487	2024-01-24	n/a	2024-04-01
CTD	SonTek CastAway-CTD	CastAway-CTD	CC2333002	2023-08-21	n/a	2024-04-01

Equipment Type	Manufacturer and System	Model Number	Serial Number	Calibration Date	Frequency	Accuracy Check Date
<i>DriX-12 (366991449)</i>						
Positioning and Attitude System	iXblue Hydrins	C7/AsteRx4	3028	2022-04-20	NA	NA
Multibeam	Kongsberg Maritime EM 2040	EM2040	40270	2024-03-02	200-400 kHz	2024-03-27
Sound Speed System	Valeport SWiFT SVP	SWiFT SVP	80115	2022-01-02	n/a	1901-01-01
Sound Speed System	Valeport SWiFT SVP	SWiFT SVP	75334	2024-01-10	n/a	1901-01-01
Sound Speed System	Valeport MiniSVS	MiniSVS	50453	2022-01-03	n/a	1901-01-01