H13573

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13573

LOCALITY

State(s):	Northern Mariana Islands
General Locality:	Western Pacific Ocean
Sub-locality:	Tinian and Aguijan Islands

2022

CHIEF OF PARTY
Héctor L. Casanova CAPT/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13573**

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):	**Northern Mariana Islands**
General Locality:	**Western Pacific Ocean**
Sub-Locality:	**Tinian and Aguijan Islands**
Scale:	**10000**
Dates of Survey:	**04/17/2022 to 08/23/2022**
Instructions Dated:	**01/06/2022**
Project Number:	**OPR-T381-RA-22**
Field Unit:	**NOAA Ship *Rainier***
Chief of Party:	**Héctor L. Casanova CAPT/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder 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 NAD83 MA11 UTM 55N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H13573

Project: OPR-T381-RA-22

Locality: Western Pacific Ocean

Sublocality: Tinian and Aguijan Islands

Scale: 1:10000

April 2022 - August 2022

NOAA Ship *Rainier*

Chief of Party: Héctor L. Casanova CAPT/NOAA

A. Area Surveyed

The survey is referred to as H13573, "Tinian and Aguijan Islands" (Sheet 3), within the Project Instructions. The surveyed area encompasses approximately 891 square nautical miles and is located in the northern Mariana Islands.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
15° 9' 45" N 145° 8' 35" E	14° 29' 45" N 145° 48' 39" E

Table 1: Survey Limits

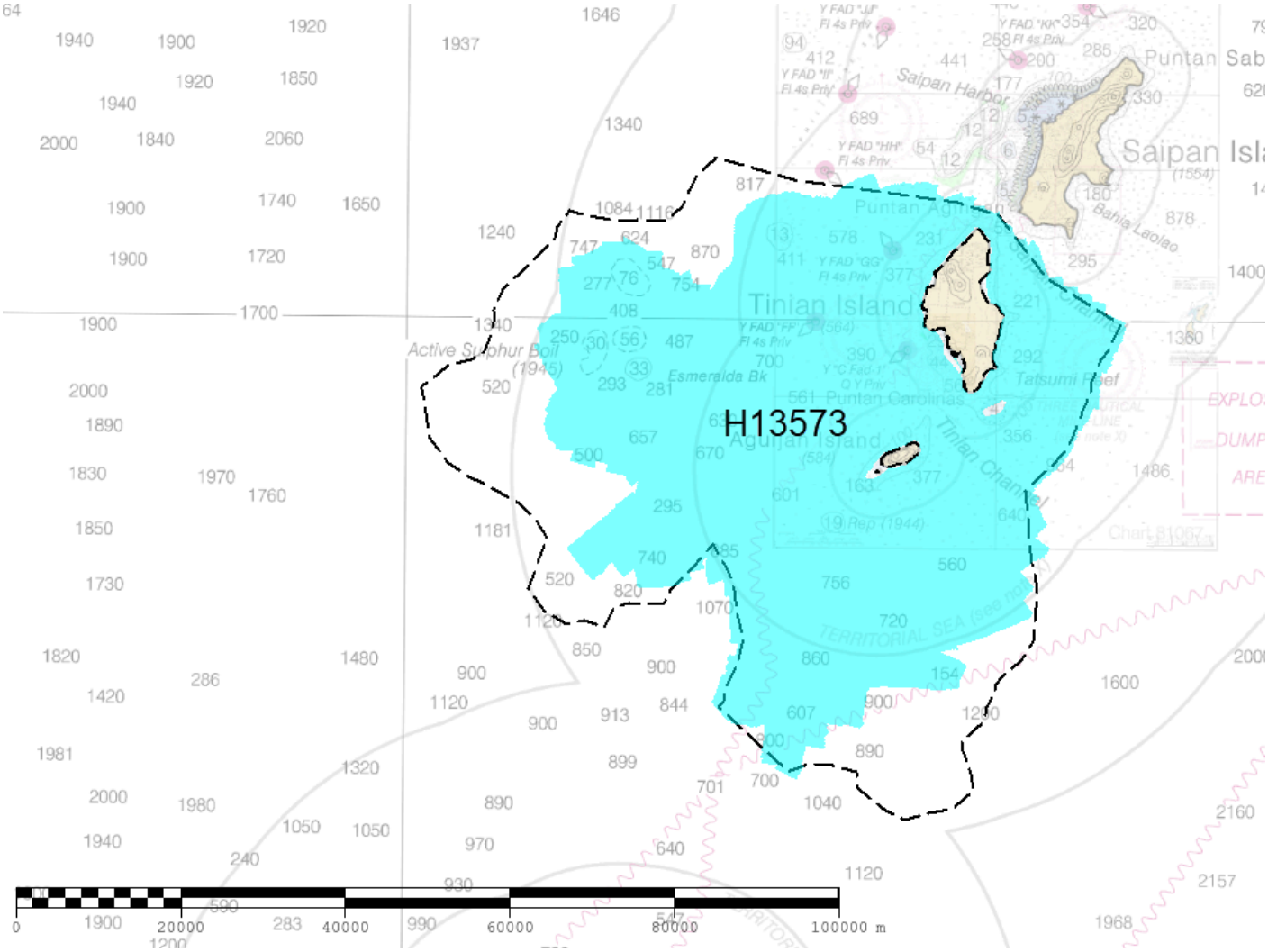


Figure 1: H13573 assigned survey area (Chart 81004).

Data were acquired within the assigned survey limits as required in the Project Instructions and HSSD unless otherwise denoted.

A.2 Survey Purpose

The ecosystem surrounding the U.S. Territory, the Commonwealth of the Northern Mariana Islands (CNMI), is experiencing stress imposed by climate change and other environmental factors. For this project, NOAA Ship RAINIER will be operating around CNMI to conduct an extensive hydrographic survey to map bathymetry and habitat around the islands, pinnacles, and reefs in support of nautical charting and habitat mapping.

With the collaboration and partnership of the National Centers for Coastal and Ocean Science (NCCOS), the National Coral Reef Monitoring Program (NCRMP), and the National Marine Fisheries Service (NMFS), this project will also study the health of coral reef systems, ocean chemistry, and fisheries habitat. This team has developed a strategy to map the waters from nearshore to depths greater than 1000 meters. Within the project area, the ship's crew will collect bathymetric data to update charts and backscatter data to characterize habitat, while visiting scientists from NCRMP will perform coral reef assessment dives and other oceanographic observations.

Data collected during this mission are pivotal to long-term biological and oceanographic monitoring of coral reef ecosystems around the CNMI. This 2022 expedition will add to information collected during monitoring and mapping surveys conducted in 2005, 2007, 2009, 2011, 2014 and 2017. Oceanographic and ecological time series data will allow scientists to evaluate potential changes in environmental conditions and coral reef health in the Mariana Archipelago. This will enable federal and state resource managers to more effectively conserve coral reef ecosystems of the CNMI, and manage ecosystem services. Data collected during this project also supports monitoring components of the NCRMP Coral Reef Ecosystem Integrated Observing System. This modern hydrographic survey will address gaps in the Seabed 2030 project, provide critical data to update National Ocean Service (NOS) nautical charting products, identify hazards, and improve maritime safety. Survey data from this project are intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Pydro QC Tools (v3.7.0) Grid QA was used to analyze H13573 multibeam echosounder (MBES) data density. The submitted H13573 finalized variable-resolution (VR) surface met HSSD density requirements as shown in the histogram below. Grid QA results determined that only 83% of H13573 nodes met full coverage resolution requirements as explained below.

For project OPR-T381-RA-22 Resolution Requirements graphs produced by Pydro’s Grid QA tool have been showing relatively low percentages of grid nodes meeting full coverage resolution requirements. The likely cause of this issue is RAINIER’s use of 64m grids in depths greater than 1000m to maintain a reasonable data density. Since the Grid QA tool was written to match the HSSD specifications with a maximum 32m grid in all waters greater than 640m, RAINIER grids created using the 64m increase in resolution will always fail the resolution requirements check in areas exceeding 1000m. This will of course decrease the percentage of grid nodes meeting coverage resolution requirements. For surveys with a large percentage of area greater than 1000m in depth, this reduction can be significant. The OCS QC Tools team has been made aware of this issue and are trying to work out a solution for this deviation from the specifications. See the Supplemental Records of the sheet submission for more information.

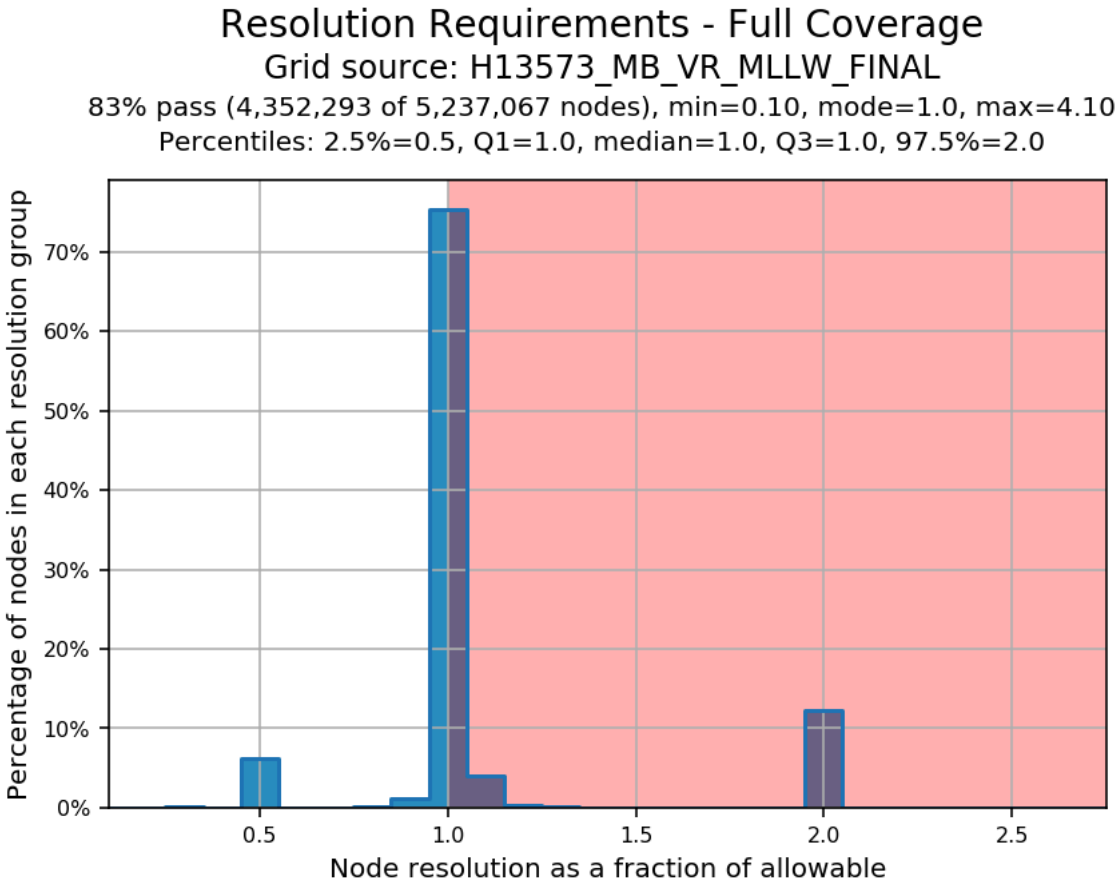


Figure 2: Pydro Grid QA derived histogram plot showing HSSD resolution requirements of H13573 finalized variable-resolution MBES data.

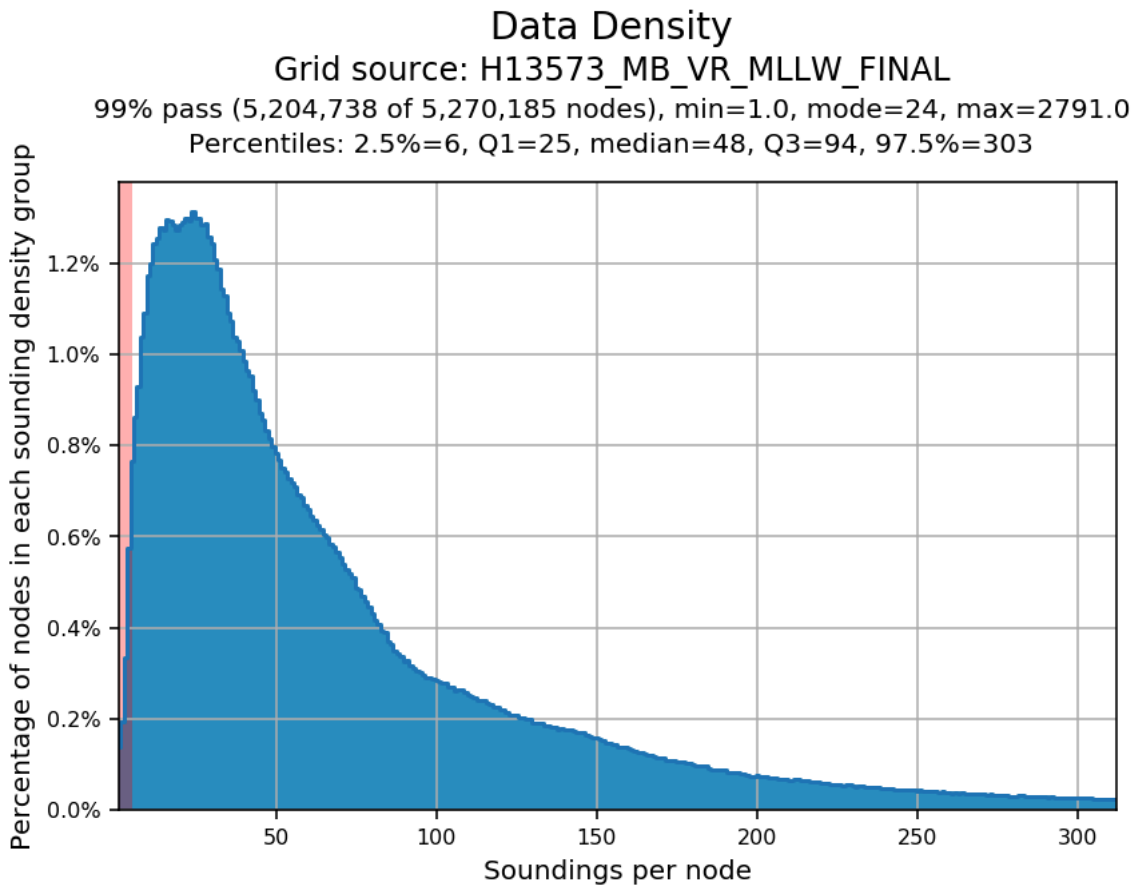


Figure 3: Pydro derived histogram plot showing HSSD density compliance of H13573 finalized variable-resolution MBES data.

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

The entire extent of the assigned sheet limits was not surveyed for H13573. Multibeam echosounder coverage was acquired to the inshore limit of hydrography, the Navigable Area Limit Line (NALL), within a majority of the sheet limits. The NALL is defined as the most seaward of the following: the surveyed 3.5 meter depth contour, the line defined by the distance seaward from the observed MHW line which is equivalent to the 0.8 millimeters at chart scale (the assigned sheet limits closely reflect this), or the inshore limit of safe navigation. For H13573, per the Project Instructions, the inshore limit of safe navigation was defined as 10 meters water depth or the inshore limit of the PRF polygon. LIDAR data was also provided

for this project and a nearshore line was established where the LIDAR was sufficient for charting and further MBES data collection was not required inshore of that line. Furthermore, per correspondence with the Project Manager, it was determined that NOAA Ship RAINIER would only acquire data to 1500 meters. Due to limitations of the ship sonar it was decided that the quality and density of data deeper than 1500 meters was substandard. Please see Supplemental Records and the Project Instructions provided with this report for more information. The figures included below illustrate the areas in which MBES data was collected.

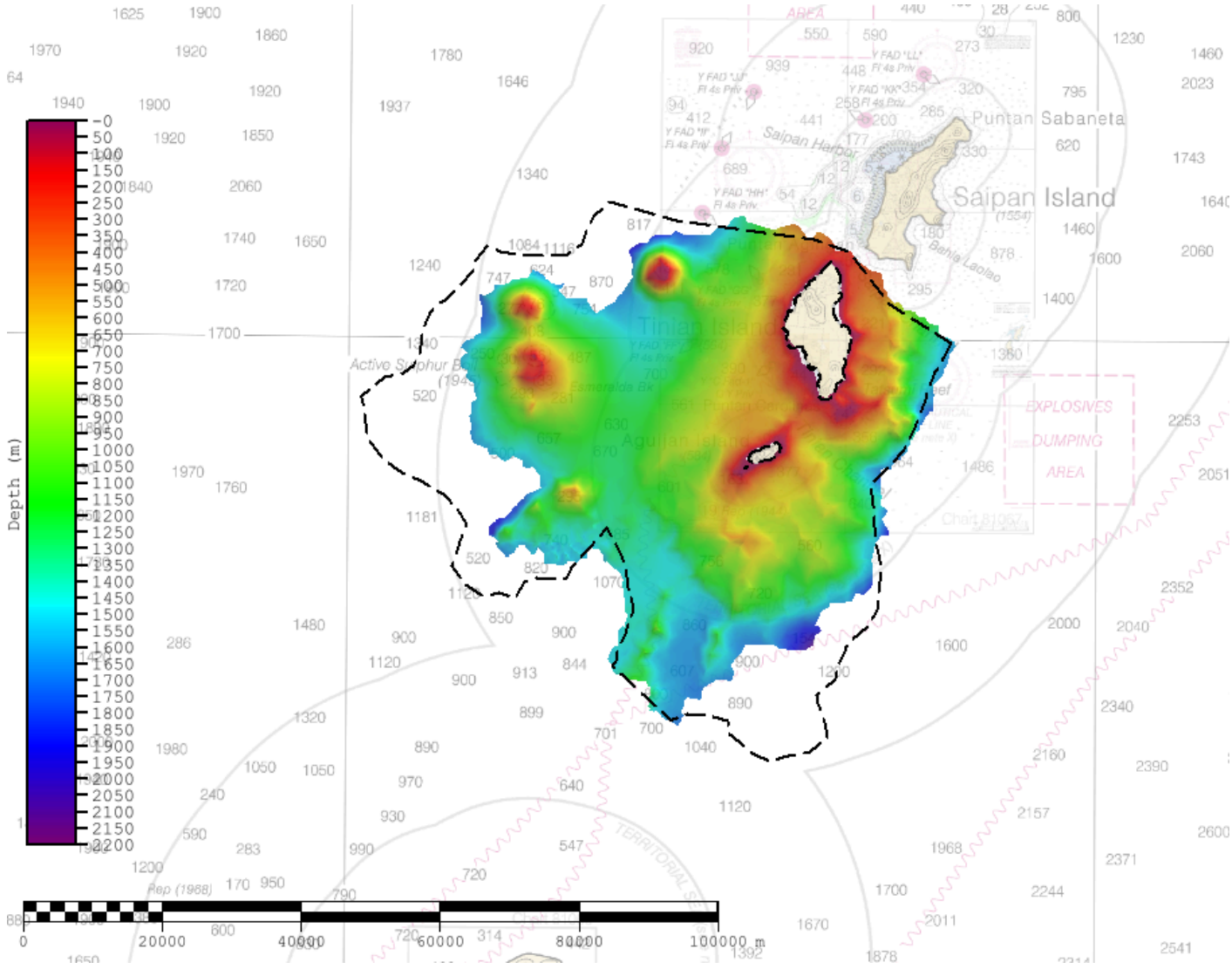


Figure 4: H13573 MBES coverage and assigned survey limits for Tinian and Aguijan Island.

A.6 Survey Statistics

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

	HULL ID	*S221*	*2803*	*2804*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0
	MBES Mainscheme	1175.23	88.61	26.92	1290.77
	Lidar Mainscheme	0.0	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/MBES Crosslines	85.99	0.0	5.38	91.37
	Lidar Crosslines	0.0	0.0	0.0	0.0
Number of Bottom Samples					0
Number Maritime Boundary Points Investigated					0
Number of DPs					3
Number of Items Investigated by Dive Ops					0
Total SNM					891.13

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
04/17/2022	107
04/18/2022	108
04/19/2022	109
04/23/2022	113
04/26/2022	116
04/27/2022	117
04/28/2022	118
05/13/2022	133
05/14/2022	134
05/27/2022	147
06/15/2022	166
07/11/2022	192
07/12/2022	193
07/13/2022	194
08/17/2022	229
08/18/2022	230
08/23/2022	235

Table 4: Dates of Hydrography

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***	***2803***	***2804***
LOA	70.4 meters	8.8 meters	8.8 meters
Draft	4.7 meters	1.1 meters	1.1 meters

Table 5: Vessels Used

Figure 5: NOAA Ship RAINIER.

Figure 6: NOAA Ship RAINIER survey launch 2803.

All data for survey H13573 was acquired by NOAA Ship RAINIER and launches 2803 and 2804. The vessels acquired MBES bathymetry, backscatter, and sound velocity profiles.

B.1.2 Equipment

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

Manufacturer	Model	Type
Applanix	POS MV 320 v5	Positioning and Attitude System
Kongsberg Maritime	EM 710	MBES
Kongsberg Maritime	EM 2040	MBES
ODIM Brooke Ocean	MVP200	Sound Speed System
Sea-Bird Scientific	SBE 19plus	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Lockheed Martin Sippican	Deep Blue XBT	Sound Speed System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

NOAA Ship RAINIER and launches collected 91.37 nautical miles of multibeam crosslines, approximately 7 percent, across a range of depths in the mainscheme data. The Compare Grids function in Pydro Explorer was used to analyze the finalized VR surfaces of H13573 mainscheme only and crossline only data. Pydro determined that 99.5 percent of nodes met allowable uncertainties. For additional results, see plots below.

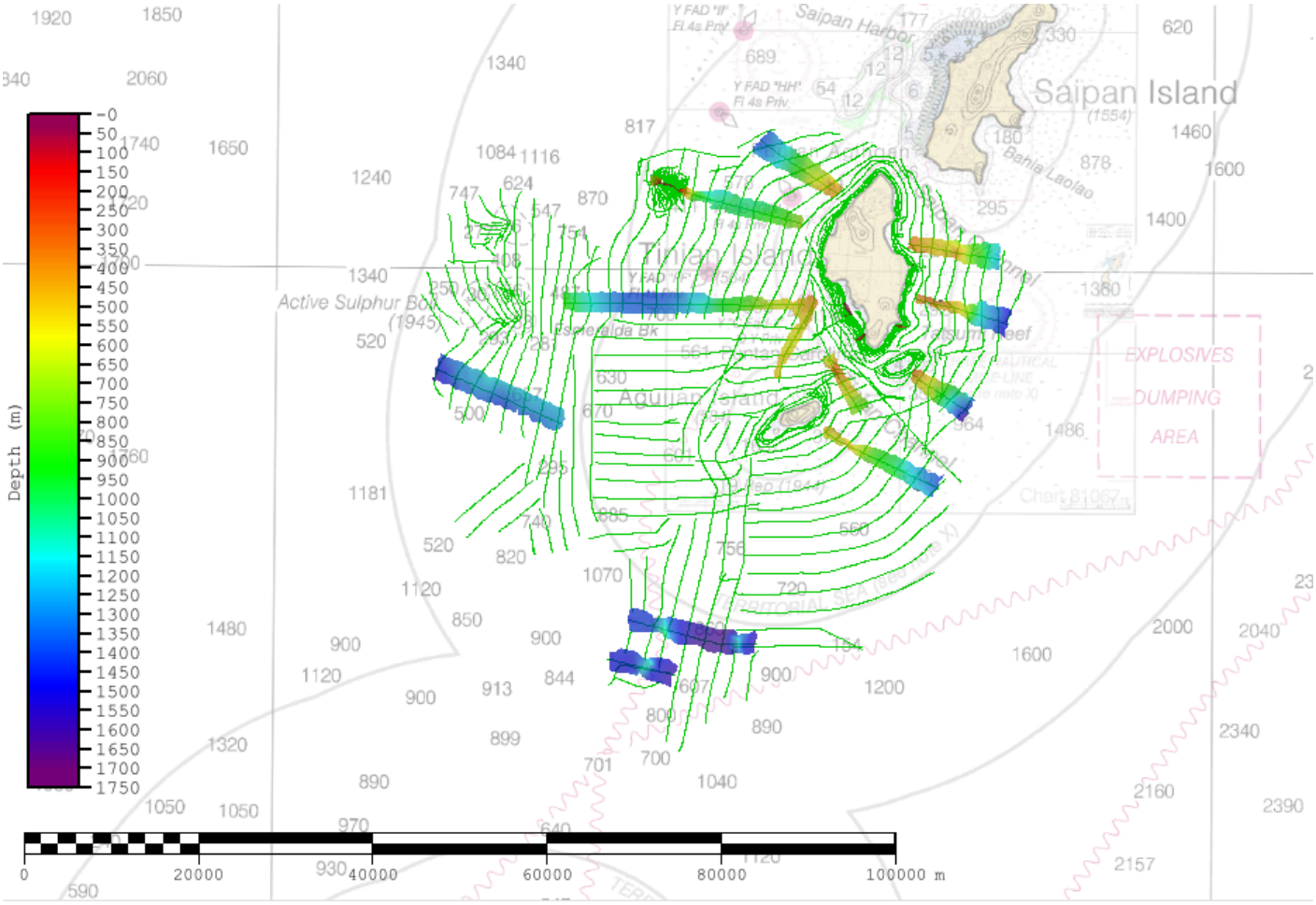
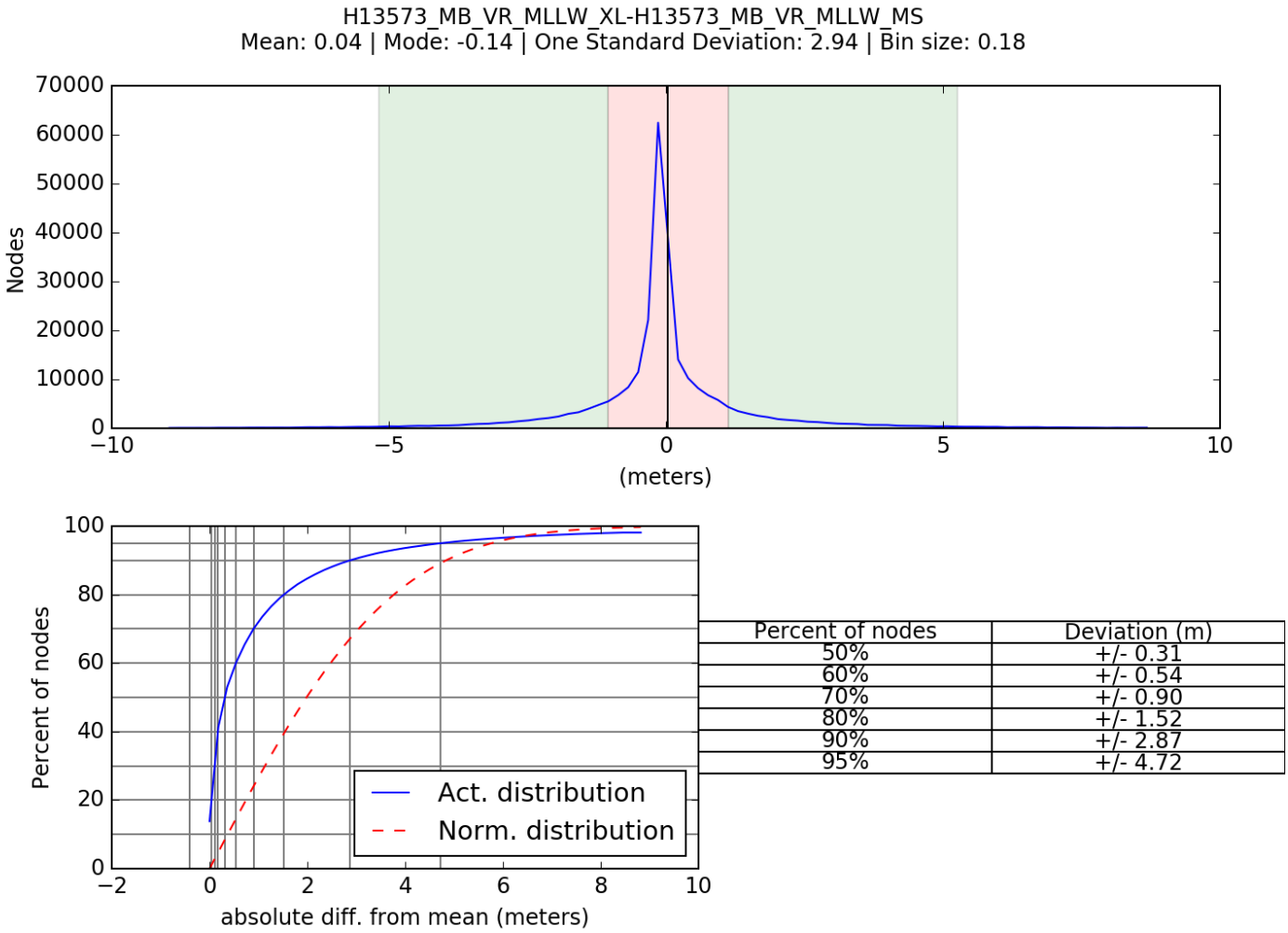


Figure 7: H13573 crossline surface overlaid on mainscheme tracklines.



Percent of nodes	Deviation (m)
50%	+/- 0.31
60%	+/- 0.54
70%	+/- 0.90
80%	+/- 1.52
90%	+/- 2.87
95%	+/- 4.72

Figure 8: Pydro derived plot showing absolute difference statistics of H13573 mainscheme to crossline data.

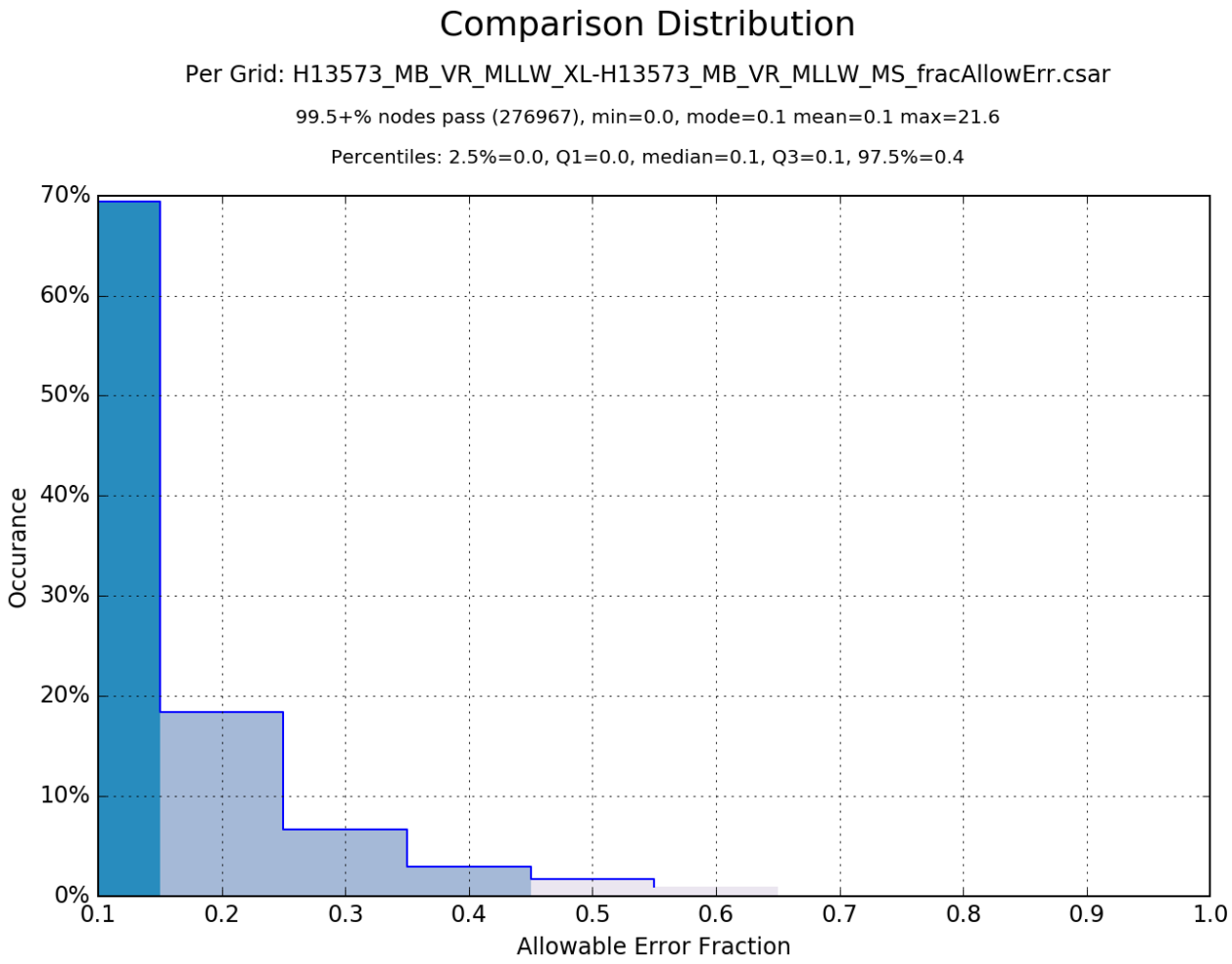


Figure 9: Pydro derived plot showing percentage-pass value of H13573 mainscheme to crossline data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.11 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S221	N/A meters/second	1 meters/second	4 meters/second	0.05 meters/second
2803, 2804	3 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13573 were derived from a combination of fixed values for equipment and vessel characteristics, as well as from field assigned values for sound speed uncertainties. Tidal uncertainty was provided in the project instructions for the NOAA vertical datum transformation model used for this survey.

In addition to the usual a priori estimates of uncertainty, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties for position, navigation, attitude, and vessel motion data from Applanix POS MV were applied during acquisition and initially in post-processing. POSPac SBET and RMS files were later applied in CARIS HIPS to supersede POS MV uncertainties associated with GPS height and position.

Uncertainty values of the submitted finalized grids were calculated in Caris using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA v5 within Pydro QC Tools was used to analyze H13573 TVU compliance. H13573 met HSSD requirements in over 99 percent of grid nodes, which is shown in the histogram plot below.

Pydro QC Tools 2 Grid QA was used to analyze H13573 multibeam echosounder (MBES) data density. The submitted H13573 variable-resolution (VR) surface met HSSD density requirements shown in the histograms below.

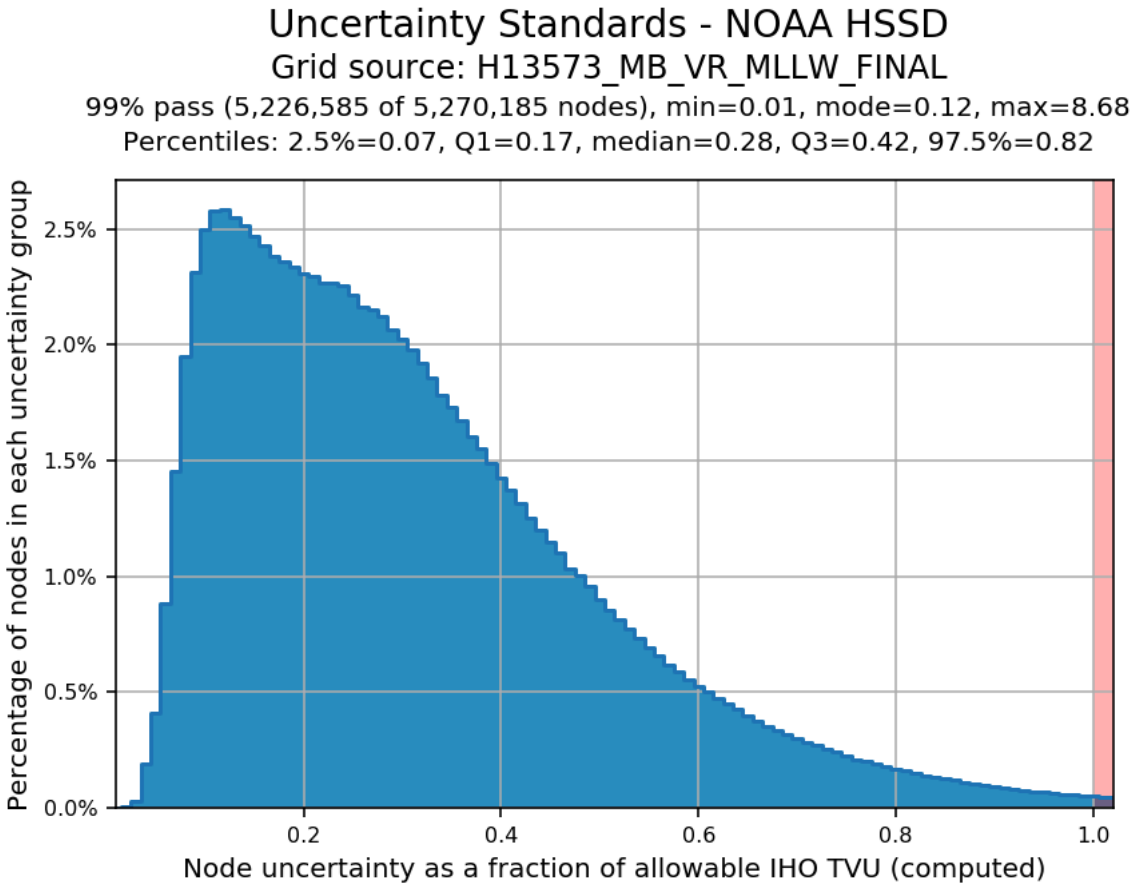


Figure 10: Pydro derived plot showing TVU compliance of H13573 finalized variable-resolution MBES data.

B.2.3 Junctions

There are two surveys that junction with H13573. The surveys, H13576 and H13572, were conducted while on OPR-T381-RA-22 and junction on the south and north ends of the H13573 sheet limits, respectively. See figure below that depicts the locations of the junction surveys relative to H13573. Information from junction analysis with H13572 can be found below.

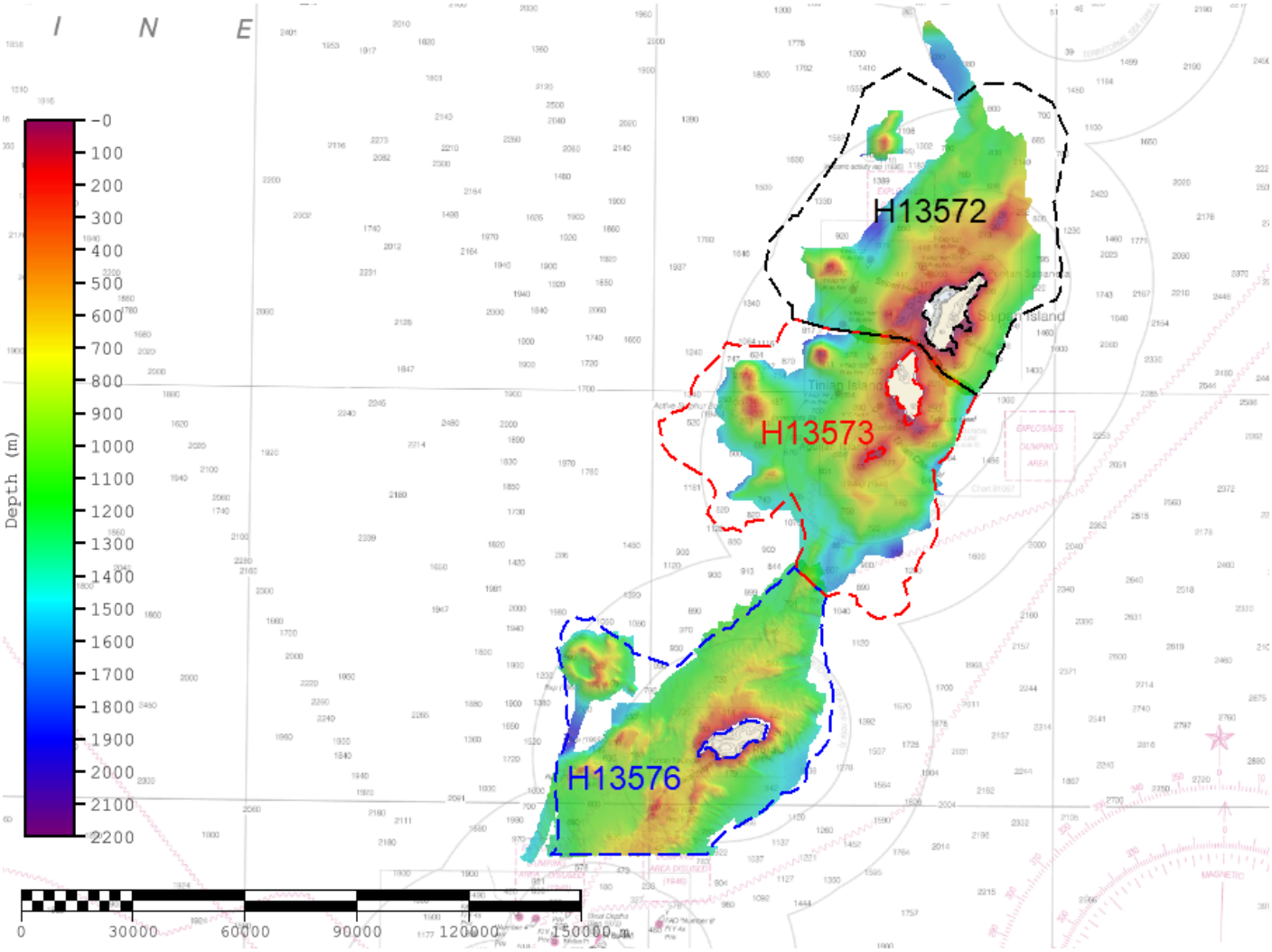


Figure 11: Overview of surveys that junction with H13573.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13572	1:10000	2022	RAINIER	N
H13576	1:10000	2022	RAINIER	S

Table 9: Junctioning Surveys

H13572

The junction with survey H13572 encompasses approximately 28 square nautical miles along the northern border of coverage. The Compare Grids function of Pydro Explorer derived a difference surface from

H13573 variable resolution surface and H13572 variable resolution surface. Pydro Compare Grids showed that 99.5 percent of nodes in the overlapping area met NOAA allowable error standards. Analysis of the difference surface indicated that there is a 0.12-meter average difference between the two surveys. For additional results, see figures below.

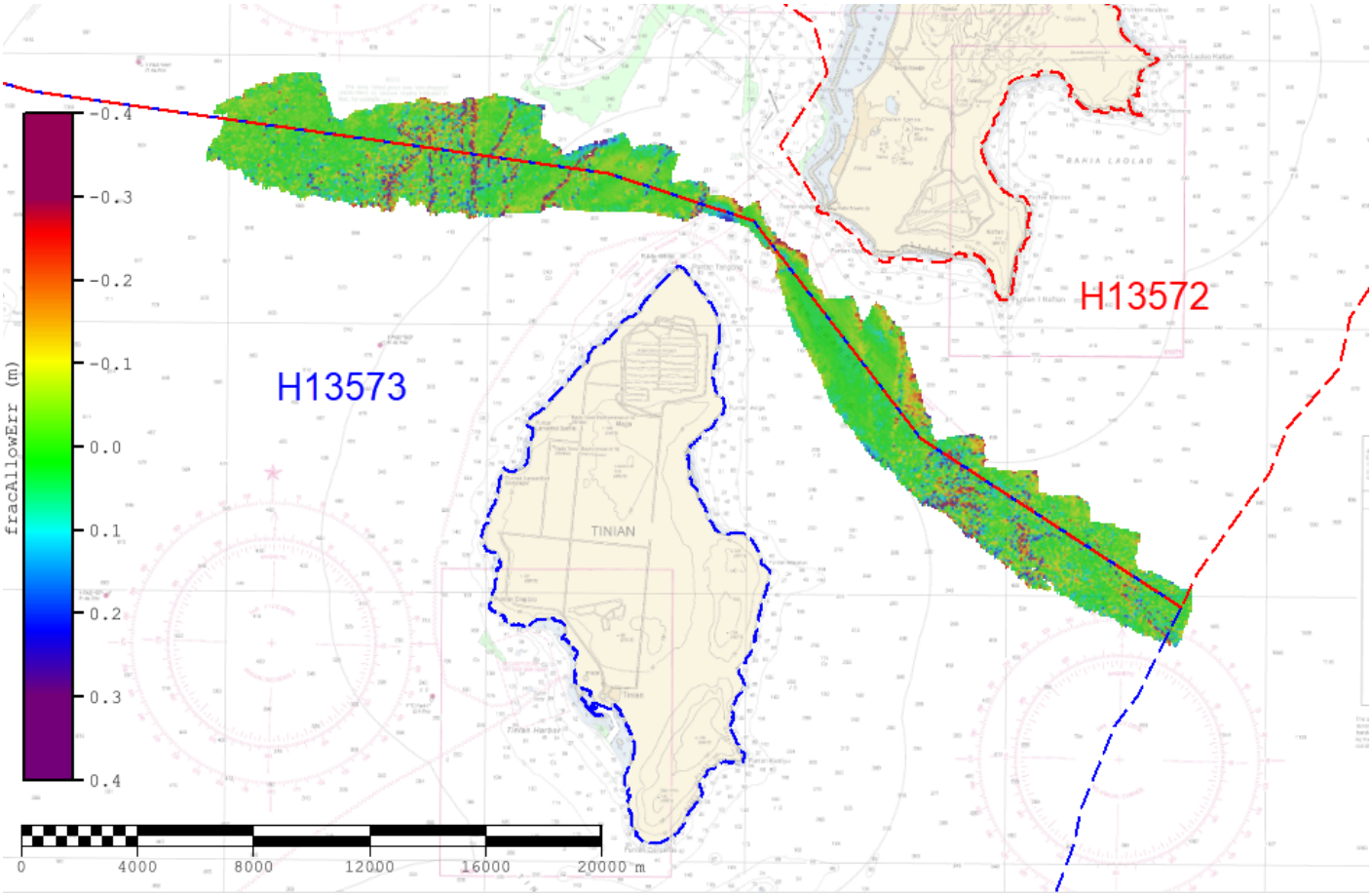
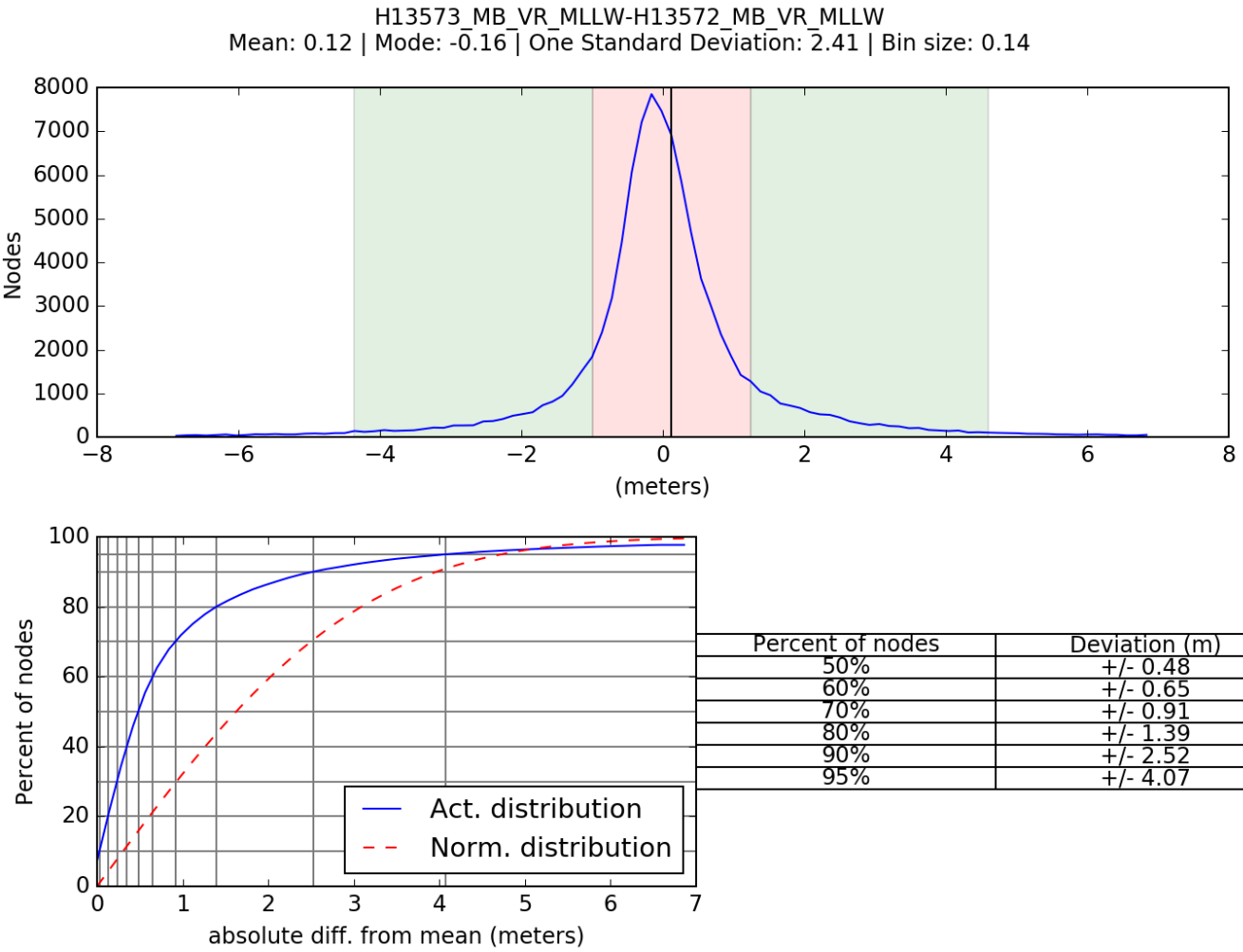


Figure 12: H13573 and H13572 fraction of allowable error junction surface.



Percent of nodes	Deviation (m)
50%	+/- 0.48
60%	+/- 0.65
70%	+/- 0.91
80%	+/- 1.39
90%	+/- 2.52
95%	+/- 4.07

Figure 13: Pydro derived plot showing absolute difference statistics of the junction between H13573 and H13572 variable resolution surface.

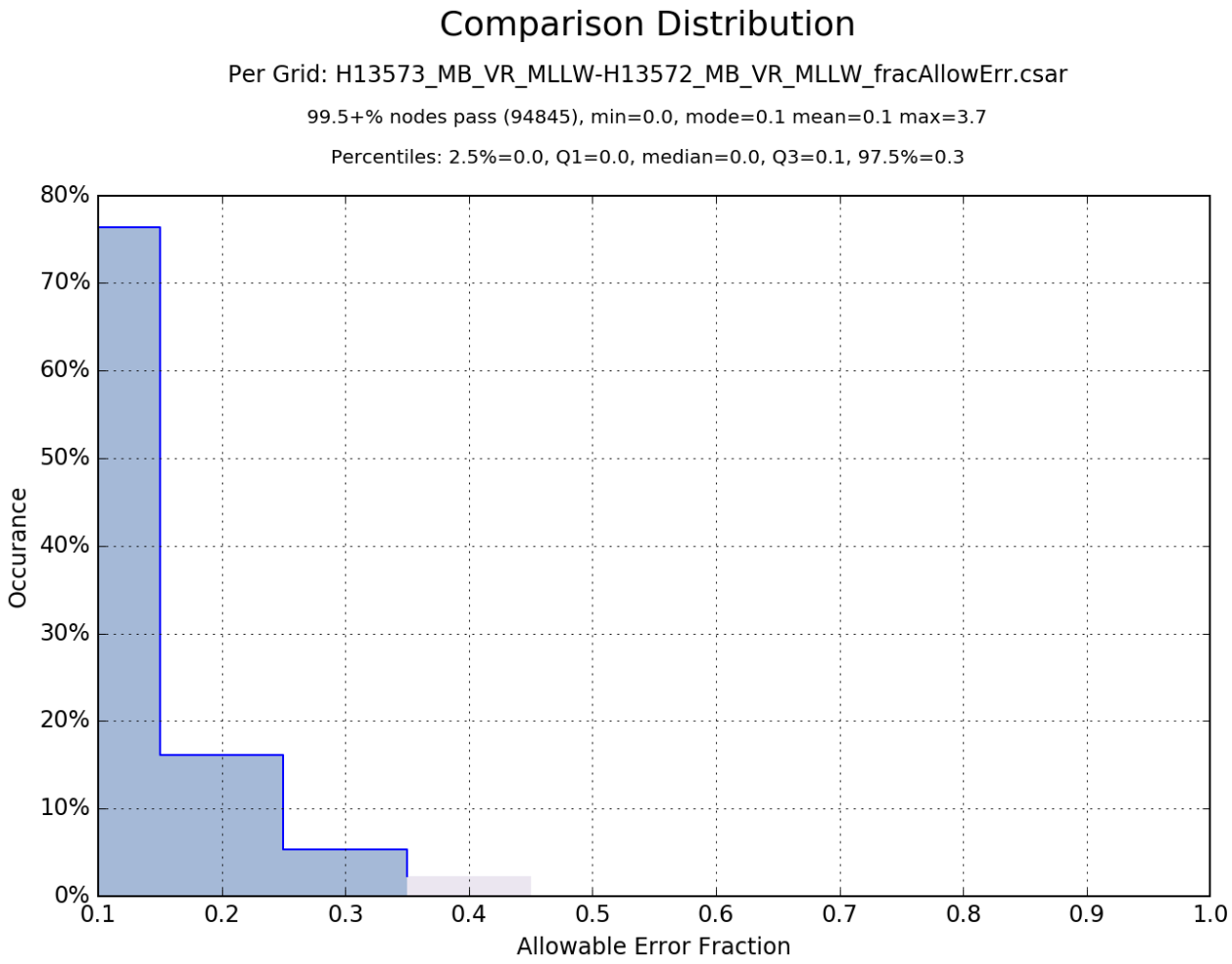


Figure 14: Pydro derived plot showing percentage-pass volume of the junction between H13573 and H13572 variable resolution surface.

H13576

Please reference the respective Descriptive Report (DR) for the junction analysis of H13576.

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

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: At least once every 4 hours or as needed.

A total of 82 sound speed profiles were acquired for this survey at discrete locations within the survey area at least once every four hours, when significant changes in surface sound speed were observed, or when operating in a new area. All casts were concatenated into a master file and applied to MBES data using the "Nearest distance within time" (4 hours) profile selection method.

Upon review of the data, sound speed issues were identified and determined to be a result of MVP and CTD casts applying to the wrong lines when georeferenced. Time and location of MVP and CTD casts overlapped resulting in ship collected data applying CTD casts from the master SVP file. To resolve this issue data collected with the ship were georeferenced with the ship master SVP file. After making the necessary file corrections, no further sound speed issues were identified.

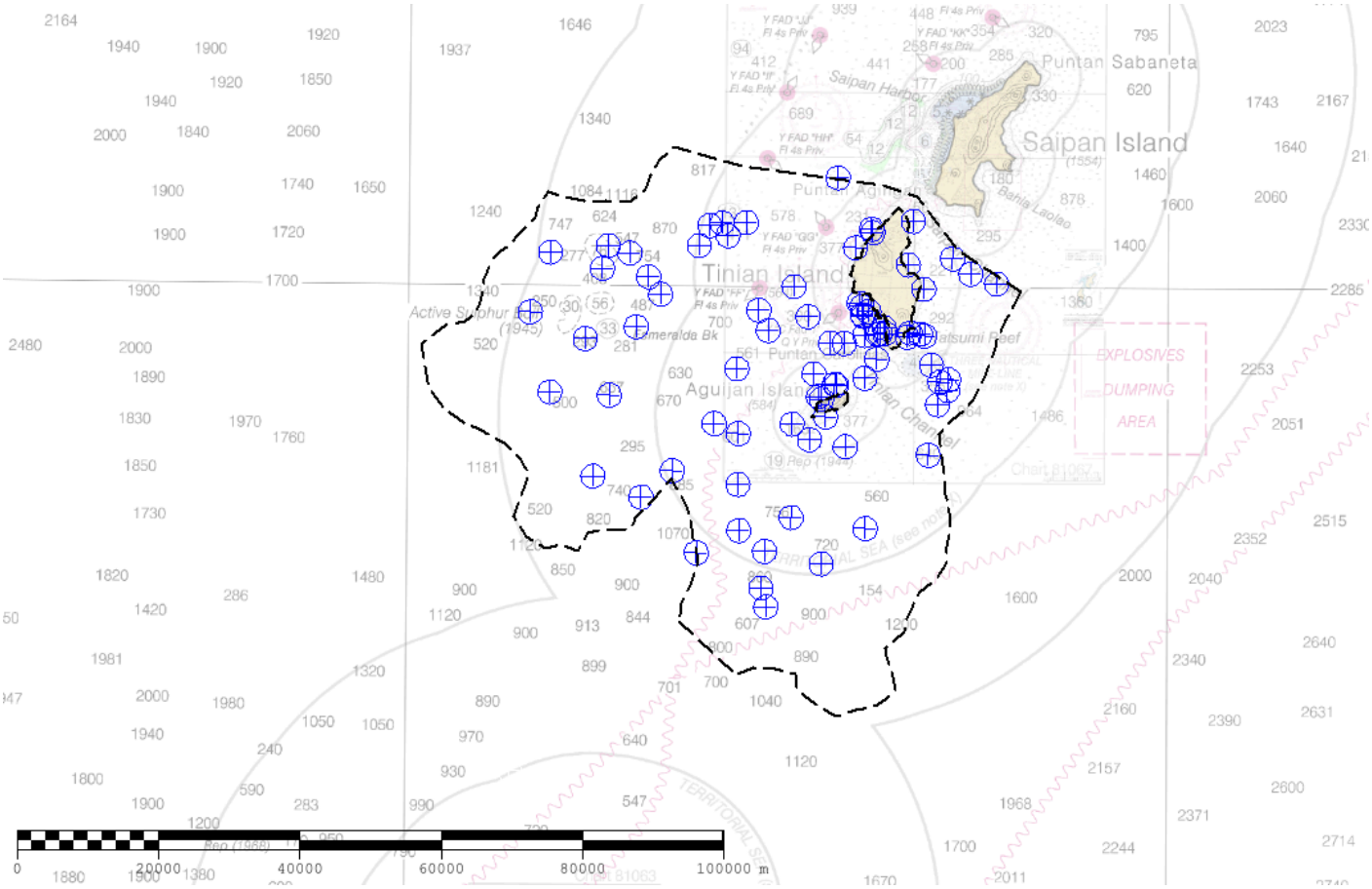


Figure 15: H13573 sound speed cast locations.

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.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Raw backscatter data were acquired as .ALL files logged during MBES operations and subsequently processed by RAINIER personnel. The .GSF files created during processing and backscatter mosaics per vessel and per frequency are delivered with this report. Backscatter processing procedures are described in the DAPR.

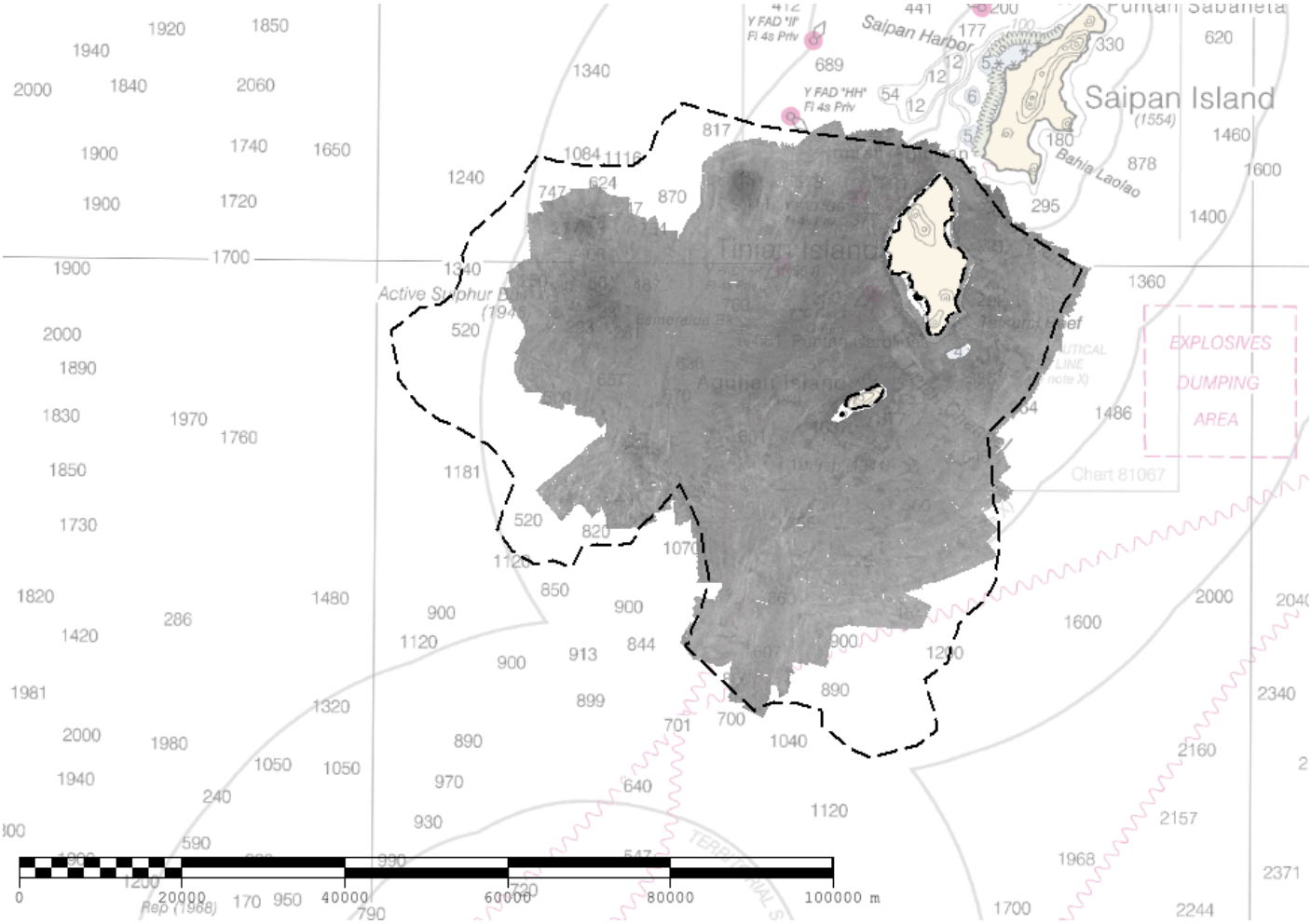


Figure 16: Overview mosaic of H13573 multibeam acoustic backscatter coverage.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.4.6

Table 10: Primary bathymetric data processing software

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
QPS	FMGT	7.10.0

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile 2022v2.

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
H13573_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	6.52 meters - 2188.77 meters	NOAA_VR	Complete MBES
H13573_MB_VR_MLLW_FINAL	CARIS VR Surface (CUBE)	Variable Resolution	6.52 meters - 2188.77 meters	NOAA_VR	Complete MBES

Table 12: Submitted Surfaces

Submitted H13573 surfaces were generated using NOAA recommended parameters for density-based (Ranges) Caris variable-resolution bathymetric grids. Per correspondence with the Project Manager, the submitted surfaces were generated with a updated Range/Resolution file, NOAA_DepthRanges_CompleteCoverage_2022_RA, that includes 64 meter grids for depths exceeding 1000 meters. See Supplemental Records for more information.

Pydro QC Tools v.3.4.5 Flier Finder, with default settings, was used to identify sounding "fliers" in the finalized H13573 VR surface. Obvious noise was rejected by the hydrographer in Caris Subset Editor. After data cleaning, the Flier Finder tool was run again and found 440 potential fliers in the Complete Coverage

surface. These were investigated and determined to be a result of the significant slope in the terrain and limited data density on both the steep slopes and the offshore edge of coverage. Therefore, these fliers have been found to be false positives. The image below depicts an example of edge fliers that have been determined to be false.

Pydro QC Tools v3.4.5 Holiday Finder was used with default settings to find holidays in the finalized H13573 VR surface. Holiday Finder detected 2 holidays in the Complete Coverage Surface. One holiday detected, located on south east end of Aguijan, was not acquired due to its location inshore of the NALL. The north west side of Aguijan also has a holiday that was not acquired due to time constraints. Both holidays were reviewed and do not impact the quality or reliability of the data. See figures below for more information.

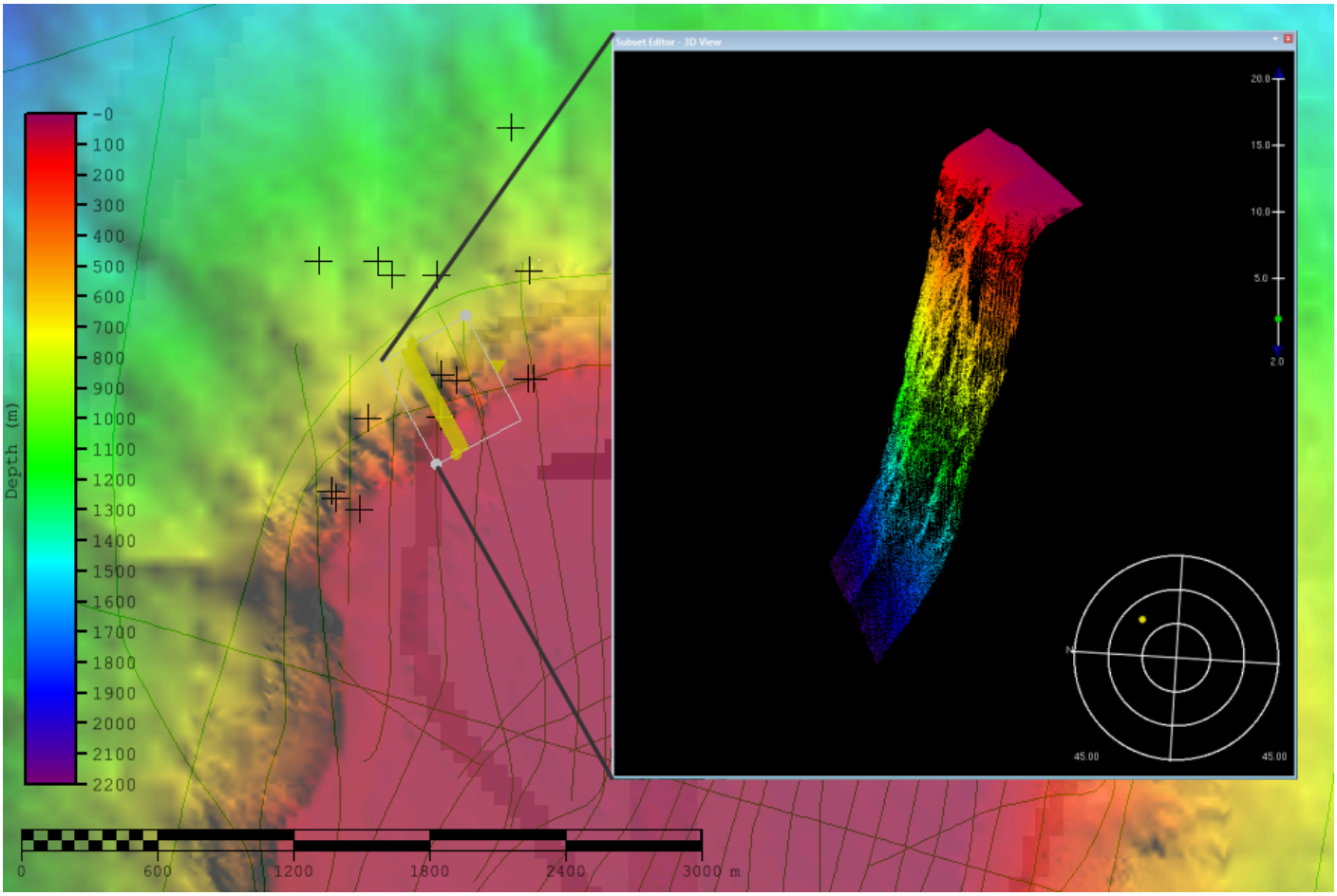


Figure 17: Example of fliers determined to be false.

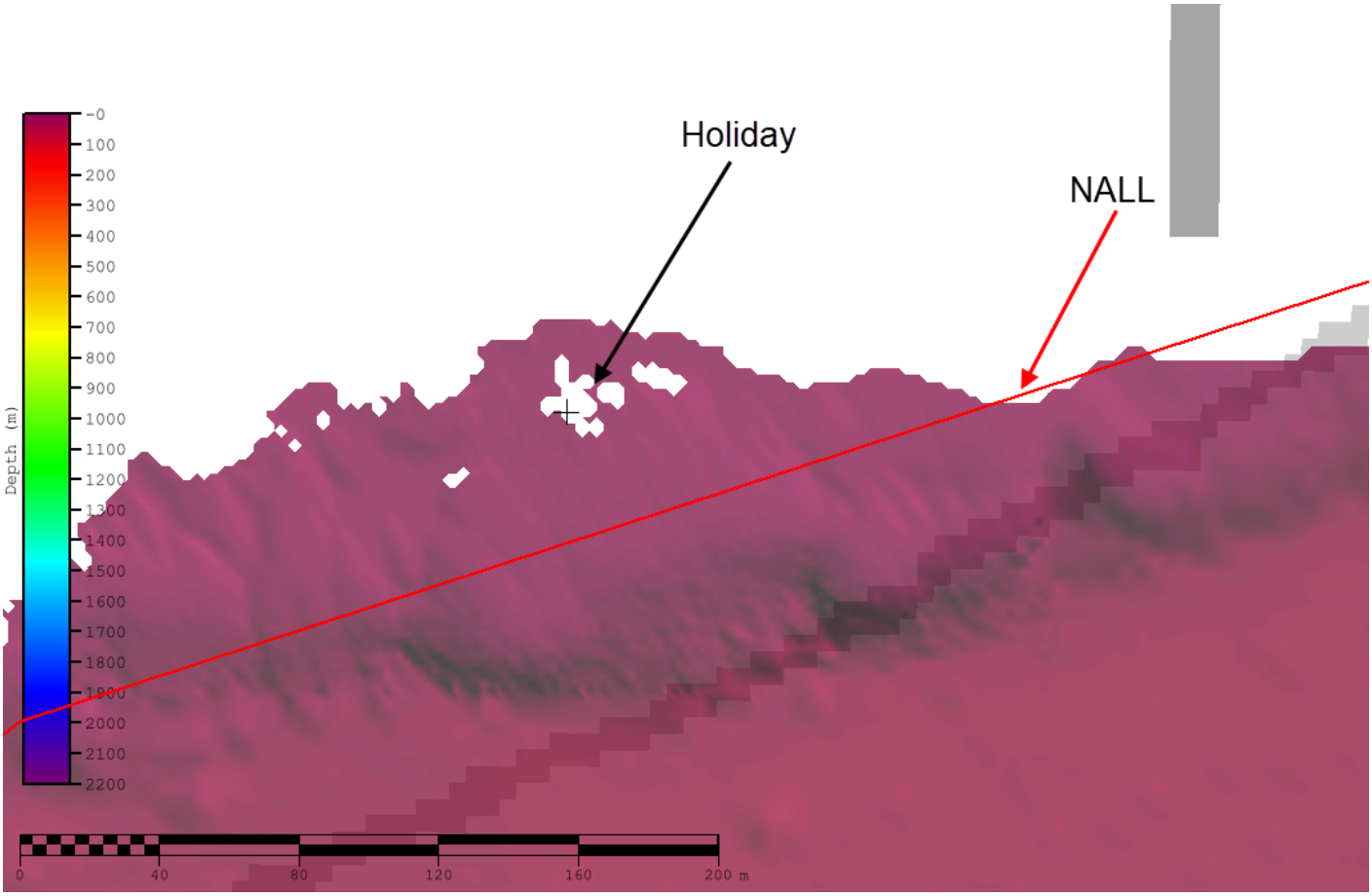


Figure 18: Example of holiday detected by QC Tools Holiday Finder.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

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

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR_T381-RA-22_GuamCNMI_EC_ERTDM2021_NAD83(MA11)-MLLW.csar OPR_T381-RA-22_GuamCNMI_EC_ERTDM2021_NAD83(MA11)-MHW.csar

Table 13: ERS method and SEP file

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983 (MA11).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 55.

RTK

Precise Positioning-Real Time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS (v8.5) software during post-processing horizontal correction of submitted H13573 MBES data.

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition.

C.3 Additional Horizontal or Vertical Control Issues

C.3.1 Delayed Heave Application

MBES line 0012_20220714_114639_S221_195 will not accept the applied delayed heave file. When applying the delayed heave file in CARIS an error is shown that the post-processed data has gaps greater

than the maximum allowed. The maximum allowable gab is set to 2.0 seconds and the gap found is 283.89 seconds. Despite this error, the appropriate SBET and RMS files applied to the line with no issue. Therefore, it was determined that the issue does not compromise the reliability or quality of the data.

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US2SP01M	1:931650	20	06/14/2022	06/14/2022
US4SP05M	1:75000	12	06/14/2022	06/14/2022
US5SP06M	1:20000	6	08/03/2017	01/23/2018

Table 14: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

ENC US5SP06M has four wire drag areas that have been covered with MBES data. The MBES data supersedes the wire drag data, so it is recommended that the charted wire drag areas are removed from the chart. Additionally, ENC US2SP01M has several charted contours and obstruction areas that have been covered with MBES data and found to vary significantly. It is recommended that theses areas be removed from the ENC. See figures below for more information.

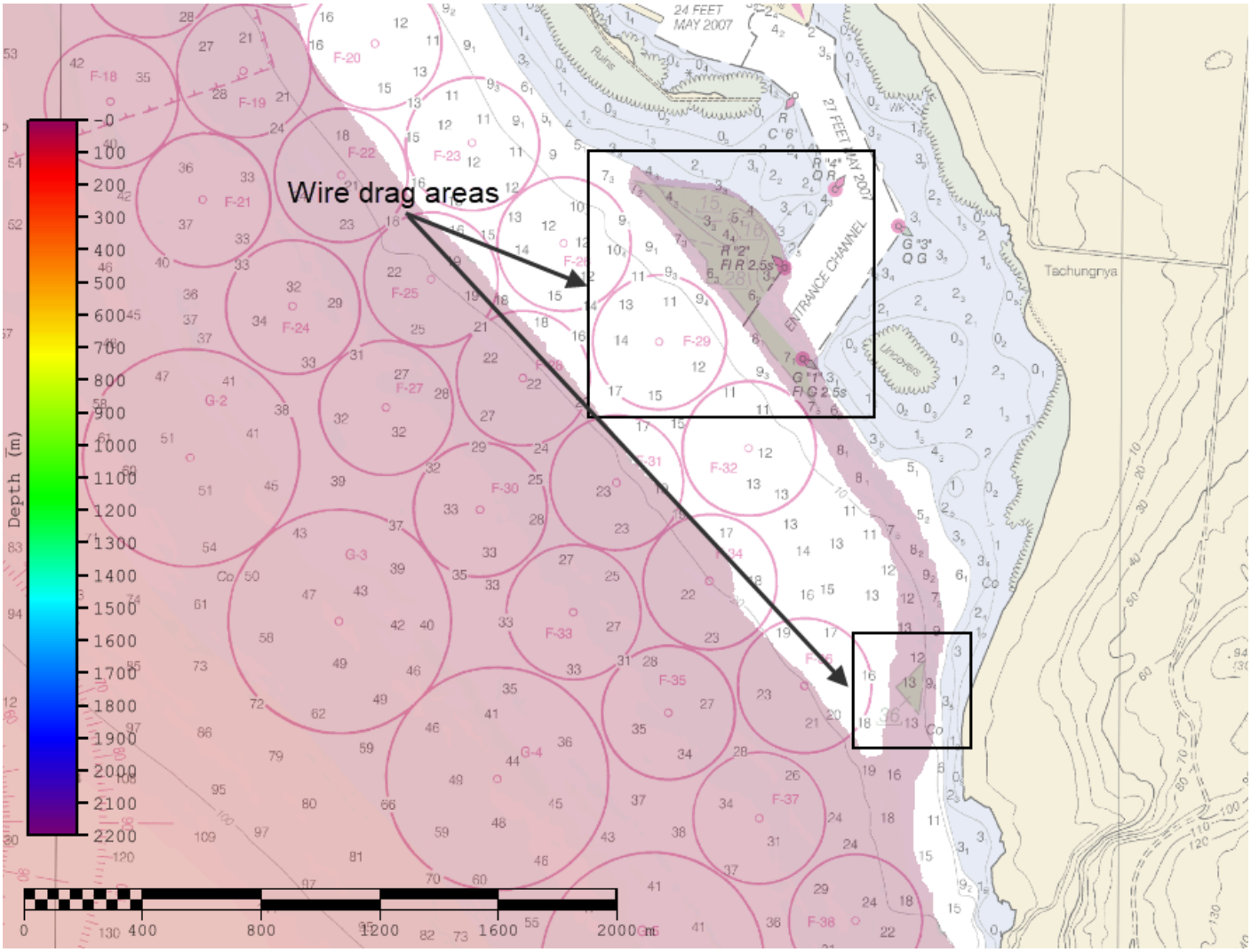


Figure 19: Example showing two charted wire drag areas with MBES coverage.

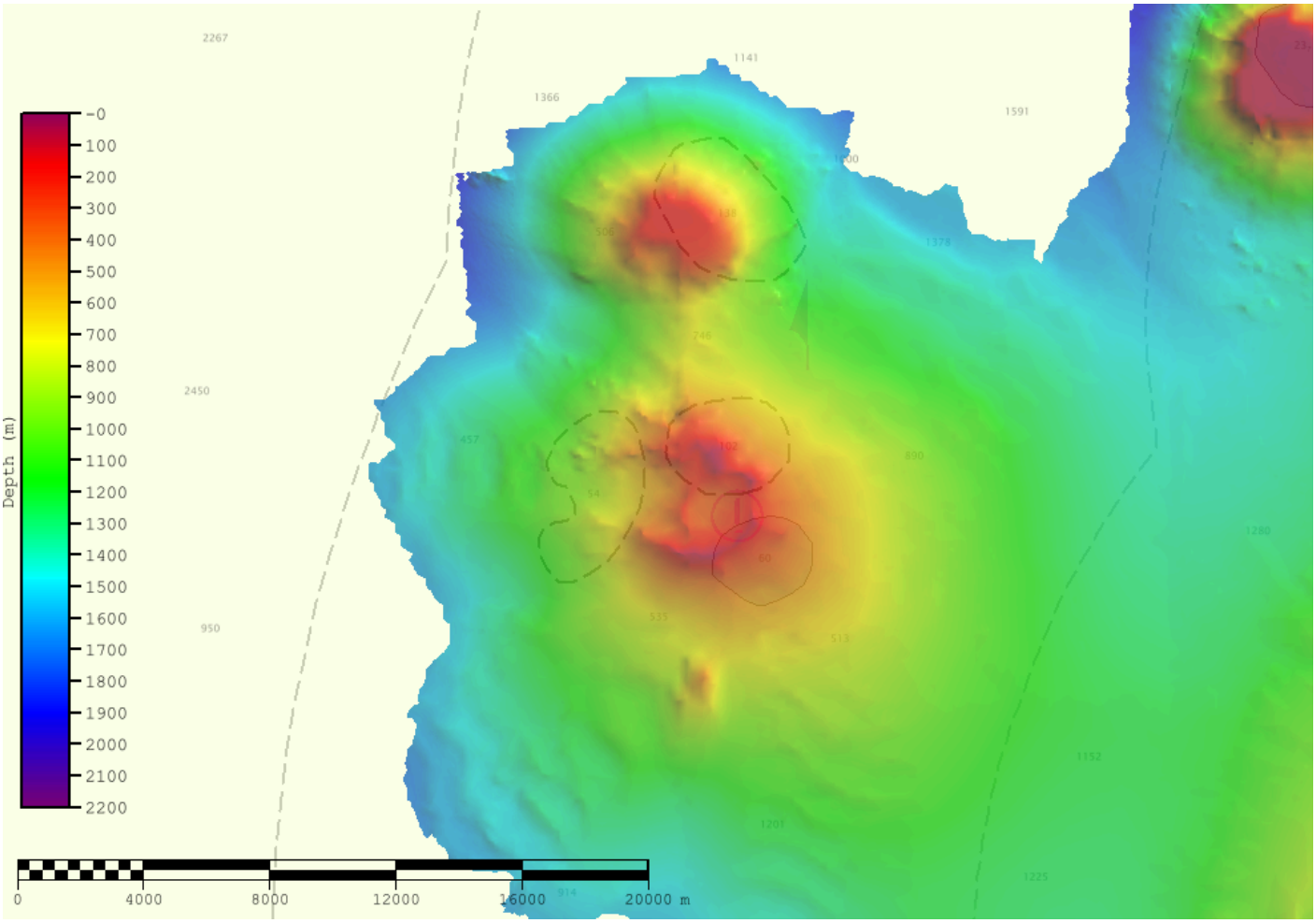


Figure 20: Example showing charted soundings disproved with MBES coverage.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Channels

A channel approaching the town of San Jose in Tinian exists but was not investigated and is covered under previous LIDAR data collected.

D.2 Additional Results

D.2.1 Aids to Navigation

Numerous Aids to Navigation (ATON) are located within the survey area. All observed aids appeared to be on station and serving their intended purpose.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

No bottom samples were required for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

A cable is charted within the surveyed area, however no evidence was detected in the H13573 MBES data.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions 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 Recommendations

No new surveys or further investigations are recommended for this area.

D.2.11 ENC Scale Recommendations

No new ENC scales 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 Specifications and Deliverables, 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
Héctor L. Casanova CAPT/NOAA	Chief of Party	09/16/2022	Digitally signed by CASANOVA.HECTOR.LUIS.1253816461 Date: 2022.09.19 09:37:22 -10'00'
Collin Walker LT/NOAA	Field Operations Officer	09/16/2022	WALKER.COLLIN.HARRISON.1523758540 2022.09.17 11:10:44 -10'00'
James B. Jacobson	Chief Survey Technician	09/16/2022	JACOBSON.JAMES.BRYAN.1269664017 I have reviewed this document 2022.09.16 13:00:17 -10'00'
Melissa A. Weber	Sheet Manager	09/16/2022	Digitally signed by WEBER.MELISSA.ANNE.1554978483 Date: 2022.09.16 09:38:12 -11'00'

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	Continuously Operating Reference Station
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
ERTDM	Ellipsoidally Referenced Tidal Datum Model
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

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
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	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File