



NOAA
Coast Survey

H13983

11NM SSE of
Charleston Entrance

OPR-G380-TJ-24
Approaches to Charleston
South Carolina

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
July 25, 2024 - October 13, 2024
License Information
CC0-1.0
Approver
CDR Megan R. Guberski



Platform and Sonar Equipment
S222 (369958000)
<i>Kongsberg Maritime EM 2040</i>

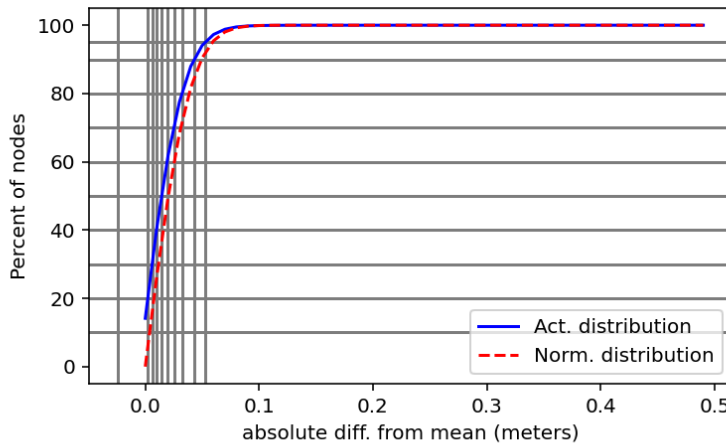
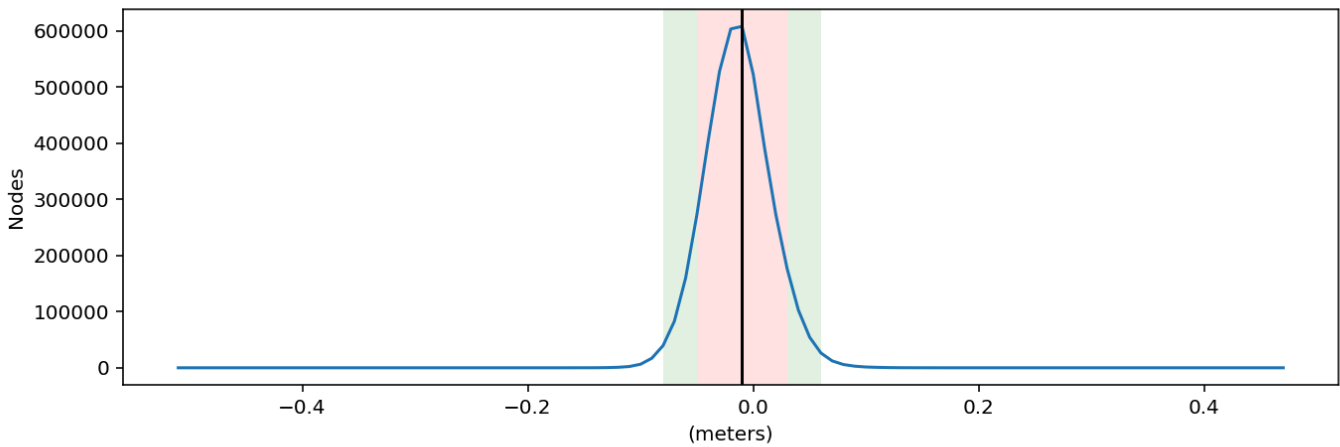
Bathymetry Grid		
H13983_MB_1m_MLLW_1of1 North American Datum 1983 (2011) Projected UTM 17, Mean Lower Low Water		
Sounding Technique: Multibeam	Full Seafloor Coverage: Yes	Feature Detection Size: 2.0m 10%
Features Detected: Yes	Bathymetric Coverage: Yes	Uncertainty Horizontal: 1m N/A
Least Depth Detected: Yes	Interpolated: No	Uncertainty Vertical: 0.25m 0.75%

Quality Control Procedure

Crosslines

The NOAA Thomas Jefferson (Vessel S222), on a sheet encompassing 1002.1 linear nautical miles of survey, collected a combined total of approximately 53.1 linear nautical miles of MBES crosslines, constituting roughly 5.3% of mainscheme mileage. A 1 meter Combined Uncertainty and Bathymetric Estimator (CUBE) surface was created for both the mainscheme and crossline data and compared using the Pydro 24 tool, "Compare Grids." The results of this comparison indicate that 100% of compared gridnodes are within the fraction of allowable error for depth/height, exceeding the minimum specification of 95% set in NOAA's 2024 Hydrographic Surveys Specification and Deliverables (HSSD). The resulting mean and standard deviation of uncertainty between the two surfaces was -0.01m and 0.03m, respectively.

H13983_MB_1m_MLLW_Final-H13983_XL_1m_MLLW
 Mean: -0.01 | Mode: -0.01 | One Standard Deviation: 0.03 | Bin size: 0.01



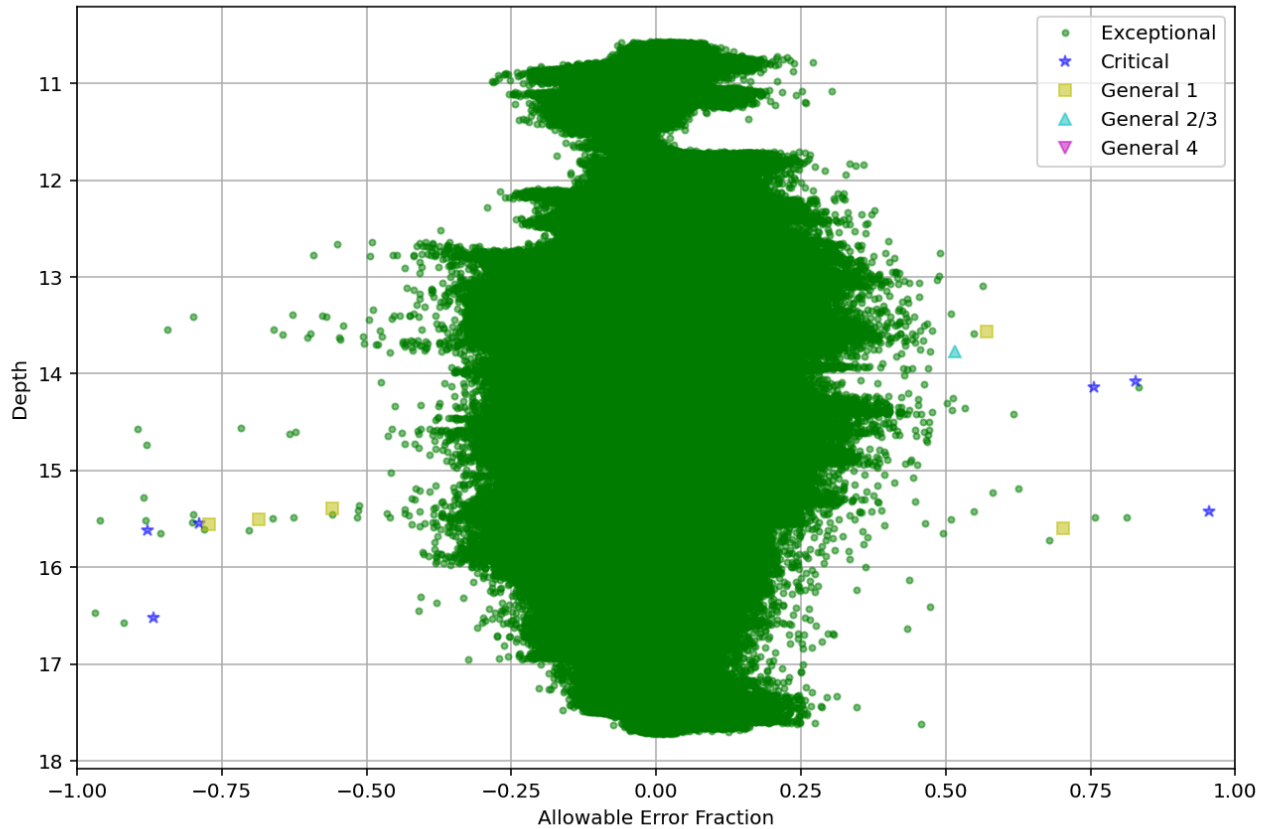
Percent of nodes	Deviation (m)
50%	+/- 0.01
60%	+/- 0.02
70%	+/- 0.03
80%	+/- 0.03
90%	+/- 0.04
95%	+/- 0.05

Summary plot of uncertainty between mainscheme and crossline surfaces of H13983

Node Depth vs. Allowable Error Fraction

Total comparisons 4294041

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



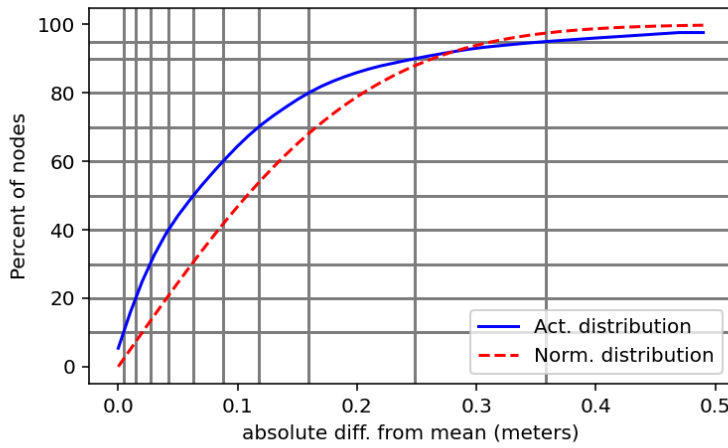
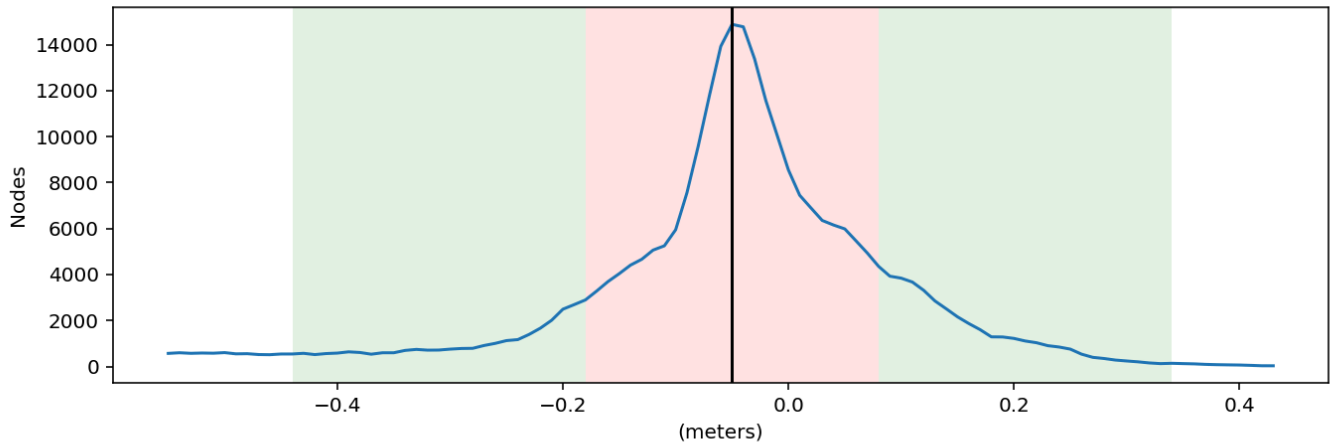
A Node Depth vs. Allowable Error Fraction plot of mainscheme and crossline surfaces for H13983

Junction Overlap

Sheet H13983 junctions with the 2015 sheet H12805. Junction comparisons were run on both distinct sections of H12805 that overlap with H13983 using the Pydro 24 tool, "Compare Grids," and the results are shown below:

A junction comparison was conducted between sheets H13983 and H12805 (the 50cm SR bag_2of4 as found on NCEI's data bathymetric viewer). The results of this comparison indicate that 100% of the compared grid nodes exceed General 1 standards for allowable error fraction. The resulting mean of this comparison was a mean of -0.05m and a standard deviation of 0.16m - verifying the consistency of the data.

H13983_MB_1m_MLLW_Final-H12805_MB_50cm_MLLW_2of4
 Mean: -0.05 | Mode: -0.05 | One Standard Deviation: 0.16 | Bin size: 0.01



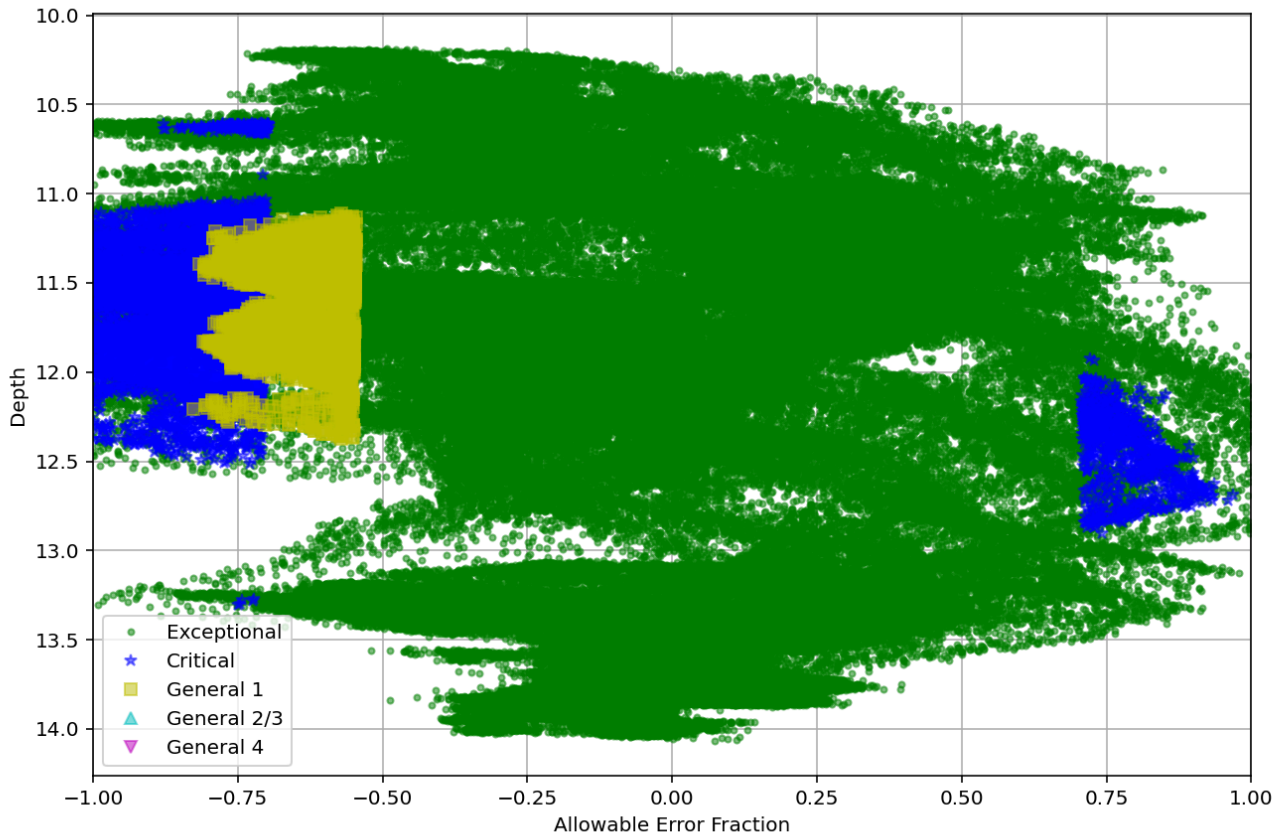
Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.09
70%	+/- 0.12
80%	+/- 0.16
90%	+/- 0.25
95%	+/- 0.36

Summary plot of uncertainty between mainscheme of H13983 and H12805

Node Depth vs. Allowable Error Fraction

Total comparisons 276492

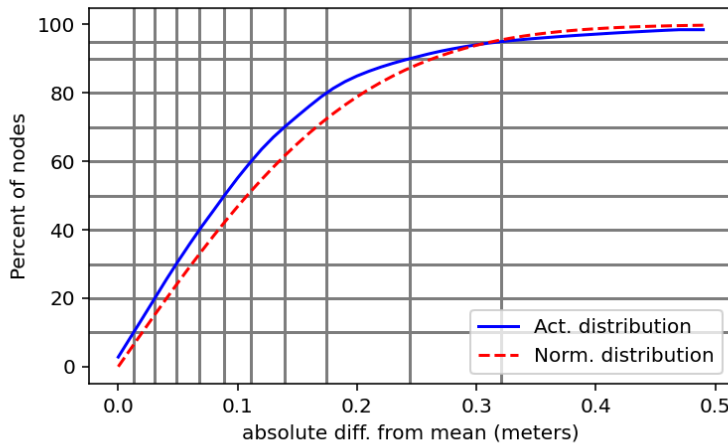
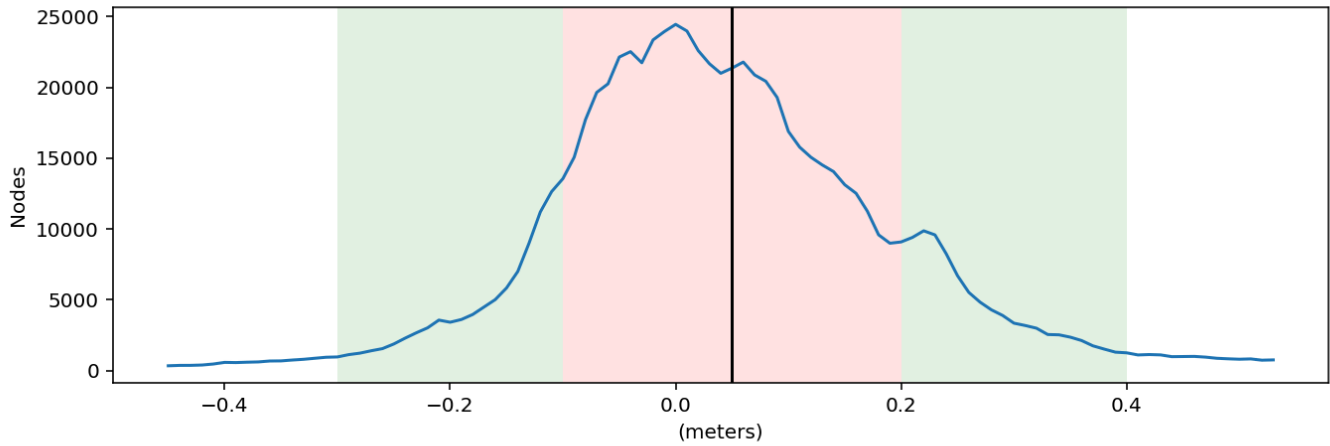
Passed States: Exceptional=93.55%, Critical=96.75%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%,



A Node Depth vs. Allowable Error Fraction plot for mainscheme junction of H13983 and H12805

A junction comparison was conducted between sheets H13983 and H12805 (the 1m SR bag_3of4 as found on NCEI's data bathymetric viewer). The results of this comparison indicate that 100% of the compared grid nodes exceed General 1 standards for allowable error fraction. The resulting mean of this comparison was a mean of 0.05m and a standard deviation of 0.16m - verifying the consistency of the data.

H13983_MB_1m_MLLW_Final-H12805_MB_1m_MLLW_3of4
 Mean: 0.05 | Mode: 0.00 | One Standard Deviation: 0.16 | Bin size: 0.01



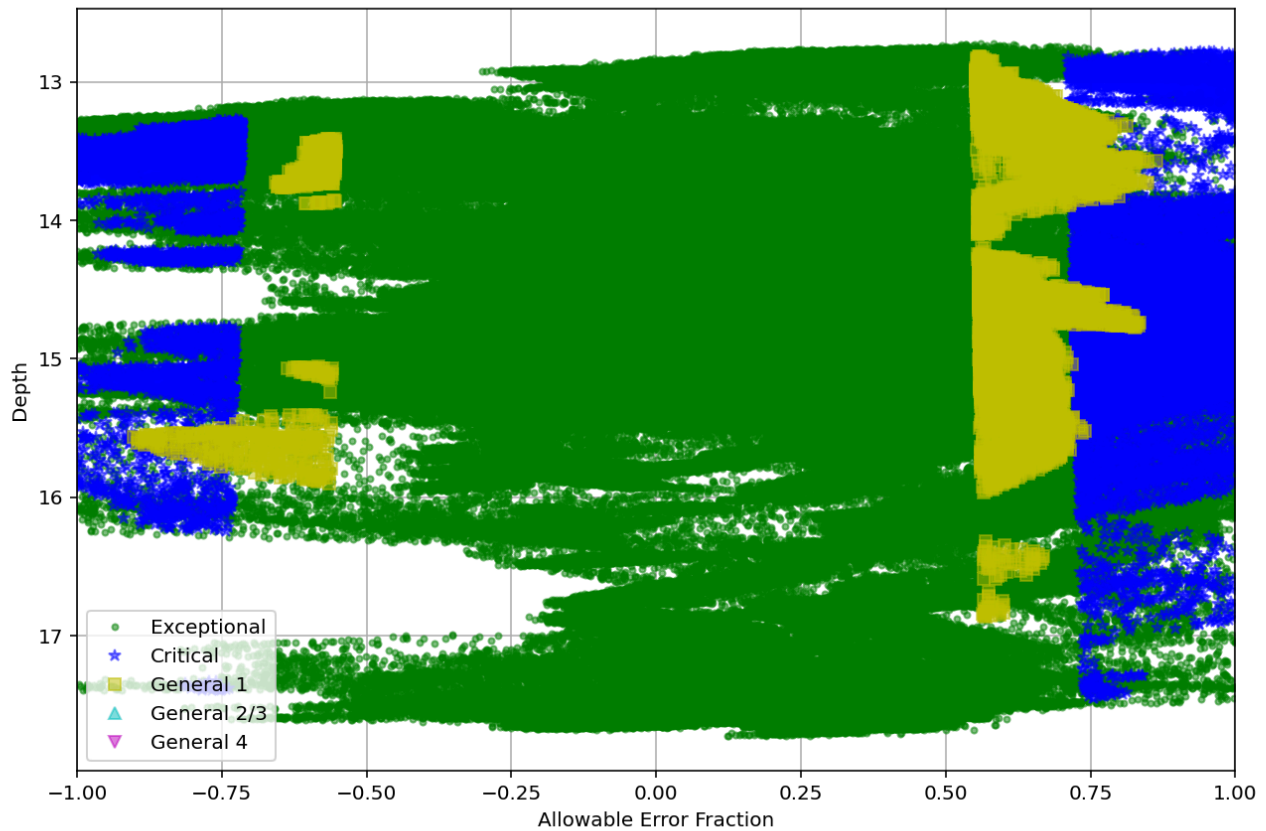
Percent of nodes	Deviation (m)
50%	+/- 0.09
60%	+/- 0.11
70%	+/- 0.14
80%	+/- 0.17
90%	+/- 0.24
95%	+/- 0.32

Summary plot of uncertainty between mainscheme of H13983 and H12805

Node Depth vs. Allowable Error Fraction

Total comparisons 762247

Passed States: Exceptional=95.82%, Critical=98.52%, General 1=100.00%, General 2/3=100.00%, General 4=100.00%,



A Node Depth vs. Allowable Error Fraction plot for mainscheme junction of H13983 and H12805

Statistical Analysis

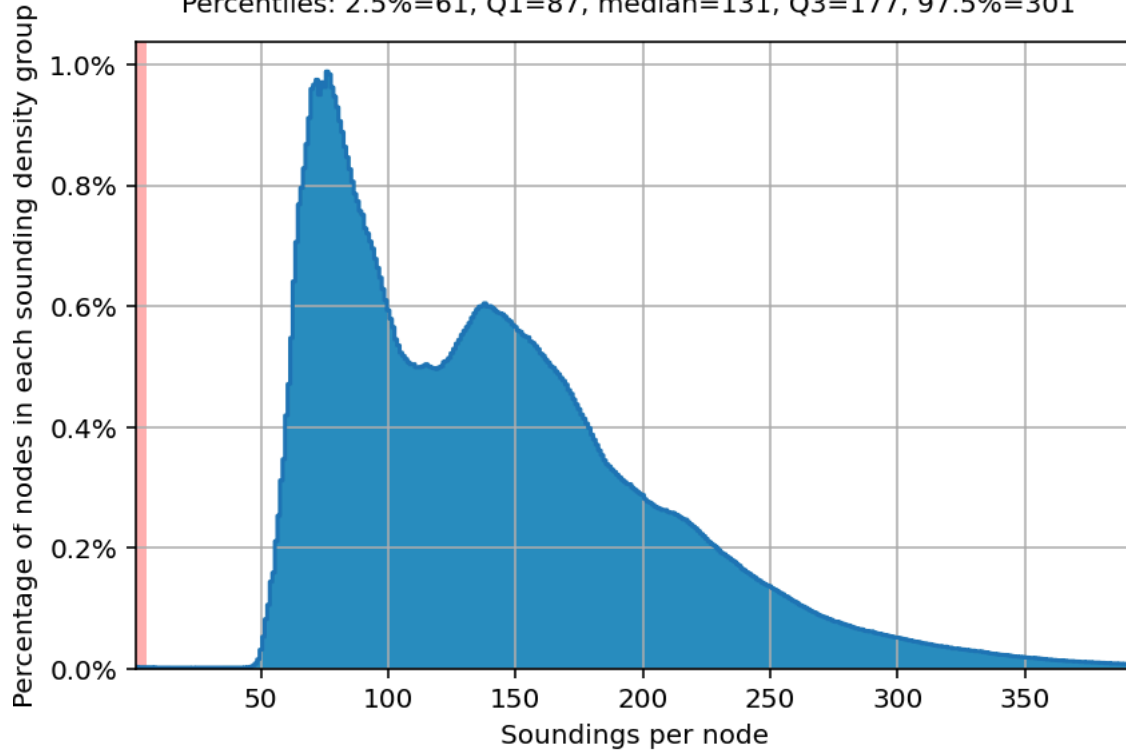
A statistical analysis of grid layers was conducted to assess the quality of bathymetry. The Pydro 24 tool, "Grid QC," was used to assess grid density, resolution, and uncertainty against the allowable standards specified in the 2024 HSSD. This survey was assigned the quality metrics of General 1 - a metric which over 99.5%+ of delivered grids surpassed.

Data Density

Grid source: H13983_MB_1m_MLLW_Final_1of1

99.5+% pass (52,545,525 of 52,551,536 nodes), min=1.0, mode=76, max=674.0

Percentiles: 2.5%=61, Q1=87, median=131, Q3=177, 97.5%=301



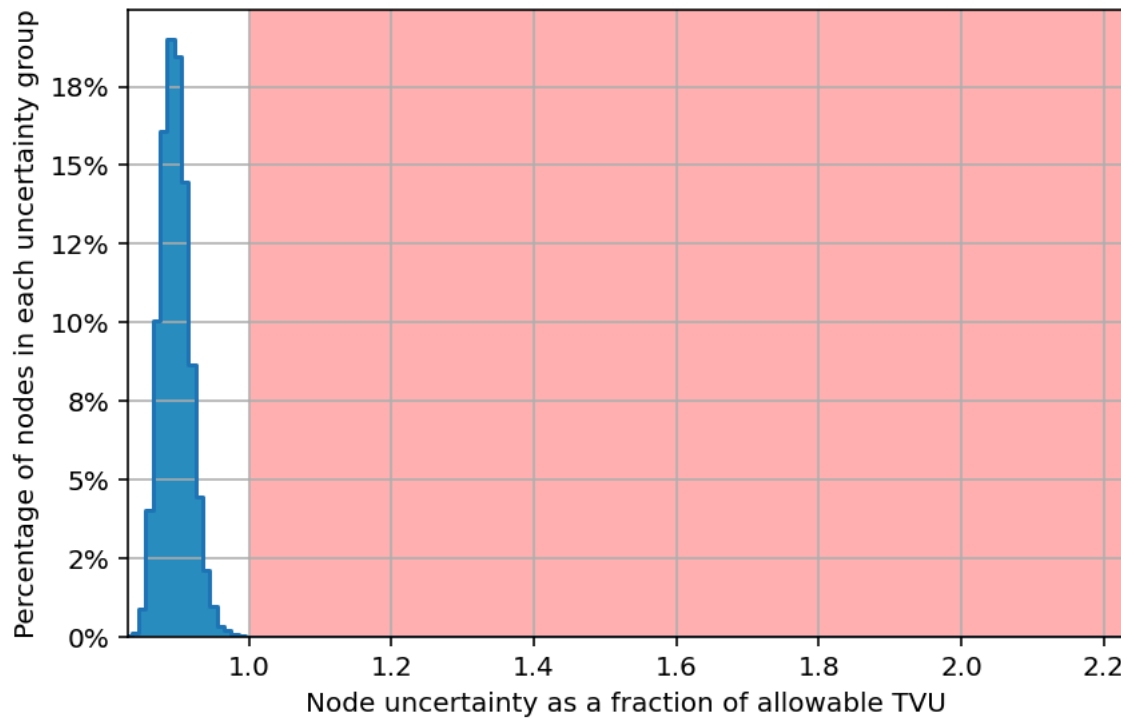
a histogram of node data density

Uncertainty Standards - NOAA Critical

Grid source: H13983_MB_1m_MLLW_1of1

99.9% pass (52,543,859 of 52,551,518 nodes), min=0.83, mode=0.89, max=14.08

Percentiles: 2.5%=0.86, Q1=0.88, median=0.89, Q3=0.91, 97.5%=0.94



Grid QC derived histogram of node uncertainty as a fraction of allowable TVU attaining quality metric "Critical."

Directed Editing

After initial collection, MBES data underwent a thorough process of editing and inspection using a series of visual inspections and NOAA's Pydro 24 QC tool, "Flier Finder," 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 1m CUBE surface as well as its uncertainty and standard deviation layers in order to further visually inspect for fliers.

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 24 QC tool, "Holiday Finder." "Holiday Finder," when given a 100% bathymetric CUBE surface, finds gaps in data larger than HSSD specifications and returns a number of files used in Caris HIPS & SIPS that aids in holiday identification and acquisition planning. Holidays were iteratively collected throughout the survey operation - ultimately ensuring no distinguishable holidays exist by the submittal of this survey.

Survey Adequacy

The data of this entire survey was acquired in accordance with the requirements set forth in the 2024 HSSD and all data falls within applicable IHO and HSSD standards (encompassing data gaps, density, and uncertainty). Thus, the data in this entire survey is adequate to supersede previous data.

Imagery Coverage

Imagery coverage assessment was not performed for this survey

Data Interpolation

Data interpolation was not performed for this survey

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.

Acquisition Output

Please refer to section 4.3.2.1.2 Acoustic Backscatter Imagery of the Field Procedures Manual (FPM 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's) for each platform. Uncertainty results for H13983 can be found in the Statistical Analysis section of the Quality Control Procedures in this document.

Error Source

Holiday lines collected on DN287 (10/13/24) display evidence of applied sound speed data which does not fully represent the real-time sound speed through the water column - as evidenced by an upside down parabolic shape at the edges of the swath. Due to operational time constraints and no available applicable sound speed profiles, this data was unable to be corrected. However, DN287 lines and previously collected data display an approximate difference in depth of 0.1m with a further 0.1m standard deviation. Overall, no significant change in the surface is created from this error source - and, as outlined in the Quality Control Procedures tab, this survey still surpasses all data quality metrics.

Unusual Condition

Unusual IMU dropouts and vertical offset issues were encountered on this survey. In an effort to troubleshoot, the POS computer system (PCS POS MC320 v5) was replaced (DN261 – 09/17/24) and a subsequent patch test was conducted to update the HIPS Vessel File (hvf). As S222 continued to encounter issues, the POS Inertial Measurement Unit (IMU) was replaced (DN272 - 09/28/24) alongside a new patch test and updated hvf. Any affected lines were either updated or reacquired and processed with the newest hvf - and no significant offsets persist.

Supplementals

- Coast Pilot Report (*Nov 06, 2024*)
- Trained Marine Mammal Observers list (*Mar 05, 2024*)
- NCEI Sound Speed Data (*Nov 04, 2024*)
- Final Survey Outline (*Oct 18, 2024*)
- Potentially Sensitive Data Findings (*Oct 08, 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	GUBERSKI.MEGAN.REBECCA.1283261189 CCA.1283261189 <small>Digitally signed by GUBERSKI.MEGAN.REBECCA.1283261189 Date: 2024.11.19 06:15:18 -08'00'</small>

Personnel

Name	Title	Certification
Alessandra M DiTommaso	Survey Technician	DITOMMASO.ALESSANDRA.MARIA.1048478758 <small>Digitally signed by DITOMMASO.ALESSANDRA.MARIA.1048478758 Date: 2024.11.19 09:45:42 -05'00'</small>
Kylea Perrin	Survey Technician	<i>Kylea Perrin</i>

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	6497	2024-06-05	NA	NA
Positioning and Attitude System	Applanix POS MV 320 v5	POS MV	8959	1970-01-01	NA	NA
Multibeam	Kongsberg Maritime EM 2040	EM 2040	40122	2024-03-27	kHz	2024-04-04
CTD	AML Oceanographic MVP200	M12981	n/a	1970-01-01	n/a	
CTD	AML Oceanographic MVP-X	MVP-X CTD	9006	2024-02-08	n/a	2024-04-01
Sound Speed System	Teledyne RESON SVP 70	SVP 70	1013077	2024-01-09	n/a	
Sound Speed System	Teledyne RESON SVP 70	SVP 70	0614179	2023-10-23	n/a	