W00506

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	W00506

LOCALITY

State(s):	Maine
General Locality:	Atlantic Ocean
Sub-locality:	Coastal Waters: Garrish Island to Godfrey's Cove

2018

CHIEF OF PARTY
Semme Dijkstra

LIBRARY & ARCHIVES

Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

W00506

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):	**Maine**
General Locality:	**Atlantic Ocean**
Sub-Locality:	**Coastal Waters: Garrish Island to Godfrey's Cove**
Scale:	**5000**
Dates of Survey:	**06/20/2018 to 07/03/2018**
Instructions Dated:	**07/18/2018**
Project Number:	**ESD-PHB-20**
Field Unit:	**University of New Hampshire**
Chief of Party:	**Semme Dijkstra**
Soundings by:	**R2Sonic 2024 (MBES)**
Imagery by:	**R2Sonic 2024 (MBES Backscatter)**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in WGS84 UTM 19N, Mean Lower Low Water. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

DESCRIPTIVE REPORT MEMO

May 06, 2020

MEMORANDUM FOR: Pacific Hydrographic Branch

FROM: Report prepared by PHB on behalf of field unit
Kurt Brown
Physical Scientist, Pacific Hydrographic Branch

SUBJECT: Submission of Survey W00506

Data were acquired by students as a part of the Summer Hydrographic Surveying course at the Center for Coastal and Ocean Mapping (CCOM) at the University of New Hampshire (UNH) fulfilling educational requirements for practical experience. The data collected fills a gap in modern high resolution bathymetry in the region. This survey continued the acquisition begun by students in the previous year's Summer Hydrographic Surveying course.

BAGs, MBES backscatter mosaic and report documentation were provided to PHB and archival at NCEI.

All soundings were reduced to Mean Lower Low Water using VDatum. The horizontal datum for this project is World Geodetic System (WGS) 1984. The projection used for this project is Universal Transverse Mercator (UTM) Zone 19.

Horizontal and vertical control information can be found in the Descriptive Report and Horizontal and Vertical Control Report.

All survey systems and methods used during this survey are described in the Data Acquisition and Processing Report.

All data were reviewed for DTONs and none were identified in this survey.

University of New Hampshire, Center for Coastal and Ocean Mapping, Joint Hydrographic Center acquired the data outlined in this report.

Significant findings can be found in the attached Descriptive Report.

This survey does meet charting specifications and is adequate to supersede prior data.

University of New Hampshire
Center for Coastal and Ocean Mapping
Joint Hydrographic Center

Descriptive Report

Type of Survey: Navigable Area

LOCALITY

States(s): Maine

General Locality: Atlantic Ocean

Sub-Locality: Coastal Waters: Gerrish Island to Godfrey's Cove (Maine)

2018

Group Members:

Lynette Davis	Andry Herizo Rasolomaharavo
Andres Fitzcarrald	Aileen Bohan
Liva Goba	Cecilia Cortina Guzman
Hadley Owen	Haruka Ogawa

Chief of Party: Semme Dijkstra

Survey

Dates: June 18th – July 10th

UNIVERSITY OF NEW HAMPSHIRE CENTER FOR COASTAL AND OCEAN MAPPING JOINT HYDROGRAPHIC CENTER	GROUP NAME:
HYDROGRAPHIC TITLE SHEET	UNH JHC/CCOM Summer Hydro
INSTRUCTIONS: The hydrographic sheet should be accompanied by this form, filled in as completely as possible when it is forwarded to the office	
State(s):	Maine
General Locality	Atlantic Ocean
Sub-Locality:	Coastal Waters: Gerrish Island to Godfrey's Cove (Maine**)**
Scale:	1:5,000
Dates of Survey:	18 June – 10 July
Instructions Date:	18 June 2018
Field Unit:	CCOM/JHC *R/V Gulf Surveyor*
Soundings by:	R2Sonic 2024 (MBES)
Imagery by:	R2Sonic 2024 Backscatter
Soundings Acquired in : Final Product:	Meters at WGS84 Meters at MLLW
Remarks:	

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A. Area Surveyed

The survey area is found in the southern Gulf of Maine. The acquisition region has a southern boundary that is offshore of Gerrish Island and a northern limit near Godfrey's Cove, just south of York Harbor (see Fig. 1). The data was collected in accordance with NOS HSSD specifications and meets IHO Special Order standards.

A.1 Survey limits

The region is located between approximately 1 and 2.25 km offshore. Depths range from roughly 26.42 m to 4.8 m.

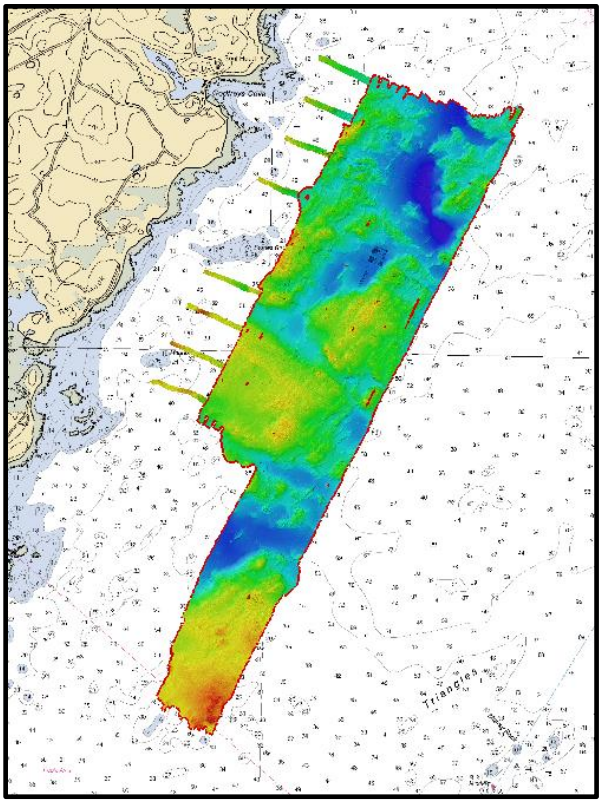


Figure 1: Survey Area with crosslines, overlain on chart 13283.

Data acquired are within the bounding coordinates described in Table 1:

Latitude	Longitude
43°07'11.3"N	70°37'24.9"W
43°07'03.9"N	70°36'32.5"W
43°04'21.9"N	70°38'17.6"W
43°04'31.2"N	70°38'36.8"W
43°05'30.4"N	70°38'03.6"W
43°05'42.0"N	70°38'24.0"W

Table 1: Survey limits

The planned survey area is bounded by these following previous surveys:

H12615 York Harbor Entrance to Cape Neddick (NOAA Vessel Hassler 2m) 2013

F00574 Offshore York Harbor ME (NOAA Vessel Thomas Jefferson 1m) 2009

H12613 Vicinity of Isles of Shoals (NOAA Vessel Hassler 2m) 2013

H10771_1_Murray Rock to Duck Island (NOAA Vessel Rude 3m) 1997

W00244 Offshore Gerrish Island Summer Hydro (RVCS and RV Cocheco 1m) 2012

USACE_2010_ME_2m (lidar) 2010

A.2 Survey Purpose

Data were acquired by students as a part of the Summer Hydrographic Surveying course at the Center for Coastal and Ocean Mapping (CCOM) at the University of New Hampshire (UNH) fulfilling educational requirements for practical experience. The data collected fills a gap in modern high resolution bathymetry in the region. This survey continued the acquisition begun by students in the previous year's Summer Hydrographic Surveying course.

A.3 Survey Quality

Data were collected to provide high-resolution multibeam echo sounder coverage supporting safe navigation for mariners off the southern coast of Maine. The survey and deliverables were prepared in accordance with the standards set out in the *NOAA NOS HSSD 2018* document, with references to *IHO S-44 (5th Edition).*

A.4 Survey Coverage

While some holidays are visible in the total bathymetric coverage, the data acquired exceed IHO Special Order specifications and can be used to supersede prior data and update regional nautical charts. Additional holiday discussion is covered in Section B.2.9.

A.5 Survey Statistics

Table 2 lists the main scheme and crossline acquisition mileage for this survey.

Main scheme	173 km
Crosslines	19 km
Total Linear	**192 km**
Total Coverage	**5.291 km^2**

Table 2: Total Survey Statistics

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

DN	Date	Data	Distance
170	6/19/18	Crosslines (XL)	8.4 km
171	6/20/18	XL	20.1 km
172	6/21/18	Mainscheme (MS)	37.4 km
173	6/22/18	MS	63.8 km
176	6/25/18	MS & Holidays	39.8 km
180	6/29/18	Holidays	13.6 km
184	7/3/18	Holidays	8.9 km

Table 3: Example km Surveyed Per Day

Vessel	*R/V Gulf Surveyor (Number of lines/Samples)*	*Total (LNM)*
SBES Mainscheme	0	0
MBES Mainscheme	201	168.5
Lidar Mainscheme	0	0
SSS Mainscheme	0	0
SBES/MBES Combo Mainscheme	0	0
SBES/SSS Combo Mainscheme	0	0
SBES/MBES Crosslines	17	22.65
Lidar Crosslines	0	0
Number of Maritime Boundary Points Investigated	0	0
Number of DPs	0	0
Number of Items Investigated by Dive Ops	0	0
Total Number of SNM	218	191.15

Table 4: Linear Nautical Miles and Square Nautical Miles

Survey Date	*Julian Day Number*	*Type of Data Acquisition*
6/18/2018	169	Patch test
6/19/2018	170	Patch test
6/20/2018	171	Cross lines
6/21/2018	172	MBES
6/22/2018	173	MBES
6/25/2018	176	MBES
6/26/2018	177	MBES
6/27/2018	178	MBES
6/28/2018	179	MBES
6/29/2018	180	MBES
7/02/2018	183	MBES
7/03/2018	184	MBES
7/06/2018	187	Equipment demobilization aboard RVGS

Table 5: Overview Dates of Acquisition

Survey lines were run with a single head wideband high resolution shallow water multibeam echo sounder and supplemented by a multi-phase echo sounder system. Linear kilometers miles for the survey were calculated using Qimera's Export NOAA CSV function.

B. Data Acquisition & Processing

B.1 Vessels and Equipment

The R/V *Gulf Surveyor* is a 48-foot, twin screw, geared diesel, propeller driven catamaran owned by CCOM/JHC at UNH. The survey described in this document was completed using a centerline strut-mounted R2Sonic 2024 MBES. Sound speed profiles were collected using a stern-mounted moving vessel profiler, the AML Oceanographic, Ltd, MVP-30. The data were collected in accordance to NOS HSSD specifications and meet IHO Special Order standards.

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 processing methods.

General specifications are as follows:

B.1.1 Vessel

R/V *Gulf Surveyor*	
Length	14.63 meters
Beam	5.36 meters
Draft	1.68 meters
Flag	U.S.
Home Port	New Castle, New Hampshire
Registry	Lakes, Bays, and Sounds plus Limited Coastwise
Official Number	1266419
Top Speed	18 knots

Table 6: Vessel Used

B.1.2 Equipment

Manufacturer	Model / Version	Type
R2Sonic	2024	MBES
Applanix	POS MV V5	Positioning and Attitude System
AML Oceanographic, Ltd	MVP30	Sound Speed System
Trimble	Trimmark 3	RTK GPS Receiver
Teledyne Odom	Echotrac CV200	SBES
Hypack	1.18	Data Acquisition Software
QINSy	8.17.1	Data Acquisition Software
Qimera	1.5.7	Data Processing Software

Table 7: Major Systems Used

The Echotrac CV200 was used to provide a nadir depth for the MVP deployment. Hypack was used for line planning and ship operations. Neither systems were used for data acquisition.

B.2 Quality Control

B.2.1 Crosslines

Crosslines totaled 10% of the main scheme data acquired for this survey and were run perpendicular to the coastline and main scheme lines.

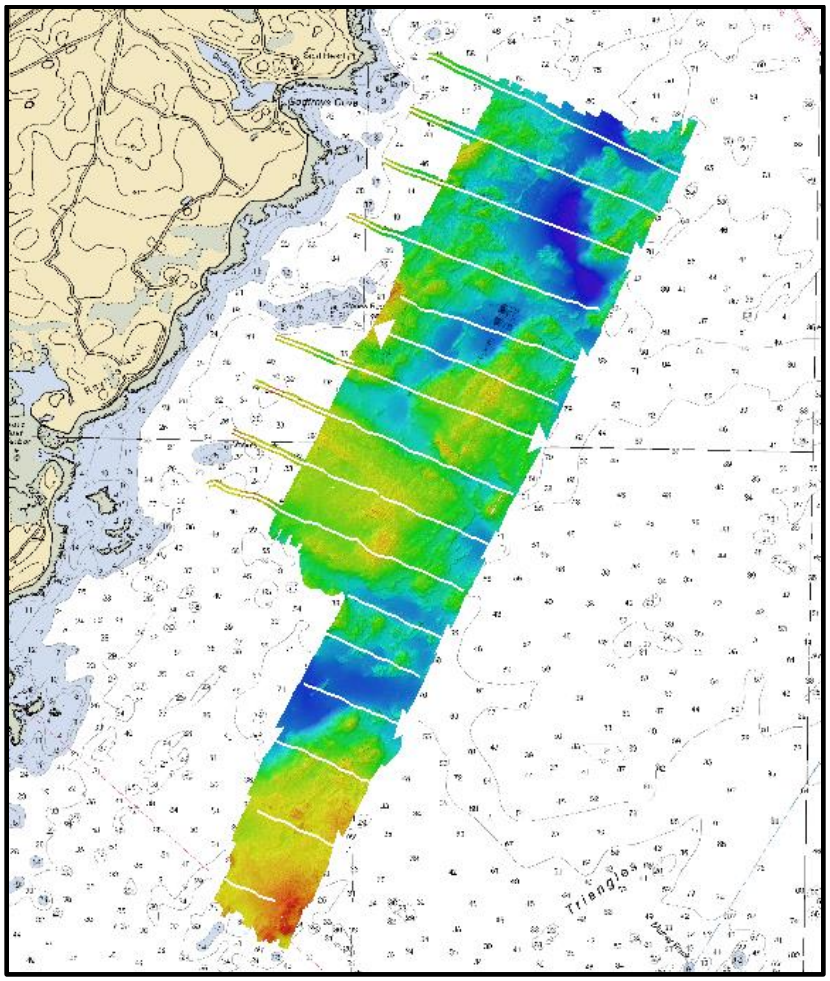


Figure 2: Crosslines over main scheme survey.

Approximately 19 linear kilometers of crosslines were acquired for this survey area. The NOS Hydrographic Survey Specifications and Deliverables document (HSSD 2018) specifies lineal mileage of crosslines to be approximately 8% of main scheme mileage, in areas surveyed with set line spacing. A 50 cm surface of the main scheme soundings was compared to a 50 cm surface of the crossline soundings. These two surfaces were differenced using Surface Difference feature in Qimera. The statistical analysis of the difference between the two surfaces is shown below in Figure 3.

While the median difference between the two surfaces was calculated to be 0.00 m, a closer investigation shows that the difference between surfaces trends negative on the port side, and positive on the starboard side, with deviation of between 10 and 40 cm at the extremes (see Figure 4).

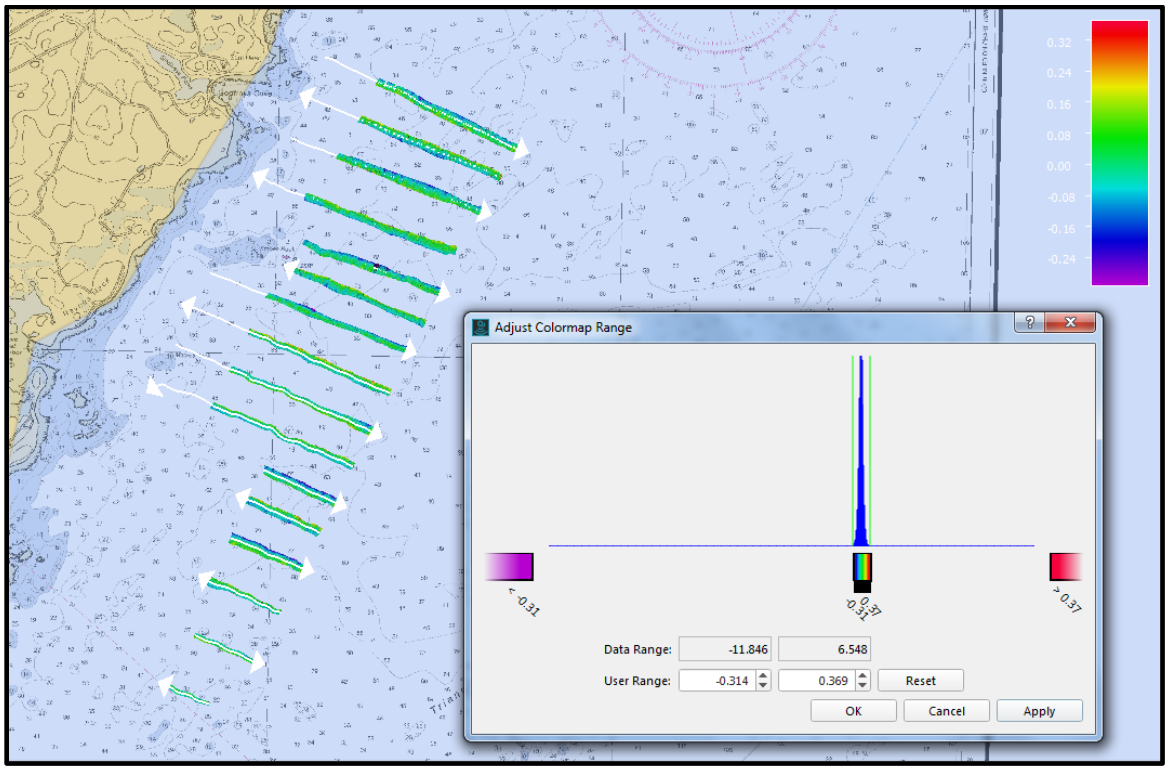


Figure 3: Crossline difference surface and statistics from Qimera. Median difference is -0.00 m; Mean is -0.00 m; Standard deviation is 0.16m.

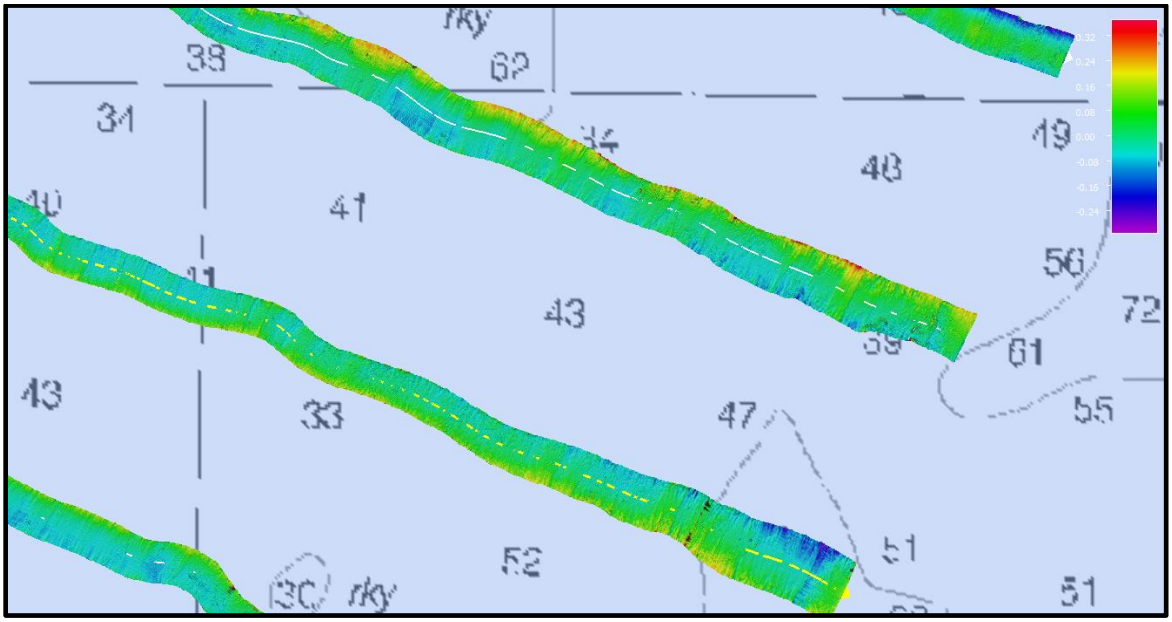


Figure 4: Blow-up of crossline difference surface. Surface units are shown in meters.

B.2.2 Uncertainty

Total propagated uncertainty values were derived from fixed values associated with the acquisition instrumentation, vessel characteristics, and uncertainty associated with sound speed measurement. Specific uncertainty values are contained in table within the DAPR.

For Special Order surveys, the maximum allowable horizontal uncertainty is 2m at a 95% confidence level, while the maximum allowable vertical uncertainty is +/- $\sqrt{(0.25)^2 + (0.0075 * d)^2}$ of a given depth (d) at a 95% confidence level.

The Gulf of Maine survey area found depths in the range of 6 to 30 meters (20-98 feet). With these values, the range of allowable TVU is **+/- 0.25m to +/- 0.34m** at 95% confidence.

Uncertainty was analyzed using the 1m CUBE surface generated in Qimera (see Fig. 5 & 6, below). Uncertainty values has a median of 0.13m , with a range of around 0.000m to 0.325m, well within the required maximum allowable uncertainty. As expected, uncertainty values are highest at the edges of the swaths. Additionally, higher uncertainty values seem to correspond to areas of higher intensity return in the backscatter.

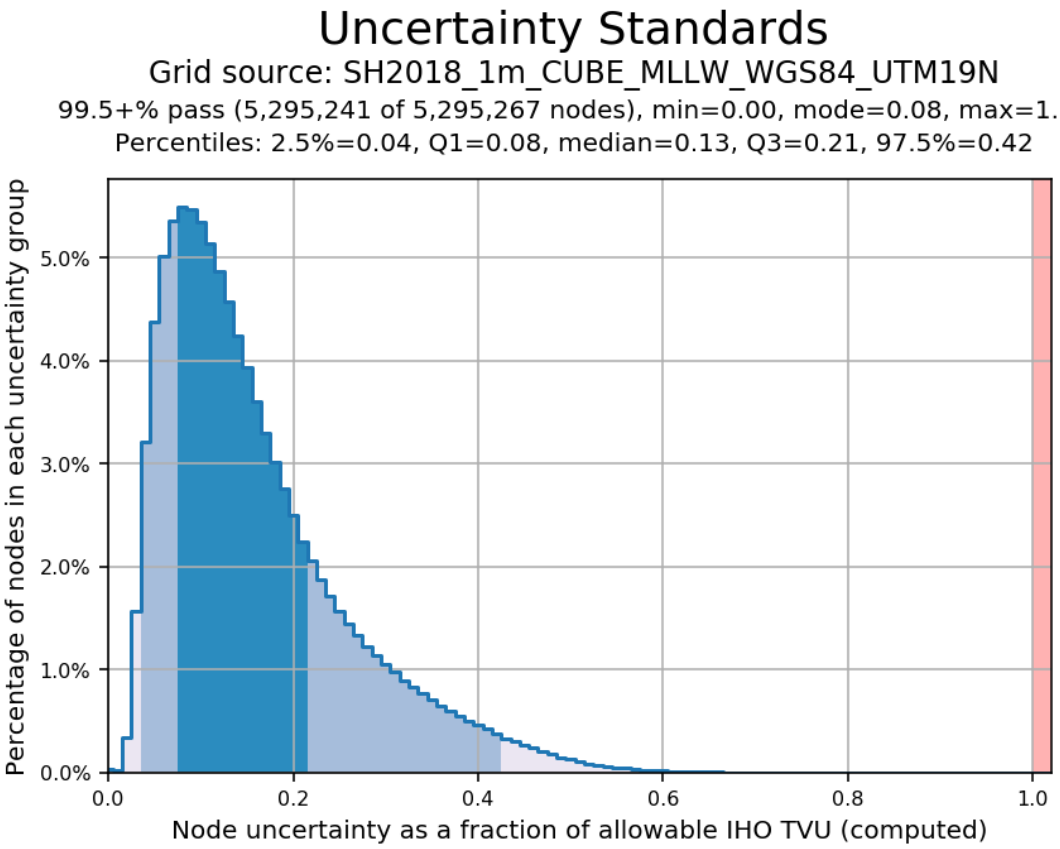


Figure 5: Plot showing percentage of nodes in each Uncertainty level from QC Tools.

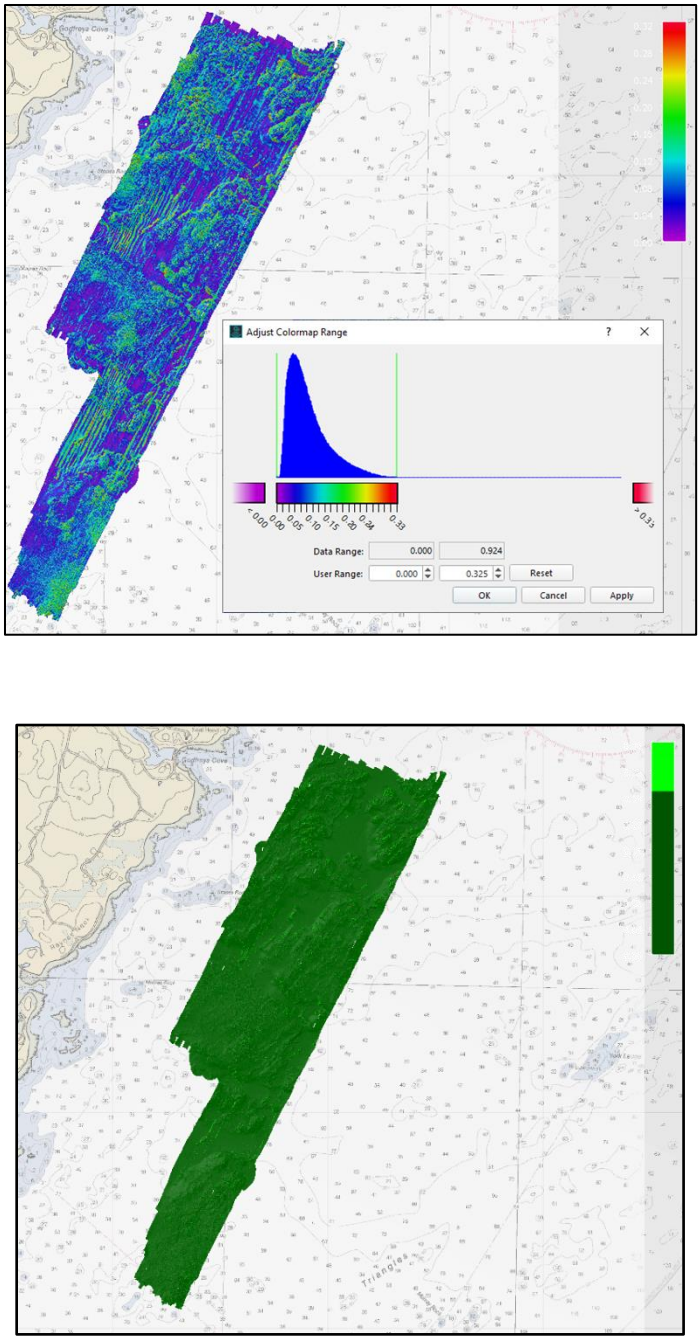


Figure 6: Qimera uncertainty map with a range of 0.01m to 0.33m.
Bottom color scale shows that almost all cells are within acceptable uncertainty with dark green 0.25m or less TVU, 0.35 – 0.25m TVU is bright green is still within acceptable uncerainty.

B.2.3 Junctioning Surveys

The following surveys junction the Gulf of Maine survey area and were identified on NCEI's (National Centers for Environmental Information) Bathymetric Data Viewer (https://maps.ngdc.noaa.gov/viewers/bathymetry/) and CCOM's Western Gulf of Maine Synthesis page (http://ccom.unh.edu/gis/maps/WGOM_4m/).

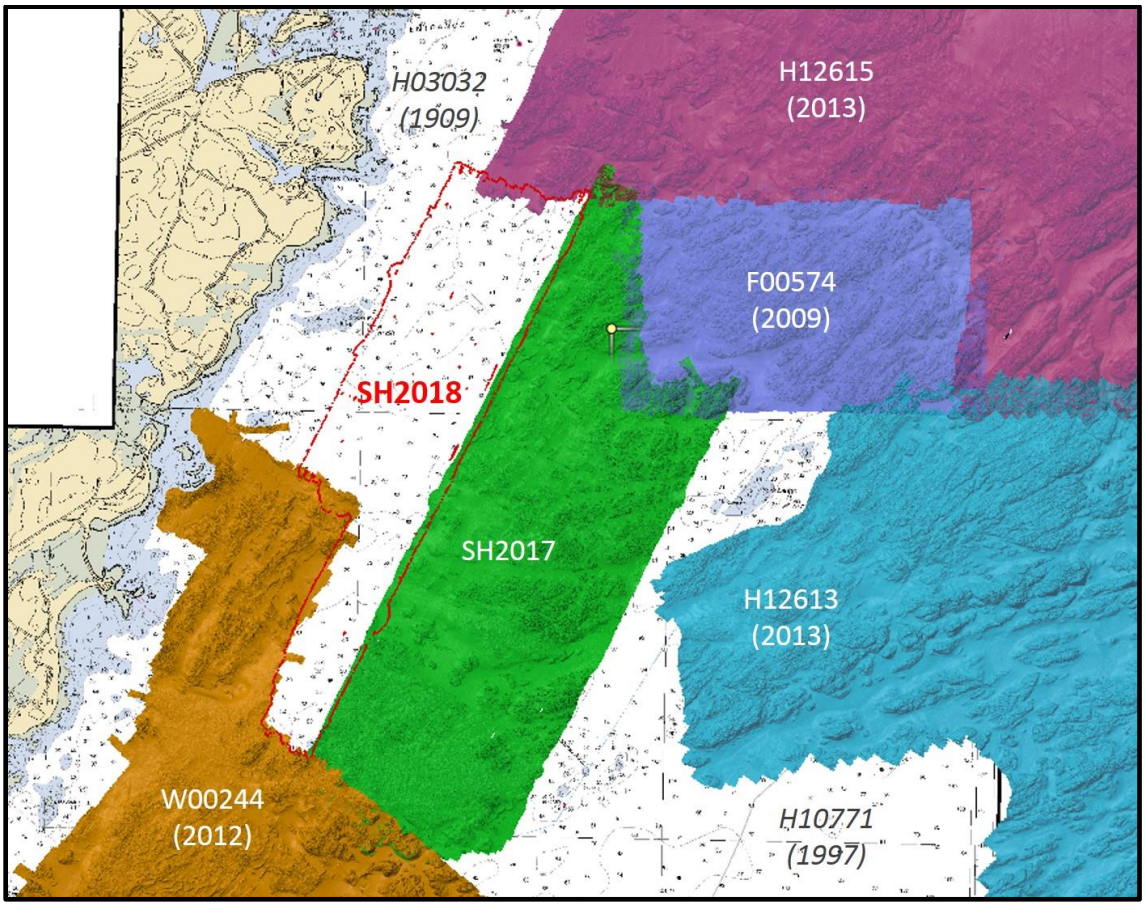


Figure 6: Regional surveys within the acquisition area (this year's survey shown in red outline).

The list of surveys located in the general Gulf of Maine survey area are:

Survey Name	Survey Year	Vessel	Acquisition Group
H12615	2013	NOAA Ship *Ferdinand R. Hassler*	NOAA
W00244	2012	R/V *Coastal Surveyor*	UNH CCOM
SH2017	2017	R/V *Gulf Surveyor*	UNH CCOM
USACE lidar	2010	Aircraft unspecified	USACE
F00574	*2009*	*NOAA Ship* Thomas Jefferson	*NOAA*
H12613	*2013*	*NOAA Ship* Ferdinand R. Hassler	*NOAA*
H03032	*1909*	*unspecified*	*NOAA*

Table 6: Junctioning Surveys

Surveys F00574 and H12613 (italicized) do not directly overlap with the data acquired in 2018. The current 2018 survey will supersede survey H03032 (italicized & underlined) from 1909.

The analysis below compares the 2018 acquisition to H12615 (to the north), W00244 (to the south), and last year's Summer Hydro 2017 project (to the east).

NOAA Survey H12615 Comparison

The 2018 Gulf of Maine survey junctions NOAA Survey H12615. These data were compared using Qimera Surface Differencing.

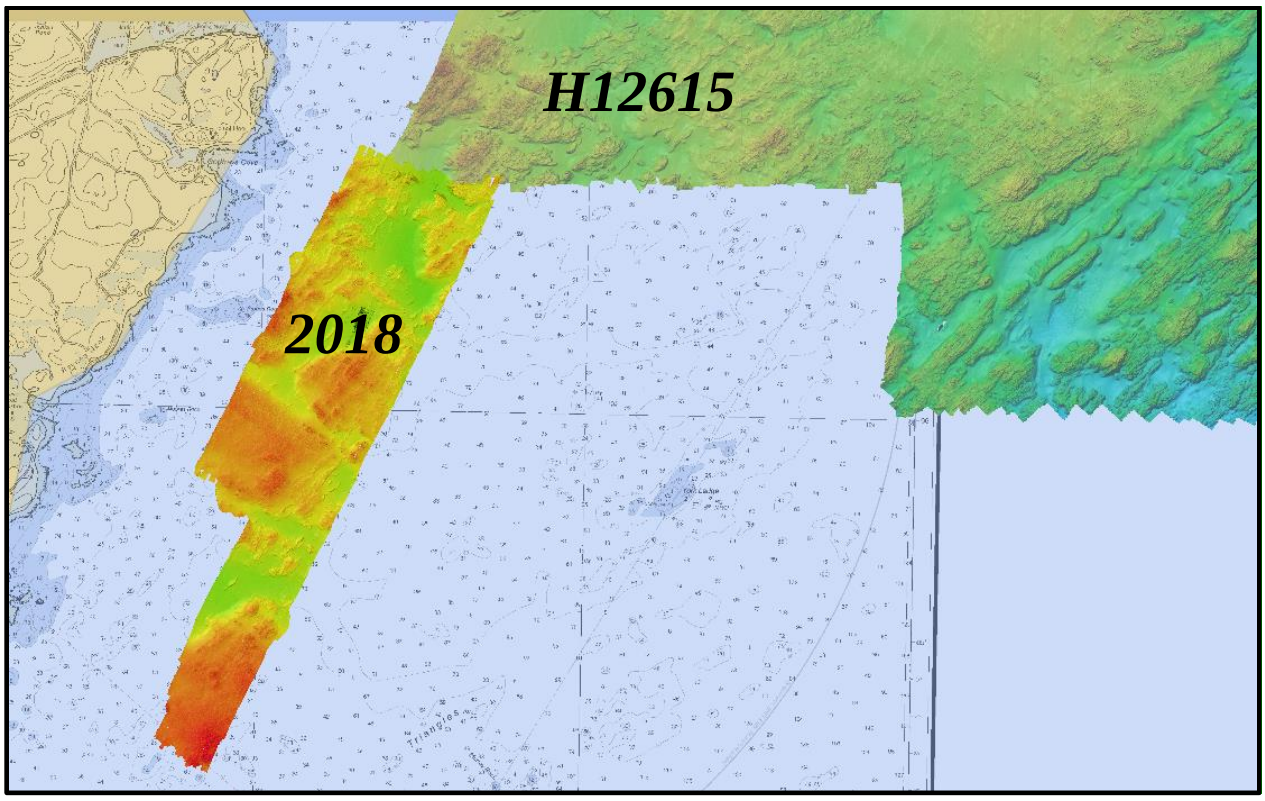


Figure 7: 2018 Gulf of Maine survey and H12615.

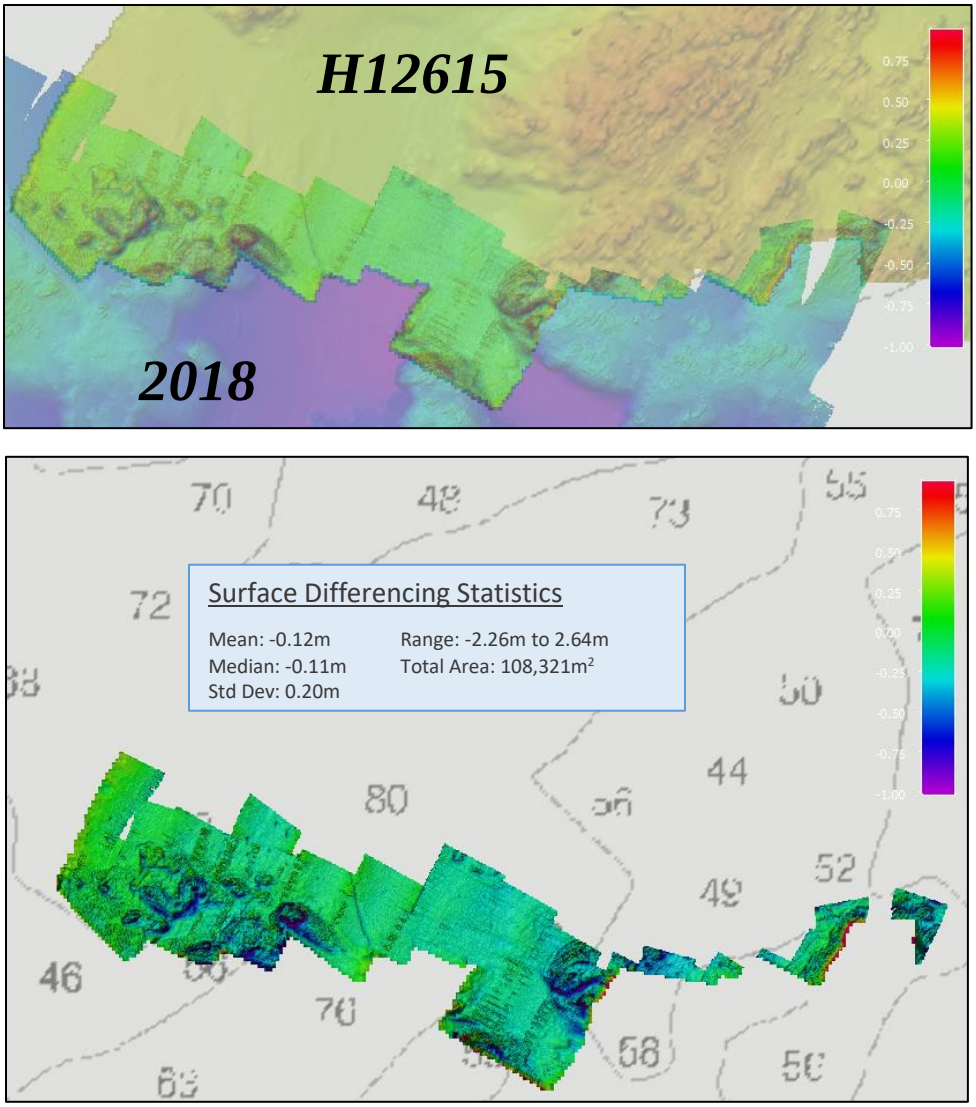


Figure 8: H12615 comparison results.

The surveys have an average difference of -0.12m with a standard deviation of 0.20m. The largest negative differences are observed over regions of rocky terrain, while the largest positive differences are along the edges of swaths from the H12615 survey.

Survey W00244 Comparison

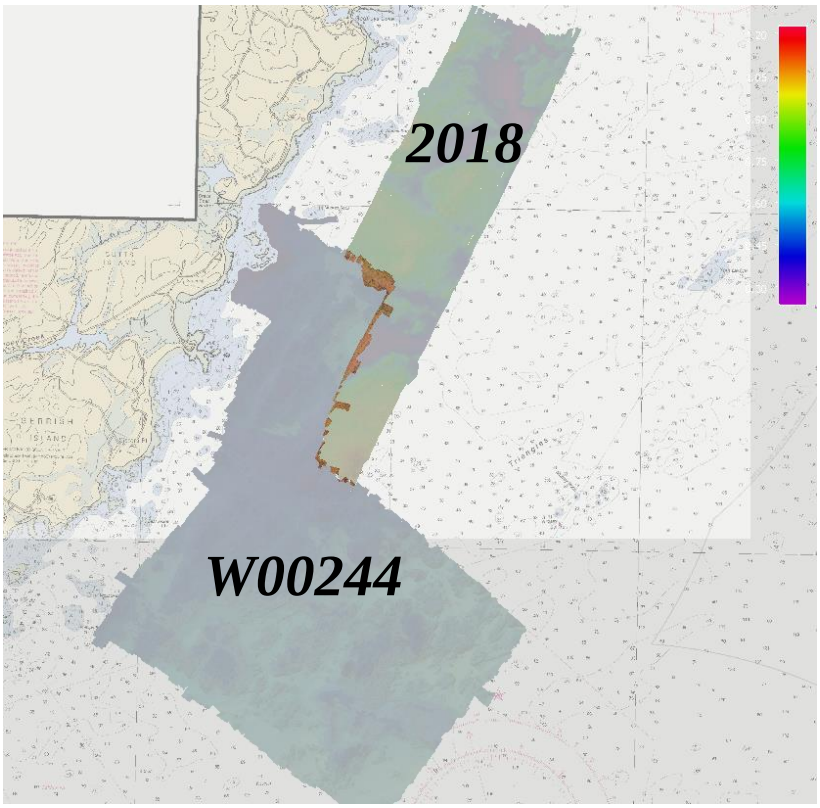


Figure 9: 2018 Gulf of Maine survey and W00244 comparison.

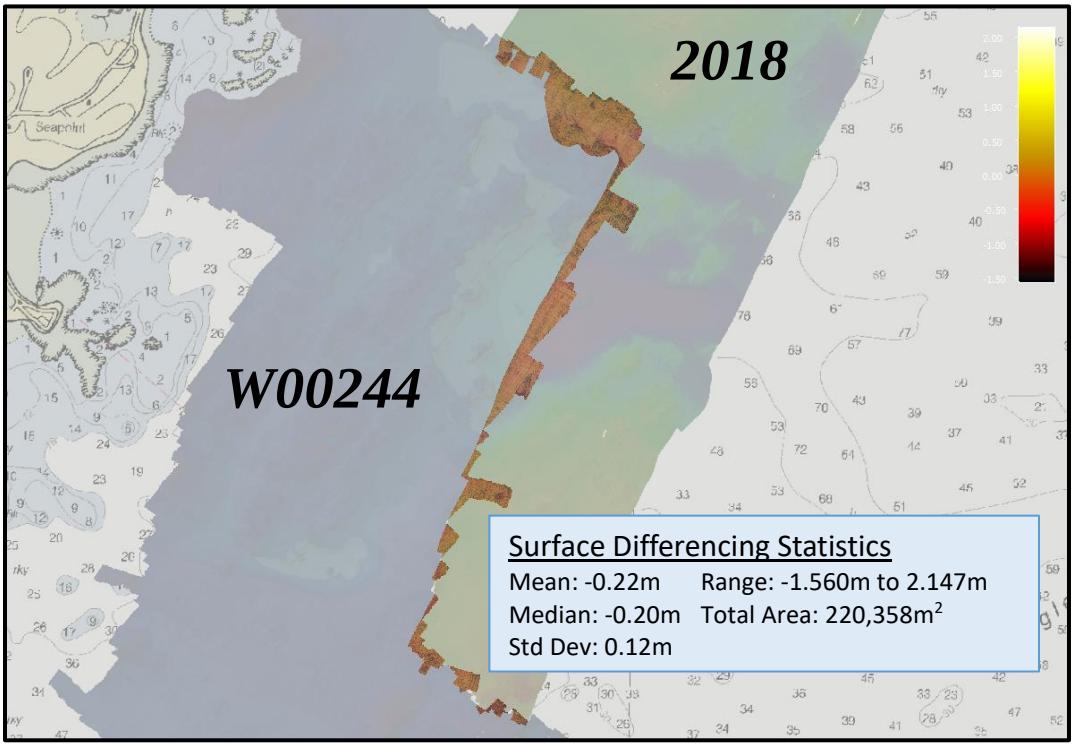


Figure 10: W00244 comparison results, southwestern notch of 2018 survey.

The average difference between the Gulf of Maine survey and W00244, Summer Hydro 2012, is -0.22m with a standard deviation of 0.12m. The largest differences observed were found in the rockier areas of W00244 and along the edges of swaths.

UNH CCOM Survey SH2017 Comparison

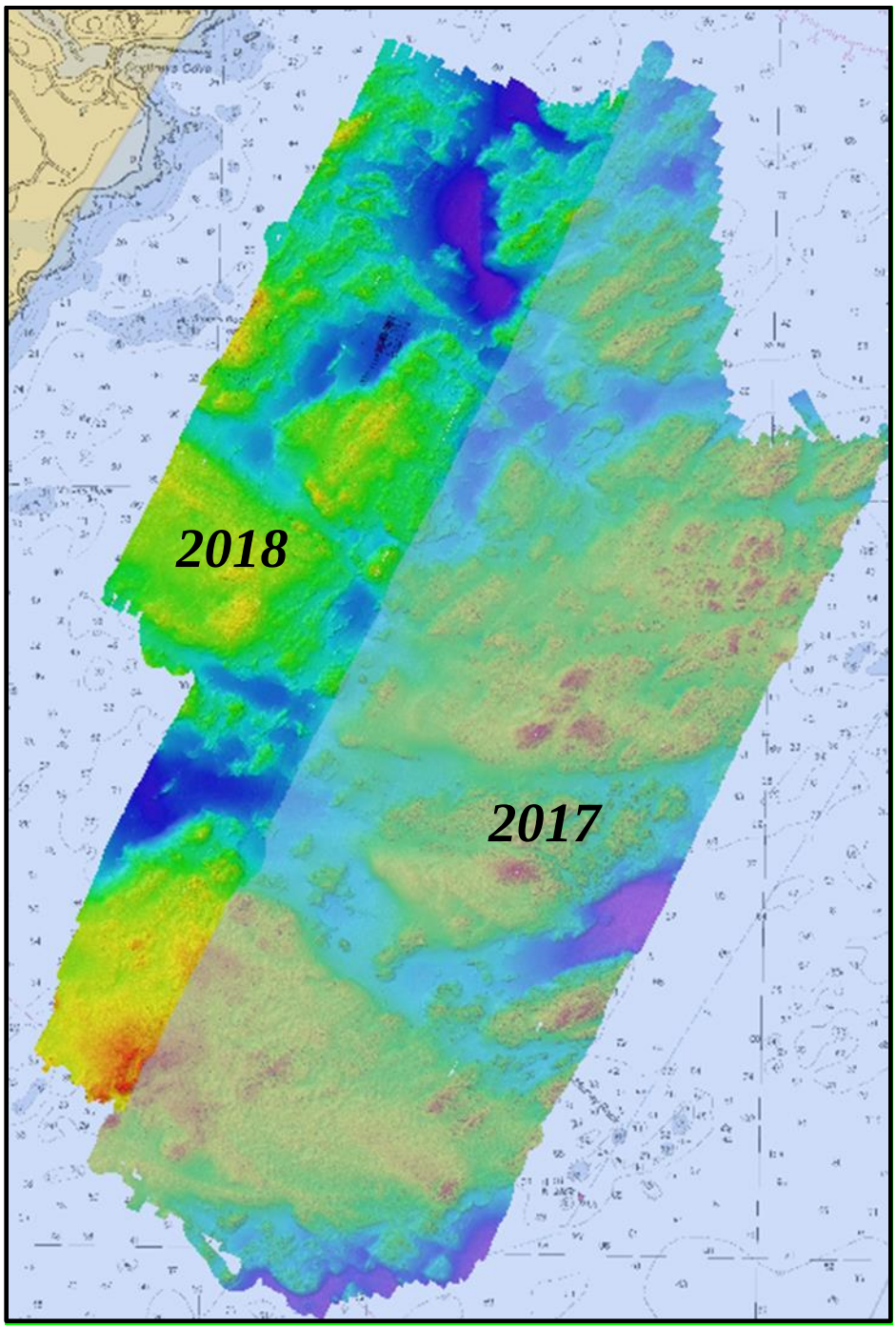


Figure 11: 2018 Gulf of Maine Survey and CCOM SH2017 survey.

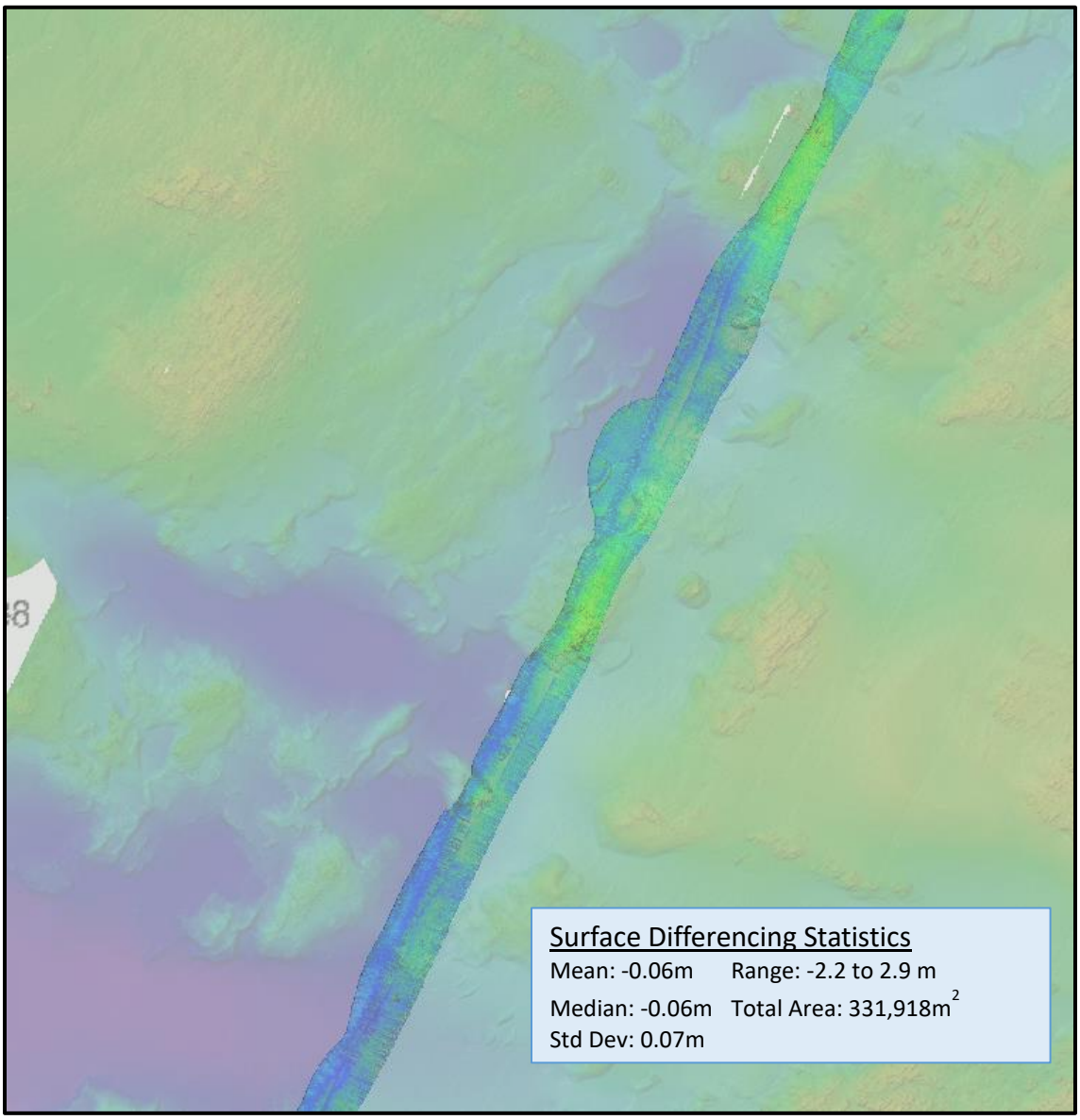


Figure 12: SH2017 comparison results zoom of an overlap area.

The SH2018 survey data acquired were deeper than the SH2017 by an average of 0.06m, with a standard deviation of 0.07m, along the length of the survey junction. The outer beams on the lines of the SH2018 data that overlap SH2017 are bit noisy. These noisy beams can be seen as areas of larger difference between the 2017 surface.

USACE 2010 Lidar

The USACE 2010 lidar just barely intersects with the 2018 survey as the lidar is reaching its maximum extinction depths for the conditions of the survey at that time. Only some small patches of returns overlap, but areas of overlap mean difference is within acceptable uncertainty levels. The SH2018 survey was deeper than the USACE 2010 lidar survey by an mean of 0.27m, with a standard deviation of 0.21m. The 2m lidar MLLW surface was compared to the 1m 2018 multibeam surface.

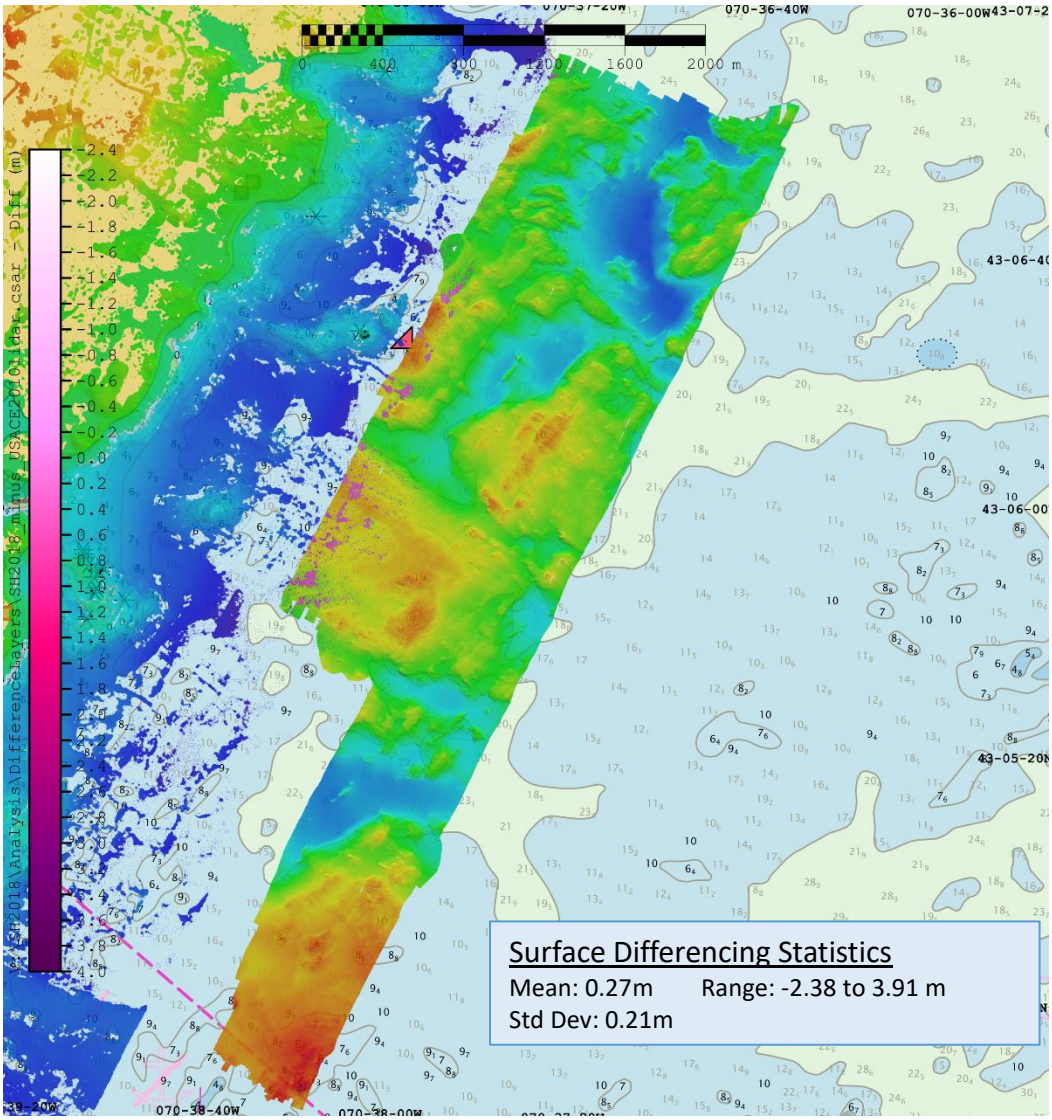


Figure 13: SH2018 overlap with USACE 2010 2m lidar

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

On Friday, June 29, 2018 (DN 180), the towfish body of the AML MVP30 snagged on the line between a lobster pot and its surface float. This resulted in the breaking of the cable and the loss of the towbody. It was recovered by divers on DN 183 but remained unusable for the rest of the class acquisition. The final day of acquisition utilized a manually deployed Odom Digibar CTD for sound speed profiles of surveyed regions.

No additional conditions or deficiencies affected equipment operational effectiveness.

B.2.6 Factors Affecting Soundings

Deployed Fishing / Lobster Gear

The majority of the survey area contained deployed lobster pots and buoys, which were visible from the RVGS. After data processing in Qimera it was not possible to distinguish active lobster traps on the seabed from derelict traps, other obstructions, or rocks.

Therefore, some temporary fishing gear may be reflected in the final dataset. These features may resemble small obstructions and meet the technical definition based on size alone, however, should not be designated as such (ref. HSSD 5.2.1.2 and FPM 4.2.6.1).

B.2.7 Sound Speed Methods

Until approximately 1141 DST on DN 180, when the towbody was lost, sound speed casts were taken with the MVP30 approximately every 10 minutes, or more frequently if regional features indicated the possibility of a distinctive water mass (for instance, off-shore of river mouths, and around bathymetric canyons.

During data acquisition, the most recent MVP SSP prior to the start of the line was used. All sound speed casts were retained, but no changes were made to the sound speed profiles used for processing due to the frequency of casts which were loaded during acquisition.

B.2.8 Coverage Equipment and Methods

A density analysis was calculated using a simple MATLAB script created by Semme Dijkstra to total the number of soundings. There were a total of 121,515,456 soundings over the 5.3 km^2 survey area, resulting in an average sounding density of nearly 23 soundings per square meter. This sounding density number is skewed slightly larger than average due to the inclusion of several – but not all – of the extra lines run over the towfish search area near Stones Rock, in order to cover small holidays in the original acquisition data (see Fig. 14 where bright green is 71.5 nodes per cell or greater).

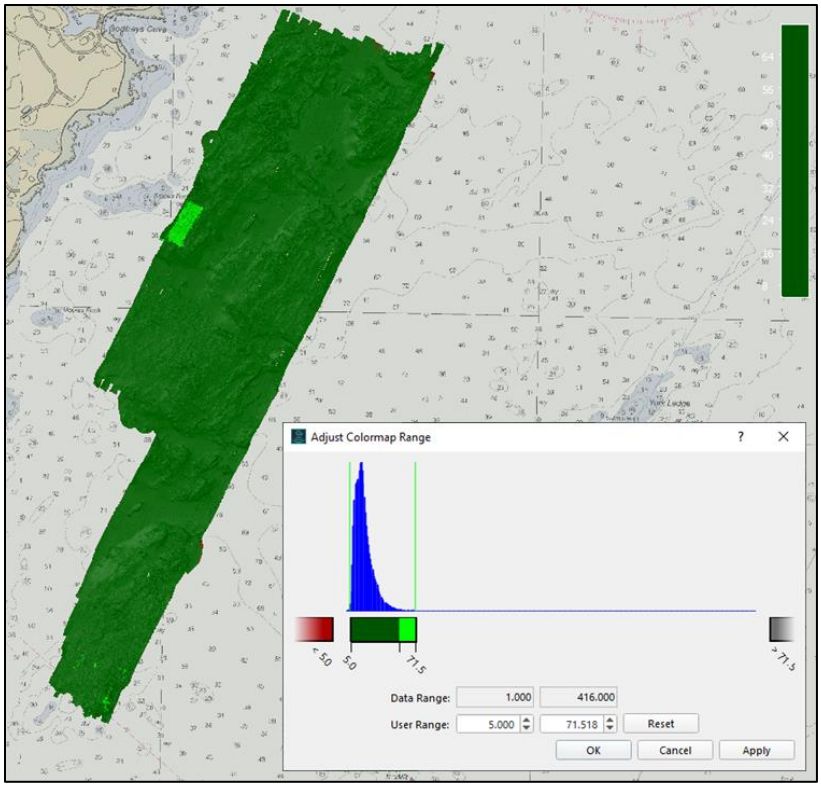


Figure 14: 2018 Gulf of Maine survey sounding density for 1m surface where green is greater than 5 soundings per cell, red is 5 or less.

B.2.9 Holidays

Holidays were addressed on DN 176, 180, and 184. Additional holidays were unable to be addressed due to time constraints associated with the class and unforeseen issues trumping data acquisition. QC tools was used to identify holidays that qualify under NOAA's HSSD. A total of 12 holidays were found. The largest holiday is roughly 150m^2 and could be due to lobster pot avoidance. Acoustic shadowing and lobster pot avoidance were an issue in this area.

Feature ID	Latitude	Longitude
4U 0000000001 00001	43.097035N	070.623161W
4U 0000010002 00001	43.082318N	070.634787W
4U 0000020003 00001	43.096371N	070.623610W
4U 0000030004 00001	43.102769N	070.619478W
4U 0000040005 00001	43.103286N	070.619185W
4U 0000050006 00001	43.110951N	070.629858W
4U 0000060007 00001	43.103667N	070.622820W
4U 0000070008 00001	43.118258N	070.620649W
4U 0000080009 00001	43.106262N	070.625838W
4U 0000090010 00001	43.116383N	070.624631W
4U 0000100011 00001	43.109198N	070.623913W
4U 0000110012 00001	43.100984N	070.634141W

Table 8: Holidays

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 Qinsy using R2Sonic multibeam echosounder “snippets”, and processed using QPS FMGeocoder Toolbox V7.7.9. Further details on backscatter acquisition and processing are including in the submitted Backscatter Report.

The GSF files containing the extracted backscatter are submitted in the Backscatter folder.. The processed mosaic is also saved as a tiff and submitted.

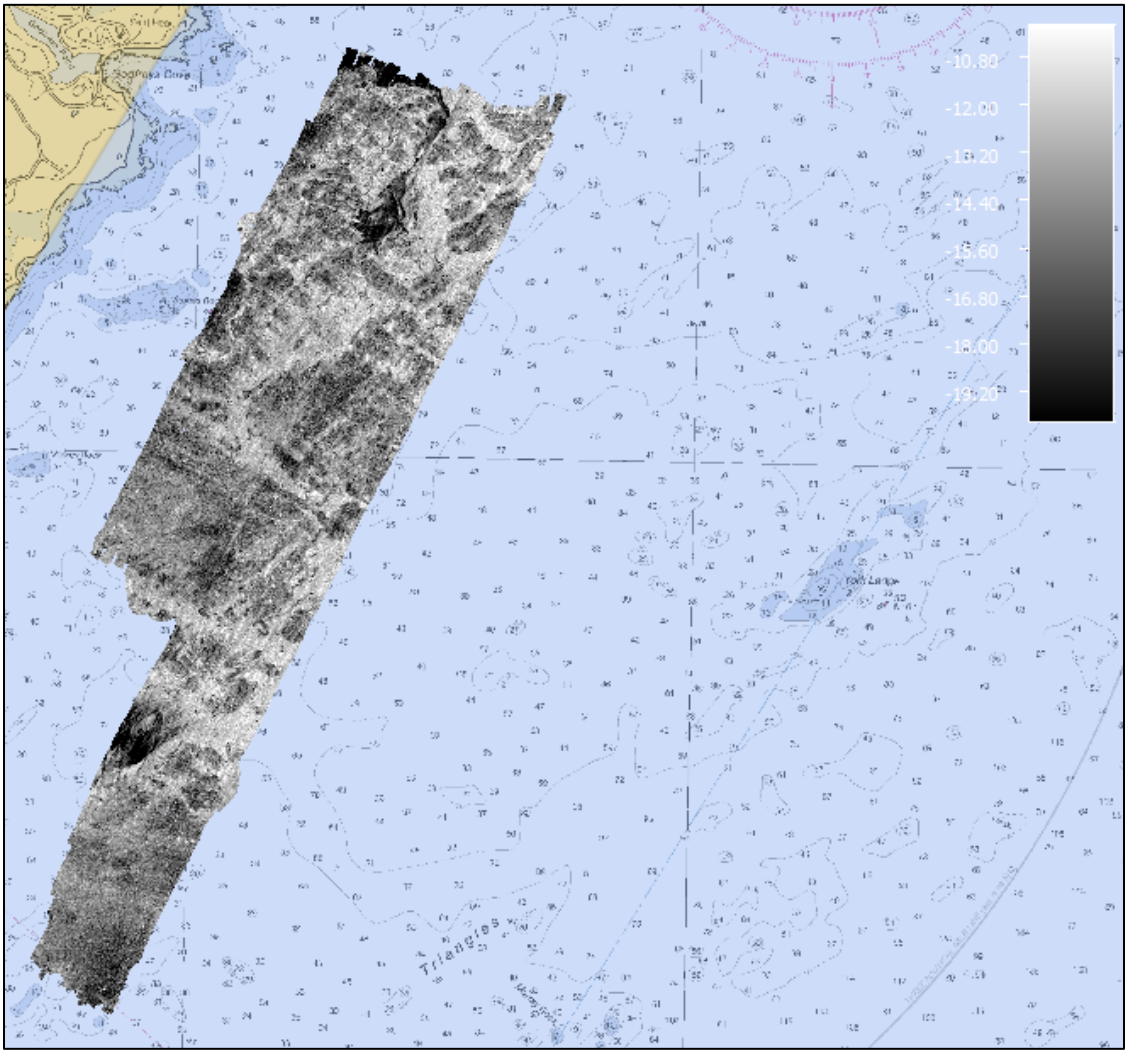


Figure 15: 2m Backscatter Mosaic overlain on chart

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the initial setup for the project as described in the DAPR.

B.5.2 Surfaces

A 1m CUBE surface was created in the submitted project. Additional surfaces such as density .tif are submitted within the 'FinalSurfaces' folder.

Surface Name	Surface Type	Data Format	Resolution (m)	Vertical Datum	Horizontal Projection
Mainscheme					
SH2018_ Backscatter_2mMosaic.tif	mosaic	.tif	2	N/A	WGS84 UTM 19N
SH2018_Backscatter_1m.tiff	mosaic	.tif	1	N/A	WGS84 UTM 19N
SH2018_1m_CUBE_MLLW_WGS84_UTM19N	CUBE	.bag	1	MLLW	WGS84 UTM 19N
DS_20180711_Mainscheme_1m_CUBE	CUBE	Dynamic surface	1	MLLW	WGS84 UTM 19N
Crosslines					
SH2018_crosslines_1m_MLLW_WGS84_UTM19N	CUBE	.bag	1	MLLW	WGS84 UTM 19N
DS_20180711_Crosslines_1m_CUBE	CUBE	Dynamic surface	1	MLLW	WGS84 UTM 19N

Table 9: Submitted Final Surfaces

B.5.3 Designated Soundings

There were no designated soundings in this survey.

B.5.4 Survey Area

Data acquired during this course, which was outside of the survey area such as the Patch Test regions and Transit Lines are excluded from this analysis and submission. While individual lines were rejected due to errors during acquisition, no data was otherwise rejected in the area surveyed.

C. Vertical and Horizontal Control

The final products of this survey are referenced to MLLW for a vertical datum, and uses a horizontal projection of WGS-84 UTM Zone 19N. Horizontal and vertical field controls were established using a Trimble RTK base station/rover pair. More information can be found in the DAPR and HVCR.

C.1 Vertical Control

Since this survey is referenced to the ellipsoid, the vertical motion of the RVGS is accurately recorded using the RTK GNSS system. The corrections were provided via a base station located at the seacoast science center at Fort Point, NH. This method accounts for the settlement and squat of the vessel, so these values were not measured.

Data was acquired with respect to the ellipsoid WGS-84 datum and transformed to MLLW using a static offset computed using VDatum. A vertical offset of -29.208 m was applied to the acquired data in Qimera. This offset was calculated using NOAA's online VDatum program, with a source year of 2016 and a target year of 2018 (see Figure 16, below). Since the survey fell within one tide zone, NA169, the offset did not vary significantly within the region. More information can be found in the DAPR and HVCR submitted with these data.

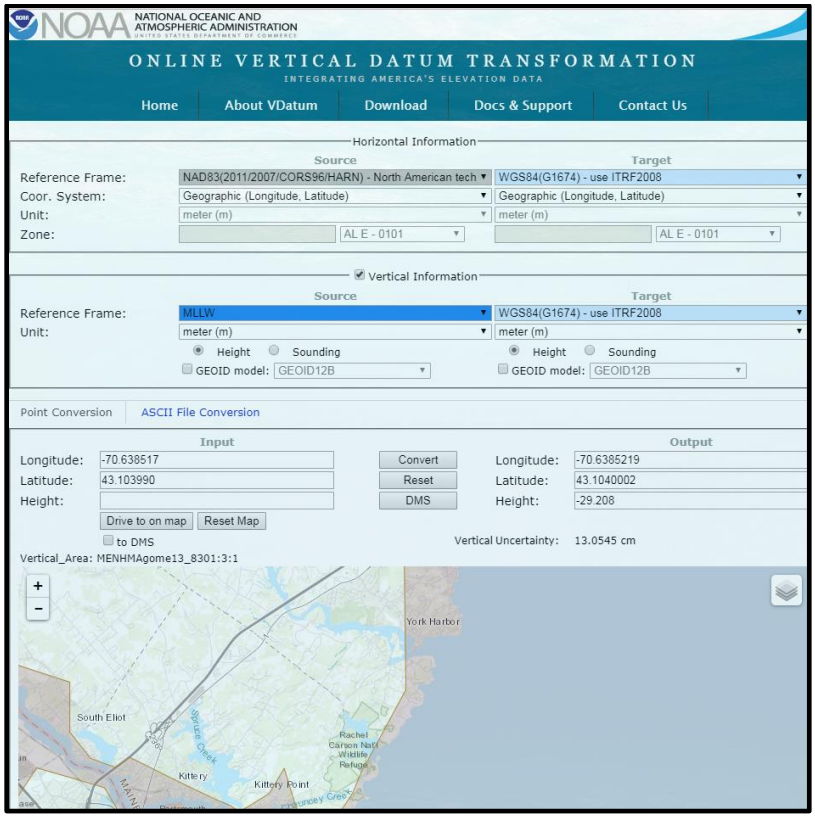


Figure 16: Vertical offset as calculated from VDatum online (2016 to 2018).

C.2 Horizontal Control

A Trimble RTK base station/rover pair was utilized for positioning corrections for the entirety of the survey. Corrections were broadcast from the Seacoast Science Center in Rye, NH.

POSPac MMS 8.0 was used to post-process horizontal position and attitude for all data. SBETs were generated and applied to all files. However, this data was applied to the acquired multibeam data due to unresolved issues from resulting artifacts.

More information can be found in the DAPR and HVCR submitted with these data.

D. Results and Recommendations

D.1 Chart Comparisons

D.1.1 Raster Chart Comparisons

No formal raster chart comparisons were made for this survey.

RNC	Title	Scale	Edition	Print Date
13278	PORTSMOUTH TO CAPE ANN; HAMPTON HARBOR	1:80000	28	08/01/2013
13286	CAPE ELIZABETH TO PORTSMOUTH; CAPE PORPOISE HARBOR; WELLS HARBOR; KENNEBUNK RIVER; PERKINS COVE	1:80000	32	12/01/2013
13260	BAY OF FUNDY TO CAPE COD	1:378838	42	02/01/2017
13274	PORTSMOUTH HARBOR TO BOSTON HARBOR; MERRIMACK RIVER EXTENSION	1:40000	29	07/01/2016
13283	PORTSMOUTH HARBOR CAPE NEDDICK HARBOR TO ISLES OF SHOALS; PORTSMOUTH HARBOR	1:20000	23	12/01/2014

Table 10: Available RNCs in the Survey Area

D.1.2 Electronic Navigational Chart Comparisons

The acquisition region was compared to a TIN created of the Electronic Navigation Chart US5NH02M, which is the largest scale ENC affected by the survey area (see Table 11). US5NH02M covers Portsmouth Harbor Cape Neddick Harbor to Isles of Shoals: Portsmouth Harbor. It is a Harbor Chart with the scale of 1:20,000. The TIN was created in Caris using guidance adapted by Semme Dijkstra from a document "ENC Quick Chart Comparison Guide," created by Cassie Bongionvanni.

Chart Name	Chart Scale	Edition	Edition Date
ENC US5NH02M	1:20,000	26	06/13/2018

Table 7: Largest scale electronic navigational charts (ENC) affected by the survey area

The following table summarizes the ENCs covering the survey area. Only the largest scale chart mentioned above was used for comparison.

ENC	Title	RNC	Scale	Edition	Update Application Date	Preliminary?
U5NH02M	Portsmouth Harbor Cape Neddick Harbor to Isles of Shoals; Portsmouth Harbor	13283	1:20000	21.0	03/10/2017	No
US4ME01M	Cape Elizabeth to Portsmouth	13286	1:80000	14.0	06/05/2017	No
US3EC10M	Bay of Fundy to Cape Cod	13260	1:378838	37.8	06/17/2016	No
US2EC04M	West Quoddy Head to New York	13006	1:675000	21.10	06/3/2016	No

Table 11: Available ENCs in the area.

The TIN was used to create a 1m surface in Qimera, which was then compared to the SH2018 1m CUBE surface (see Fig. 14).

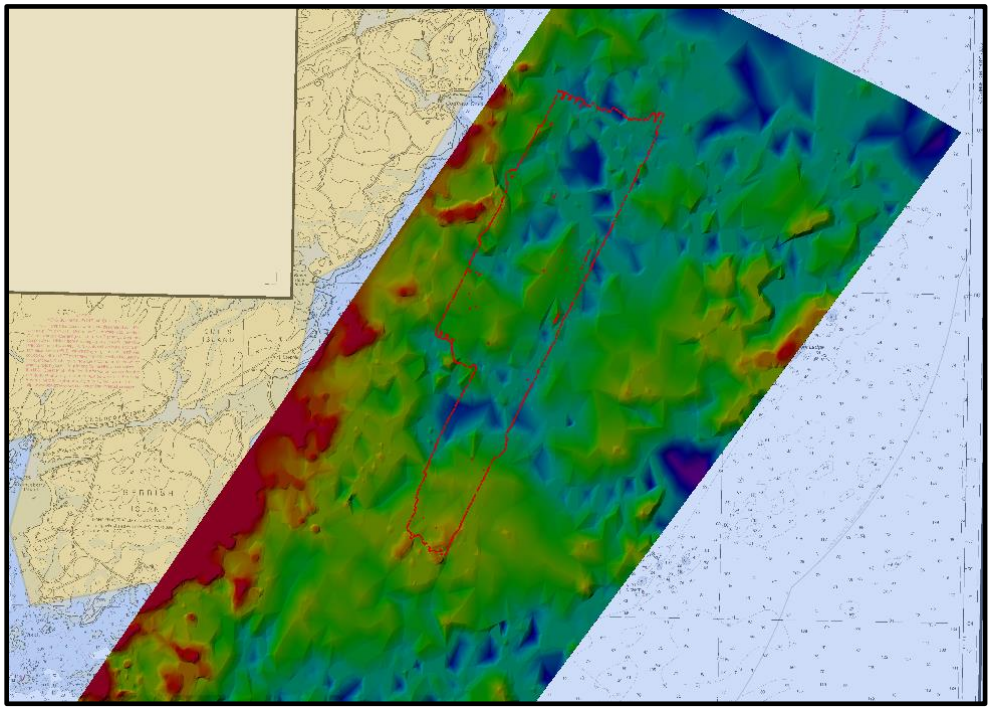


Figure 17: 2018 Gulf of Maine survey area outline overlain on TIN of ENC US5NH02M.

Using the ENC TIN surface as the standard surface and SH2018 1m CUBE surface as the new surface, surface differencing in Qimera resulted in differences ranging from -8.4m to positive 5.0m (see Fig. 15, below). Positive values mean that the SH2018 data are shallower than the historic data; negative values indicate the area is deeper than the ENC's soundings.

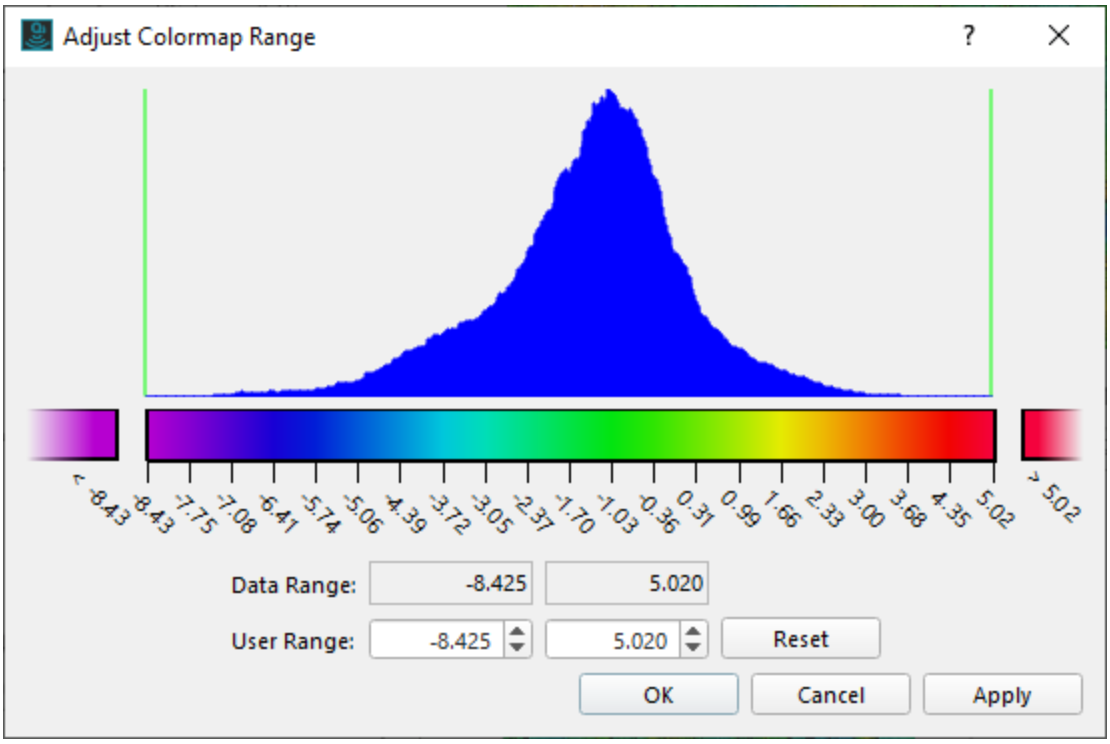


Figure 18: ENC and 2018 Gulf of Maine survey range of surface differences

In Figure 19 below, the red regions indicate areas where SH2018 data are shoaler to the ENC data, at differences of greater than 2m. The blue and purple regions are areas where the SH2018 data are deeper than the historic data, at values of up to 8.4m in difference. The difference between the two surfaces results has a mean value of SH2018 depths at 1.4m deeper than the ENC data, with a standard deviation of 1.55m.

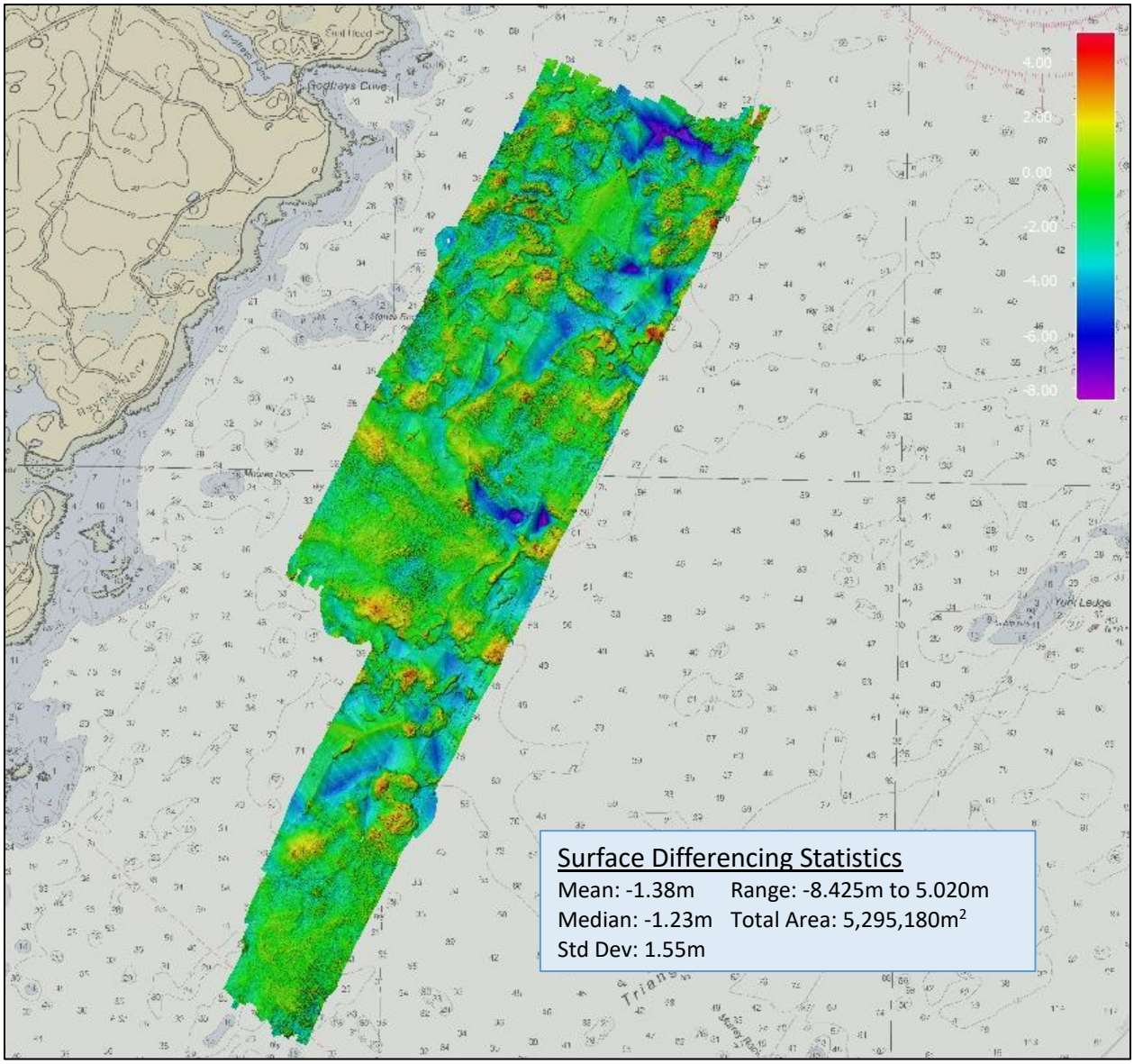


Figure 19: Surface difference between 1m TIN of ENC US5NH02M and 1m CUBE surface from 2018 Gulf of Maine survey.

The greatest differences between the surfaces are found in the deeper sections of the seabed, where new multibeam data indicate greater depths than the historic data. Shoaler multibeam data than charted depths are found along ridge lines and irregular areas of dynamic bathymetry.

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

There are no charted features for this survey.

D.1.6 Uncharted Features

There are no uncharted features for this survey.

D.1.7 Dangers to Navigation

A Danger to Navigation Report was submitted with this survey.

D.1.8 Shoal and Hazardous Features

No shoals or hazardous features were observed in these data.

D.1.9 Channels

No channels exist in 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

Twelve bottom sampling sites were visited utilizing the RVGS on DN190. Sample locations were chosen from backscatter and bathymetric surfaces acquired in the main survey area (see Fig. 17 for sample locations). Video coverage was obtained at every location. Bottom samples using a Shipek grab sampler were attempted at every site, with samples obtained at 10 of the 12 sites.

Details can be found in the DAPR and in the Bottom Sample Report submitted with this survey. The Bottom Sample Report includes photos, S-57 NATSUR/NATQUA encodings and full descriptions.

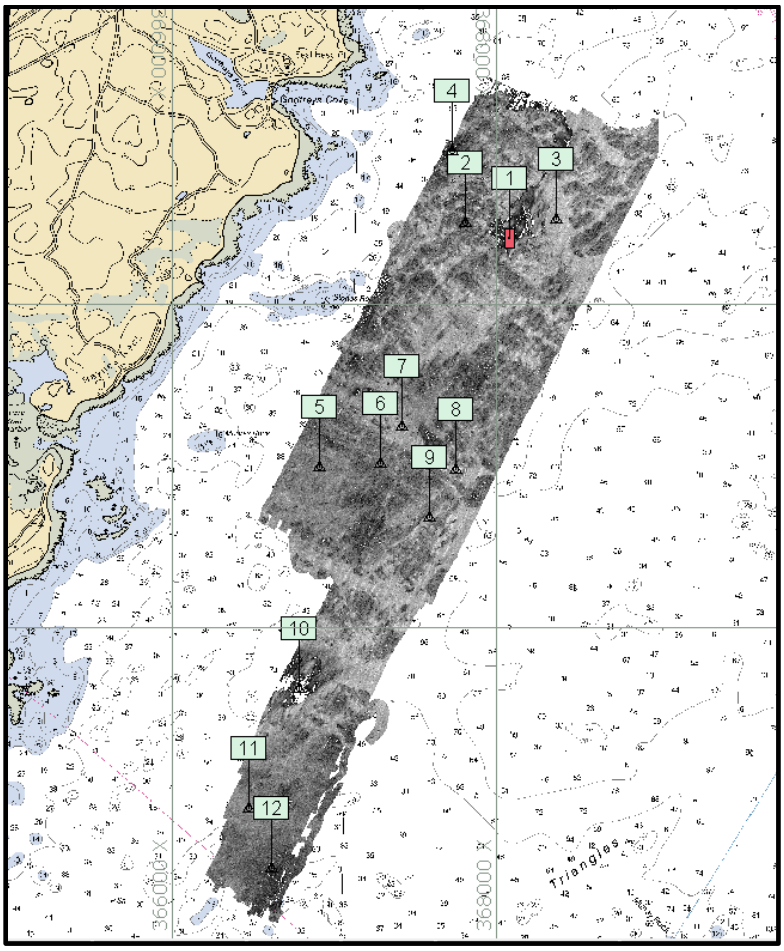


Figure 20: Bottom sampling locations overlaid on backscatter mosaic.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not investigated due to time constraints.

D.2.2 Prior Surveys

See junctioning survey section for more information.

D.2.3 Aids to Navigation

Aids to Navigation (ATONs) within the surveyed limits were visually confirmed to be on station and serving intended purposes.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Submarine features were investigated and attributed in the sheet's final feature file if deemed significant.

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

Survey recommendations subsequent to this survey include a continuation of the survey priorities from the Summer Hydrographic Field course in 2017 and 2018. This includes regions inshore of the 2018 survey area, and shoalar regions east of the 2017 region, around York Ledge and Murray Rock. Additionally, coverage of 2018 survey holidays is desirable but not required.

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 Survey Summary Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

F. Table of Acronyms

AML	Applied Microsystems, Ltd
BAG	Bathymetric Attributed Grid
CCOM	Center for Coastal and Ocean Mapping
CO-OPS	Center for Operational Oceanographic Products and Services
CUBE	Combined Uncertainty and Bathymetry Estimator
DGPS	Differential Global Positioning System
DN	Day Number
DTON	Danger to Navigation
EDT	Eastern Daylight Time
ENC	Electronic Navigation Chart
FPM	Field Procedures Manual
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSSD	Hydrographic Surveys Specifications and Deliverables

HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IHO S-44	IHO Standards for Hydrographic Surveys, Special Publications No. 44
IMU	Inertial Motion Unit
JHC	Joint Hydrographic Center
MLLW	Mean Lower-Low Water
NAD83	North American Datum of 1983
NGDC	National Geophysical Data Center
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
POS MV	Position and Orientation System for Marine Vessels
R/V	Research Vessel
RVGS	R/V *Gulf Surveyor*
SSP	Sound Speed Profile
TPU	Total Propagated Uncertainty
THU	Total Horizontal Uncertainty
TVU	Total Vertical Uncertainty
UNH	University of New Hampshire

APPROVAL PAGE

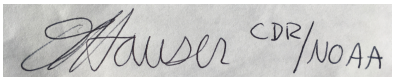
W00506

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

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Collection of backscatter mosaics
- Processed survey data and records
- Bottom Samples
- GeoPDF of survey product

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



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Approved:_____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch