Cruise Report

R/V *Marcus G. Langseth*

U.S. Law of the Sea Cruise to Map the Foot of the Slope of the Northeast U.S. Atlantic Continental Margin: Leg 8

Cruise MGL15-12
July 30 – August 29, 2015
New York, NY to Woods Hole, MA

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1 Cruise Outline

MGL15-12 was leg 8 of the continuing long-term bathymetric mapping of the continental margin on the eastern seaboard of the U.S. The objective of the cruise was to collect all of the bathymetric, acoustic backscatter, and sub-bottom data that might be useful to support a potential submission by the U.S. under the U.N. Convention on the Law of the Sea, Article 76 (Mayer *et al*., 2002). The responsibility for conducting the mapping was given to the National Oceanic and Atmospheric Administration (NOAA) by the U.S. Congress, and has been implemented since 2003 through a cooperative agreement with the Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center at the University of New Hampshire.

This cruise supplemented data from prior cruises [Gardner, 2004; Cartwright and Gardner, 2005; Calder and Gardner, 2008; Armstrong and Calder, 2012] to identify the morphology of the Foot of the Slope (FoS) in the mid-Atlantic coast of the U.S. (Figure 1). The cruise consisted of primary bathymetric mapping in water depths of approximately 5000 m using the R/V *Marcus G. Langseth* (Figure 2), operated by Lamont-Doherty Earth Observatory of Columbia University. The primary mapping sonar was a Kongsberg EM122 multibeam echosounder (bathymetry and acoustic backscatter), with a Knudsen Engineering 3260 chirp sub-bottom profiler, and a Bell Aerospace BGM-3 marine gravimeter. Motion measurement was provided by a Kongsberg Seapath 200 GPS-aided inertial motion unit; sound speed profile measurements were conducted using Sippican expendable bathythermograph (XBT), expendable sound velocity (XSV), and expendable conductivity, temperature, and depth (XCTD) probes. Details of the systems used can be found in Section 2. Scientific personnel for the cruise were provided by CCOM/JHC, with the support of the marine technician group provided by LDEO. The personnel list can be found in Section 6.

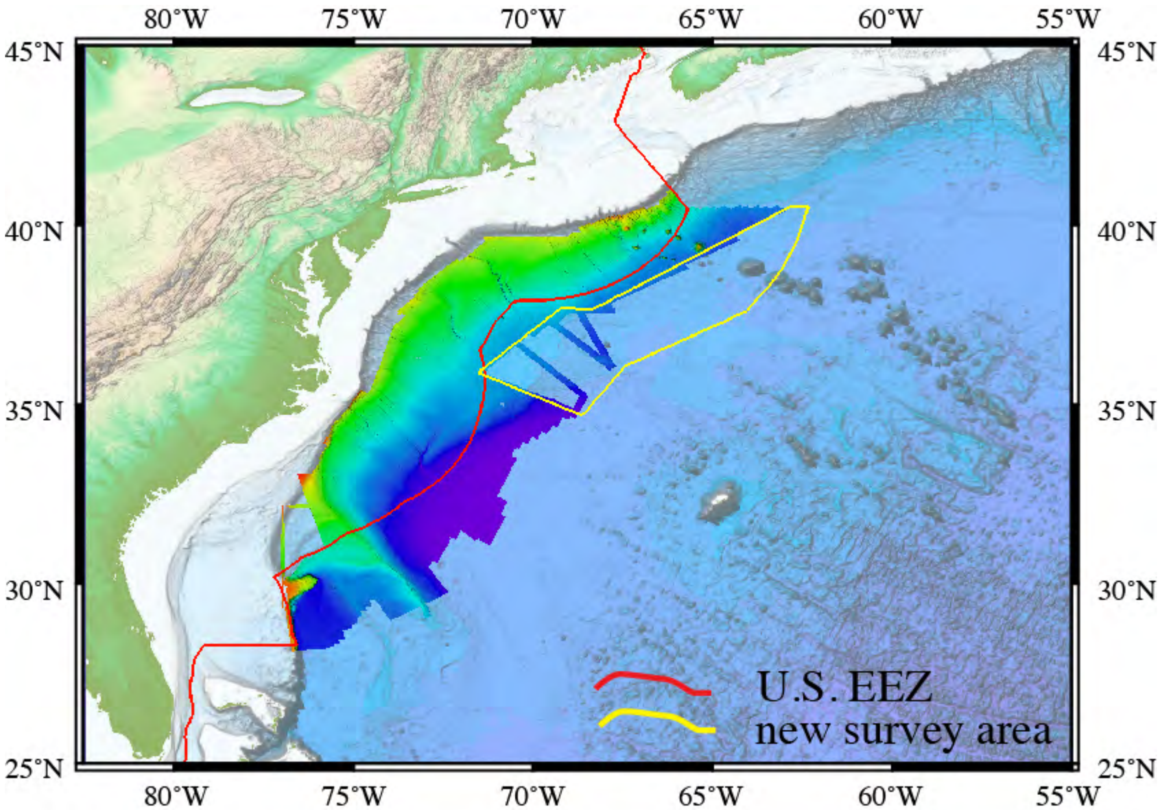


Figure 1: General location of the survey on the U.S. Atlantic continental margin. Data shown is a composite of the previous cruises conducted under this program, along with predicted bathymetry as background. The actual survey polygon used was adjusted during the survey to optimize data collection within the time available, and with respect to data quality.

Figure 2: R/V *Marcus G. Langseth* departing San Francisco, CA with the Golden Gate Bridge in the background.

The cruise started on 2015-07-29, with the *Langseth* alongside at the New York Maritime College, Bronx, NY. Mobilization and dock-side testing, including daily

BIST tests of the EM122, was conducted on 2015-07-29, and the ship departed New York, NY 2015-07-31/0100[1]. The ship proceeded down the East River and through Hell's Gate, and then out to sea at approximately 11 kt, and headed for a previously selected patch-test (multibeam calibration) site as indicated in Figure 3. As the ship came within range of the patch-test area, an XSV, an XBT (Deep Blue), and then an XCTD were launched to confirm the calibration of the XBT system that was used for the remainder of the mission, and then a full patch test was conducted as described in Section 4. Thereafter, the *Langseth* proceeded to the southern end of the operations area to pick up mapping where the previous leg left off.

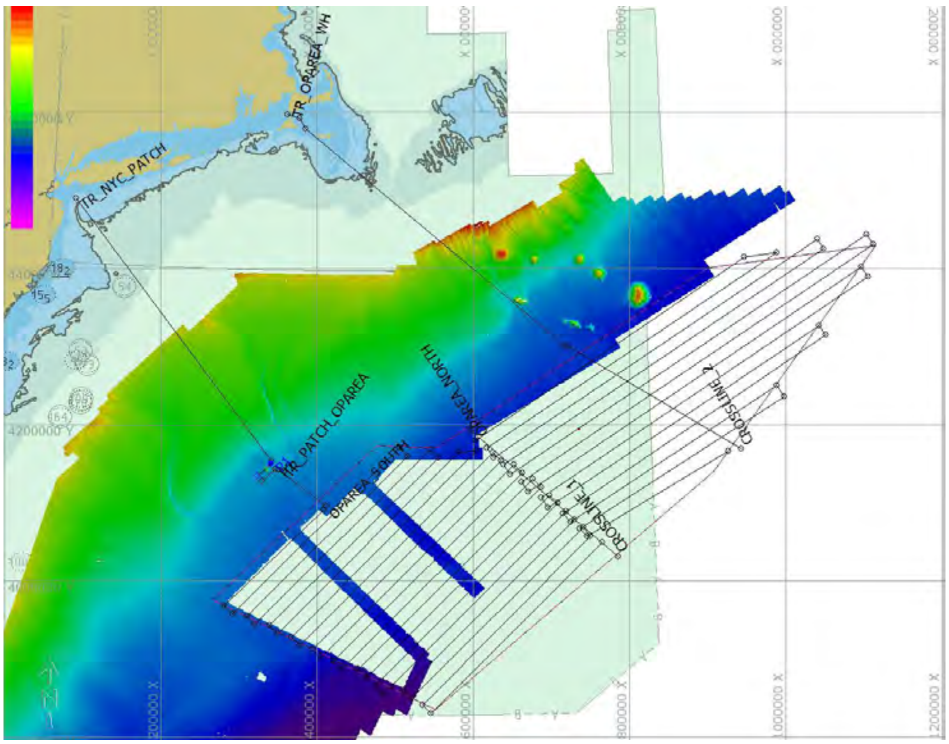


Figure 3: Initial line-plan for the survey, indicating the departure and arrival ports, the location of the patch-test area, and the two segments of the operational area.

Routine mapping then commenced. Sufficient XBTs were taken during the cruise to assess any changes in sound speed in the water mass surrounding the ship, with routine XBT launches at 0000, 0600, 1200, and 1800 UTC when possible, and other launches as required. Sound speed at the transducer head was compared with the sound speed at transducer depth from the most recent sound speed profile using the Kongsberg Survey Information System (SIS) software, and a new XBT launch was conducted when the difference between the two estimates was more than 0.5 ms^{-1} for more than a few minutes. Details of the XBT launch frequency, location, and other metadata are provided in Section 8.

[1] Note that dates and times are all given in UTC unless otherwise indicated; ship time zone was Eastern Daylight Time, GMT-4.

A total of 10,796 km (5,829 nmi) of planned lines were run in the survey area, including a cross-line, used to analyse the consistency of the data as detailed in Section 13. The mapping effort was monitored by the science party and supervised by the Chief Scientist, with the assistance of the ship's crew and the LDEO resident marine technicians. Data quality was monitored in real time using the watch-stander stations in the ship's survey lab, and data processing and quality control was conducted during shipboard operations as detailed in Section 2.6 and 3. Shipboard preliminary data products were created to ensure data quality (see Section 9), but final data products were constructed after the cruise.

Mapping continued until 2015-08-28/0742, at which point the ship broke line and made way for Woods Hole, MA, arriving 2015-08-29/2015. A total area of 157,166 km^2 (45,822 nmi^2) was mapped during the cruise in 24.5 survey days. There were also two days transit and two days for a medical evacuation. A survey calendar is shown in
Table 1.

Table 1: Survey calendar for Leg 8's mapping mission.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
		28 July 209	29 July 210	30 July 211	31 July 212	1 August 213	2 August 214
Activity		Travel	Mobilization NYC	Repairs/Transit	Transit	Patch Test/Survey	Survey South
XBTs Launched		0	0	0	5	11	12
	3 August 215	4 August 216	5 August 217	6 August 218	7 August 219	8 August 220	9 August 221
Activity	Survey South	Survey South	Survey South	Survey South	Survey South	Survey South	Survey South
XBTs Launched	13	12	14	10	9	11	8
	10 August 222	11 August 223	12 August 224	13 August 225	14 August 226	15 August 227	16 August 228
Activity	Survey South	Survey South	Survey South	Survey South	Survey South	Survey South/Xline	Survey North
XBTs Launched	7	12	7	7	9	8	13
	17 August 229	18 August 230	19 August 231	20 August 232	21 August 233	22 August 234	23 August 235
Activity	Survey/Med. Evac.	Med. Evac.	Med. Evac./Survey	Survey North	Survey North	Survey North	Survey North
XBTs Launched	15	2	7	7	9	7	6
	24 August 236	25 August 237	26 August 238	27 August 239	28 August 240	29 August 241	
Activity	Survey North	Survey North	Survery North	Survey North	Transit	Transit/Woods Hole	
XBTs Launched	9	4	8	12	6	1	

2 Survey Equipment

2.1 Multibeam Echosounder

Langseth is equipped with a Kongsberg Maritime EM122 multibeam echo-sounder system (12 kHz), serial number 109. The system generates sound in the region of 12 kHz in a wide swath across-track (of configurable width up to 150° but approximately 1° along-track), and then receives in a set of beams that are long along-track, but approximately 1° wide across-track. A sequence of up to nine acoustic sectors at frequencies varying from 11.550-12.598 kHz can be generated on transmit to compensate for ship's yaw, at a source level of approximately 220 dB re. 1
μPa at 1m. Optionally, the outer sectors of the transmit beam can be frequency modulated to improve overall signal-to-noise ratio. The system was operated in Deep FM high-density equidistant mode throughout the cruise, with a pulse length of approximately 15 ms. Pulse repetition rate varied with water depth.

An AML Oceanographic Micro SV, serial number 204749, was used to measure sound speed at the transducer. Calibration was conducted by the manufacturer on 2015-06-30; the certificates of conformance and calibration are in Section 11.2.

Kongsberg Seafloor Information System (SIS), version 3.9.2 build 187 (2012-09-06) was used to monitor and control the EM122.

2.2 Kongsberg Seapath Motion Sensor

The EM122 was provided with position and motion information using a Kongsberg Maritime Seapath 200 inertial motion unit (IMU), serial number 4217, which was provided wide-area satellite-based differential positioning correctors from a CNav 3050 GPS receiver, serial number 11443, using the Northern Atlantic regional corrections transponder. The Seapath system provided motion estimates with uncertainty on the order of 0.02° (r.m.s.) for roll, pitch, and heading, heave accuracy of 0.05 m (r.m.s.), and positioning accuracy of approximately 0.70-1.0 m (CEP).

Kongsberg's embedded system software, version 2.03.03, was used to monitor and control the performance of the Seapath.

2.3 Knudsen 3260 Sub-bottom Profiler

The sub-bottom profiler (SBP) used was a Knudsen Engineering 3260 rack-mounted echosounder, serial number K2K-07-0915, connected to permanently hull-mounted Masssa transducers. The system was used at a nominal frequency of 3.5 kHz only so as not to interfere with the EM122, and was synchronized to the firing rate of the EM122 so as to minimize interference between the two systems. The source level of the 3260 is expected to be approximately 220 dB re. 1 μPa at 1 m, but may vary in practice. The system was configured for 64 ms linear frequency modulated (LFM) pulses.

Knudsen EchoControlClient software, version 2.73, was used to monitor and control the system.

2.4 Gravity Meter

The *Langseth* carries a Bell Aerospace Textron BGM-3 marine gravimeter, serial numbers 332 (CPS), 223 (sensor), 103100001 (power supply) and 130 (signal conditioner). The system is mounted on the floor in the main lab of the *Langseth*. The portable gravity meter used to provide tie-points was a Lacoste and Romberg Inc. model with no discernable model number, serial number G237.

2.5 XBT Launch System

The XBT launch system is a Sippican (Lockheed-Martin) Mk21 launcher, serial number 030405. The control computer was running version 2.13.1 of Sippican's WinMk21 software (Mk21Coeff 2.9.1, Mk2AL 2.14.1).

2.6 System Configuration

Figure 4 shows the placement of the instrument displays in the main lab. A summary of serial numbers and software versions is provided in

Table 2.

Figure 4: Placement of instrument displays in the main lab of the *Langseth* during the mapping mission.

Table 2: Summary of serial numbers and software versions for the various components of the mapping system, including data processing software, used during the mapping mission.

Instrument Name	Part	Make	Model Num	Serial Num
EM122				
	Topside Unit (PU)	Simrad/Kongsberg	EM-122	109
	SIS Workstation	Simrad/Kongsberg	HWS N5	HWS5122803
	SIS Version	Simrad/Kongsberg	EM-122	3.92, Build 187
	Firmware Version	Transmitter Software	1.1.1	20080617
		Reciever Software	1.1.1	20100218
		ESP Software	2.2.3	20090702
		Processing Software	1.2.8	20120702
		Datagram Version	3.1.4	20120508
		Data Distribution Service	3.5.4	20120124
Seapath				
	IMU	Simrad/Kongsberg	Seatex-5	2695
	Processor Unit	Simrad/Kongsberg	SeaPath 200	4217
	Firmware Version		2.03.03	70227
CNAV				

Instrument Name	Part		Make	Model Num	Serial Num
	Antennae		C&C Technologies	C-NAV 3050	
	Processor Unit		CNAV 3050	CNAV3050 m	11443
	Firmware Version		SAPPHIRE	30508	
TSG					
	Processor Unit		Seabird	SBE 45 J-Box	132
	Probe		Seabird MicroTSG	SBE-45	4559446-071
Surface Sound Speed					
	Probe		AML Oceanographic	Micro-X	204749
XBT System					
	Software Version		WinMK21		Ver 2.13.1
	Launcher hardware		Sippican		30405
	Launcher hardware		Sippican		
Knudsen					
	Topside Processor			D229 04331	K2K-07-0915
	Transducer Type		Knudsen SBP 3260		
	Software Version		EchoControlClient	D409-04184	V. 2.73
	Firmware Version				K2K15005
Marine Gravity Meter System					
	Sensor		Bell Aerospace	BGM-3	223
	CPS		Bell Aerospace	BGM-3	322
	Gyro		Bell Aerospace	BGM-3	
	Gyro Electronics PCB		Bell Aerospace	BGM-3	49
	Control PCB		Bell Aerospace	BGM-3	42
	Stabilization PCB		Bell Aerospace	BGM-3	39
	Inter-connecting PCB		Bell Aerospace	BGM-3	117
	Signal Conditioner		Bell Aerospace	BGM-3	130
	P/S Sensor CDC 18R		Bell Aerospace	BGM-3	887
	D15-30 P/S		Bell Aerospace	BGM-3	N/A
	5E100 P/S		Bell Aerospace	BGM-3	N/A
	Power Supply		Bell Aerospace	BGM-3	103100001
	Power Supply		Bell Aerospace	BGM-3	103100002
	Gyroscope		Bell Aerospace	BGM-3	F0235
	Gyroscope		Bell Aerospace	BGM-3	D0270
Hand Gravity Meter					
	Sensor		Lacoste & Romberg Inc		G237

3 Data Protocols

3.1 Collection

Data collection was conducted subject to typical hydrographic protocols for deep-water mapping. Static offsets for the positions of the components of the survey system were provided by *Langseth* based on the latest survey report for the ship (dated 2015-08-08, Section 11.1). Static angular offsets and time latency were assessed through the patch test procedure described in Section 4, and were applied in the Kongsberg SIS software and thence to the real-time processing module in the EM122.

The SIS software was configured to automatically start new line files every eight hours, but the lines were incremented manually every six hours on 0000, 0600, 1200, and 1800 UTC where possible given the length of the survey lines. Line changes on the Knudsen Engineering 3260 were synchronized with the EM122 so that corresponding lines were always captured on each system. Turns were not recorded on either system, although ensonification was continued, and the data was monitored, throughout the turn.

Speed of sound at the transducer was determined by an AML Oceanographic Micro SV sing-around sensor that was fed directly to the EM122 processing station in order to correct for refraction in beam-steering computations. Sound speed profiles (SSP) in the upper part of the water column were derived from XBT launches, extended using almanac data from the World Ocean Database or Real Time Oceanographic Forecasting System (RTOFS) using the UNOLS MAC SVP Editor software[2], version 1.0.2, installed on the Kongsberg Maritime SIS workstation. After manual inspection, these extended and simplified profiles were then sent to the EM122 over the network in order to avoid any dropped pings or stop/start update cycles. Routine XBT launches were conducted at 0000, 0600, 1200, and 1800 UTC when possible to coincide with line changes in the data capture systems; where shorter lines were required, or line changes could not be synchronized to these six hour intervals.. In addition, the sound speed at transducer depth from the SSP was compared in the SIS console with the current real-time sound speed at the transducer; if a difference of more than 0.5 ms^{-1} was observed for more than a few minutes, a new XBT launch was initiated. The XBT launch system is described in Section 2.5, the metadata is in Section 8, and analyses of the XBTs launched are in Section 12.

The Knudsen Engineering 3260 SBP was operated throughout the cruise, except during the patch test, typically with a nominal depth gate of 200 m about the expected depth. Full digital records were recorded in SEG-Y format.

[2] SVP Editor, http://mac.unols.org/resources/tool-sound-velocity-profile-svp-editor-v105, downloadable from ftp://ftp.ccom.unh.edu/fromccom/MAC_DATA.

The gravity meter calibration ties were conducted by the LDEO technicians, and are available in Section 11.3.

3.2 Processing

Data from both the EM122 and the 3260 were made available on the *Langseth*'s internal network using a network share from the ship's primary server. Files were copied from the server to local storage for archive and processing at the completion of each line.

Data processing for the MBES bathymetry data was conducted using CARIS HIPS 9.0.16, with visualization products being created with QPS Fledermaus 7.4.4b via BAG[3] files exported from HIPS. A separate flow-path between HIPS and HYPACK was established for intermediate gridded products being created in HIPS, so that current data could be placed in the same geographic context with prior data and used for line planning. GeoTIFF images were used for transfer. Data processing for the SBP data was conducted in Chesapeake SonarWiz 6.01.0008.

The MBES bathymetry data were processed using the CUBE algorithm, implemented in HIPS. A grid resolution of 100 m was used for all depths of water encountered. The CUBE calibration parameters used are given in Section 0. Quality control of the MBES data was carried out by the watchstanders, ensuring that any anomalous depth measurements were either appropriately handled by the CUBE software in use within HIPS, or were remediated by hand if necessary. Comparisons between the cross-lines collected and the main-scheme lines were computed in HIPS BASE Editor, in order to assess the consistency of the data. Results of these comparisons are given in Section 13.

After the grid product was finalized in HIPS, surface filtering was applied to the raw data so that legacy point-cloud files of surface-consistent sounding observations could be generated. These were exported in ASCII format for use in future products. Grids were exported in BAG and GeoTIFF formats from HIPS, and separate grid in geographic coordinates were constructed in Fledermaus from the exported ASCII data. Preliminary data products were constructed onboard, and are illustrated in Section 9, but final products were produced ashore.

The MBES backscatter data were processed using the GeoCoder algorithm, implemented in QPS FMGT. A grid resolution of 50 m was used for all depths of water encountered. The calibration parameters used are given in Section 11.5. Mosaics of backscatter were exported in GeoTIFF and Fledermaus SD format for review and combination with bathymetric data in the visualization environment.

[3] http://www.opennavsurf.org

Sub-bottom profiler data was processed using Chesapeake SonarWiz to the extent of converting the data into imagery and exporting it in forms suitable for correlation with the MBES data. No further quality control was conducted.

For compatibility with previous legs of the cruise, the filenames used by the SIS software were translated into sequential filenames, starting with line number 604. Translation tables for MBES and SBP data are provided in Section 7. FGDC-compliant metadata was constructed semi-automatically for each line of MBES and SBP data at the end of the cruise.

Data from the cruise were archived by *Langseth* for ingestion through the R2R program[4], and were made available after the cruise on portable hard drive. Separately, CCOM/JHC provided processed data with metadata to the National Centers for Environmental Information (NCEI) using the data center (formerly the National Geophysical Data Center) in Boulder, CO. The shipboard archive contained raw data from all instruments, including meteorological observations, ship bridge logs, navigation information, and other underway sensor information.

[4] http://www.rvdata.us

4 Patch Test Results

Data for the patch test were captured and named separately from the main-scheme and transit lines, and held in a separate directory in the data archive. A total of four patch-test lines were run:

1. Across seamount at 9 kts.
2. Reciprocal line at 9 kts.
3. Re-occupied line 1 at 4.5 kts.
4. Parallel line to line 1, 10 kts.

The data were ingested into CARIS HIPS in a project separate from that where the main-scheme lines were processed ("patchtest"), and conventional processing was applied to allow the data to be used in the calibration tool within HIPS. Examination of the data showed that no offsets were required to be adjusted in the EM122 configuration.

It was therefore concluded that offsets of:

1. Pitch: -0.23°
2. Roll: -0.54°
3. Yaw: 0.43°
4. Timing: 0.0 ms

should be maintained for survey.

5 Daily Narrative

2015-07-28 (JD209) – New York Maritime Academy, Bronx, New York, NY.
Joined ship, alongside the Pier of the Maritime Academy. Confirmed that XBT and XSV supplies were loaded and stowed, and unpacked remainder of equipment for the data processing and survey monitoring.

2015-07-29 (JD210) – New York Maritime Academy, Bronx, New York, NY.
Science in-brief and ship familiarization; safety briefing and demonstrations; cruise overview for the science party and marine technicians. The Maritime Academy campus lost power approximately 1430, apparently due to power drain in very hot weather. Ship's emergency power kept the lights on, but the clean science power was off most of the day, returning approximately 2030 when the ship lit off the main engines (using the restored shore power) in order to ensure power continuity and ready for departure. The problem was subsequently found to be that a fuel pump for the auxiliary generator failed, and therefore the generator could not be started. Among other things, this meant that there was no means to run the hotel and science load short of starting the main engines. More problematically, the main engines need compressed air to start, which is normally supplied via the auxiliary generator-run compressors (it also runs the cooling pumps). Consequently, the auxiliary generator needs to be running before the cruise can depart since otherwise there would be no means to restart the engines in the face of an engine casualty. Spare parts are actively being sought. Knudsen and Kongsberg systems were configured ready for data collection.

2015-07-30 (JD211) – New York Maritime Academy, Bronx, New York, NY
Sailing delayed until 2015-07-31/0030 to allow time to procure a replacement fuel pump for the auxiliary generator that was causing difficulties yesterday. Meanwhile, line plans were passed to the bridge for the initial transit and patch test, and set up in *Langseth*'s navigation software. Fuel pump for the auxiliary generator finally arrived at approximately 2320, and was fitted.

2015-07-31 (JD212) – New York Maritime Academy, Bronx, New York, NY.
Gangway pulled 0045 and lines slipped 0105 to start MGL15-12. Langseth transited down the East River and out to sea, passing the Verrazano Narrows bridge approximately 0315. Sounding commenced at approximately 0320, although in ~17m of water, the quality was sub-optimal, and the lines were not named or taken for ECS processing; LDEO technicians indicated that they would submit to NSF R2R, however. At 0400 approximately, LDEO technicians reported that Internet connectivity had ceased due to router and hardware changes to High Seas Net at Scripps Institute of Oceanography. Fleet Broadband connectivity was still available, however, albeit with limited network ports on the ship.
0410: successfully executed a BIST test on the EM122 system
1208: Dropped below 100 m depth, turned on water-column logging. XBT training was conducted for those hands not familiar. Capture on 6-hr increments unless otherwise indicated, started.

1354: Ship turned to avoid crossing traffic.
1400: Excessive noise from Knudsen in EM122; appeared to be due to lack of synchronization from the EM122 to the Knudsen. Ship technicians believed that their version of EM122 needed further equipment from Kongsberg to allow for synchronisation, although this is not the case on other systems. Seeking confirmation ashore for the appropriate procedure.
1805: Noise from Knudsen was observed to be not as prevalent once the ship moved into deeper (~2700 m) water.

2015-08-01 (JD213) – Transit to patch test site, surveying
Continued to transit to the patch test site. Dropped XSV-01 and Deep Blue 0130, then XCTD-02 0159, slowing ship to 3kt beforehand (maximum speed for XCTD is 3.5kt). First XCTD-02 not fully functional; second probe launched 0215. Second broke wire before terminal depth, but collected most of the important parts of the upper watercolumn beforehand. Attempted to load XSV profile into SIS via SVP Editor but found that the version installed did not recognise the format and would not work. Downloaded and installed the latest version (1.0.5) from the MAC website and installed; still no go. Attempted to load the XCTD profiles, but SVP Editor reported "no valid data" for these. Returned to XBT Deep Blue profile for patch test. For patch test, set transmit control auto-tilt to zero degrees (rather than default three degrees) as recommended by MAC procedures during last patch test on *Langseth*.
0312: Patch test commenced with first pitch line, heading A-B in the diagram. Knudsen secured for duration of patch test. It appears that the patch test site was, unfortunately, in the middle of the Gulf Stream, so there were ~2kt head currents and changes in sound speed at the transducer. Downline speed approximately 9 kts rather than 10 kts.
0417: End of first patch test line. Captured new XBT-based profile for sound speed at end of first line, since the surface sound speed appeared to be more stable for the patch test area than where the previous profile was collected (even though it was very close in space). Loaded new profile (serial 1239917) at the end of line.
0444: Start of second pitch line. Current was pushing the ship, so the bridge crew were matching turns to give approximately 9 kts speed over ground.
0606: End of second pitch line.
0617: Start of third patch test line, at ~4.5 kts (half speed of previous lines) for latency.
0807: End of third patch test line; back to 10kts to move to yaw lines.
0913: Start of fourth line of patch test, first yaw line.
1006: End of fourth line of patch test. Secured pinging 1015 to conduct BIST test; passed. Analysis of patch test showed no offsets required to be added to the current configuration, so the ship moved to start the survey proper.
1352-1359: Acquisition stopped for SIS PC rebooting due to an OS issue.
1427: End of transit and started acquisition in SOUTH_OPAREA.

1600: Moved EM122 into "Deep" mode (had auto-switched to "Very Deep" in ~4400 m).

1630: Moved Knudsen to "Bottom Refered" TVG mode to see if this was significantly better than the "No TVG" that had been used previously.

1656: Moved Knudsen back to "No TVG": the alternative TVG generated some sense of deeper structure, but generated so much more noise in the water column and sub-surface that it was hard to see. Back to the original settings for the immediate data collection.

1715: Encountered pockets of significantly different surface water with speed of sound differences on the order of 5 ms^{-1} observed to appear and disappear within ~30 min.

1745: Third profile in thirty minutes (change on order 10 ms^{-1}). Monitored time series from the TSG in order to get a sense of the trend of the surface sound speed, and possible causes, and adapting to the closest profile available while the surface was changing rapidly.

1818: Drop-out on surface sound speed sensor at EM122, after inconsistent readings. Power cycle of unit to reset.

1850: Noticed significant static offset between sound speed sensor at transducer and TSG measurement (order 13 ms^{-1}). Swapped to alternative probe at transducer in order to test for a bad probe. Micro SV powered off 1851 for swap. Back online 1851 and immediately back in sync with the TSG.

1900: Micro SV transducer still showing evidence of problems, and went offline. Took new SVP cast with Deep Blue, switched EM122 into manual surface sound speed mode, input surface sound speed from TSG measurements, re-interpolated SSP cast, and re-sent to system. (Issue was that the casts are set up with the surface sound speed being sent out by the EM122, so if it is exporting incorrect surface sound speeds from a faulty probe, the casts being extended and configured in SVP Editor are also incorrect for speed at the transducer depth.)

1935: Micro SV transducer tested, cable cleaned up and re-settled into connectors; system then started generating data consistent with the TSG, and therefore system was reset to 'sensor' for surface sound speed.

1940: Based on information from the beach on connectors for synchronization of the EM122 and Knudsen, cable was prepared by LDEO technicians to allow for testing. There was apparently ambiguity on which of the auxiliary BNC connectors on the Knudsen synchronizes which channel (3.5 kHz or 12 kHz), but according to Knudsen engineers, it is acceptable to send the synchronization pulse to both channels, even if one is off, and the auxiliary channels required are those that connect to J402 on the processor boards in the 3260 (and therefore can be checked by simple inspection). On the *Langseth* Knusden system, the auxiliary BNC connectors that are used for synchronization are Aux 2 and 5.

1958: Micro SV probe at transducer head failed again with the same symptoms: drop of 7 ms^{-1} almost instantaneously, and out of agreement with the TSG sound speed. Back to manual mode for surface sound speed on the EM122 (i.e., with sound speed from TSG manually translated to SIS console) while the LDEO technicians replace the measurement module (rather than the probe) for the Micro SV.

2005: Micro SV probe head replaced and sensor brought back on line, and matching TSG. Now using probe head 204842.

2018: Approximately 15 min. appeared to be the magic number for the Micro SV sensor; probe dropped again, very quickly, to approximately 1535 ms^{-1}, so the system was returned to manual mode with input from the TSG rather than the surface sound speed probe.

2130: After some investigation it appeared that the difficulty with the Micro sv may have been insufficient flow-through of water in the sensor bath, with consequent accumulation of algae on the sensor faces. This apparently caused the sensor to read low, and occasionally fail due to build-up of organic matter. The LDEO technicians removed, cleaned, and re-installed the sensors in such a manner as to provide higher flow rates, and the installation was then monitored for 20 min. to ensure that there was no subsequent failure. Since that appeared to be the case, the EM122 was returned to 'sensor' sound speed input at 2130.

2140: Sadly, the fix was apparently illusory. The Micro SV started to fluctuate again shortly after being re-selected, and was consequently taken out of service to be replaced with the older sensor that has been operating for some time prior to 'upgrade'. System was returned to manual control with surface sound speeds being entered from the TSG readout.

2210: In order to get a better idea on when to drop XBT probes, the LDEO technicians were requested to generate a time series plot of the data from the TSG, Figure 5. This allowed an estimate to be made for when a trend into a new water mass was complete, so that a new profile could be taken.

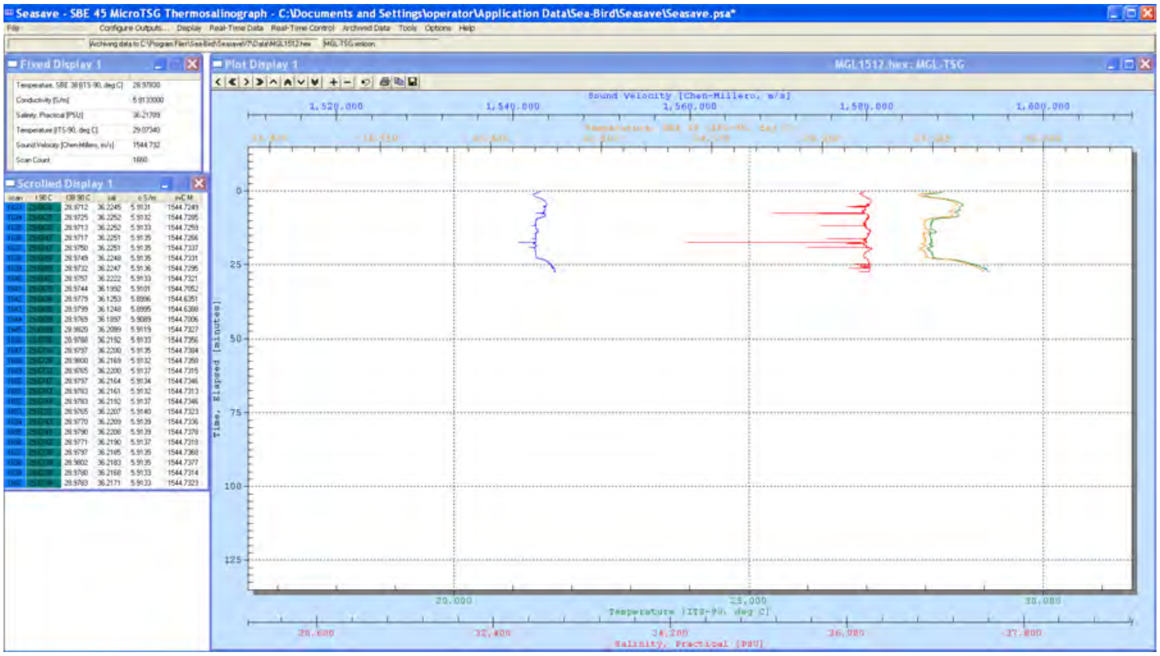


Figure 5: Screen-shot of the thermosalinograph output time series, showing the dynamic behaviour of the water masses in the survey area, in this case moving into a pocket of warmer water, presumably an eddy generated by the Gulf Stream.

2015-08-02 (JD 214) – Surveying in southern operational area

Problems with the Micro SV continued, with the LDEO technicians attempting to resolve the issue. Apart from potential contamination with biological material, there was also found to be a DC voltage on the sink where the sensors are mounted. A different configuration was attempted, but with inconclusive results. The investigation continued.

0005: Adjusted EM122 to allow for FM chirp in an attempt to improve swath width in the face of bubble sweep-down noise. System responded well with increased swath, although still had issues if the ship took pitches of more than 3-4 degrees.

0102: End of first line of survey. At this time, the LDEO technicians having completed the wiring for synchronizing the EM122 and the Knudsen using information from shore and the EM122 hardware manuals, the Knudsen was switched to external synchronization, and subsequently successfully pinged at the rate of the EM122, and synchronized to it.

0150: Start of second line. Significantly smoother ride heading northeast on track that coming down southwest. At this time, the Micro SV sensor having been stable for an hour, the EM122 was again configured to use it for surface sound speed; survey party monitoring of the system against the TSG output was continued, however. Considerable lightning and rain outside.

1703: End of second line. Micro SV continued to provide stable readings, and was used throughout. Watercolumn conditions were still variable throughout the line, and frequent XBT casts were taken to compensate.

1754: Start of third line, heading southwest.

2300: Weather began to deteriorate significantly as the ship headed southwest, mainly due to large waves, head seas, and 30-35kt winds. This led to marginal data at times, particularly in the backscatter signal.

2340: Micro SV sound speed sensor once again began to provide erroneous data. This time the suspicion was that the sensor was taking bubbles due to the deteriorating weather conditions outside as the ship beat into the waves going southwest. The LDEO technicians moved it into the water supply that goes through the de-bubbler, and this appeared to improve things, but the EM122 was set to manual surface sound speed mode, and monitored by the survey team. The LDEO technicians were requested to prepare a backup plan for using the TSG input for the EM122 in case the Micro SV continued to experience problems.

2015-08-03 (JD 215) – Surveying in southern operational area

0100: Conducted a walk-through of the configuration of the TSG and Micro SV sensors with the LDEO technicians. The TSG is in the *Langseth*'s main-deck wet lab space, Figure 6, where sea water from an intake at the same level as the transducer, and approximately 1.5-3m forward on the hull, was led through approximately 30 m of piping to a de-bubbler, and then into the **TSG (Figure 7).**

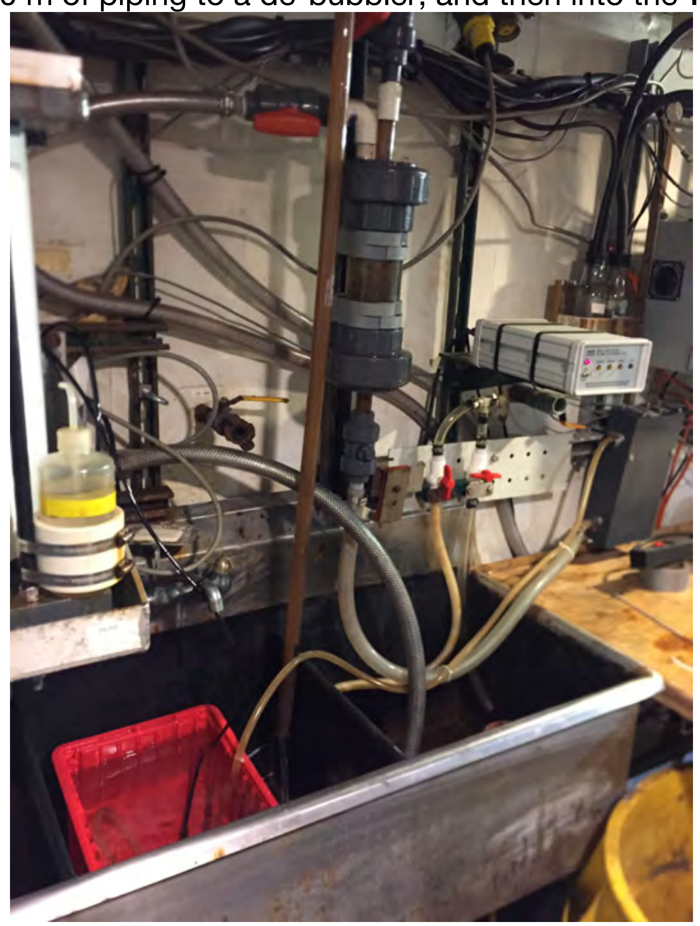


Figure 7The output from the TSG was then led into a plastic measurement cell (in the sink) containing the Micro sv (Figure 8). This configuration was put together during the cruise in order to avoid ground-loops in the sink (which was one cause of the difficulties previously encountered with the system), and to attempt to ensure that the Micro SV obtained water from the TSG as quickly as possible, at a sufficiently high flow-through rate.

Figure 6: The main-deck wet lab of the R/V Langseth during MGL15-12. The de-bubbler for the TSG is the wall-mounted grey cylinder in the center of the image, with the white pCO_2 tank to the left, and the gas analyzer to the far right. The dark grey box plumbed into the sink is the TSG.

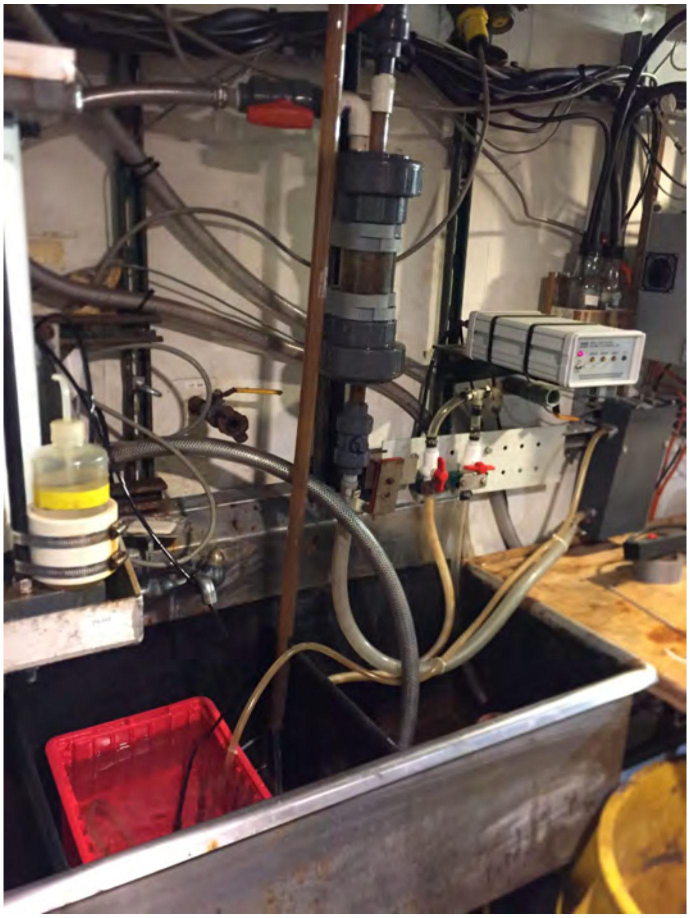


Figure 7: De-bubbler (vertical cylinder center frame), TSG (dark grey box wall-mounted far right), and plastic measurement cell for the Micro SV (in sink, bottom left).

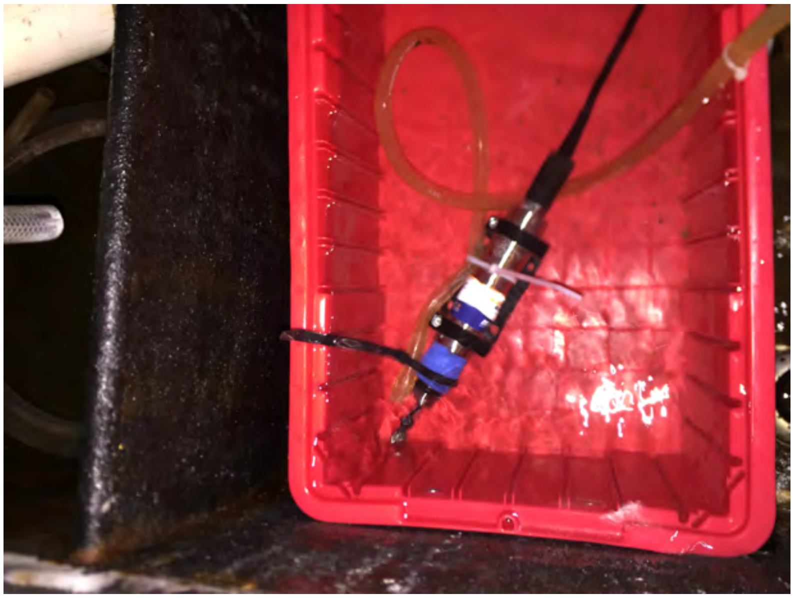


Figure 8: Micro SV sensor in measurement tank in the wet lab sink. The tubing leads from the output of the TSG, in an attempt to ensure that the Micro SV sensor head is surrounded by water immediately from the TSG.

Observation of this configuration in operation led to the conclusion that some of the erroneous readings taken with the system may have been due to residual bubbles within the output from the TSG (when heading southwest into the seas, copious streams of bubbles were observed leaving the de-bubbler exit tubing, and occasional erroneous observations were observed even from the TSG). The configuration selected had the maximal chances of avoiding this situation, so the survey crew were instructed to remain on manual input of sound speed from the TSG output, but to monitor the Micro SV output for stability.

1237: Analysis of the TSG and Micro SV outputs as time series showed a significant (although not perfect) correlation between large pitch events, and the erroneous readings observed from the Micro SV, Figure 9. The analysis also showed that the sensors were tracking well otherwise, since the last adjustments to their configuration (Figure 6 - Figure 8). The ship having just turned northward to start the next line, large pitch events were considered unlikely (for 16 hrs), and the EM122 was again configured to accept input from the Micro SV, while the survey crew monitored for stability in the face of large pitch events ("large" meaning beyond approximately five degrees peak).

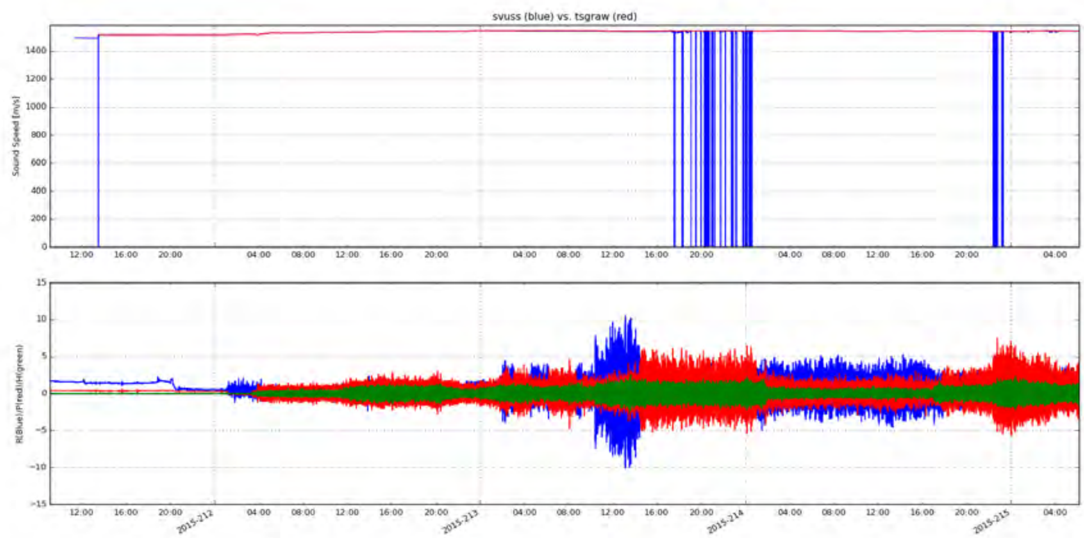


Figure 9: Comparison (top panel) between Micro SV (blue) and TSG sound speed (red), and (bottom panel) attitude time series of roll (blue), pitch (red), and heave (green). Erroneous data from the Micro SV appears to be partially correlated with pitch.

2359: Other than as noted, a routine day of surveying in good weather conditions. Weather conditions deteriorating towards end of day, however, with rain and lightning storms.

2015-08-04 (JD 216) – Surveying in the southern operational area.

0100: Having received approval from LDEO office of marine operations, the Captain authorized increase of pitch on the props to give better speed through water. Speed increased to 11.5 kts, giving speed over ground closer to 12 kts on the northeast run.

2250: End of line, and reboot of SIS to ensure that there were no residual effects after changes that had been made to sound speed sensor input during the previous few days. (The GUI had been showing evidence of failure to redraw correctly.) A BIST was also conducted, which the EM122 passed.

2255: Inspection of data collected to date in the survey showed what appeared to be a consistent downward refraction, although this appeared to be spatially localized. The casts being collected by XBT all appeared to be higher than the climatological mean for the area, based on World Ocean Atlas information derived from SVP Editor. Suspecting that this might be related to the refraction, an attempt was made to use the Real Time Oceanographic Forecasting System (RTOFS) model built into SVP Editor, and this resulted in a significantly better match in the deeper water to the profile in the surface being collected by XBTs. Use of the RTOFS model to provide information to extend XBT casts requires an internet connection; the SIS machine was confirmed to be internet connected, however, which made this a feasible solution.

2015-08-05 (JD 217) – Surveying in the southern operational area.

0020: Took XBT cast to address surface sound speed difference, and extended with RTOFS model as reference cast. Cast appeared to successfully match the data gathered from the XBT better at the interface between estimated sound speed and modelled sound speed. The only observed difficulty with this procedure was some fragility of the SVP Editor software when accessing the RTOFS system (over the Internet). This appeared to be resolved best by restarting SVP Editor before processing a cast. Since there was at the time no observable refraction effect, however, no further conclusion as to whether this resolved the issues observed was reached.

1236: In an attempt to understand what appeared at first glance to be a persistent refraction issue (downward refracted outer edges to the swath), an XSV-01 and XBT Deep Blue were launched in rapid succession. Comparison of the two profiles in a patched version of SVP Editor (versions up to 1.0.5 cannot load XSV-01 data) showed no significant difference between the profiles, leading to the conclusion that, to the extent that the sound speed variability of the watercolumn could be captured with expendable technologies, it was being captured. Sound speed issues at the transducer head were also considered unlikely as a potential source of error, since there were two independent systems measuring the sound speed, which were observed to agree with each other. Despite further investigation into previous data from the same system, there was no obvious cause for this effect.

1431: SIS restart and BIST test passed.

2015-08-06 (JD 218) – Surveying in the southern operational area.

1150: BIST test passed.

2359: Except as otherwise noted, a routine day of surveying.

2015-08-07 (JD 219) – Surveying in the southern operational area.

2359: Except as otherwise noted, a routine day of surveying.

2015-08-08 (JD 220) – Surveying in the southern operational area.

0601: After the scheduled line change at 0600, the EM122 was observed to lose lock on the bottom, resulting in a small data gap. The sea conditions were ideal. Bottom lock was re-established automatically after some time, with the EM122 "walking" the swath out from narrow to full width (Figure 10). The gap being small, and not in a critical area, no further action was taken.

2359: Except as otherwise noted, a routine day of surveying.

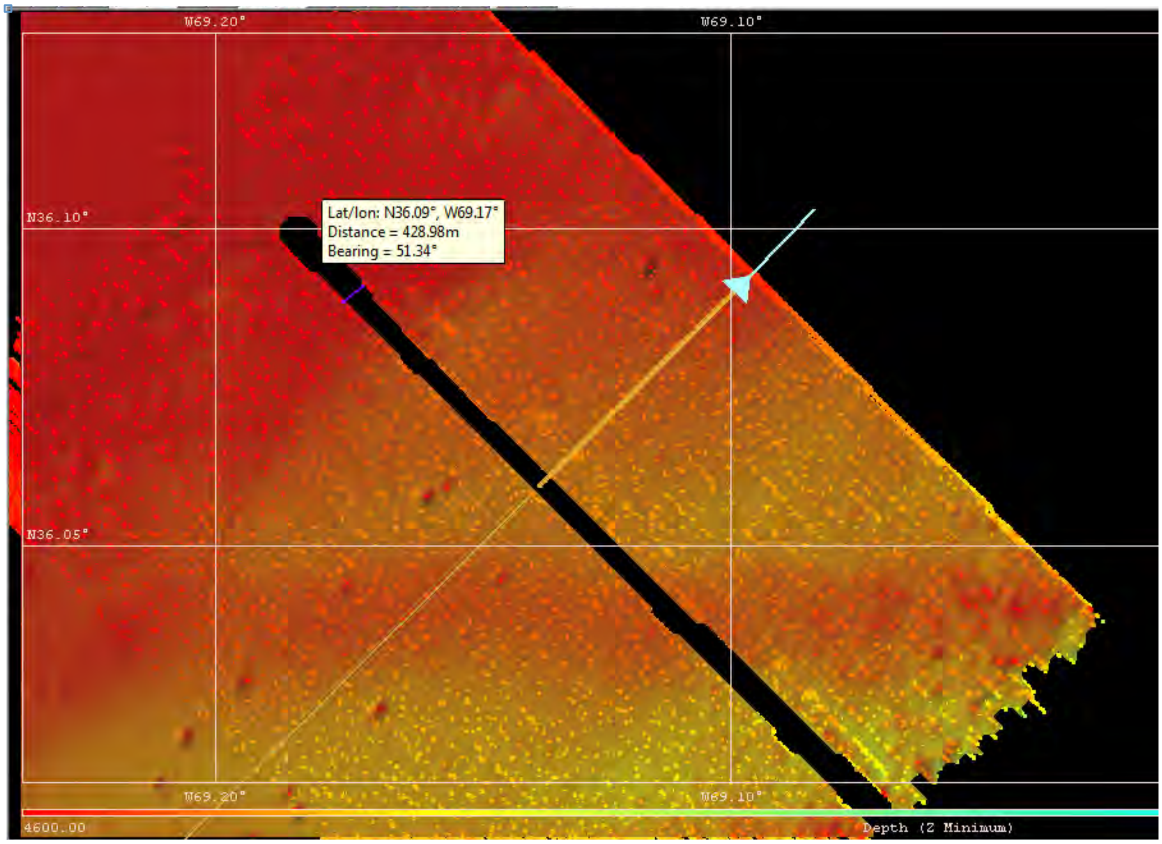


Figure 10: Loss of bottom detection between line 42 and 43. A first rough estimation of the possible gap is approximately 400 m.

2015-08-09 (JD 221) – Surveying in the southern operational area.

0600-0900: Deteriorating sea conditions made acquisition conditions difficult and reduced the EM122 coverage (Figure 11).

1619: End of line 11. During the turn, the SIS computer was restarted as a preventative maintenance issue, and a new BIST was conducted, which the system passed.

2359: Except as otherwise noted, a routine day of surveying.

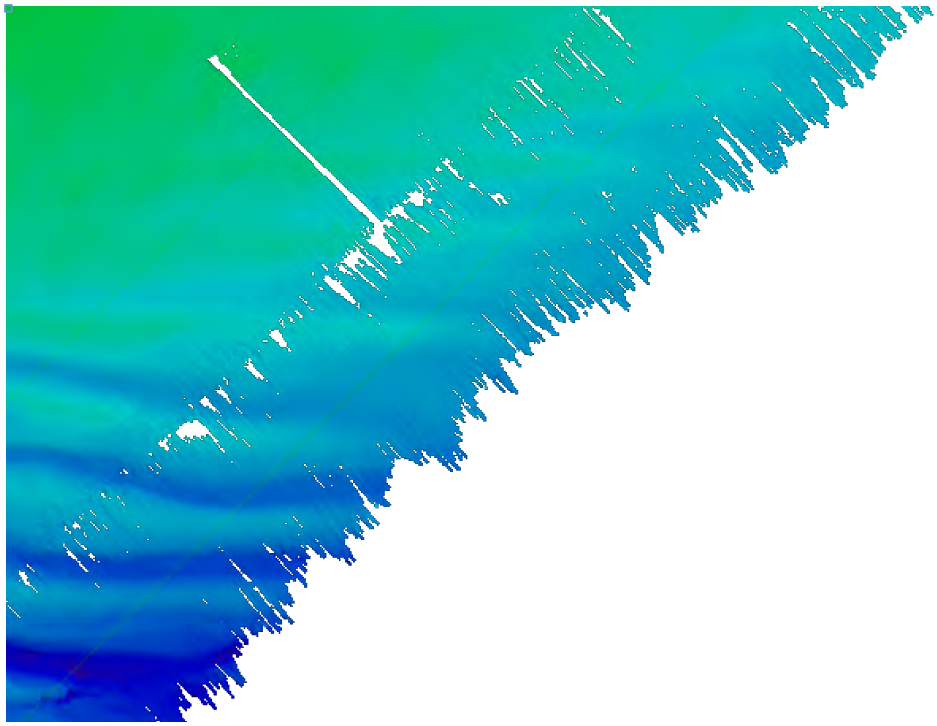


Figure 11: Reduced coverage for line 47 due to bad weather conditions.

2015-08-10 (JD 222) – Surveying in the southern operational area.

A routine day of surveying in the southern operational area, with decreasing seas.

2015-08-11 (JD 223) – Surveying in the southern operational area.

1235: During an attempt to fix the vessel's internet connection, the *Langseth* technicians were forced to reset the science network switch. As a result of this operation, the EM122 was unable to receive Seapath attitude data for approximately one minute (Figure 12). This also brought to light, contrary to previous descriptions, that the attitude data was being provided through UDP packets rather than directly to the EM122 over a serial cable, making it a potential source of the outer beam "wobble" effects observed in the data during rough weather conditions.

Date	Time	Type	No.	Disabl.	Message
2015 08 11	12:34:47	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:34:52	3	722		EM122: Attitude Velocity data not valid for ping
2015 08 11	12:34:57	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:35:00	122	650		(DDS) Echo sounder EM122_109. Frequency of received AttVel datagrams on PU UDP5 is less than 90% of e Expected/received (Hz): 90.00/0.00
2015 08 11	12:35:07	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:35:09	3	722		EM122: Attitude Velocity data not valid for ping
2015 08 11	12:35:17	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:35:27	3	722		EM122: Attitude Velocity data not valid for ping
2015 08 11	12:35:27	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:35:37	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:35:45	3	722		EM122: Attitude Velocity data not valid for ping
2015 08 11	12:35:47	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:35:57	3	2501		(PU Sensor) Attitude/Velocity on PU port UDP5 is missing.
2015 08 11	12:36:00	122	650		(DDS) Echo sounder EM122_109. Frequency of received AttVel datagrams on PU UDP5 is less than 90% of e Expected/received (Hz): 90.00/0.00
2015 08 11	12:36:03	3	722		EM122: Attitude Velocity data not valid for ping
2015 08 11	12:42:53	1	205		Checking XYZ: 2 Datagram too small
2015 08 11	13:09:25	3	2503		(PU Sensor) GGA on PU port COM1 is missing.

Figure 12: Error messages in SIS related to the loss of attitude data during the science network switch reset event.

2359: Other than as noted, a routine day of surveying.

2015-08-12 (JD 224) - Surveying in the southern operational area.

0045: Following a warning flash, the Seapath motion sensor indicator lights showed that navigation had been compromised, and that the attitude data being supplied to the EM122 was degraded. The LDEO technicians restarted the Seapath, the SIS data logger, and the EM122 topside unit while the ship dead-headed back up the line to a position prior to the problems being evident in the data. The ship then came about and re-joined the line, and logging was restarted approximately 0115. There was no identified causative issue for the compromised performance of the Seapath, although it appeared to be possible that the system received bad corrections from the CNav 3050, or had some issue with the Kalman filter.

2359: Other than as noted, a routine day of surveying.

2015-08-13 (JD 225) – Surveying in the southern operational area.

A routine day of surveying in the southern operational area.

2015-08-14 (JD 226) – Surveying in the southern operational area.

0500: By mistake the bridge started running survey line 18 as a rhumb line (instead of a great circle). This caused an offset of approximately 500 m from the planned line. After the bridge team rectified the problem, the vessel returned (slowly to avoid acquisition artefacts) to the planned line.

2359: Other than as noted, a routine day of surveying.

2015-08-15 (JD 227) – Surveying in the southern operational area/cross-line to northern area/surveying in the northern operational area.

1025: After completing the last main-scheme line in the southern operational area, a cross-line was conducted through the end-points off all of the prior lines, and the positions of the planned end-points of the remaining lines; in addition this line repositioned the *Langseth* to commence survey operations in the northern operational area.

2300: After completing the cross-line for the southern section, *Langseth* commenced surveying in the northern section with very good weather conditions (winds under 10 kts, seas almost flat).

2359: Other than as noted, a routine day of surveying.

2015-08-16 (JD 228) – Surveying in the northern operational area.

A routine day of surveying in OPAREA NORTH. Good weather conditions continued, making surveying significantly simpler. Strong sound speed refraction and surface sound speed variability was observed, however, as expected given the survey track's proximity to the position of the Gulf Stream. This resulted in some refraction artefacts in the data that apparently responded to sound speed profile variations not evident by comparison of the surface sound speed at the transducer and profile sound speed at the transducer depth. The effects appeared to be spatially localized around the region of approximately 38° 22.3'N/66° 30.0'W.

2015-08-17 (JD229) – Surveying in the northern operational area/Medical Evacuation Transit.

1745: Due to a medical emergency with one of the crewmen, the Captain, based on the advice of an on-call Doctor, required that we break line and transit immediately at best available speed for Nantucket, so that the crewman could be evacuated. The existing survey line (planned line 24, Kongsberg capture line 85) was interrupted, and the transit data collected separately.

2015-08-18 (JD230) – Medical Evacuation Transit

1815: Dropped off sick crew member off Nantucket and started heading back out to the operational area. The transit line was offset to the south of the line run back to shore in order to cover new area (although the area had also been previously mapped by Legs 2-3 of the same mapping campaign, using USNS *Henson*, in 2005).

2015-08-19 (JD231) – Medical Evacuation Transit/Surveying in northern operational area.

0118: Depth having dropped below 500 m, the EM122 settings were returned to those generally in use for deep water mapping (dynamic dual swath, high density equidistant beam-forming, FM on) and a T-7 XBT was taken to update the sound speed profile. Transit line logging restarted with Kongsberg line 92.

1525: In an effort to recover some of the time lost in the medivac, the ship agreed to attempt to run at a higher average speed. To do so, however, requires the ship to run the shafts at 750 rpm rather than the usual 600 rpm, which can result in higher ambient self-noise. The ship declutched on one shaft to allow the engines to be raised to 750 rpm, brought the shaft back on line, and then repeated the process.

1710: Recommenced survey on planned line 24 (Kongsberg capture line 96). Continued at higher shaft rate, making 13.4 kts (with current) downline, to test noise performance. BIST test analysis indicated a loss of approximately 5-8 dB across the receiver channels due to higher shaft rate and consequent higher speed through water, although the improvement in speed over ground was marginal (~0.2 kts).

1948: Examination of data on line showed that the swath width had been materially impacted (~1km per side) by the increase in noise from running the shafts at 750 rpm. In addition, the engine-room watch reported temperature fluctuations on the port engine that caused it to have to be run at 70-75%, causing increased noise on the outer port swath. These effects combined meant that the *Langseth* was not improving speed over ground, but was reducing swath by running at 750 rpm, with the conclusion that it was impracticable to continue to run at this rate for the remainder of the cruise. The Captain therefore ordered reduced rates on both engines, and the engine-room watch brought the ship back to 600 rpm on both shafts.

2359: Other than as noted, a routine day of surveying.

2015-08-20 (JD232) – Surveying in the northern operational area.
Routine day of surveying in the northern operational area.

2015-08-21 (JD233) – Surveying in the northern operational area.
Routine day of surveying in the northern operational area.

2015-08-22 (JD234) – Surveying in the northern operational area.
Routine day of surveying in the northern operational area.

2015-08-23 (JD235) – Surveying in the northern operational area.
Routine day of surveying in the northern operational area.

2015-08-24 (JD236) – Surveying in the northern operational area.

Several failures to launch XBTs triggered an investigation into possible causes. A visual inspection of the XBT system components identified the presence of corrosion on one of three terminals of the launcher (Figure 13). A replacement launcher was substituted, and immediately resolved the problem.

2015-08-25 (JD237) – Surveying in the northern operational area.
Routine day of surveying in the northern operational area.

Figure 13: Detail of the XBT launcher with the corroded terminal connector (left). Intermittent contact with the pads in the XBTs caused failures in recognizing new probes, and in collecting data during operations. A new launcher was subsequently substituted.

2015-08-26 (JD238) – Surveying in the northern operational area.
1754: Completed planned line 36, and started prospecting line along 350nmi limit line towards area north of the New England Seamounts.

2015-08-27 (JD239) – Surveying in the far northern operational area.
Routine day of survey in the far northern operational area around the New England Seamounts, with increasing weather when heading northeast into the swell that caused data quality reduction due to aeration from pitching.

2015-08-28 (JD240) – Surveying in the far northern operational area/transit.
0456: Completed planned line 43 of the survey, which was the last survey line in the area around the New England Seamounts. Proceeded then to a planned transit line as requested by USGS researchers.
0742: Completed planned transit line, and returned control of the ship to the Ship's Master for transit to Woods Hole, MA. Transit continued for the remainder of the day.

2015-08-29 (JD241) – Transit/Arrival Woods Hole,MA.
0320: The ship having diverted to pick up a malfunctioning WHOI mooring before going back to the dock, and the depth being under 500 m, collection of transit

data was stopped, with the last line being Kongsberg line 144. At this point, control of the Knudsen and Kongsberg systems were returned to LDEO for their internal data collection purposes, and SVP Editor was set to “server” mode, so that it started sending sound speed profiles from the World Ocean Atlas to the Kongsberg system.

The ship continued to transit, picking up the pilot at the Martha’s Vinyard pilot station at 1800. Arrived Woods Hole, MA at the Woods Hole Oceanographic Institute dock at 2015. Closing gravity tie completed with LDEO technicians to complete leg 8 of the east coast mapping campaign.

6 Personnel List

The *Langseth* provided deck officers, crew, and support personnel as appropriate for the safe operation of the ship. Four resident technicians were provided by LDEO (Columbia University) to provide assistance in operating the computer and survey equipment on the ship, and to train the science party in their correct usage. The ship and scientific party are listed in Table 3.

Table 3: Ship and science party personnel during MGL15-12, leg 8 of the U.S. continental shelf east coast mapping program.

Name	Organisation	Role
Dr. Brian R. Calder	CCOM-JHC/UNH	Chief Scientist
CAPT Mark Landow	LDEO	Ship's Master
Breckenridge Crum	LDEO	Chief Mate
Christine Fernadez O'Toole	LDEO	Second Mate
Daniel Protano	LDEO	Third Mate
Matthew Tucke	LDEO	Chief Engineer
Dr. Giuseppe Masetti	CCOM-JHC/UNH	Watchstander/Scientist
Scott Loranger	CCOM-JHC/UNH	Watchstander/Graduate Student
David Armstrong	CCOM-JHC/UNH	Watchstander/Scientist
Indra Prasetyawan	CCOM-JHC/UNH	Watchstander/Graduate Student
Hirokazu Kurita	CCOM-JHC/UNH	Watchstander/Graduate Student
Amon Kimeli	CCOM-JHC/UNH	Watchstander/Graduate Student
Robert Koprowski	LDEO	Cruise Chief Science Officer
Robert Steinhaus	LDEO	LDEO Chief Science Officer
Guilles Guerin	LDEO	IT Technician
Mert Kucuk	LDEO	Technician
Cameron Chassey	M.A.T.E. PROGRAM	M.A.T.E. Intern

7 File Name Translations

In order to maintain compatibility with previous legs of the survey, lines from the Kongsberg SIS and Knudsen Engineering data capture software were renamed to provide a sequential line number scheme. The tables for these translations follow.

Table 4: Line name translations for Kongsberg EM122 data files captured in sis.

ID	Original Name	Translated Name
0	0000_20150731_031456_Langseth	Atlantic_line_604tran.all
1	0001_20150731_041635_Langseth	Atlantic_line_605tran.all
2	0002_20150731_115947_Langseth	Atlantic_line_606tran.all
3	0003_20150731_180027_Langseth	Atlantic_line_607tran.all
4	0004_20150731_235857_Langseth	Atlantic_line_608tran.all
5	0005_20150801_031229_Langseth	Atlantic_line_609patch.all
6	0006_20150801_044450_Langseth	Atlantic_line_610patch.all
7	0007_20150801_062109_Langseth	Atlantic_line_611patch.all
8	0008_20150801_091438_Langseth	Atlantic_line_612patch.all
9	0009_20150801_102235_Langseth	Atlantic_line_613tran.all
10	0010_20150801_120435_Langseth	Atlantic_line_614tran.all
11	0011_20150801_135527_Langseth	Atlantic_line_615tran.all
12	0012_20150801_140227_Langseth	Atlantic_line_616tran.all
13	0013_20150801_143015_Langseth	Atlantic_line_617.all
14	0014_20150801_145130_Langseth	Atlantic_line_618.all
15	0015_20150801_203001_Langseth	Atlantic_line_619.all
16	0016_20150802_015058_Langseth	Atlantic_line_620.all
17	0017_20150802_060850_Langseth	Atlantic_line_621.all
18	0018_20150802_120007_Langseth	Atlantic_line_622.all
19	0019_20150802_175504_Langseth	Atlantic_line_623.all
20	0020_20150803_000012_Langseth	Atlantic_line_624.all
21	0021_20150803_060838_Langseth	Atlantic_line_625.all
22	0022_20150803_120410_Langseth	Atlantic_line_626.all
23	0023_20150803_180015_Langseth	Atlantic_line_627.all
24	0024_20150804_000015_Langseth	Atlantic_line_628.all
25	0025_20150804_035006_Langseth	Atlantic_line_629.all
26	0026_20150804_114958_Langseth	Atlantic_line_630.all
27	0027_20150804_120008_Langseth	Atlantic_line_631.all
28	0028_20150804_180015_Langseth	Atlantic_line_632.all
29	0029_20150804_233517_Langseth	Atlantic_line_633.all
30	0030_20150805_060143_Langseth	Atlantic_line_634.all
31	0031_20150805_120021_Langseth	Atlantic_line_635.all

ID	Original Name	Translated Name
32	0032_20150805_152924_Langseth	Atlantic_line_636.all
33	0033_20150805_180004_Langseth	Atlantic_line_637.all
34	0034_20150806_014854_Langseth	Atlantic_line_638.all
35	0035_20150806_060449_Langseth	Atlantic_line_639.all
36	0036_20150806_120747_Langseth	Atlantic_line_640.all
37	0037_20150806_180010_Langseth	Atlantic_line_641.all
38	0038_20150807_000019_Langseth	Atlantic_line_642.all
39	0039_20150807_045009_Langseth	Atlantic_line_643.all
40	0040_20150807_120014_Langseth	Atlantic_line_644.all
41	0041_20150807_180008_Langseth	Atlantic_line_645.all
42	0042_20150808_001310_Langseth	Atlantic_line_646.all
43	0043_20150808_060105_Langseth	Atlantic_line_647.all
44	0044_20150808_120001_Langseth	Atlantic_line_648.all
45	0045_20150808_172136_Langseth	Atlantic_line_649.all
46	0046_20150809_000003_Langseth	Atlantic_line_650.all
47	0047_20150809_060129_Langseth	Atlantic_line_651.all
48	0048_20150809_120014_Langseth	Atlantic_line_652.all
49	0049_20150809_170609_Langseth	Atlantic_line_653.all
50	0050_20150810_000008_Langseth	Atlantic_line_654.all
51	0051_20150810_062225_Langseth	Atlantic_line_655.all
52	0052_20150810_114015_Langseth	Atlantic_line_656.all
53	0053_20150810_180015_Langseth	Atlantic_line_657.all
54	0054_20150811_000006_Langseth	Atlantic_line_658.all
55	0055_20150811_051159_Langseth	Atlantic_line_659.all
56	0056_20150811_120010_Langseth	Atlantic_line_660.all
57	0057_20150811_180014_Langseth	Atlantic_line_661.all
58	0058_20150811_214017_Langseth	Atlantic_line_662.all
59	0059_20150812_011841_Langseth	Atlantic_line_663.all
60	0060_20150812_060027_Langseth	Atlantic_line_664.all
61	0061_20150812_120010_Langseth	Atlantic_line_665.all
62	0062_20150812_164900_Langseth	Atlantic_line_666.all
63	0063_20150813_000002_Langseth	Atlantic_line_667.all
64	0064_20150813_034514_Langseth	Atlantic_line_668.all
65	0065_20150813_093127_Langseth	Atlantic_line_669.all
66	0066_20150813_173129_Langseth	Atlantic_line_670.all
67	0067_20150813_180012_Langseth	Atlantic_line_671.all
68	0068_20150814_000022_Langseth	Atlantic_line_672.all
69	0069_20150814_032631_Langseth	Atlantic_line_673.all
70	0070_20150814_093350_Langseth	Atlantic_line_674.all

ID	Original Name	Translated Name
71	0071_20150814_120239_Langseth	Atlantic_line_675.all
72	0072_20150814_200155_Langseth	Atlantic_line_676.all
73	0073_20150815_022420_Langseth	Atlantic_line_677.all
74	0075_20150815_043151_Langseth	Atlantic_line_678.all
75	0076_20150815_105614_Langseth	Atlantic_line_679.all
76	0077_20150815_180009_Langseth	Atlantic_line_680.all
77	0078_20150815_230113_Langseth	Atlantic_line_681.all
78	0079_20150816_060007_Langseth	Atlantic_line_682.all
79	0080_20150816_104321_Langseth	Atlantic_line_683.all
80	0081_20150816_130132_Langseth	Atlantic_line_684.all
81	0082_20150816_180014_Langseth	Atlantic_line_685.all
82	0083_20150817_000206_Langseth	Atlantic_line_686.all
83	0084_20150817_053419_Langseth	Atlantic_line_687.all
84	0085_20150817_120006_Langseth	Atlantic_line_688.all
85	0086_20150817_175245_Langseth	Atlantic_line_689tran.all
86	0087_20150818_001005_Langseth	Atlantic_line_690tran.all
87	0088_20150818_040033_Langseth	Atlantic_line_691tran.all
88	0092_20150819_011849_Langseth	Atlantic_line_692tran.all
89	0093_20150819_073012_Langseth	Atlantic_line_693tran.all
90	0094_20150819_151947_Langseth	Atlantic_line_694tran.all
91	0095_20150819_160921_Langseth	Atlantic_line_695tran.all
92	0096_20150819_170947_Langseth	Atlantic_line_696.all
93	0097_20150819_192647_Langseth	Atlantic_line_697.all
94	0098_20150820_012904_Langseth	Atlantic_line_698.all
95	0099_20150820_073002_Langseth	Atlantic_line_699.all
96	0100_20150820_120111_Langseth	Atlantic_line_700.all
97	0101_20150820_163551_Langseth	Atlantic_line_701.all
98	0102_20150820_223449_Langseth	Atlantic_line_702.all
99	0103_20150821_053839_Langseth	Atlantic_line_703.all
100	0104_20150821_113008_Langseth	Atlantic_line_704.all
101	0105_20150821_180016_Langseth	Atlantic_line_705.all
102	0107_20150821_225406_Langseth	Atlantic_line_706.all
103	0108_20150822_045505_Langseth	Atlantic_line_707.all
104	0109_20150822_105519_Langseth	Atlantic_line_708.all
105	0110_20150822_142105_Langseth	Atlantic_line_709.all
106	0111_20150822_180306_Langseth	Atlantic_line_710.all
107	0112_20150823_000013_Langseth	Atlantic_line_711.all
108	0113_20150823_075932_Langseth	Atlantic_line_712.all
109	0114_20150823_120017_Langseth	Atlantic_line_713.all

ID	Original Name	Translated Name
110	0115_20150823_180000_Langseth	Atlantic_line_714.all
111	0116_20150824_001352_Langseth	Atlantic_line_715.all
112	0117_20150824_061321_Langseth	Atlantic_line_716.all
113	0118_20150824_120012_Langseth	Atlantic_line_717.all
114	0119_20150824_172859_Langseth	Atlantic_line_718.all
115	0120_20150825_000005_Langseth	Atlantic_line_719.all
116	0121_20150825_061533_Langseth	Atlantic_line_720.all
117	0122_20150825_075705_Langseth	Atlantic_line_721.all
118	0123_20150825_123004_Langseth	Atlantic_line_722.all
119	0124_20150825_202331_Langseth	Atlantic_line_723.all
120	0125_20150826_022100_Langseth	Atlantic_line_724.all
121	0126_20150826_061850_Langseth	Atlantic_line_725.all
122	0127_20150826_083923_Langseth	Atlantic_line_726.all
123	0128_20150826_120147_Langseth	Atlantic_line_727.all
124	0129_20150826_143105_Langseth	Atlantic_line_728.all
125	0130_20150826_152250_Langseth	Atlantic_line_729.all
126	0131_20150826_175438_Langseth	Atlantic_line_730.all
127	0132_20150827_000016_Langseth	Atlantic_line_731.all
128	0133_20150827_042635_Langseth	Atlantic_line_732.all
129	0134_20150827_080505_Langseth	Atlantic_line_733.all
130	0135_20150827_085251_Langseth	Atlantic_line_734.all
131	0136_20150827_114145_Langseth	Atlantic_line_735.all
132	0137_20150827_125024_Langseth	Atlantic_line_736.all
133	0138_20150827_185143_Langseth	Atlantic_line_737.all
134	0139_20150827_230238_Langseth	Atlantic_line_738.all
135	0140_20150827_234852_Langseth	Atlantic_line_739.all
136	0141_20150828_050250_Langseth	Atlantic_line_740tran.all
137	0142_20150828_115051_Langseth	Atlantic_line_741tran.all
138	0143_20150828_180551_Langseth	Atlantic_line_742tran.all
139	0144_20150829_000006_Langseth	Atlantic_line_743tran.all

Table 5: Line name translations for Knudsen Engineering 3260 data files.

ID	Original Name	Translated Name
1	0001_212_0307_110227_CHP3.5_DET_000.sgy	Atlantic_line_605tran.sgy
1	0001_212_0737_110227_CHP3.5_DET_000.sgy	Atlantic_line_605tran_b.sgy
2	0002_212_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_606tran.sgy
2	0002_212_1322_110227_CHP3.5_DET_000.sgy	Atlantic_line_606tran_b.sgy
3	0003_212_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_607tran.sgy
4	0004_212_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_608tran.sgy
13	0013_213_1426_110227_CHP3.5_DET_000.sgy	Atlantic_line_617.sgy
14	0014_213_1544_110227_CHP3.5_DET_000.sgy	Atlantic_line_618.sgy
15	0015_213_2026_110227_CHP3.5_DET_000.sgy	Atlantic_line_619.sgy
16	0016_214_0147_110227_CHP3.5_DET_000.sgy	Atlantic_line_620.sgy
17	0017_214_0605_110227_CHP3.5_DET_000.sgy	Atlantic_line_621.sgy
18	0018_214_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_622.sgy
19	0019_214_1751_110227_CHP3.5_DET_000.sgy	Atlantic_line_623.sgy
20	0020_214_2356_110227_CHP3.5_DET_000.sgy	Atlantic_line_624.sgy
21	0021_215_0605_110227_CHP3.5_DET_000.sgy	Atlantic_line_625.sgy
22	0022_215_1200_110227_CHP3.5_DET_000.sgy	Atlantic_line_626.sgy
23	0023_215_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_627.sgy
24	0024_215_2356_110227_CHP3.5_DET_000.sgy	Atlantic_line_628.sgy
25	0025_216_0346_110227_CHP3.5_DET_000.sgy	Atlantic_line_629.sgy
26	0026_216_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_630.sgy
27	0027_216_1212_110227_CHP3.5_DET_000.sgy	Atlantic_line_631.sgy
28	0028_216_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_632.sgy
29	0029_216_2331_110227_CHP3.5_DET_000.sgy	Atlantic_line_633.sgy
30	0030_217_0557_110227_CHP3.5_DET_000.sgy	Atlantic_line_634.sgy
31	0031_217_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_635.sgy
32	0032_217_1525_110227_CHP3.5_DET_000.sgy	Atlantic_line_636.sgy
33	0033_217_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_637.sgy
34	0034_218_0145_110227_CHP3.5_DET_000.sgy	Atlantic_line_638.sgy
35	0035_218_0600_110227_CHP3.5_DET_000.sgy	Atlantic_line_639.sgy
36	0036_218_1203_110227_CHP3.5_DET_000.sgy	Atlantic_line_640.sgy
37	0037_218_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_641.sgy
38	0038_218_2356_110227_CHP3.5_DET_000.sgy	Atlantic_line_642.sgy
39	0039_219_0446_110227_CHP3.5_DET_000.sgy	Atlantic_line_643.sgy
40	0040_219_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_644.sgy
41	0041_219_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_645.sgy
42	0042_220_0008_110227_CHP3.5_DET_000.sgy	Atlantic_line_646.sgy
43	0043_220_0556_110227_CHP3.5_DET_000.sgy	Atlantic_line_647.sgy
44	0044_220_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_648.sgy

ID	Original Name	Translated Name
45	0045_220_1717_110227_CHP3.5_DET_000.sgy	Atlantic_line_649.sgy
46	0046_220_2356_110227_CHP3.5_DET_000.sgy	Atlantic_line_650.sgy
47	0047_221_0557_110227_CHP3.5_DET_000.sgy	Atlantic_line_651.sgy
48	0048_221_1155_110227_CHP3.5_DET_000.sgy	Atlantic_line_652.sgy
49	0049_221_1701_110227_CHP3.5_DET_000.sgy	Atlantic_line_653.sgy
50	0050_221_2356_110227_CHP3.5_DET_000.sgy	Atlantic_line_654.sgy
51	0051_222_0618_110227_CHP3.5_DET_000.sgy	Atlantic_line_655.sgy
52	0052_222_1136_110227_CHP3.5_DET_000.sgy	Atlantic_line_656.sgy
53	0053_222_1755_110227_CHP3.5_DET_000.sgy	Atlantic_line_657.sgy
54	0054_222_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_658.sgy
55	0055_223_0507_110227_CHP3.5_DET_000.sgy	Atlantic_line_659.sgy
56	0056_223_1155_110227_CHP3.5_DET_000.sgy	Atlantic_line_660.sgy
57	0057_223_1755_110227_CHP3.5_DET_000.sgy	Atlantic_line_661.sgy
58	0058_223_2135_110227_CHP3.5_DET_000.sgy	Atlantic_line_662.sgy
59	0059_224_0114_110227_CHP3.5_DET_000.sgy	Atlantic_line_663.sgy
60	0060_224_0556_110227_CHP3.5_DET_000.sgy	Atlantic_line_664.sgy
61	0061_224_1155_110227_CHP3.5_DET_000.sgy	Atlantic_line_665.sgy
62	0062_224_1644_110227_CHP3.5_DET_000.sgy	Atlantic_line_666.sgy
63	0063_224_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_667.sgy
64	0064_225_0340_110227_CHP3.5_DET_000.sgy	Atlantic_line_668.sgy
65	0065_225_0926_110227_CHP3.5_DET_000.sgy	Atlantic_line_669.sgy
66	0066_225_1755_110227_CHP3.5_DET_000.sgy	Atlantic_line_670.sgy
67	0067_225_1801_110227_CHP3.5_DET_000.sgy	Atlantic_line_671.sgy
68	0068_225_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_672.sgy
69	0069_226_0322_110227_CHP3.5_DET_000.sgy	Atlantic_line_673.sgy
70	0070_226_0929_110227_CHP3.5_DET_000.sgy	Atlantic_line_674.sgy
71	0071_226_1158_110227_CHP3.5_DET_000.sgy	Atlantic_line_675.sgy
72	0072_226_1957_110227_CHP3.5_DET_000.sgy	Atlantic_line_676.sgy
73	0073_227_0219_110227_CHP3.5_DET_000.sgy	Atlantic_line_677.sgy
74	0075_227_0427_110227_CHP3.5_DET_000.sgy	Atlantic_line_678.sgy
75	0076_227_1051_110227_CHP3.5_DET_000.sgy	Atlantic_line_679.sgy
76	0077_227_1755_110227_CHP3.5_DET_000.sgy	Atlantic_line_680.sgy
77	0078_227_2256_110227_CHP3.5_DET_000.sgy	Atlantic_line_681.sgy
78	0079_228_0555_110227_CHP3.5_DET_000.sgy	Atlantic_line_682.sgy
79	0080_228_1038_110227_CHP3.5_DET_000.sgy	Atlantic_line_683.sgy
80	0081_228_1256_110227_CHP3.5_DET_000.sgy	Atlantic_line_684.sgy
81	0082_228_1755_110227_CHP3.5_DET_000.sgy	Atlantic_line_685.sgy
82	0083_228_2357_110227_CHP3.5_DET_000.sgy	Atlantic_line_686.sgy
83	0084_229_0529_110227_CHP3.5_DET_000.sgy	Atlantic_line_687.sgy

ID	Original Name	Translated Name
84	0085_229_1155_110227_CHP3.5_DET_000.sgy	Atlantic_line_688.sgy
85	0086_229_1748_110227_CHP3.5_DET_000.sgy	Atlantic_line_689tran.sgy
85	0086_229_1827_110227_CHP3.5_DET_000.sgy	Atlantic_line_689tran_b.sgy
85	0086_229_1903_110227_CHP3.5_DET_000.sgy	Atlantic_line_689tran_c.sgy
85	0086_229_1943_110227_CHP3.5_DET_000.sgy	Atlantic_line_689tran_d.sgy
86	0087_230_0005_110227_CHP3.5_DET_000.sgy	Atlantic_line_690tran.sgy
87	0088_230_0356_110227_CHP3.5_DET_000.sgy	Atlantic_line_691tran.sgy
87	0088_230_0427_110227_CHP3.5_DET_000.sgy	Atlantic_line_691tran_b.sgy
87	0088_230_0453_110227_CHP3.5_DET_000.sgy	Atlantic_line_691tran_c.sgy
87	0088_230_0812_110227_CHP3.5_DET_000.sgy	Atlantic_line_691tran_d.sgy
88	0092_231_0114_110227_CHP3.5_DET_000.sgy	Atlantic_line_692tran.sgy
88	0092_231_0416_110227_CHP3.5_DET_000.sgy	Atlantic_line_692tran_b.sgy
88	0092_231_0434_110227_CHP3.5_DET_000.sgy	Atlantic_line_692tran_c.sgy
89	0093_231_0725_110227_CHP3.5_DET_000.sgy	Atlantic_line_693tran.sgy
90	0094_231_1515_110227_CHP3.5_DET_000.sgy	Atlantic_line_694tran.sgy
91	0095_231_1604_110227_CHP3.5_DET_000.sgy	Atlantic_line_695tran.sgy
92	0096_231_1704_110227_CHP3.5_DET_000.sgy	Atlantic_line_696.sgy
93	0097_231_1921_110227_CHP3.5_DET_000.sgy	Atlantic_line_697.sgy
94	0098_232_0124_110227_CHP3.5_DET_000.sgy	Atlantic_line_698.sgy
95	0099_232_0725_110227_CHP3.5_DET_000.sgy	Atlantic_line_699.sgy
96	0100_232_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_700.sgy
97	0101_232_1630_110227_CHP3.5_DET_000.sgy	Atlantic_line_701.sgy
98	0102_232_2230_110227_CHP3.5_DET_000.sgy	Atlantic_line_702.sgy
99	0103_233_0534_110227_CHP3.5_DET_000.sgy	Atlantic_line_703.sgy
100	0104_233_1126_110227_CHP3.5_DET_000.sgy	Atlantic_line_704.sgy
101	0105_233_1756_110227_CHP3.5_DET_000.sgy	Atlantic_line_705.sgy
102	0107_233_2250_110227_CHP3.5_DET_000.sgy	Atlantic_line_706.sgy
103	0108_234_0451_110227_CHP3.5_DET_000.sgy	Atlantic_line_707.sgy
104	0109_234_1051_110227_CHP3.5_DET_000.sgy	Atlantic_line_708.sgy
105	0110_234_1416_110227_CHP3.5_DET_000.sgy	Atlantic_line_709.sgy
106	0111_234_1758_110227_CHP3.5_DET_000.sgy	Atlantic_line_710.sgy
107	0112_234_2356_110227_CHP3.5_DET_000.sgy	Atlantic_line_711.sgy
108	0113_235_0755_110227_CHP3.5_DET_000.sgy	Atlantic_line_712.sgy
109	0114_235_1156_110227_CHP3.5_DET_000.sgy	Atlantic_line_713.sgy
110	0115_235_1755_110227_CHP3.5_DET_000.sgy	Atlantic_line_714.sgy
111	0116_236_0009_110227_CHP3.5_DET_000.sgy	Atlantic_line_715.sgy
112	0117_236_0609_110227_CHP3.5_DET_000.sgy	Atlantic_line_716.sgy
113	0118_236_1155_110227_CHP3.5_DET_000.sgy	Atlantic_line_717.sgy
114	0119_236_1724_110227_CHP3.5_DET_000.sgy	Atlantic_line_718.sgy

ID	Original Name	Translated Name
115	0120_236_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_719.sgy
116	0121_237_0611_110227_CHP3.5_DET_000.sgy	Atlantic_line_720.sgy
117	0122_237_0753_110227_CHP3.5_DET_000.sgy	Atlantic_line_721.sgy
118	0123_237_1225_110227_CHP3.5_DET_000.sgy	Atlantic_line_722.sgy
119	0124_237_2019_110227_CHP3.5_DET_000.sgy	Atlantic_line_723.sgy
120	0125_238_0216_110227_CHP3.5_DET_000.sgy	Atlantic_line_724.sgy
121	0126_238_0614_110227_CHP3.5_DET_000.sgy	Atlantic_line_725.sgy
122	0127_238_0835_110227_CHP3.5_DET_000.sgy	Atlantic_line_726.sgy
123	0128_238_1157_110227_CHP3.5_DET_000.sgy	Atlantic_line_727.sgy
124	0129_238_1426_110227_CHP3.5_DET_000.sgy	Atlantic_line_728.sgy
125	0130_238_1518_110227_CHP3.5_DET_000.sgy	Atlantic_line_729.sgy
126	0131_238_1750_110227_CHP3.5_DET_000.sgy	Atlantic_line_730.sgy
127	0132_238_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_731.sgy
128	0133_239_0422_110227_CHP3.5_DET_000.sgy	Atlantic_line_732.sgy
129	0134_239_0800_110227_CHP3.5_DET_000.sgy	Atlantic_line_733.sgy
130	0135_239_0848_110227_CHP3.5_DET_000.sgy	Atlantic_line_734.sgy
131	0136_239_1137_110227_CHP3.5_DET_000.sgy	Atlantic_line_735.sgy
132	0137_239_1245_110227_CHP3.5_DET_000.sgy	Atlantic_line_736.sgy
133	0138_239_1847_110227_CHP3.5_DET_000.sgy	Atlantic_line_737.sgy
134	0139_239_2258_110227_CHP3.5_DET_000.sgy	Atlantic_line_738.sgy
135	0140_239_2344_110227_CHP3.5_DET_000.sgy	Atlantic_line_739.sgy
136	0141_240_0458_110227_CHP3.5_DET_000.sgy	Atlantic_line_740tran.sgy
137	0142_240_1158_110227_CHP3.5_DET_000.sgy	Atlantic_line_741tran.sgy
138	0143_240_1801_110227_CHP3.5_DET_000.sgy	Atlantic_line_742tran.sgy
139	0144_240_2355_110227_CHP3.5_DET_000.sgy	Atlantic_line_743tran.sgy

8 XBT Launch Metadata

A total of 261 XBTs were launched during the course of the survey, Figure 14, of which 24 (9.2%) failed on or after launch. The metadata associated with these launches are given in the table on the following pages, and is available digitally with the cruise report archive.

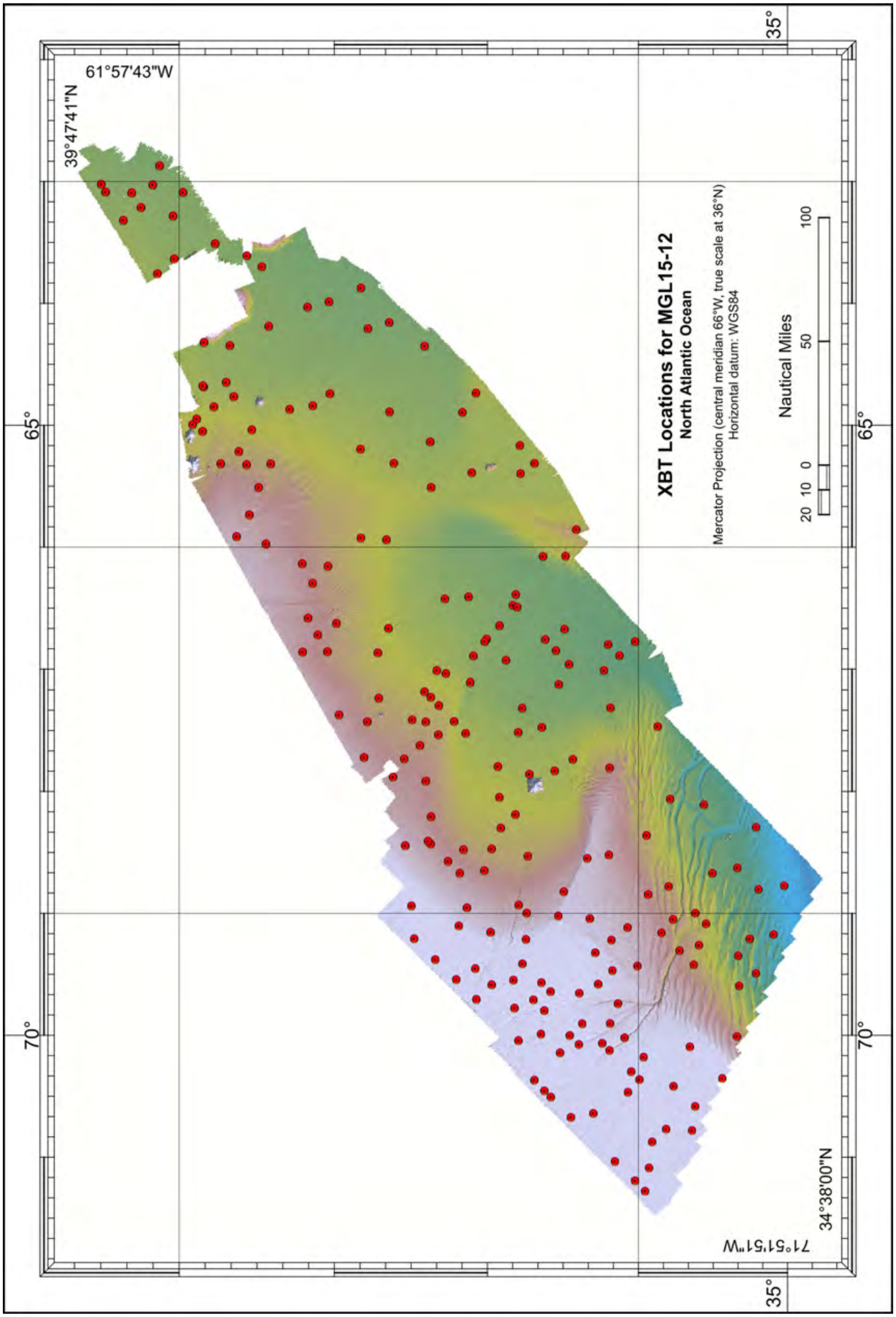


Figure 14: Locations of the XBTs launched during the course of the survey in an attempt to understand the sound speed profile structure of the watercolumn and therefore correct for refraction.

Table 6: XBT launch metadata. Date and time are as reported by the Sippican Mk.21 software, while latitude and longitude (decimal degrees) are from the ship's position recorded by the Mk.21 system. Positions reflect the approximate location of the ship at the start of the XBT launch. Maximum depth is the final termination depth of the XBT after discarding any inconsistent data. TDR SS is the transducer sound speed reported in the Kongsberg SIS console at the time of the launch of the XBT. EM122 Filename is the file name used to send the SSP to the EM122 through the SVP Editor software.

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1029010	2015-07-31	12.24	39 20.734	72 37.858	124.1	1493	20150731_122459	T-7
1239920	2015-07-31	14:19	39 04.399	72 22.975	757.4	1493	20150731_141916	Deep Blue
1029015	2015-07-31	18:04	38 33.874	71 51.121	843	1493	20150731_180449	T-7
1239919	2015-07-31	21:21	38 07.334	71 25.721	N/A	N/A	N/A	Deep Blue/user error[1]
1239918	2015-07-31	21:37	38 05.283	71 23.527	757	1540	20150731_213705	Deep Blue
1239915	2015-08-01	00:00	37 47.616	71 06.399	756	1546	20150731_000159	Deep Blue
32606	2015-08-01	02:00	37 33.371	70 53.004	847	1544	N/A	XSV[2]
1239914	2015-08-01	02:05	37 33.371	70 53.004	760	1544	20150801_015200	Deep Blue
10016786	2015-08-01	02:10	37 33.371	70 53.004	N/A	N/A	N/A	XCTD[3]
10016873	2015-08-01	02:20	37 32.371	70 51.004	1381	1544	N/A	XCTD[2]
1239917	2015-08-01	04:20	37 22.148	70 57.154	760	1544	20150801_041625	Deep Blue
1239913	2015-08-01	11.52	37 15.263	70 29.350	759	1504	20150801_115257	Deep Blue
1239916	2015-08-01	16:45	37 41.477	70 22.512	760	1540	20150801_164252	Deep Blue
1239912	2015-08-01	17:19	36 37.797	70 27.065	756.8	1543	20150801_171952	Deep Blue
1239911	2015-08-01	17:44	36 35.191	70 30.303	758	1540	20150801_174409	Deep Blue
1239910	2015-08-01	18:58	36 27.292	70 40.098	757	1537	20150801_185824	Deep Blue
1239909	2015-08-01	21:51	36 09.713	71 01.750	758	1542	20150801_215317	Deep Blue
1239980	2015-08-01	23:11	36 01.866	71 11.309	759	1542	20150801_230913	Deep Blue
1239979	2015-08-01	23:54	35 59.971	71 17.347	757	1541	20150801_235009	Deep Blue
1239978	2015-08-02	03:06	35 54.673	71 06.659	757	1541	N/A	Deep Blue/Bad cast (Wx)
1239977	2015-08-02	03:08	35 55.190	71 06.050	767	1542	N/A	Deep Blue/Bad cast (Wx)
1029014	2015-08-02	03:16	35 56.133	71 04.921	842	1542	20150802_032303	T7
1239976	2015-08-02	05:56	36 18.392	70 03.498	753.3	1542	20150802_060152	Deep Blue
1239972	2015-08-02	09:45	36 48.164	70 02.518	759.2	1493	20150802_094512	Deep Blue
1239974	2015-08-02	12:05	36 4.7098	69 42.206	758	1541	20150802_120519	Deep Blue
1239975	2015-08-02	13:17	37 12.761	69 32.321	760	1541	20150802_131715	Deep Blue

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239972	2015-08-02	14:26	37 20.748	69 22.390	757	1542	20150802_142624	Deep Blue
1239971	2015-08-02	15:33	37 28.964	69 12.125	757	1540	20150802_153335	Deep Blue
1239970	2015-08-02	18:39	37 30.166	68 55.884	756.8	1542	20150802_183949	Deep Blue
1239969	2015-08-02	22:20	37 05.603	69 26.688	759	1541	20150802_222405	Deep Blue
1240001	2015-08-02	23:28	36 58.933	69 35.000	759.2	1539	20150802_232938	Deep Blue
1240002	2015-08-03	01:00	36 49.659	69 46.328	760.2	1540	20150803_010142	Deep Blue
1240003	2015-08-03	02:44	36 39.443	69 59.029	756.8	1542	20150803_024614	Deep Blue
1239997	2015-08-03	03:53	36 31.755	70 08.232	757.4	1541	20150803_035353	Deep Blue
1239998	2015-08-03	09:54	35 54.771	70 52 338	759.2	1541	20150803_095411	Deep Blue
1239994	2015-08-03	13:00	35 47.156	70 46.105	757.5	1519	20150803_134452	Deep Blue
1239993	2015-08-03	15:37	35 4.3648	70 27.981	755.7	1542	20150803_153732	Deep Blue
1239999	2015-08-03	17:28	36 19.242	70 10.084	759.2	1542	20150803_172801	Deep Blue
1239995	2015-08-03	18:02	36 24.058	70 04.252	758	1541.9	20150803_180227	Deep Blue
1240004	2015-08-03	18:27	36 27.552	70 00.010	756.8	1542.1	20150803_182708	Deep Blue
1240000	2015-08-03	19:40	36 37.707	69 47.594	759	1543	20150803_194120	Deep Blue
1239996	2015-08-03	20:09	36 41.775	69 42.622	759	1541.8	20150803_201204	Deep Blue
1240029	2105-08-03	21:05	36 49.606	69 33.001	759	1540.3	20150803_210743	Deep Blue
1240030	2105-08-03	23:41	37 11.317	69 05.959	759	1541.4	20150803_234356	Deep Blue
1240031	2015-08-04	04:28	37 32.744	68 26.512	759.2	1540.8	20150804_042842	Deep Blue
1240032	2015-08-04	07:58	37 08.564	68 57.212	757.4	1540.3	20150804_075948	Deep Blue
1240033	2015-08-04	09:35	37 08.956	68 59.155	757.4	1539.6	20150804_093645	Deep Blue
1240034	2015-08-04	12:04	36 46.635	69 24.528	756.8	1541.1	20150804_120457	Deep Blue
1240035	2015-08-04	13:31	36 38.946	69 34.055	755.7	1542.2	20150804_133051	Deep Blue
1240036	2015-08-04	14:05	36 35.490	69 38.311	760	1542.9	20150804_140626	Deep Blue
1240037	2015-08-04	16:05	36 22.678	69 56.016	760	1542.1	20150804_160559	Deep Blue
1240038	2015-08-04	17:17	36 14.722	70 03.701	757	1541.9	20150804_171716	Deep Blue
1240039	2015-08-04	17:42	36 11.944	70 07.074	760	1542.9	20150804_174208	Deep Blue
1240040	2015-08-04	18:56	36 03.239	70 17.594	757	1541.9	20150804_185646	Deep Blue
1239897	2015-08-04	19:23	36 00.024	70 21.467	755.1	1542.0	20150804_192330	Deep Blue
1240012	2015-08-04	22:18	35 38.875	70 46.747	760		20150804_221807	Deep Blue

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239905	2015-08-05	00:04	35 37.071	70 35.663	756.8	1540.7	20150805_000907	Deep Blue
1239898	2015-08-05	01:17	35 45.987	70 25.012	757.4	1540.1	20150805_011954	Deep Blue
1239902	2015-08-05	02:54	35 58.175	70 10.400	759.2	1541.5	20150805_025453	Deep Blue
1239906	2015-08-05	03:51	36 05.737	70 01.231	759	1541.7	20150805_035312	Deep Blue
1239903	2015-08-05	04:36	36 11.781	69 53.916	756.8	1540.4	20150805_043606	Deep Blue
1239904	2015-08-05	06:05	36 23.926	69 39.084	757.4	1542.3	20150805_060536	Deep Blue
1239906	2015-08-05	08:35	36 45.067	69 12.948	757.4	1540.3	20150805_083652	Deep Blue
1239899	2015-08-05	11:20	37 11.208	68 40.215	757.4	1541.6	20150805_112055	Deep Blue
1239900	2015-08-05	11:53	37 15.915	68 34.250	759.2	1539.9	20150805_115350	Deep Blue
32605	2015-08-05	12:36	37 22.604	68 25.699	849.8	1541.5	20150805_124138	XSV1
1240017	2015-08-05	12:49	37 23.728	68 24.313	759	1540.2	20150805_124922	Deep Blue
1240018	2015-08-05	15:36	37 37.479	67 52.690	759	1541.3	20150805_153641	Deep Blue
1240019	2015-08-05	18:04	37 22.433	68 12.104	760	1541.2	20150805_180425	Deep Blue
1240020	2015-08-05	20:11	37 09.791	68 28.241	757.4	1541.3	20150805_201338	Deep Blue
1240021	2015-08-05	21:33	37 01.571	68 38.694	759	1541.6	20150805_213452	Deep Blue
1240022	2015-08-06	00:02	36 47.974	68 55.733	757.4	1541.8	20150805_000256	Deep Blue
1240023	2015-08-06	00:38	36 44.992	68 59.517	759	1544.1	20150806_003834	Deep Blue
1240024	2015-08-06	04:52	36 16.610	69 34.623	756.8	1542.2	20150806_045239	Deep Blue
1240025	2015-08-06	05:55	36 08.688	69 44.317	758.0	1540.8	20150806_055800	Deep Blue
1240026	2015-08-06	12:10	36 26.653	70 21.107	758	1541.50	20150806_121039	Deep Blue
1240027	2015=08-06	13:50	35 39.577	70 05.600	759	1541.9	20150806_134954	Deep Blue
1240028	2015-08-06	17:44	36 10.680	69 27.757	758	1543	20150806_174440	Deep Blue
1239945	2015-08-06	18:36	36 17.702	69 19.110	756.8	1542.9	20150806_183645	Deep Blue
1239949	2015-08-06	20:19	36 32.029	69 01.309	759.2	1544.4	20150806_202238	Deep Blue
1239953	2015-08-06	23:21	35 58.212	68 28.411	759.2	1543	20150806_232438	Deep Blue
1239954	2015-08-07	02:25	37 24.168	67 55.231	759.2	1541.7	20150807_022920	Deep Blue
1239946	2015-08-07	03:25	37 32.433	67 44.328	758	1543.9	20150807_032828	Deep Blue
1239950	2015-08-07	06:01	37 26.756	67 37.296	759.2	1540.6	20150807_060213	Deep Blue
1239947	2015-08-07	10:36	36 55.216	68 17.815	759.2	1542.6	20150807_103651	Deep Blue
1239951	2015-08-07	12:04	36 44.431	68 31.479	758.0	1542.0	20150807_120422	Deep Blue

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239955	2015-08-07	13:59	36 30.279	68 49.253	756.8	1543.1	20150807_135913	Deep Blue
1239948	2015-08-07	15:24	36 19.872	69 02.227	759..8	1543.7	20150807_152444	Deep Blue
1239952	2015-08-07	16:36	36 11.150	69 13.029	760	1543.1	20150807_163622	Deep Blue
1239956	2015-08-07	17:59	36 00.843	69 25.721	759	1542.1	20150807_175903	Deep Blue
1240005	2015-08-08	00:28	35 20.640	70 00.548	760	1542.1	20150808_002835	Deep Blue
1240009	2015-08-08	06:09	36 04.681	69 06.858	758	1542.1	20150808_060940	Deep Blue
1240010	2015-08-08	11:54	36 49.096	68 11.650	759	1543.5	20150808_115330	Deep Blue
1240006	2015-08-08	12:42	36 55.635	68 02.825	759	1542.9	20150808_124256	Deep Blue
1240007	2015-08-08	15:39	37 19.761	67 31.733	759	1541.0	20150808_153919	Deep Blue
1240008	2015-08-08	16:13	37 24.700	67 25.303	759	1543.5	20150808_161337	Deep Blue
1240011	2015-08-08	17:31	37 22.372	67 13.403	759	1543.2	20150808_173144	Deep Blue
1240012	2015-08-08	18:03	37 19.395	67 17.553	759.8	1541.0	20150808_180312	Deep Blue
1240016	2015-08-08	18:59	37 13.469	67 25.277	759.2	1542.2	20150808_185917	Deep Blue
1240015	2015-08-08	19:38	37 09.071	67 30.992	759.8	1543.4	20150808_193856	Deep Blue
1240014	2015-08-08	21:24	36 56.800	67 46.854	758	1541.7	20150808_212745	Deep Blue
1240013	2015-08-09	02:24	36 21.067	68 32.217	756.8	1542.3	20150809_022651	Deep Blue
1239957	2015-08-09	08:41	35 51.207	69 09.340	759.2	1543.4	20150809_084107	Deep Blue
1239958	2015-08-09	10:40	35 43.911	69 18.302	758.6	1542.10	20150809_104018	Deep Blue
1239959	2015-08-09	12:03	35 38.345	69 25.200	759	1540.5	20150809_120405	Deep Blue
1239960	2015-08-09	18:19	35 19.754	69 35.523	760	1541.8	20150809_181910	Deep Blue
1239961	2015-08-09	20:43	35 35.987	69 15.167	758	1542.7	20150809_204556	Deep Blue
1239962	2015-08-09	22:19	35 46.381	69 02.968	759	1543.3	20150809_222130	Deep Blue
1239963	2015-08-09	23:53	35 56.493	68 50.494	759.2	1540.6	20150809_235309	Deep Blue
1239964	2015-08-10	02:14	36 12.015	68 31.128	758	1541.2	20150810_021637	Deep Blue
1239965	2015-08-10	06:25	36 43.685	67 51.081	759.8	1541.9	20150810_062542	Deep Blue
1239966	2015-08-10	11:13	37 16.844	67 01.744	760	1542.3	20150810_071303	Deep Blue
1239967	2015-08-10	12:42	37 07.113	67 06.259	759	1542.0	20150810_124225	Deep Blue
1239968	2015-08-10	15:35	36 48.121	67 30.891	756	1541.4	20150810_153540	Deep Blue
1239872	2015-08-10	17:41	36 33.671	67 49.428	758	1542.0	20150810_174143	Deep Blue
1239871	2015-08-10	23:32	35 48.338	68 46.415	759	1540.2	20150810_233207	Deep Blue

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239870	2015-08-11	00:49	35 37.918	68 59.341	759	1540.9	20150811_005151	Deep Blue
1239869	2015-08-11	01:20	35 33.372	69 04.902	759	1541.8	20150811_012059	Deep Blue
1239868	2015-08-11	02:49	35 20.646	69 20.496	758	1541.2	20150811_025252	Deep Blue
1239867	2015-08-11	03:44	35 13.200	69 29.517	759	1540.7	20150811_034453	Deep Blue
1239866	2015-08-11	06:41	35 15.738	69 12.458	759	1541.7	20150811_064135	Deep Blue
1239865	2015-08-11	12:08	35 57.072	68 21.355	756	1541.7	20150811_120816	Deep Blue
1239864	2015-08-11	15:55	36 26.114	67 44.639	757	1541.06	20150811_155743	Deep Blue
1239863	2015-08-11	17:29	36 38.778	67 28.410	759	1542.7	20150811_123963	Deep Blue
1239862	2015-08-11	18:24	36 46.418	67 18.551	757	1540.9	20150811_182442	Deep Blue
1329861	2015-08-11	20:39	37 05.446	66 53.731	758	1541.4	20150811_204116	Deep Blue
1239885	2015-08-11	21:47	37 01.285	66 44.579	759	1543.0	20150811_215121	Deep Blue
1239887	2015-08-11	23:01	36 53.133	66 55.232	758	1540.8	20150811_230107	Deep Blue
1239888	2015-08-12	06:05	36 11.935	67 48.298	759	1541.7	20150812_060533	Deep Blue
1239892	2015-08-12	11:38	35 30.908	68 39.798	759	1540.2	20150812_114010	Deep Blue
1239891	2015-08-12	15:03						Deep Blue. Bad data. Possible contact between filament and vessel. Not Used
1239890	2015-08-12	18:40						Deep blue bad probe
1239889	2015-08-12	18:43	35 11.931	68 48.133	759	1541.5	20150812_184351	Deep Blue
1239893	2015-08-12	19:53	35 20.755	68 37.259	758	1539.5	20150812_195309	Deep Blue
1239894	2015-08-12	23:37	35 47.781	68 03.560	760	1541.5	20150812_233709	Deep Blue
1239895	2015-08-13	05:24	36 32.020	67 07.122	760	1541.8	20150812_052501	Deep Blue
1239896	2015-08-13	09:34	36 50.207	66 28.231	756.2	1541.3	20150813_093415	Deep Blue
1239933	2015-08-13	11:27	36 37.430	66 45.097	758	1541.2	20150813_112709	Deep Blue
1239937	2015-08-13	12:04	36 33.143	66 50.679	758	1541.3	20150813_120425	Deep Blue
1239941	2015-08-13	12:50	36 27.834	66 57.810	759	1541.9	20150813_125052	Deep Blue
1239942	2015-08-13	15:14	36 11.850	67 18.207	757.4	1541.2	20150813_151722	Deep Blue
1239943	2015-08-13	20:50	35 34.792	68 05.235	759	1540.6	20150813_205726	Deep Blue
1239944	2015-08-14	01:20	35 01.888	68 46.022	759.2	1540.4	20150814_012036	Deep Blue
1239938	2015-08-14	06:42	35 13.205	68 17.451	758	1540.9	20150814_064220	Deep Blue

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239934	2015-08-14	11:48	35 52.303	67 28.264	758	1541.2	20150814_114904	Deep Blue
1239939	2015-08-14	14:44	36 14.072	67 00.337	759	1541.8	20150814_144420	Deep Blue
1239935	2015-08-14	16:33						Deep Blue – Bad data in rain
1239940	2015-08-14	16:37						Deep Blue – Bad data in rain
1029011	2015-08-14	16:56	36 29.242	66 40.636	844.9	1540.4	20150814_165905	T7
1239936	2015-08-14	23:09	36 12.383	66 47.543	756.8	1539.7	20150814_230940	Deep Blue
1329873	2015-08-14	23:42	36 08.855	66 52.138	759	1540.0	20150814_234208	Deep Blue
1329874	2015-08-15	05:26	36 01.771	66 46.316	759	1539.6	20150815_052610	Deep Blues
1239878	2015-08-15	11:01	36 29.389	66 04.394	756.8	1540.7	20150815_110104	Deep Blue
1239877	2015-08-15	13:38	36 48.662	66 29.491	758	1540.2	20150815_133855	Deep Blue
1239881	2015-08-15	14:37	36 55.434	66 38.391	759	1541.3	20150815_143711	Deep Blue
1239882	2015-08-15							Deep Blue – failed in tube.
1239875	2015-08-15	15:29	37 1.584	66 46.508	759	1540.6	20150815_152928	Deep Blue
1239876	2015-08-15	19:27	37 29.747	67 24.137	760	1542.0	20150815_192934	Deep Blue
1239879	2015-08-15	23:46	37 48.665	67 43.431	756	1542.1	20150815_234812	Deep Blue
1239880	2015-08-16	01:18	37 58.238	67 22.846	756.8	1542.4	20150816_012109	Deep Blue
1239883	2015-08-16	03:29						Deep Blue – No data
1239884	2015-08-16	03:35	38 12.706	66 51.382	759.2	1541.1	20150816_033522	Deep Blue
1239921	2015-08-16	08:18	38 38.234	65 54.498	756.8	1536.0	20150816_081832	Deep Blue
1239922	2015-08-16	12:30	38 55.004	65 00.012	758	1534.7	20150816_123236	Deep Blue
1239925	2015-08-16	13:23	38 53.735	64 56.922	759	1536.0	20150816_132306	Deep Blue
1239923	2015-08-16	13:56	38 51.289	65 02.614	759	1533.8	20150816_135638	Deep Blue
1239924	2015-08-16	15:27	38 44.251	65 18.863	758	1535.4	20150816_152741	Deep Blue
1239926	2015-08-16	17:42	38 33.240	65 44.059	759	1536.0	20150816_174226	Deep Blue
1239927	2015-08-16	18:57	38 27.058	65 58.008	758	1536.9	20150816_185705	Deep Blue
1239928	2015-08-16	22:12	38 10.847	66 34.169				Deep Blue – Bad Data
1239929	2015-08-16	22:16	38 10.602	66 34.716	759.2	1539.8	20150816_221611	Deep Blue
1239930	2015-08-16	23:07	38 06.957	66 42.834	759	1542.7	20150816_231022	Deep Blue
1239931	2015-08-17	00:04	38 03.188	66 51.037	758	1542.2	20150817_000442	Deep Blue
1239932	2015-08-17	03:40	37 47.461	67 25.241	758	1542.5	20150817_034057	Deep Blue

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239849	2015-08-17	05:39	37 36.562	67 27.754	758	1541.4	20150817_053940	Deep Blue
1239853	2015-08-17							Deep Blue – Bad Data
1029007	2015-08-17							T-7 – Bad Data
1239857	2015-08-17	06:45	37 43.052	67 13.780	757.4	1542.0	20150817_064540	Deep Blue
1239850	2015-08-17	09:25	37 59.708	67 37.431	760	1541.4	20150817_092509	Deep Blue
1239854	2015-08-17	10:47	38 08.609	66 17.727	757.4	1539.7	20150817_104707	Deep Blue
1239858	2015-08-17	11.28	38 12.933	66 08.089	760	1536.6	20150817_112847	Deep Blue
1239851	2015-08-17	14:20	38 29.663	65 30.314	759	1535.9	20150817_142016	Deep Blue
1239852	2015-08-17	15:08	38 34.515	65 19.213	759	1535.2	20150817_150834	Deep Blue
1239855	2015-08-17	1537	38 37.411	65 12.559	758	1537.1	20150817_153725	Deep Blue
1239856	2015-08-17	17:05	38 46.593	64 51.293	758	1540.6	20150817_170739	Deep Blue
1239859	2015-08-17	17:41	38 50.676	64 41.767	758	1542	20150817_174347	Deep Blue
1239860	2015-08-17	21:30	39 10.321	65 26.157	757	1536.2	20150817_212133	Deep Blue
1239992	2015-08-18	03:53	39 45.178	66 46.562	757.4	1537.9	20150818_035520	Deep Blue
1239990	2015-08-18	09:47	40 16.233	67 59.866	337.6	1532.9	20150818_095021	Deep Blue
1029008	2015-08-19	01:24	40 14.458	68 06.773	760.4	1530.6	20150819_012445	T-7
1029016	2015-08-19	07:34	39 37.339	66 44.230	844.5	1537.5	20150819_073423	T-7
1029012	2015-08-19	13:37	39 03.762	65 30.872	852	1536.5	20150819_133710	T-7
1239991	2015-08-19	17:17	38 51.172	64 40.601	759.2	1539.2	20150819_171717	Deep Blue
1239989	2015-08-19	19:32	38 50.892	64 18.822	758.0	1541.6	20150819_193227	Deep Blue
1239988	2015-08-19	21:55	38 42.556	64 38.481	759	1542.8	20150819_215800	Deep Blue
1239987	2015-08-19	22:47	38 39.453	64 45.694	757.4	1541.7	20150819_224712	Deep Blue
1239986	2015-08-20	00:47	38 32.342	65 02.197	758.6	1540.3	20150820_004725	Deep Blue
1239985	2015-08-20	02:40						Deep Blue (Bad Data)
1239984	2015-08-20	02:43	38 25.064	65 18.933	758	1542.6	20150820_024358	Deep Blue
1239983	2015-08-20	08:36	38 03.115	66 08.520	758	1542.1	20150820_083858	Deep Blue
1239982	2015-08-20	12:58	37 43.446	66 51.902	759	1541.9	20150820_125816	Deep Blue
1239981	2015-08-20	16:44	37 25.141	67 10.542	759.2	1540.4	20150820_164410	Deep Blue
1239848	2015-08-20	19:04	37 39.323	66 39.785	759	1542.0	20150820_190400	Deep Blue
1239847	2015-08-21							Deep Blue (Bad Data)

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1239846	2015-08-21							Deep Blue (Bad Data)
1029009	2015-08-21	01:13	38 19.231	65 10.369	853.2	1541.9	20150821_011346	T-7
1239844	2015-08-21	04:16	38 40.384	64 21.209	758	1542.2	20150821_042044	Deep Blue
1239843	2015-08-21	06:44	38 31.499	64 19.733	631	1541.4	20150821_064636	Deep Blue
1239845	2015-08-21	09:44	38 18.062	64 51.053	758	1541.2	20150821_094843	Deep Blue
1239842	2015-08-21	15:54	37 49.816	65 55.252	759	1541.9	20150821_155411	Deep Blue
1239841	2015-08-21	18:53	37 34.378	66 29.454	759	1541.3	20150821_185318	Deep Blue
1239837	2015-08-21	21:38	37 20.306	67 00.142	758	1541.8	20150821_213937	Deep Blue
1239838	2015-08-22	03:45	37 39.875	65 55.973	759.0	1541.7	20150822_034526	Deep Blue
1239839	2015-08-22	08:44	38 08.519	64 51.031	758	1542.6	20150822_084755	Deep Blue
1239840	2015-08-22	11:34	38 25.494	64 11.476	758	1541.9	20150822_113630	Deep Blue
1029013	2015-08-22	15:00	38 28.462	63 41.932	857	1540.0	20150822_150058	T-7
1029017	2015-08-22	20:47	38 01.937	64 44.183	829.1	1541.4	20150822_204708	T-7
1093202	2015-08-22	23:08						T-7 (Bad Data)
1093198	2015-08-22	23:15	37 50.043	65 11.452	865.5	1540.9	20150822_231527	T-7
1093194	2015-08-23	05:15	37 17.465	66 24.221	838.5	1540.9	20150823_051901	T-7
1093202	2015-08-23	09:23	37 07.087	66 25.826				T-7 (Bad Data)
1093199	2015-08-23	09:30	37 07.690	66 24.375	742	1540.9	20150823_093047	T-7
1093195	2015-08-23	15:06	37 37.283	65 18.683	869	1540.9	20150823_150645	T-7
1093204	2015-08-23	20:49						T-7 (Bad Data)
1093200	2015-08-23	20:53	38 10.663	64 01.632	861.4	1540.9	2010823_205352	T-7
1093196	2015-08-24	03:05						T-7 (Bad Data)
1093205	2015-08-24	03:09	38 02.337	63 58.892	859.0	1541.0	20150824_030953	T-7
1093201	2015-08-24	07:49	37 41.424	64 47.470				T-7 (Bad Data)
1093197	2015-08-24	07:55	37 41.011	64 48.414				T-7 (Bad Data)
1103206	2015-08-24	08:07	37 40.191	64 50.299				T-7 (Bad Data)
1103208	2015-08-24	08:19	37 39.200	64 52.566	901.8	1542.0	20150824_082232	T-7
1103203	2015-08-24	11:43	37 22.768	65 30.210	885.4	1541.7	20150824_114701	T-7
1103198	2015-08-24	17:38	36 48.990	66 23.210	891.3	1542.1	20150824_173842	T-7
1103199	2015-08-24	23:40	37 22.599	65 08.572	889.5	1542.2	20150824_234157	T-7

Serial Number	Date	Time	Latitude (N)	Longitude (W)	Max. Depth (m)	TDR SS (ms^{-1})	EM122 Filename	Notes
1103204	2015-08-25	03:55	37 46.906	64 12.793	880.7	1541.0	20150825_035659	T-7
1103200	2015-08-25	09:06	37 39.300	64 08.396	893.6	1541.9	20150825_090950	T-7
1103209	2015-08-25	15:04	37 06.608	65 23.064	893.6	1542.4	20150825_150348	T-7
1103205	2015-08-25	20:46	36 38.398	66 04.268	898.3	1540.0	20150825_204656	T-7
1103201	2015-08-26	03:05	37 10.145	64 53.528	904.0	1541.2	20150826_030529	T-7
1093097	2015-08-26	08:50	37 05.185	64 43.122	876.1	1541.9	20150826_085327	T-7
1093096	2015-08-26	11:46	36 47.224	65 23.562	834	1541.1	20150826_114605	T-7
1093095	2015-08-26	15:37	36 25.180	65 51.061	908.8	1541.6	20150826_153756	T-7
1093094	2015-08-26	18:38	36 40.955	65 19.643	852		20150826_184441	T-7. Suspect data
1093093	2015-08-26	18:46	36 41.863	65 18.285	849	1542.0	20150826_184625	T-7
1093092	2015-08-26	19:39	36 47.648	65 09.601	843	1541.4	20150826_193946	T-7
1093091	2015-08-26	20:59	36 55.541	64 57.690	887	1541.9	20150826_205910	T-7
1093090	2015-08-27	00:46	37 24.961	64 20.658	882.5	1542.3	20150827_004654	T-7
1093086	2015-08-27	03:45	37 49.455	63 52.868	898	1541.0	20150827_034844	T-7
1093087	2015-08-27	07:55	38 33.580	63 36.270	876.1	1543.7	20150827_075822	T-7
1093088	2015-08-27	09:04	38 45.716	63 31.655	852.0	1540.4	20150827_090422	T-7
1093089	2015-08-27	10:47	38 58.187	63 06.355	854.4	1542.5	20150827_105211	T-7
1093098	2015-08-27	11:55	39 07.038	62 52.351				T-7 (Bad Data)
1093099	2015-08-27	11:59	39 07.921	62 51.815	867.3	1543.2	20150827_115930	T-7
1093100	2015-08-27	14:31	39 10.340	63 10.629	884.8	1539.4	20150827_143148	T-7
1093101	2015-08-27	16:12	39 02.796	63 16.923	882.5	1540.1	20150827_161202	T-7
1093102	2015-08-27	19:00	39 02.274	63 37.873	856.7	1537.2	20150827_190023	T-7
1093103	2015-08-27	20:56	39 14.819	63 12.617	878.4	1537.9	20150827_205657	T-7
1093104	2015-08-27	21:29	39 18.270	63 05.570	856	1540.5	20150827_212935	T-7
1093105	2015-08-28	00:46	39 30.259	63 01.285	867.3	1538.4	20150828_004655	T-7
1093106	2015-08-28	01:07	39 28.562	63 04.755	878.4	1537.3	20150828_010759	T-7
1093107	2015-08-28	02:27	39 21.714	63 18.697	876.1	1537.8	20150828_022731	T-7
1093108	2015-08-28	04:46	39 08.848	63 44.614	893.6	1536.2	20150828_044814	T-7
1093109	2015-08-28	10:58	39 35.192	65 02.574	893.6	1536.2	20150828_110051	T-7
1103186	2015-08-28	17:05	39 57.440	66 28.066	893.6	1537.7	20150828_170533	T-7
1103187	2015-08-29	00:03	40 05.239	68 08.928	854.4	1536.6	20150829_000306	T-7

Notes to the Table:

1. A Deep Blue probe was deployed, but the software was configured for a T-7; data not used.
2. Taken for pre-patch test comparison, but not used due to limitations in software used to load profile into SIS.
3. Taken for pre-patch test comparison, but not used due to time-out of the probe launch window.

9 Ship-Board Preliminary Products

Grids of data collected during the survey were generated as quality control objects during the survey. A resolution of 100 m was generally used. The final 100 m composite of all of the data collected during this leg is shown in Figure 15, with vertical exaggeration of 5x for shading, and artificial sun-illumination from the northeast. Acoustic backscatter was also processed as part of the quality control process; the final composite, at a resolution of 50 m is shown in Figure 16. A perspective view of the composite bathymetry over the whole of the Atlantic Ocean area surveyed for the U.S. UNCLOS effort to the end of Leg 8 is shown in

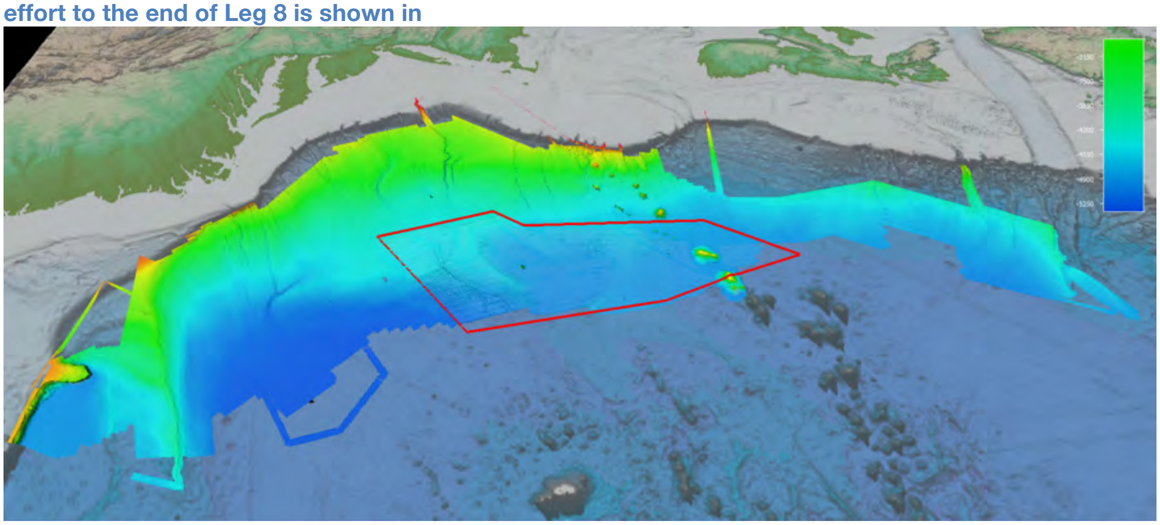


Figure 17, and a perspective view of the backscatter collected during Leg 8 is shown in Figure 18. A plot of estimated surface currents and surface water temperature is shown in Figure 19. Green dots indicate the location of XBT launches (Section 8).

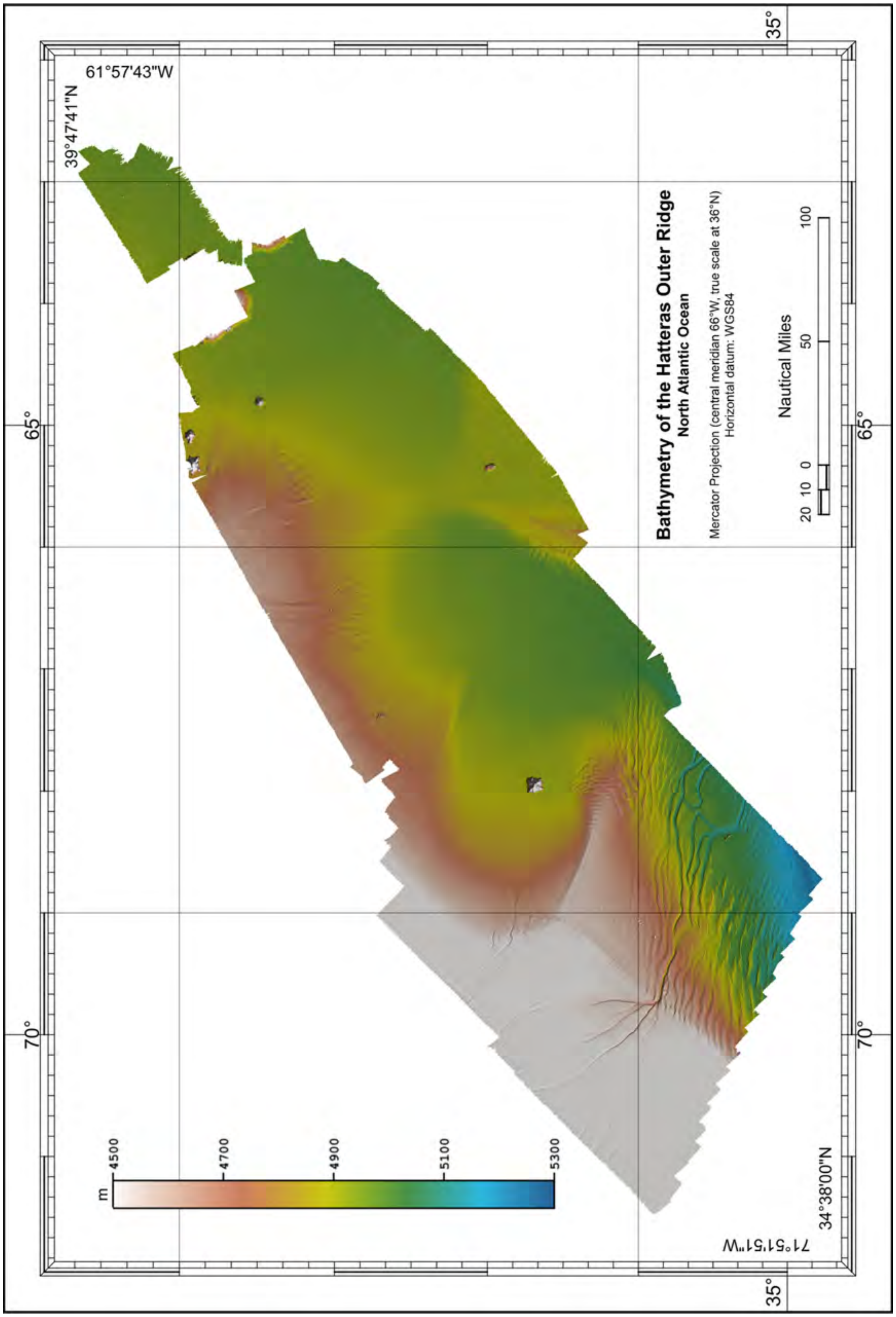


Figure 15: Shaded relief bathymetry of the Hatteras Outer Ridge, the northeastern portion of the U.S. continental shelf, and the eastern New England seamount chain.

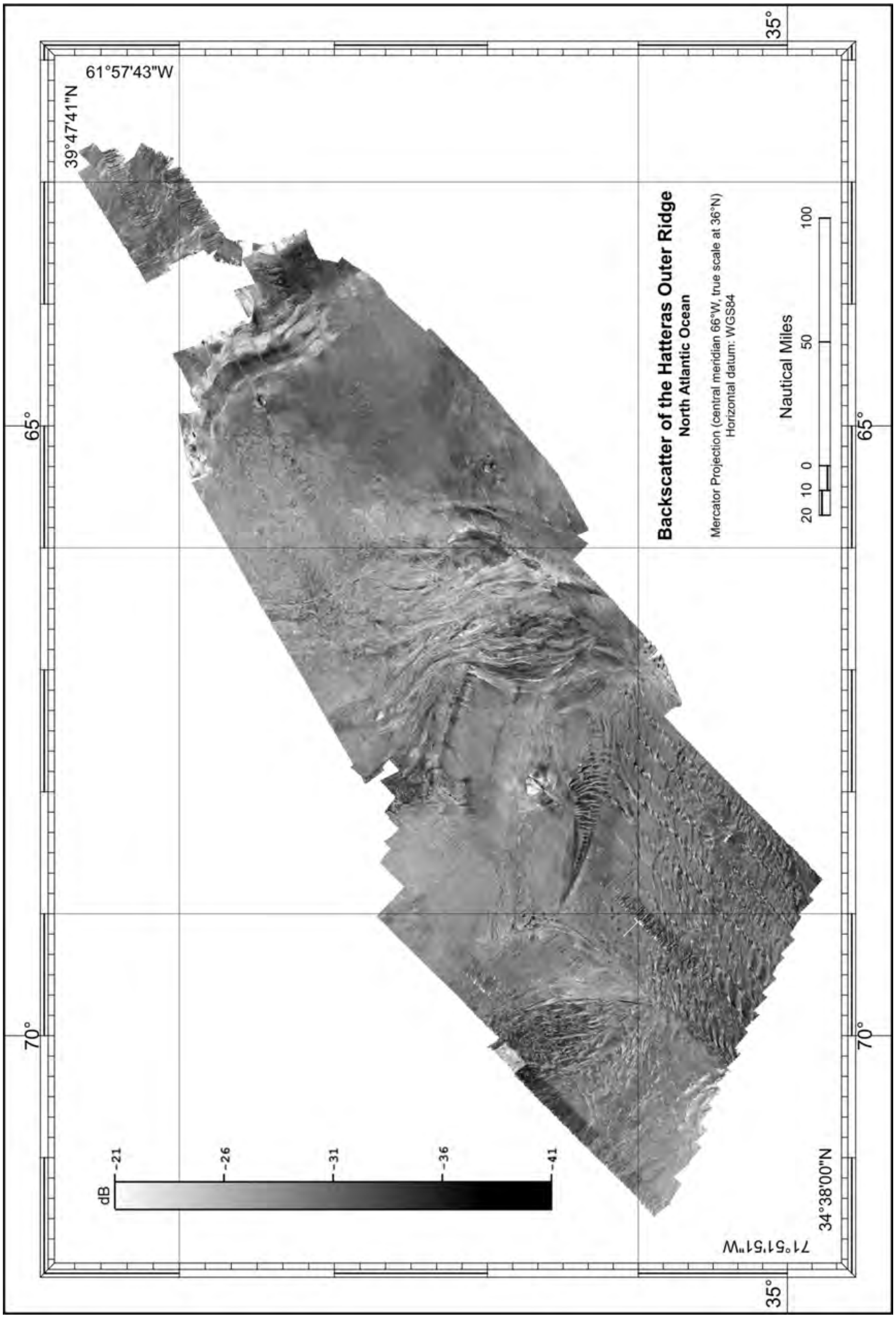


Figure 16: Acoustic backscatter associated with Figure 15.

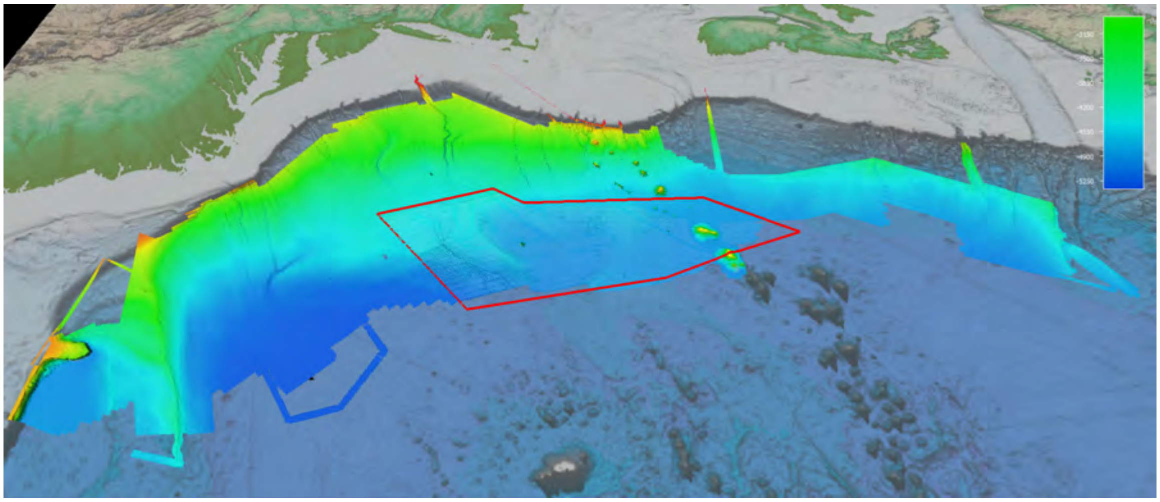


Figure 17: Perspective view of all Atlantic Ocean data collected for the U.S. UNCLOS bathymetry project to the end of Leg 8.

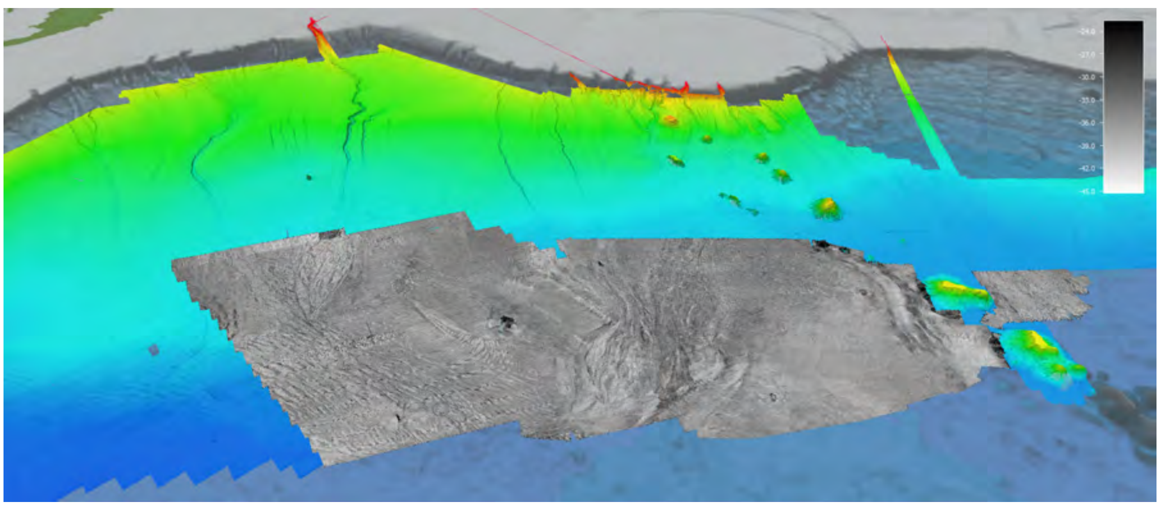


Figure 18: Perspective view of backscatter collected during Leg 8 of the U.S. UNCLOS survey, with supporting bathymetry from previous legs.

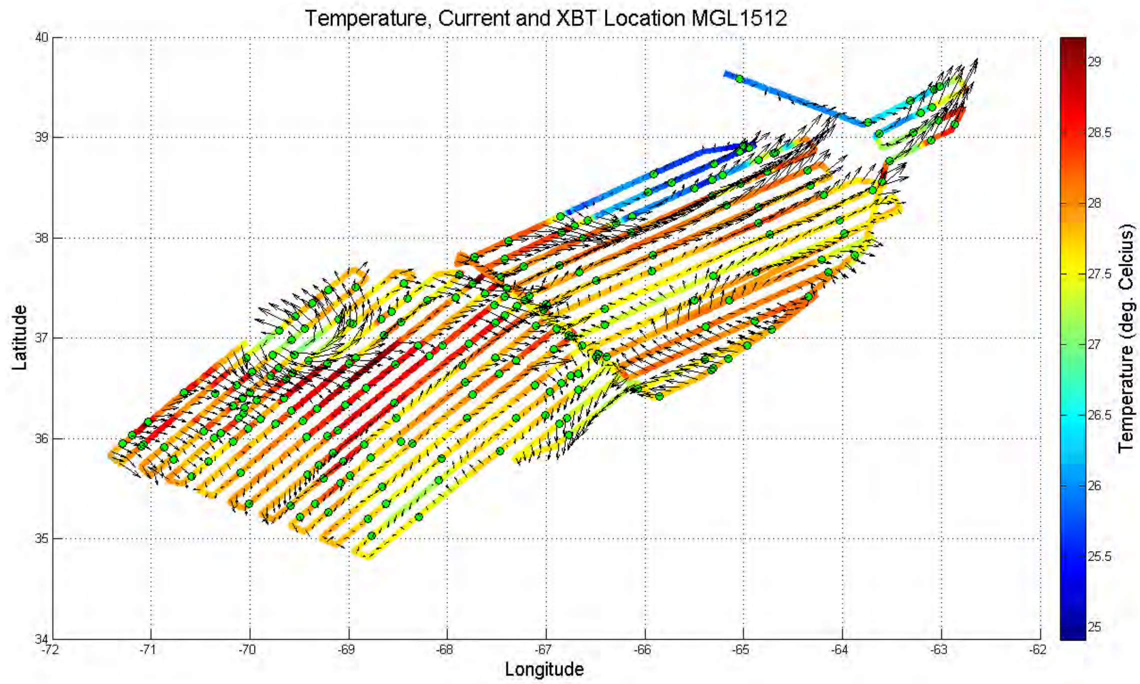


Figure 19: Plot of surface temperature observed using *Langseth*'s TSG (colored strip), along with estimated surface currents (arrow field) and XBT launch locations (green dots). Current speed ranged from 0.01 – 2.2 ms^{-1} (0.02 – 4.2 kt), with the core of the Gulf Stream averaging 1.8 ms^{-1} (3.9 kt) on an overall average for the cruise of 0.6 ms^{-1} (1.2 kt).

10 References

Armstrong, A. A. and B. R. Calder, 2012. Cruise Report: U.S. Law of the Sea Cruise to Map the Foot of the Slope of the Northeast U.S. Atlantic Continental Margin: Leg 7. Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center. [online: http://www.ccom.unh.edu/law_of_the_sea.html]

Calder, B. R. and J. V. Gardner, 2008. Cruise Report: U.S. Law of the Sea Cruise to Map the Foot of the Slope of the Northeast U.S. Atlantic Continental Margin: Leg 6. Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center. [online: http://www.ccom.unh.edu/law_of_the_sea.html]

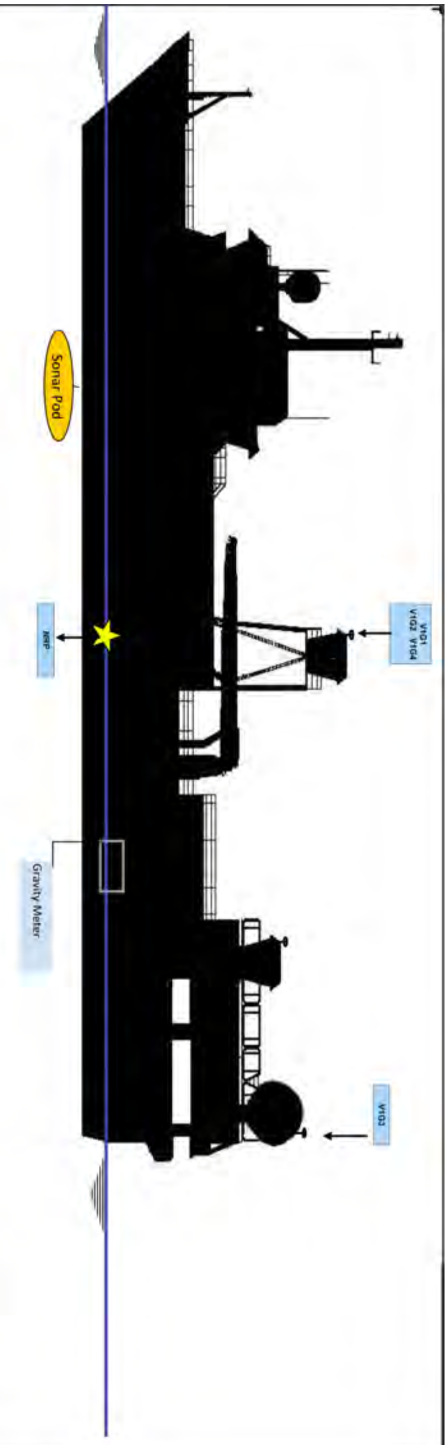
Cartwright, D. and J. V. Gardner, 2005. Cruise Report: U.S. Law of the Sea Cruise of Map the Foot of the Slope and 2500-m Isobath of the Northeast U.S. Atlatnic Continental Margin: Legs 4 and 5. Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center. [online: http://www.ccom.unh.edu /law_of_the_sea.html]

Gardner, J. V., 2004. Cruise Report: U.S. Law of the Sea Cruise to Map the Foot of the Slope and 2500-m Isobath of the Northeast U.S. Atlantic Continental Margin. Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center. [online: http://www.cccom.unh.edu/law_of_the_sea.html]

Mayer, L. A., M. Jakobsson, and A. A. Armstrong, 2002. The Compilation and Analysis of Data Relevant to a U.S. Claim Under the United Nations Law of the Sea Article 76. Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center. [online: http://www.ccom.unh.edu/law_of_the_sea.html]

11 Calibration Documents

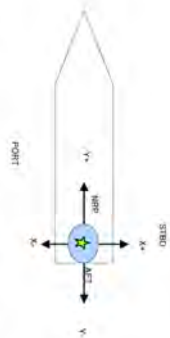
11.1 Langseth Installation Survey



Negative values are above water

All measurements in meters

		STBD/PORT (X)	FORE/AFT (Y)	UP/DOWN (Z)
NRP	NAVIGATION REFERENCE POINT	0.00	0.00	0.00
V1G1	C-Nav 3050	0.00	0.00	-16.90
V1G2	SeaPath 200	0.00	1.50	-16.90
V1G3	C-Nav 2000	-2.10	-29.20	-14.50
V1G4	Pos MV	-1.30	1.20	-16.90
V1R1	PosNet	-1.30	0.00	-16.90
Sonar Pod	EM122 Knudsen ADCP	0.00	20.20	7.49
MRU	Seapath MRU	2.30	14.16	-4.30
BGM	Bell Gravity Meter	0.00	-13.10	1.10



Note: All Echosounders are used in Spectra with 6.6m ship's draft correction applied.

11.2 AML Oceanographic Micro SV Sensors

AML OCEANOGRAPHIC
Xchange your old ideas

Certificate of Conformity

Customer:	Columbia University
AML Reference Number:	Sales Order #34095
Customer PO Number:	COLUM-0000053244
Asset Serial Number:	010844
Asset Product Type:	Micro X-Series, Primary Only, 6000m Ti Housing
Housing Depth Rating:	6000 dbar / meters
Additional Description:	

Certification Date (dd/mm/yyyy):	23/7/2015
Certified By:	

Robert Haydock
President
AML Oceanographic

AML Oceanographic certifies that the equipment described above has been tested in accordance with the product's technical specifications, brochures and / or relevant drawings. Housing depth rating refers to the maximum deployment depth of this instrument; on-board sensors may further restrict this range. AML Oceanographic certifies that calibrations on this instrument have been completed with equipment referenced to traceable standards.

Instrument configuration files and soft copy certificates are available at our on-line Customer Centre at www.AMLoceanographic.com/support

AML Oceanographic
2071 Malaview Avenue, Sidney B.C. V8L 5X6 CANADA
T: +1-250-656-0771 F: +1-250-655-3655 Email: service@AMLoceanographic.com

Certificate of Calibration

Customer:	Columbia University
Asset Serial Number:	204749
Asset Product Type:	SV•Xchange™ Calibrated Sensor
Calibration Type:	Sound Velocity
Calibration Range:	1375 to 1625 m/s
Calibration RMS Error:	-.0098
Calibration ID:	204749 999999 204749 300615 104835
Installed On:	010844

Coefficient A:	0.000000E+0	Coefficient H:	1.947311E-7
Coefficient B:	0.000000E+0	Coefficient I:	0.000000E+0
Coefficient C:	-1.263106E-8	Coefficient J:	0.000000E+0
Coefficient D:	1.947634E-7	Coefficient K:	0.000000E+0
Coefficient E:	-1.865538E-5	Coefficient L:	0.000000E+0
Coefficient F:	1.953723E-7	Coefficient M:	0.000000E+0
Coefficient G:	1.794542E-7	Coefficient N:	0.000000E+0

Calibration Date (dd/mm/yyyy): 30/6/2015

Certified By:

Robert Haydock

President, AML Oceanographic

AML Oceanographic certifies that the asset described above has been calibrated or recalibrated with equipment referenced to traceable standards. Please note that Xchange™ sensor-heads may be installed on assets other than the one listed above; this calibration certificate will still be valid when used on other such assets. If this instrument or sensor has been recalibrated, please be sure to update your records. Please also ensure that you update the instrument's coefficient values in any post-processing software that you use, if necessary. Older generation instruments may require configuration files, which are available for download at our Customer Centre at www.AMLoceanographic.com/support

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11.3 Gravity Ties

11.3.1 Opening Station: Brooklyn Navy Yard, New York, NY

RV Langseth Gravity Tie Form

CruiseID	MGL1512	☑ PRE ☐ POST
Date	7/27/15	
Port	Bronx, NY SUNY Maritime College	
Operator	Robert Koprowski	

Pier side Reading #1

Ship's position (C-Nav)	LAT 40° 48.2889' N	LONG 073° 47.7362' W	ALT -11.821 m
Shipboard BGM	Shipboard BGM reading (mGal) 979820	Height of Pier over Main Deck (m)[1] 8.7 Ft	
Portable GPS Time	TIME 15:09		
Portable GPS Position	LAT 40°48.294' N	LONG 073° 47.730' W	ALT 84.1 Ft
L&R Readings	Reading 1 3837.69 (15:20)	Reading 2 3837.76 (15:30)	Reading 3 3837.65 (15:40)

Tie Point

Tie Point Description (also include relevant documentation/maps/pictures)	Brooklyn Navy Yard - Lehigh Concrete Pier K		
Portable GPS Time	TIME 17:26		
Portable GPS Position	LAT 40° 42.432' N	LONG 073° 58.275	ALT 10.1 Ft
L&R Readings	Reading 1 3828.87 (17:40)	Reading 2 3828.84 (17:50)	Reading 3 3828.87 (18:00)

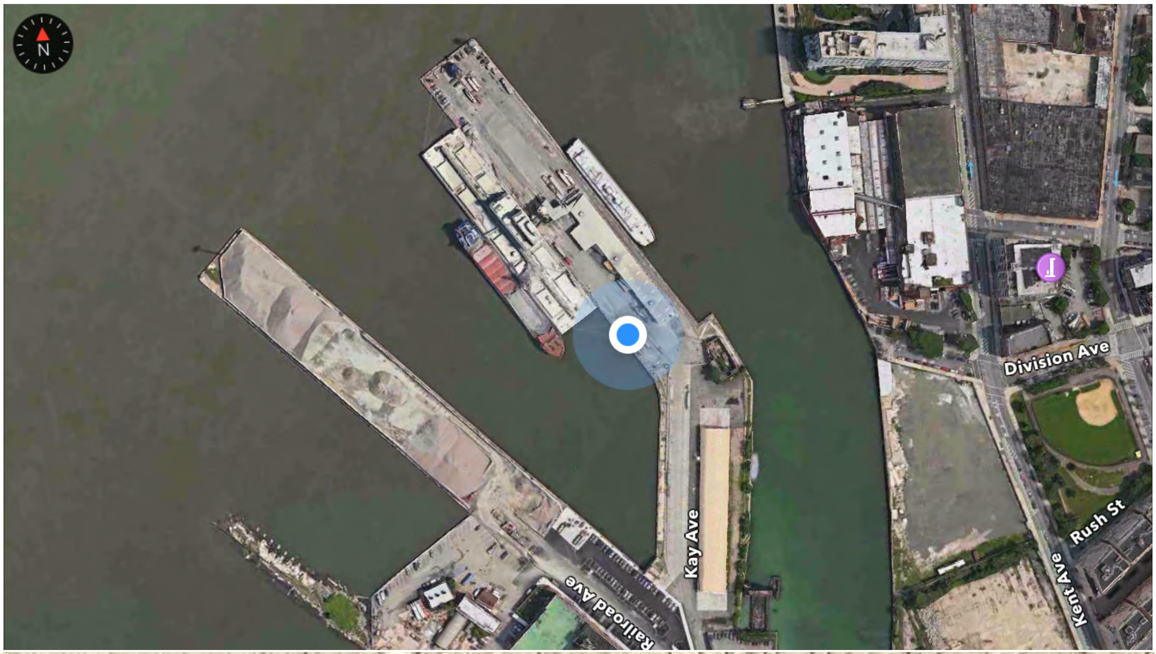
Pier side L&R reading #3

Shipboard BGM	Shipboard BGM reading (mGal) 979820	Height of Pier over Main Deck (m) 15.4 Ft	
Portable GPS Time	TIME 18:35		
Portable GPS Position	LAT 40° 48.292' N	LONG 073° 47.729' W	ALT 71.2 Ft
L&R Readings	Reading 1 3837.72 (18:38)	Reading 2 3837.67 (18:48)	Reading 3 3837.76 (18:58)

Notes

Pre Cruise for MGL1512 - UNH ECS multibeam cruise.

1. Height of pier over main deck should be entered in meters. Use a negative value to indicate pier is below main deck.
Form v1.1 2008-08-18


N
Division Ave
Rush St
Kent Ave
Kay Ave
Railroad Ave

GRAVITY STATION DESCRIPTION

LAT. 40° 42' 26"N
LONG. 73° 58' 19"W
ELEV.
POSIT. REF. C&GS 7 45
ELEV. REF.

STATION NO. 0046.31
COUNTRY U.S.A.
STATE/PROVINCE New York
CITY/NEAREST CITY Brooklyn
STATION NAME Navy Yard - Pier 'K'
g = 980,272.0

__ INTERNATIONAL __ EXCENTER __ CALIBRATION __ NATIONAL __ AIRPORT __ HARBOR CONTROL X HARBOR

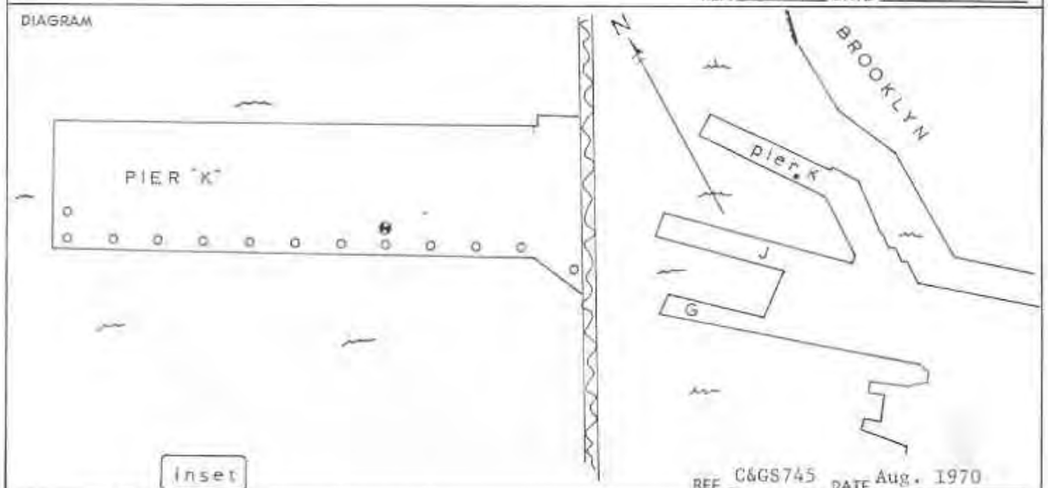
IGSN 71 g = 980257.5

DESCRIPTION

The station is located in Brooklyn Navy Yard on the south side of pier 'K', 6 inches away from the fourth bollard from the south-eastern corner of the pier, or the eighth bollard from the north-western end of the pier.

REF. Fld. Bk. DATE June 1965

DIAGRAM



REF C&GS745 DATE Aug. 1970

DATE	OBS. BY	INST.	SOURCE	STATION OF REF.	VALUE	Δg	
Jun 1965	Evans-NAVOCEANO	WO-464	Abst.	0046.08	980,271.9	+ 0.1	ABA

NAVOCEANO-3165/1 (Rev. 6-70)

11.3.2 Closing Station: Woods Hole Oceanographic Institute Dock, Woods Hole, MA

RV Langseth Gravity Tie Form

CruiseID	MGL1512	PRE	POST X
Date	08/29/2015 1700 EST / 21:00 UTC		
Port	Woods Hole Oceanographic Institute Dock, MA		
Operator	Robert Koprowski		

Pier side Reading #1

Dock Height: 5.73 m

Ship's position (C-Nav)	LAT 41°31.4077'N	LONG 070°40.3023'W	ALT -11.133
Shipboard BGM	Shipboard BGM reading (mGal) 979867	Height of Pier over Main Deck (m)[1] 0	
Portable GPS Time	TIME 29 Aug. 2015		
Portable GPS Position	LAT 41° 31.415' N	LONG 070° 40.303' W	ALT 33.1
L&R Readings	Reading 1 3880.11	Reading 2 3880.11	Reading 3 3880.12
	21:15	21:25	21:35

Tie Point

Tie Point Description (also include relevant documentation/maps/pictures)	Gravity Tie & Pierside tie @ same point @ WHOI pier. (Site LA)		
Portable GPS Time	TIME 29 Aug. 2015		
Portable GPS Position	LAT 41° 31.415' N	LONG 070° 40.303'W	ALT 33.1
L&R Readings	Reading 1 3880.12	Reading 2 3880.09	Reading 3 3880.12
	21:45	21:55	22:05

Pier side L&R reading #3

Shipboard BGM	Shipboard BGM reading (mGal) 979867	Height of Pier over Main Deck (m) 1.9m	
Portable GPS Time	TIME —		
Portable GPS Position	LAT —	LONG —	ALT -10.47m
L&R Readings	Reading 1 —	Reading 2 —	Reading 3 —

Notes

1. Height of pier over main deck should be entered in meters. Use a negative value to indicate pier is below main deck.
Form v1.1 2008-08-18

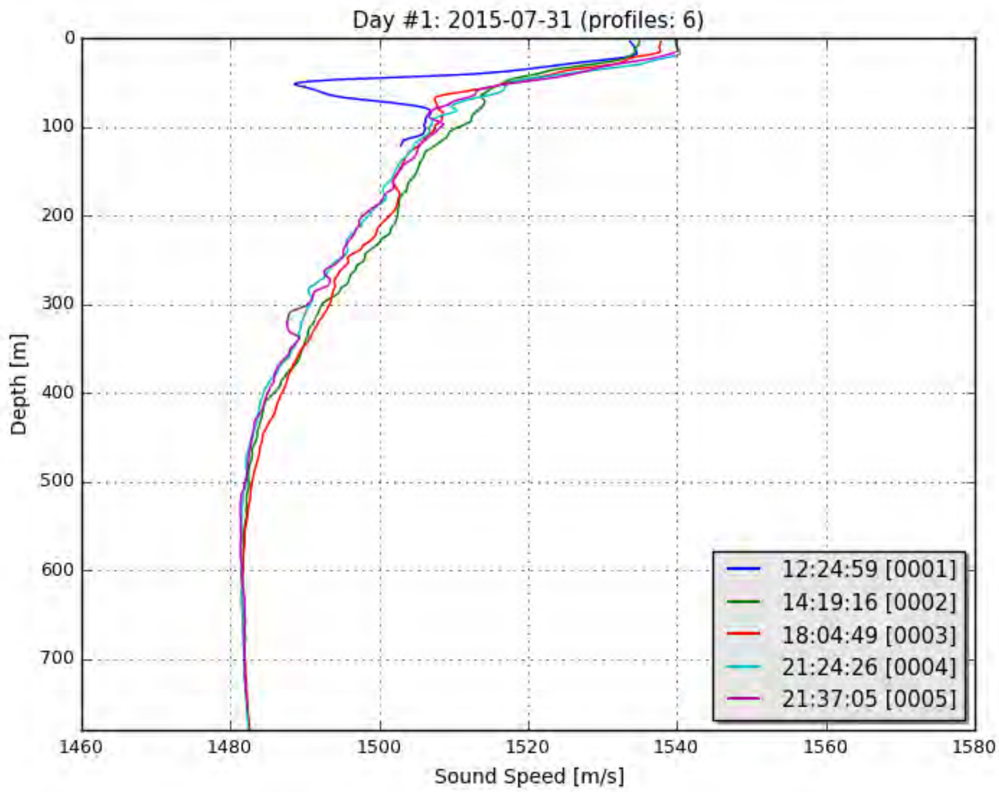
11.4 CUBE Algorithm Parameters

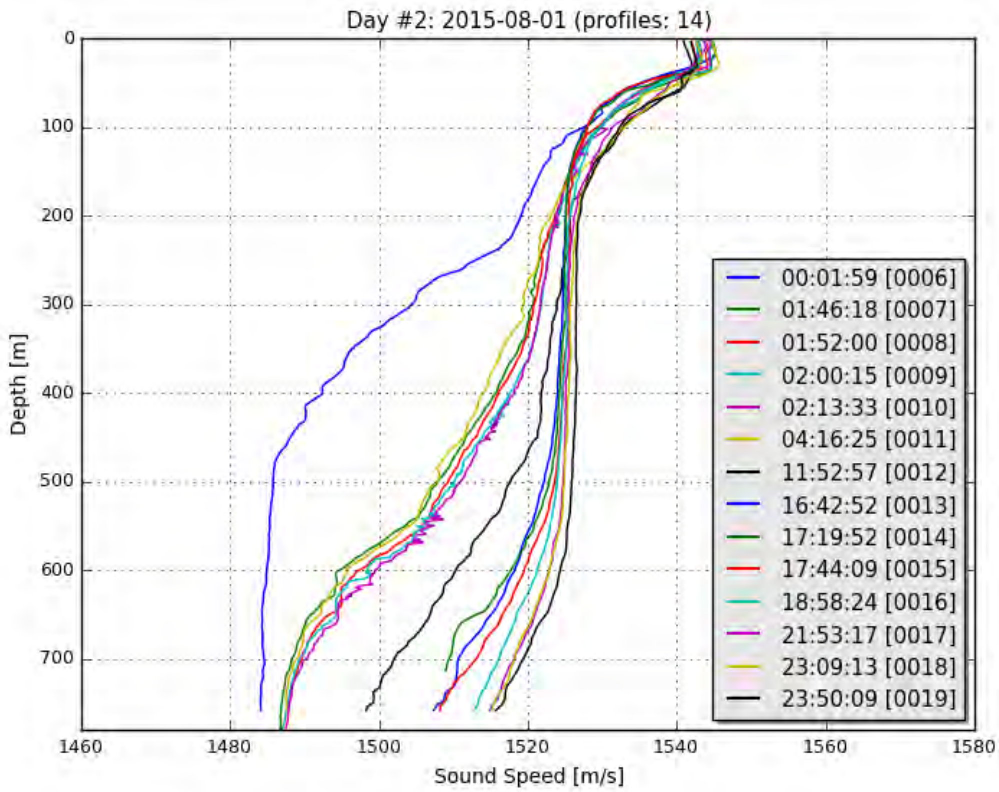
The CUBE algorithm implementation in HIPS was configured with CARIS' "deep" settings. These set the reference IHO uncertainty model to S.44 ed. 4 order 3 (a = 1.0, b = 0.023), and use standard CUBE reference parameters except that the distance capture scale is set to 0.20 and the minimum distance is set to 2.0 m.

11.5 GeoCoder Algorithm Parameters

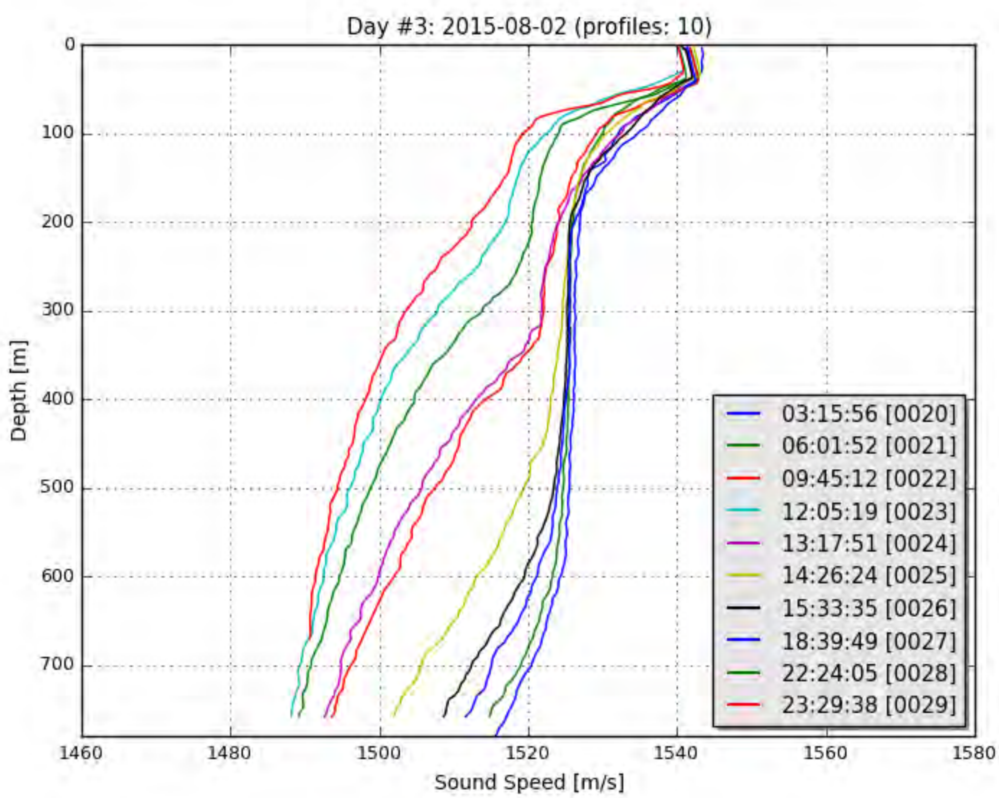
The GeoCoder implementation in FMGT was set to the standard configuration for FMGT 7.4.4b. This configures the algorithm to carry out transmit and receive power/gain corrections, apply beam pattern corrections, accept all beams, use the absorption coefficients from file, and apply no backscatter bias. The algorithm uses a "flat" AVG correction with window 300 pings, computing statistics in logarithmic space. The mosaic used the "blend" method with a 50% inter-line blending, and dB mean estimation. Navigation is taken from the default source in the input file, with automatically determined sonar defaults. Dual swath compensation was turned off. The default processing pipeline was used.

12 Daily XBT Analyses

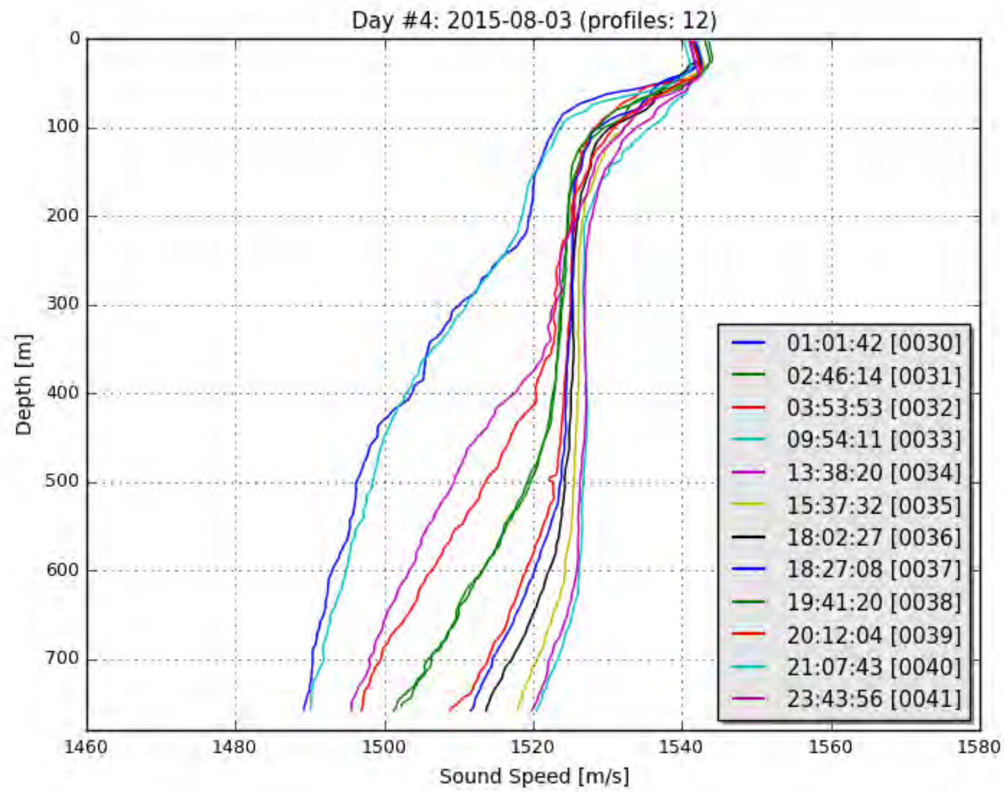




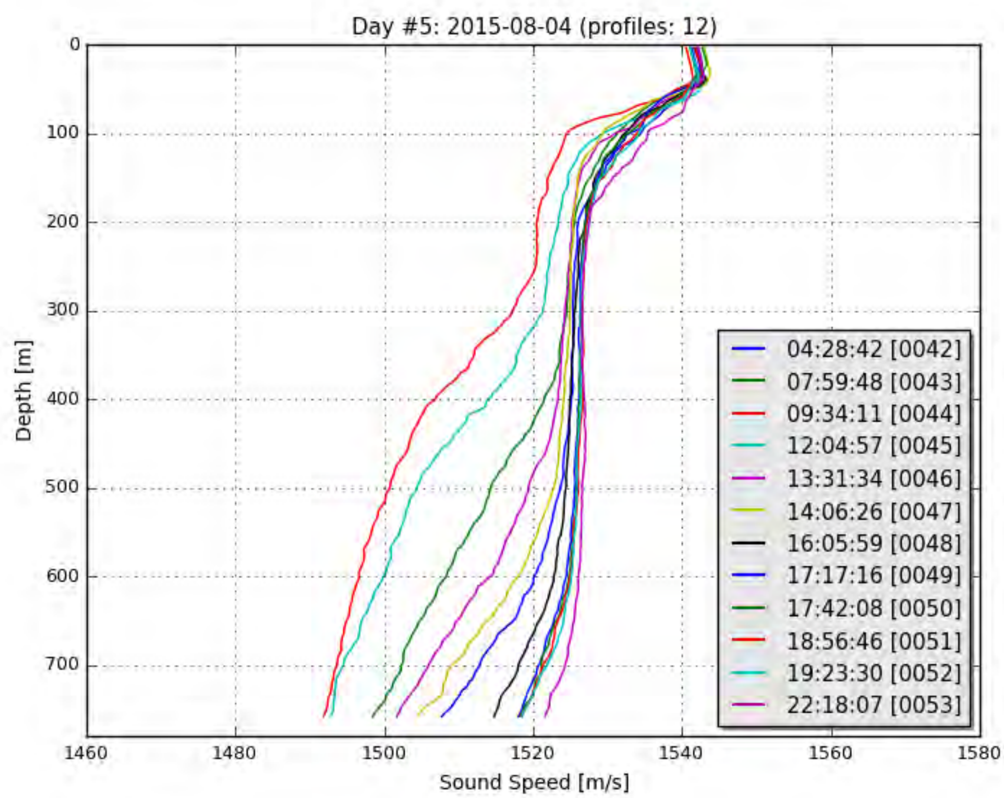
Day #2: 2015-08-01 (profiles: 14)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:01:59 [0006]
01:46:18 [0007]
01:52:00 [0008]
02:00:15 [0009]
02:13:33 [0010]
04:16:25 [0011]
11:52:57 [0012]
16:42:52 [0013]
17:19:52 [0014]
17:44:09 [0015]
18:58:24 [0016]
21:53:17 [0017]
23:09:13 [0018]
23:50:09 [0019]



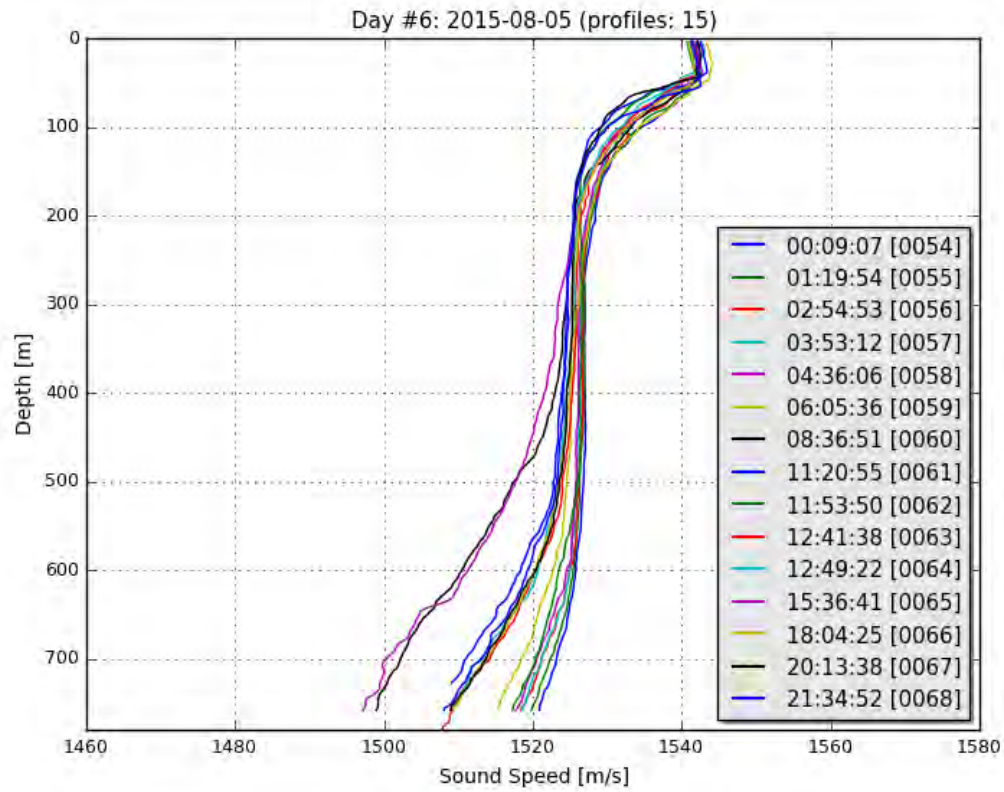
Day #3: 2015-08-02 (profiles: 10)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
03:15:56 [0020]
06:01:52 [0021]
09:45:12 [0022]
12:05:19 [0023]
13:17:51 [0024]
14:26:24 [0025]
15:33:35 [0026]
18:39:49 [0027]
22:24:05 [0028]
23:29:38 [0029]

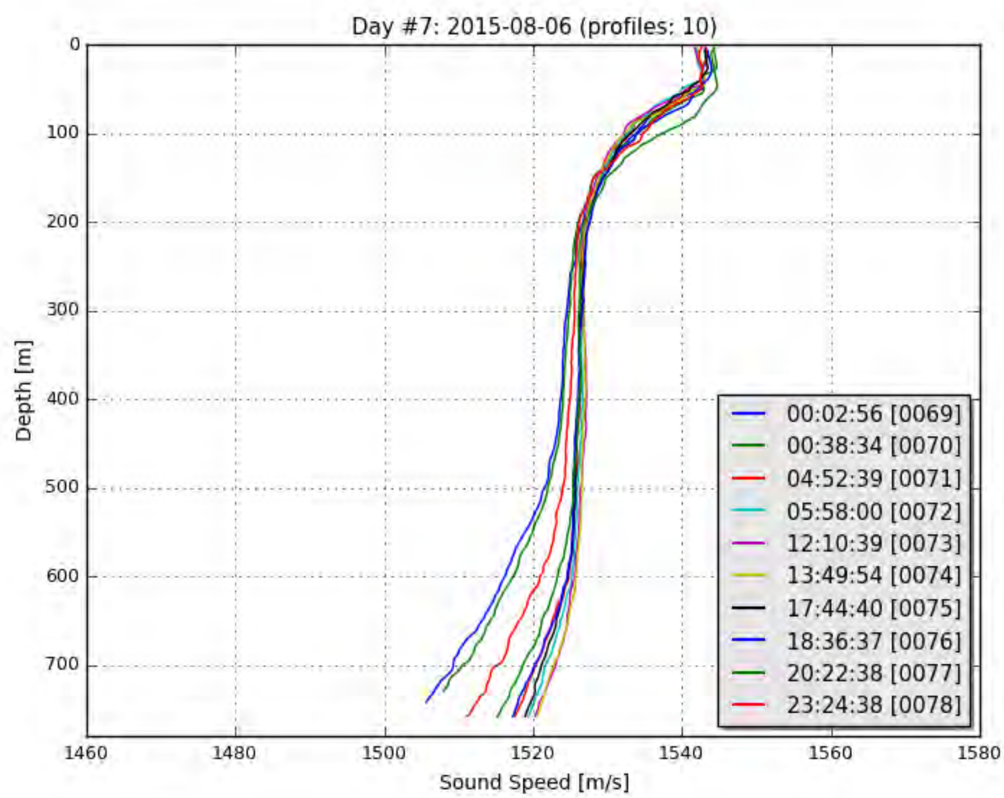


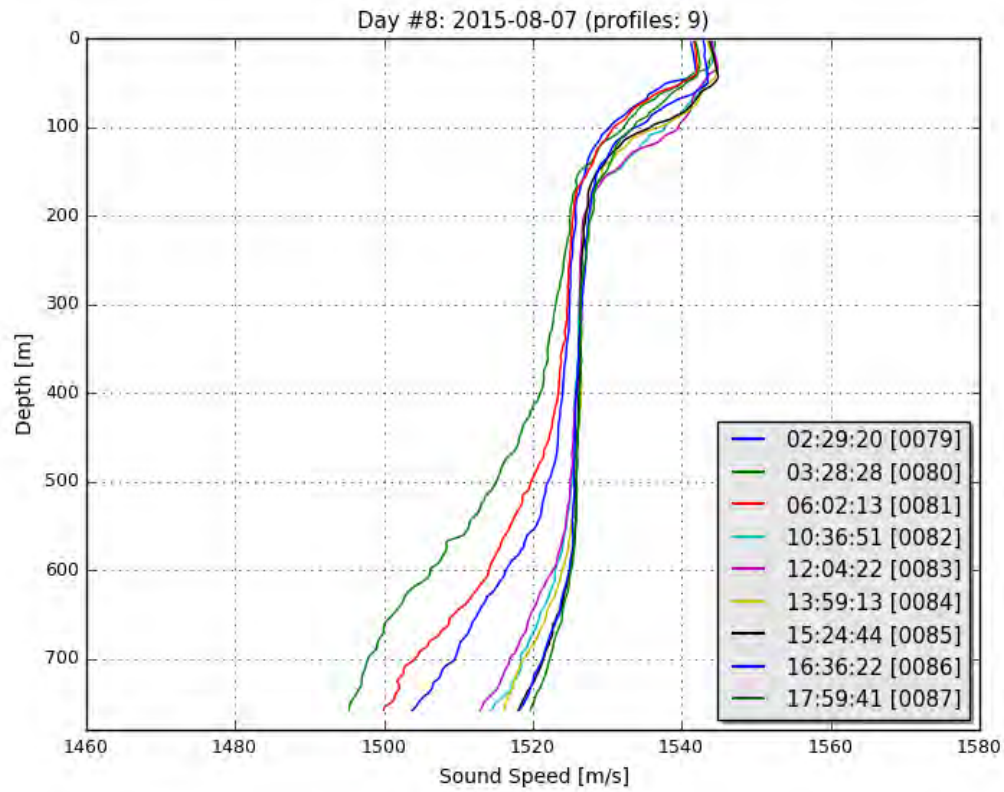
Day #4: 2015-08-03 (profiles: 12)
Depth [m]
Sound Speed [m/s]
01:01:42 [0030]
02:46:14 [0031]
03:53:53 [0032]
09:54:11 [0033]
13:38:20 [0034]
15:37:32 [0035]
18:02:27 [0036]
18:27:08 [0037]
19:41:20 [0038]
20:12:04 [0039]
21:07:43 [0040]
23:43:56 [0041]



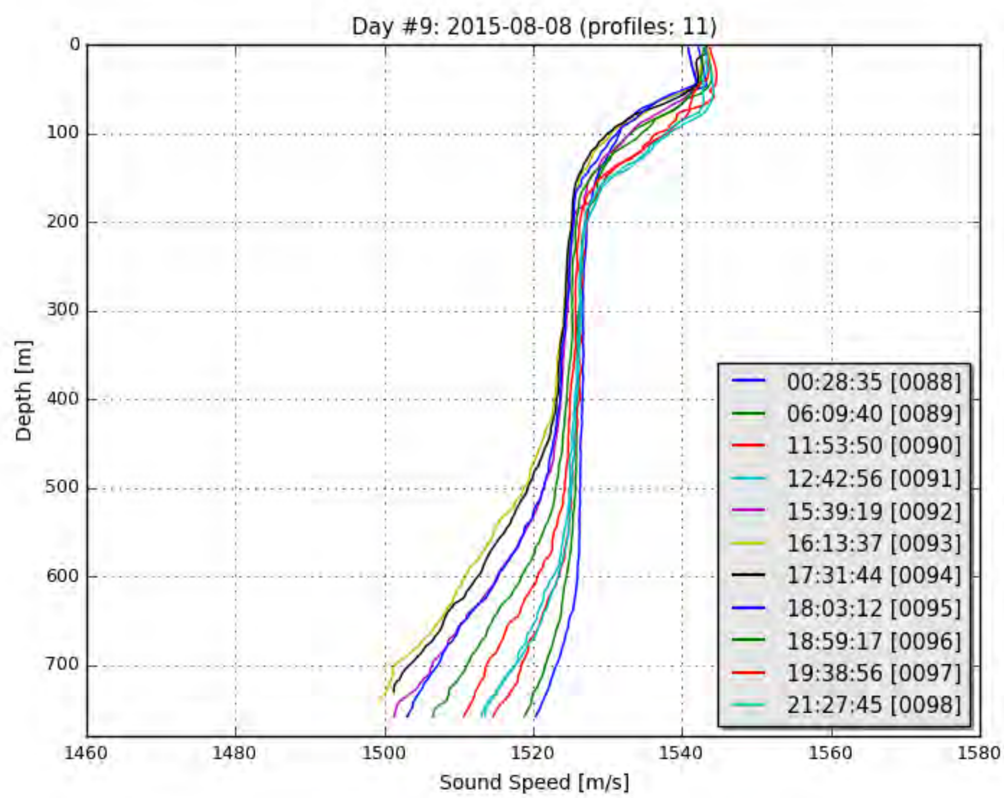
Day #5: 2015-08-04 (profiles: 12)
Depth [m]
Sound Speed [m/s]
04:28:42 [0042]
07:59:48 [0043]
09:34:11 [0044]
12:04:57 [0045]
13:31:34 [0046]
14:06:26 [0047]
16:05:59 [0048]
17:17:16 [0049]
17:42:08 [0050]
18:56:46 [0051]
19:23:30 [0052]
22:18:07 [0053]


Day #6: 2015-08-05 (profiles: 15)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:09:07 [0054]
01:19:54 [0055]
02:54:53 [0056]
03:53:12 [0057]
04:36:06 [0058]
06:05:36 [0059]
08:36:51 [0060]
11:20:55 [0061]
11:53:50 [0062]
12:41:38 [0063]
12:49:22 [0064]
15:36:41 [0065]
18:04:25 [0066]
20:13:38 [0067]
21:34:52 [0068]

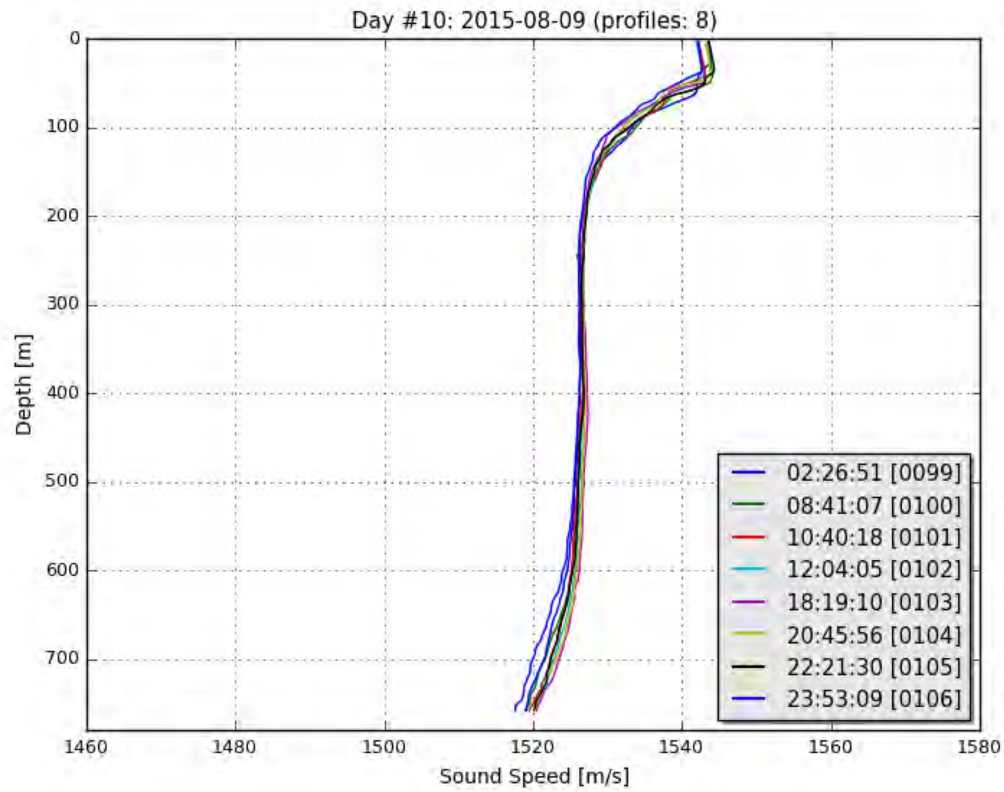

Day #7: 2015-08-06 (profiles: 10)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:02:56 [0069]
00:38:34 [0070]
04:52:39 [0071]
05:58:00 [0072]
12:10:39 [0073]
13:49:54 [0074]
17:44:40 [0075]
18:36:37 [0076]
20:22:38 [0077]
23:24:38 [0078]



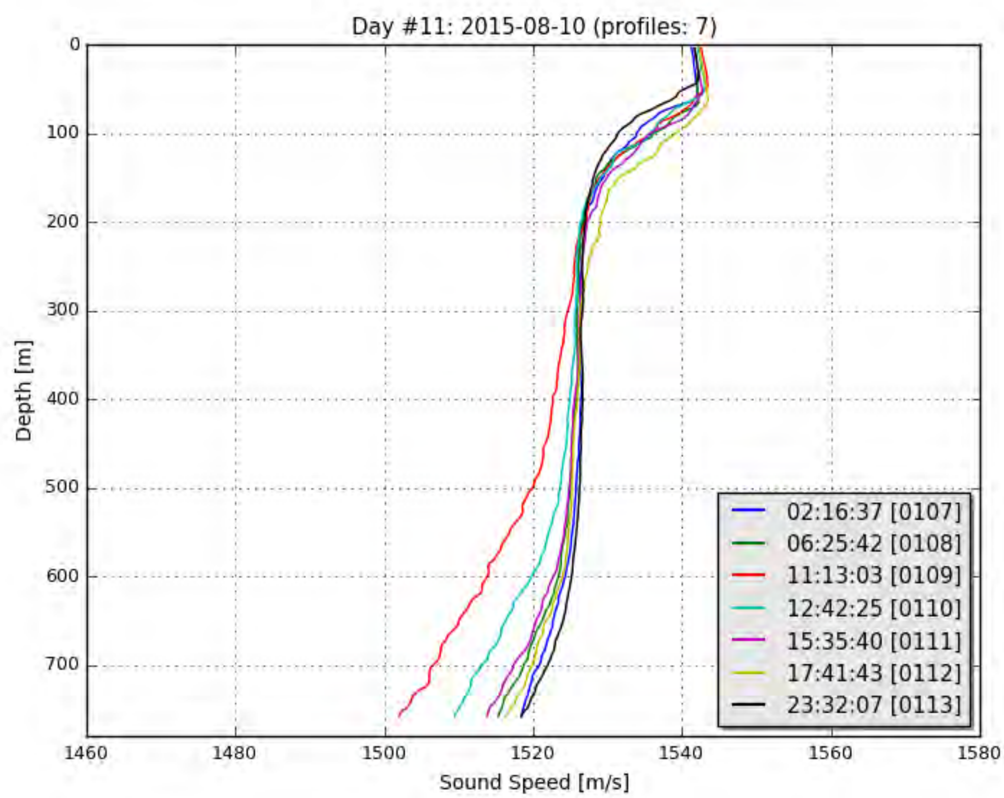
Day #8: 2015-08-07 (profiles: 9)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
02:29:20 [0079]
03:28:28 [0080]
06:02:13 [0081]
10:36:51 [0082]
12:04:22 [0083]
13:59:13 [0084]
15:24:44 [0085]
16:36:22 [0086]
17:59:41 [0087]



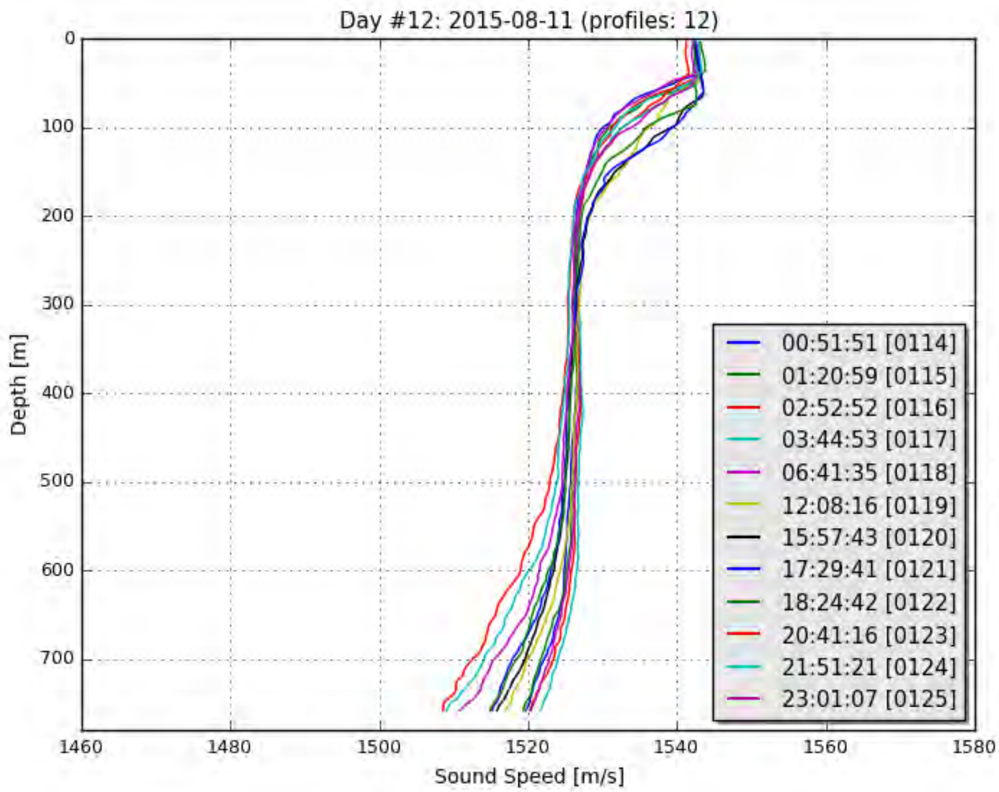
Day #9: 2015-08-08 (profiles: 11)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:28:35 [0088]
06:09:40 [0089]
11:53:50 [0090]
12:42:56 [0091]
15:39:19 [0092]
16:13:37 [0093]
17:31:44 [0094]
18:03:12 [0095]
18:59:17 [0096]
19:38:56 [0097]
21:27:45 [0098]



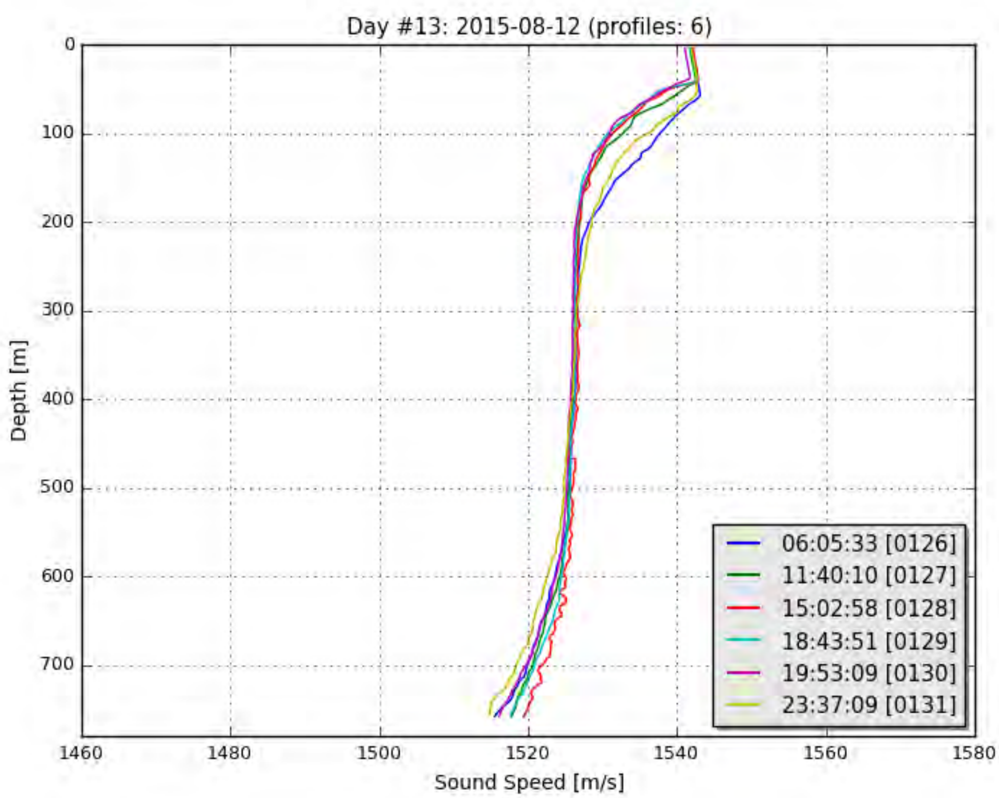
Day #10: 2015-08-09 (profiles: 8)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
02:26:51 [0099]
08:41:07 [0100]
10:40:18 [0101]
12:04:05 [0102]
18:19:10 [0103]
20:45:56 [0104]
22:21:30 [0105]
23:53:09 [0106]



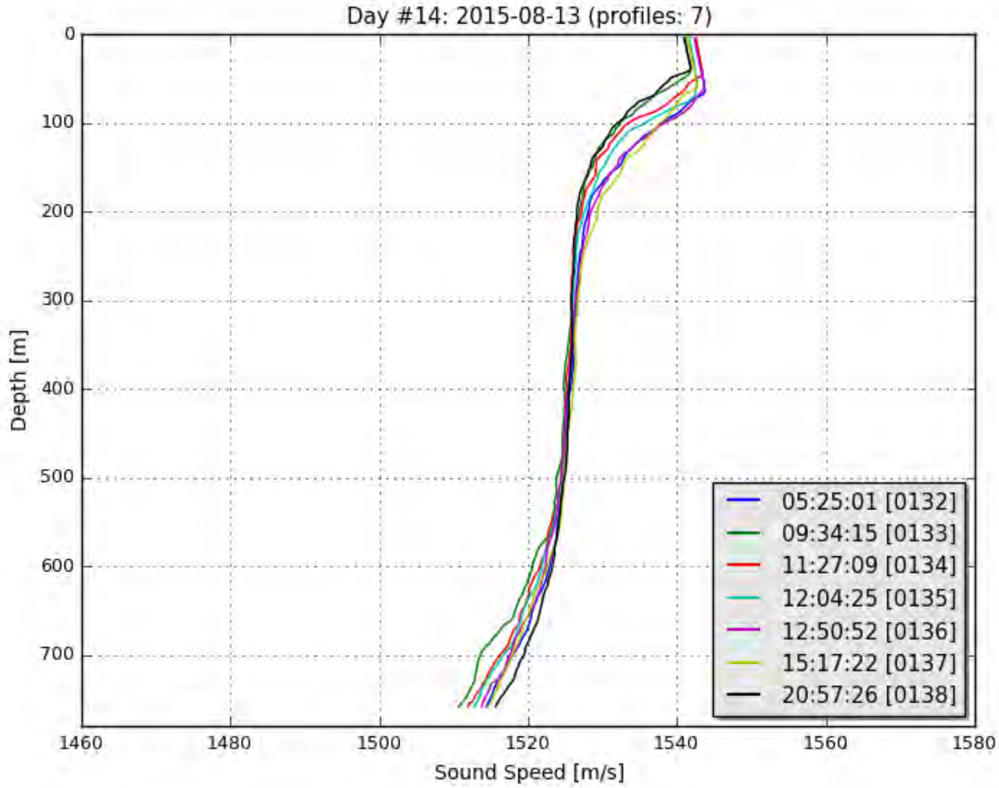
Day #11: 2015-08-10 (profiles: 7)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
02:16:37 [0107]
06:25:42 [0108]
11:13:03 [0109]
12:42:25 [0110]
15:35:40 [0111]
17:41:43 [0112]
23:32:07 [0113]

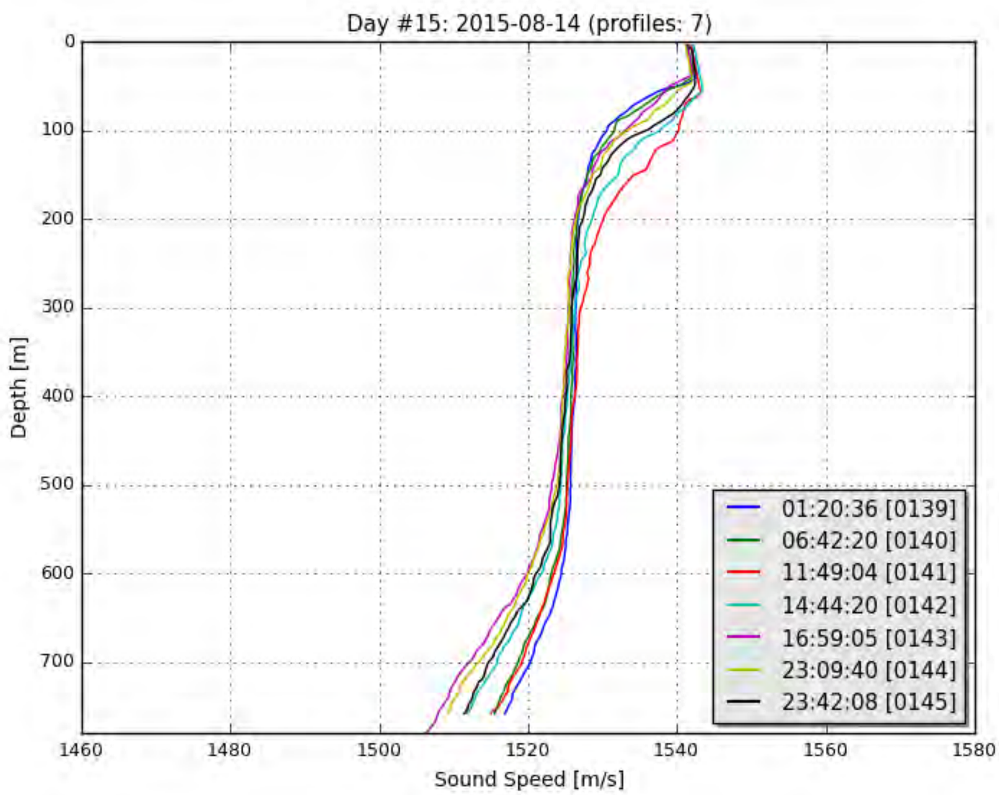


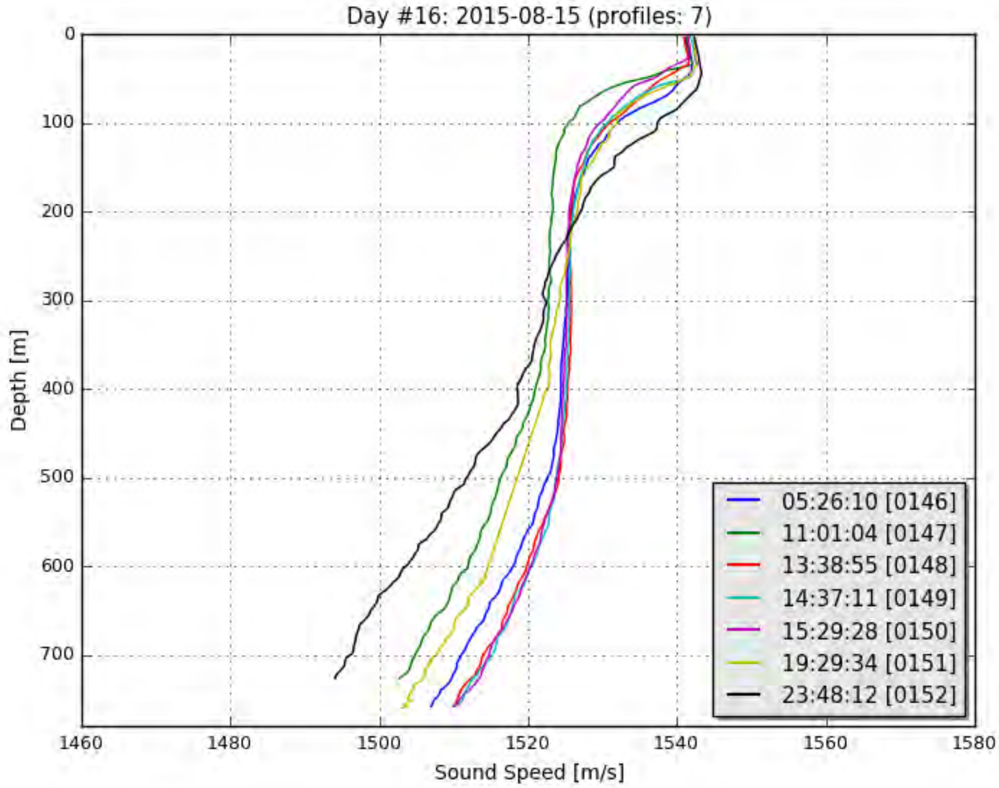
Day #12: 2015-08-11 (profiles: 12)
Depth [m]
Sound Speed [m/s]
00:51:51 [0114]
01:20:59 [0115]
02:52:52 [0116]
03:44:53 [0117]
06:41:35 [0118]
12:08:16 [0119]
15:57:43 [0120]
17:29:41 [0121]
18:24:42 [0122]
20:41:16 [0123]
21:51:21 [0124]
23:01:07 [0125]

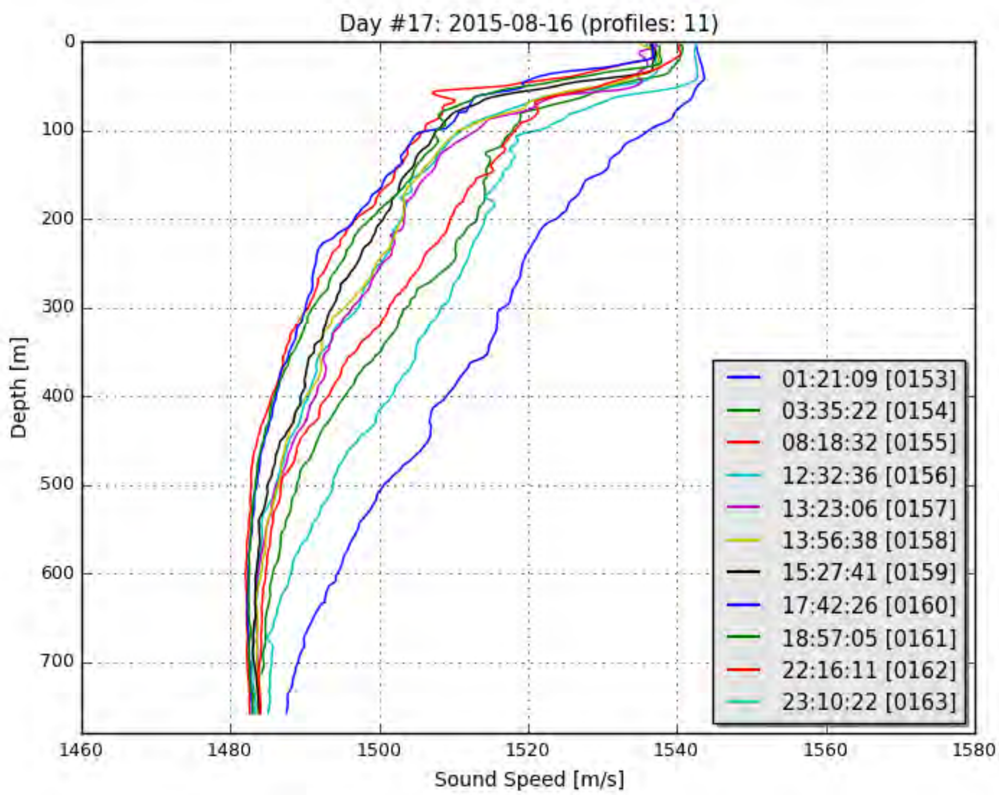


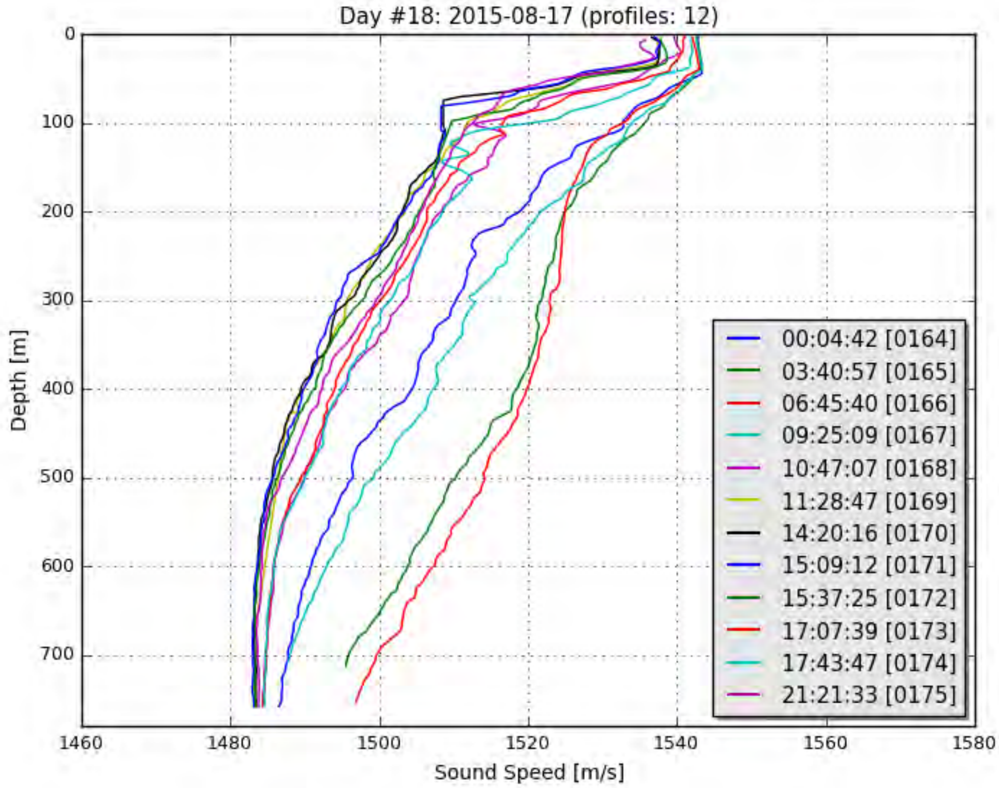
Day #13: 2015-08-12 (profiles: 6)
Depth [m]
Sound Speed [m/s]
06:05:33 [0126]
11:40:10 [0127]
15:02:58 [0128]
18:43:51 [0129]
19:53:09 [0130]
23:37:09 [0131]


Day #14: 2015-08-13 (profiles: 7)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
05:25:01 [0132]
09:34:15 [0133]
11:27:09 [0134]
12:04:25 [0135]
12:50:52 [0136]
15:17:22 [0137]
20:57:26 [0138]

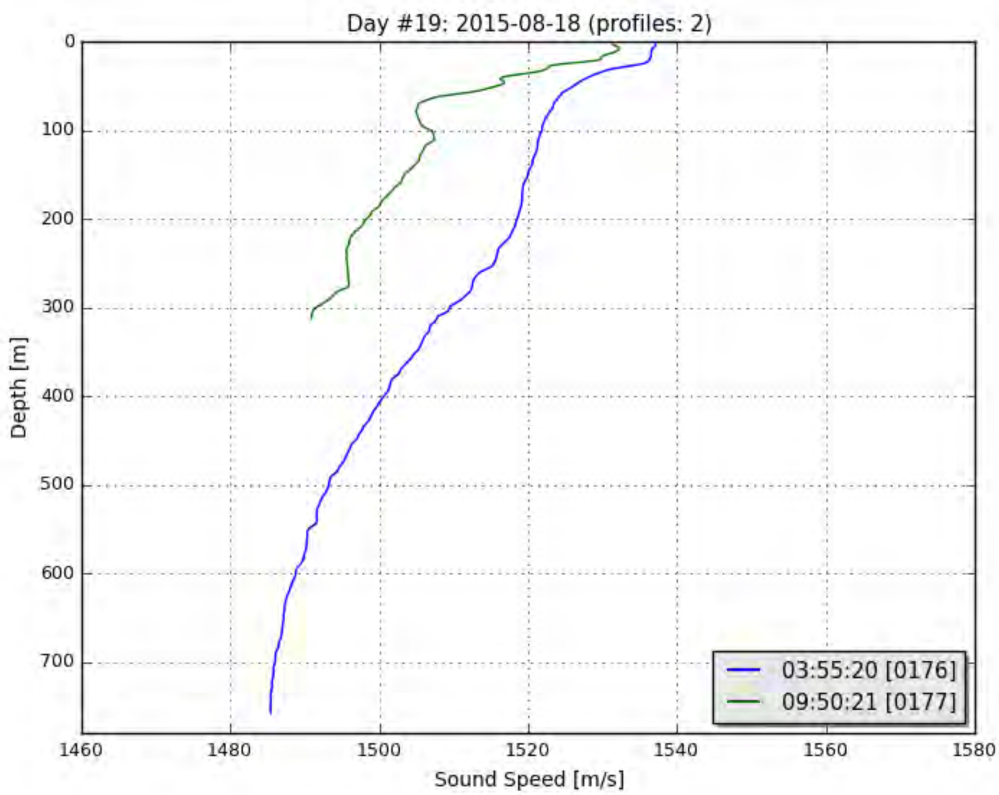

Day #15: 2015-08-14 (profiles: 7)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
01:20:36 [0139]
06:42:20 [0140]
11:49:04 [0141]
14:44:20 [0142]
16:59:05 [0143]
23:09:40 [0144]
23:42:08 [0145]


Day #16: 2015-08-15 (profiles: 7)
Depth [m]
Sound Speed [m/s]
05:26:10 [0146]
11:01:04 [0147]
13:38:55 [0148]
14:37:11 [0149]
15:29:28 [0150]
19:29:34 [0151]
23:48:12 [0152]

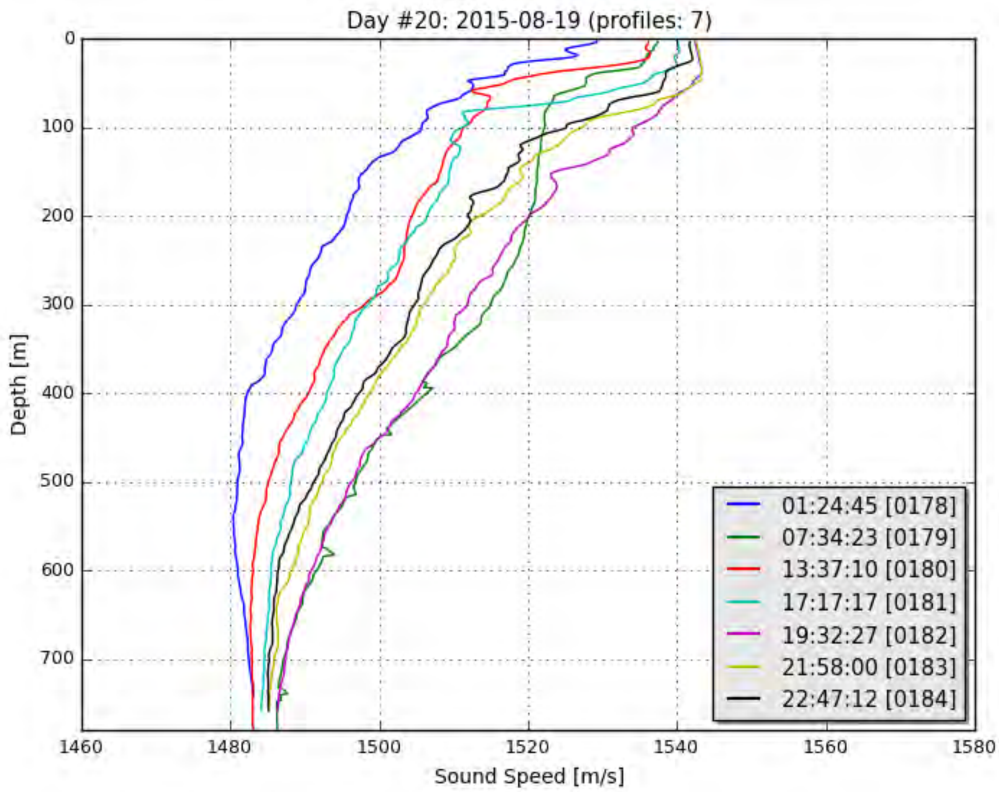

Day #17: 2015-08-16 (profiles: 11)
Depth [m]
Sound Speed [m/s]
01:21:09 [0153]
03:35:22 [0154]
08:18:32 [0155]
12:32:36 [0156]
13:23:06 [0157]
13:56:38 [0158]
15:27:41 [0159]
17:42:26 [0160]
18:57:05 [0161]
22:16:11 [0162]
23:10:22 [0163]



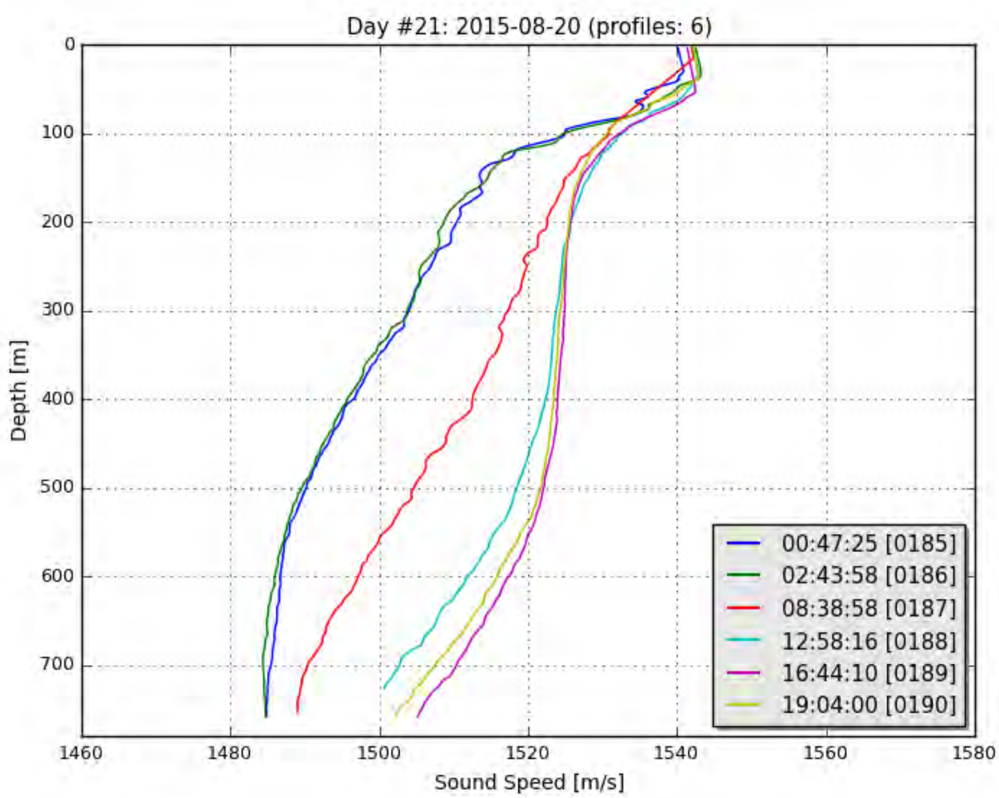
Day #18: 2015-08-17 (profiles: 12)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:04:42 [0164]
03:40:57 [0165]
06:45:40 [0166]
09:25:09 [0167]
10:47:07 [0168]
11:28:47 [0169]
14:20:16 [0170]
15:09:12 [0171]
15:37:25 [0172]
17:07:39 [0173]
17:43:47 [0174]
21:21:33 [0175]



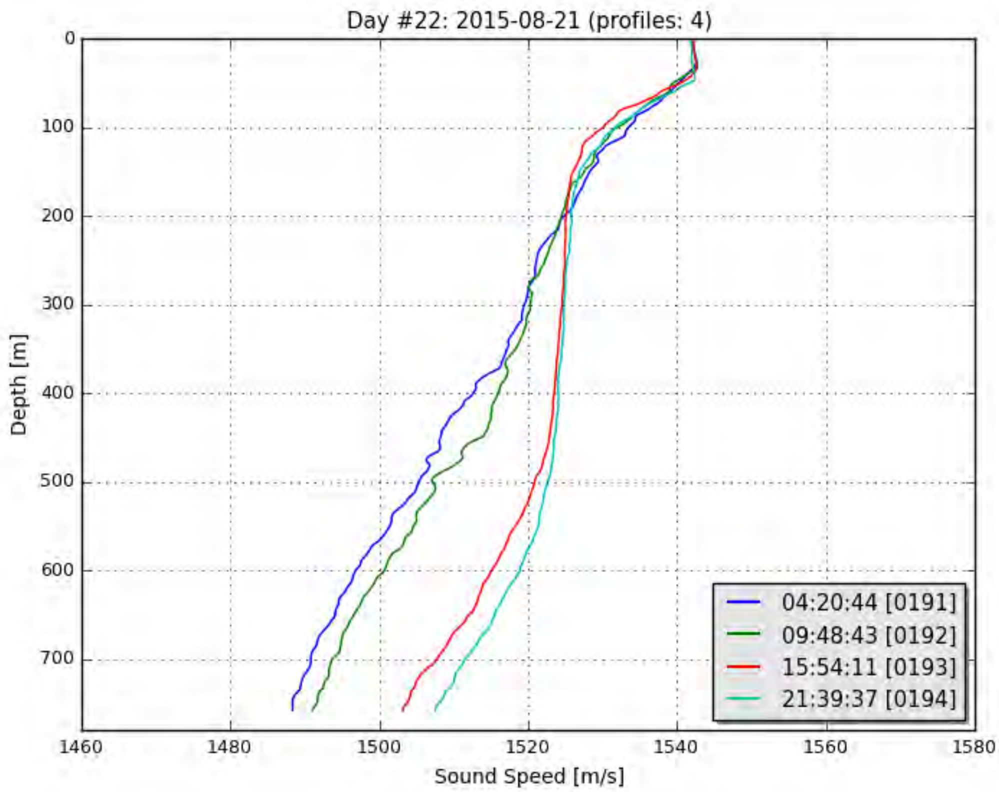
Day #19: 2015-08-18 (profiles: 2)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
03:55:20 [0176]
09:50:21 [0177]

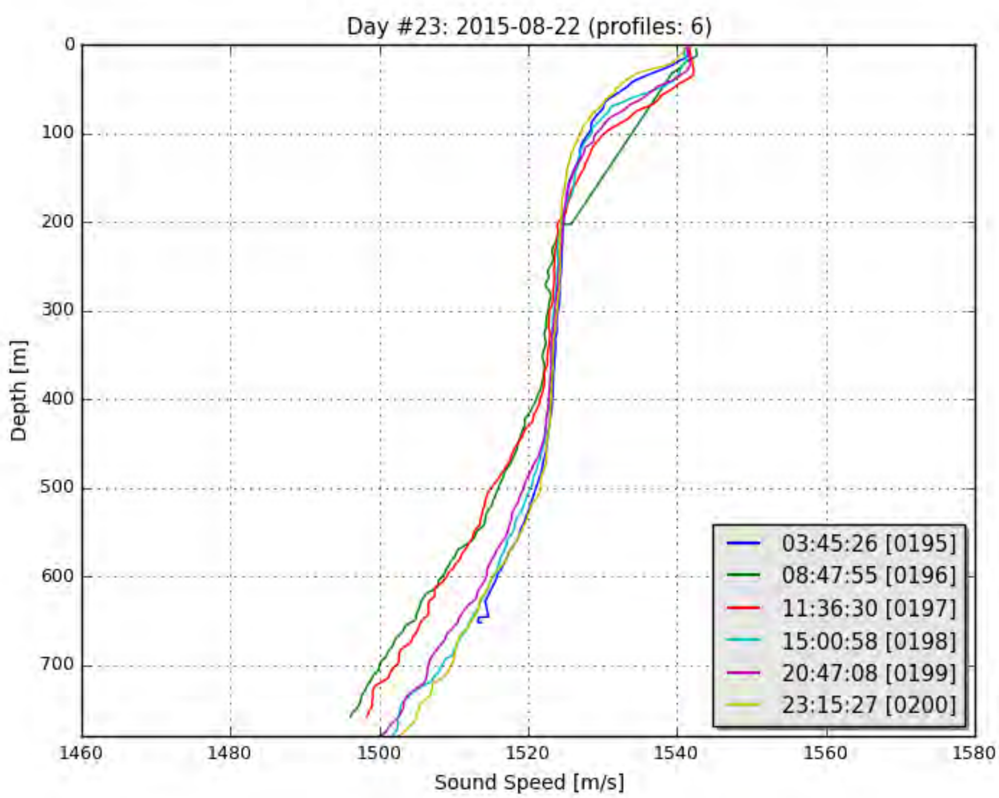


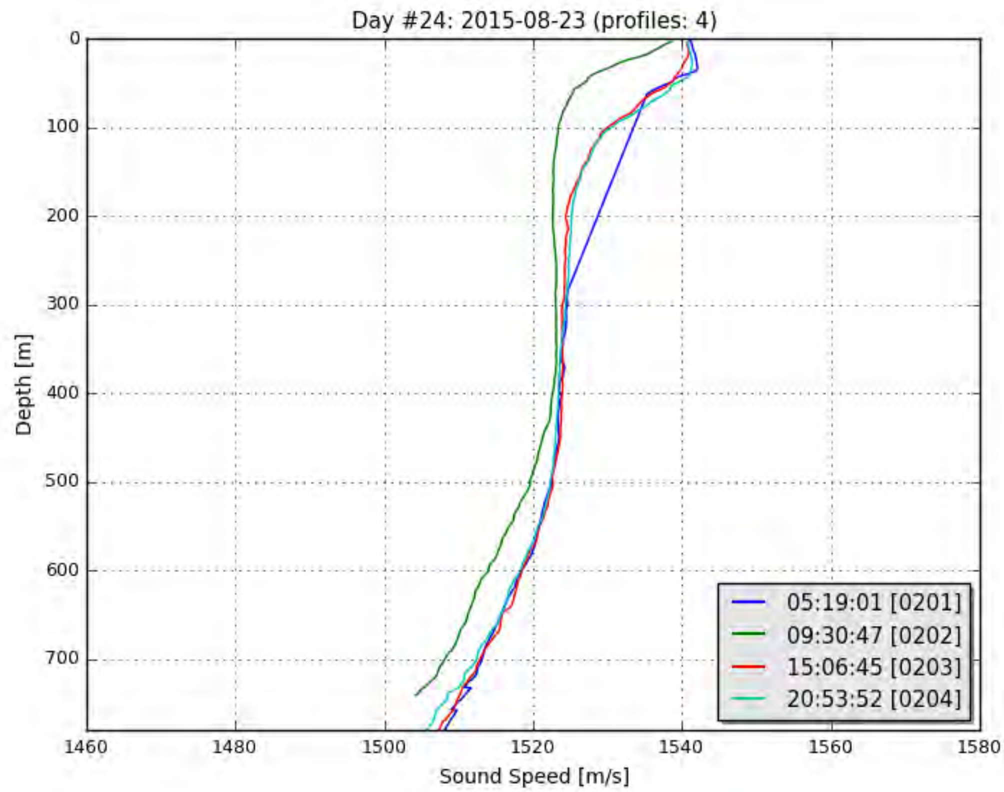
Day #20: 2015-08-19 (profiles: 7)
Depth [m]
Sound Speed [m/s]
01:24:45 [0178]
07:34:23 [0179]
13:37:10 [0180]
17:17:17 [0181]
19:32:27 [0182]
21:58:00 [0183]
22:47:12 [0184]

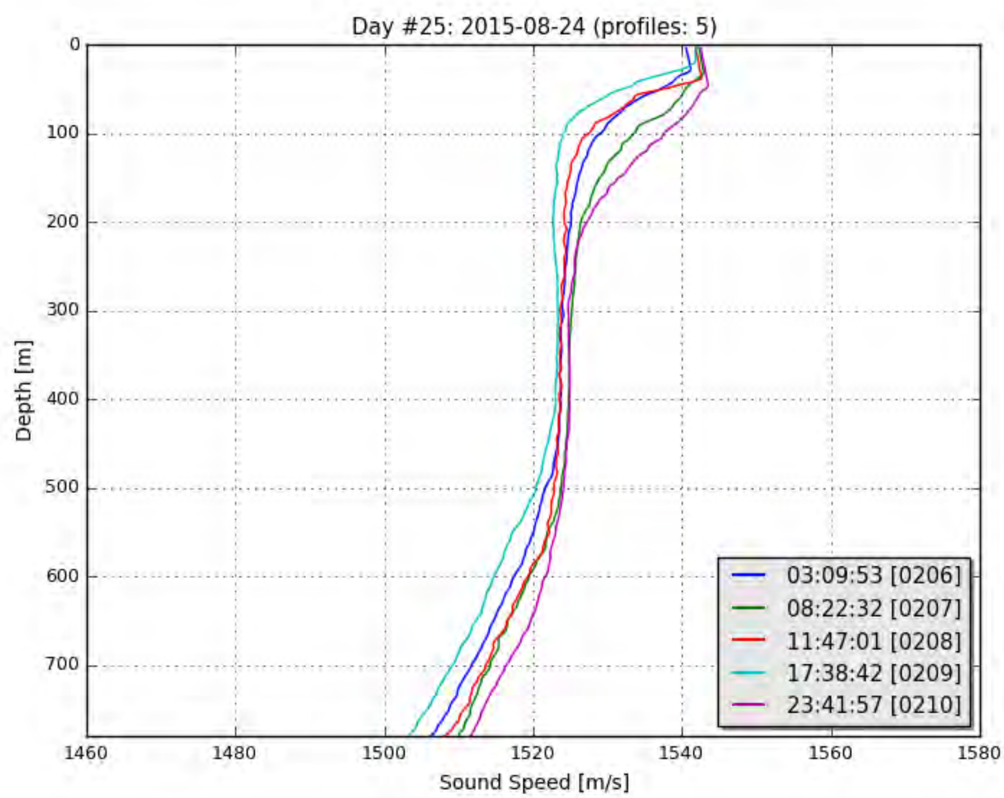


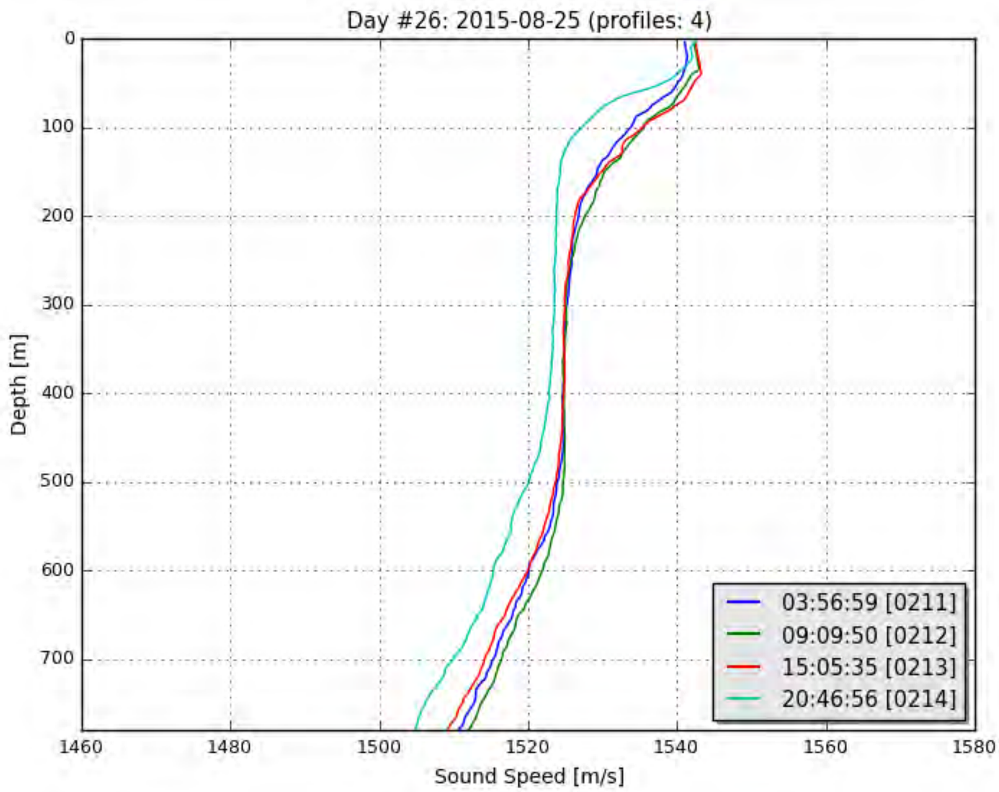
Day #21: 2015-08-20 (profiles: 6)
Depth [m]
Sound Speed [m/s]
00:47:25 [0185]
02:43:58 [0186]
08:38:58 [0187]
12:58:16 [0188]
16:44:10 [0189]
19:04:00 [0190]

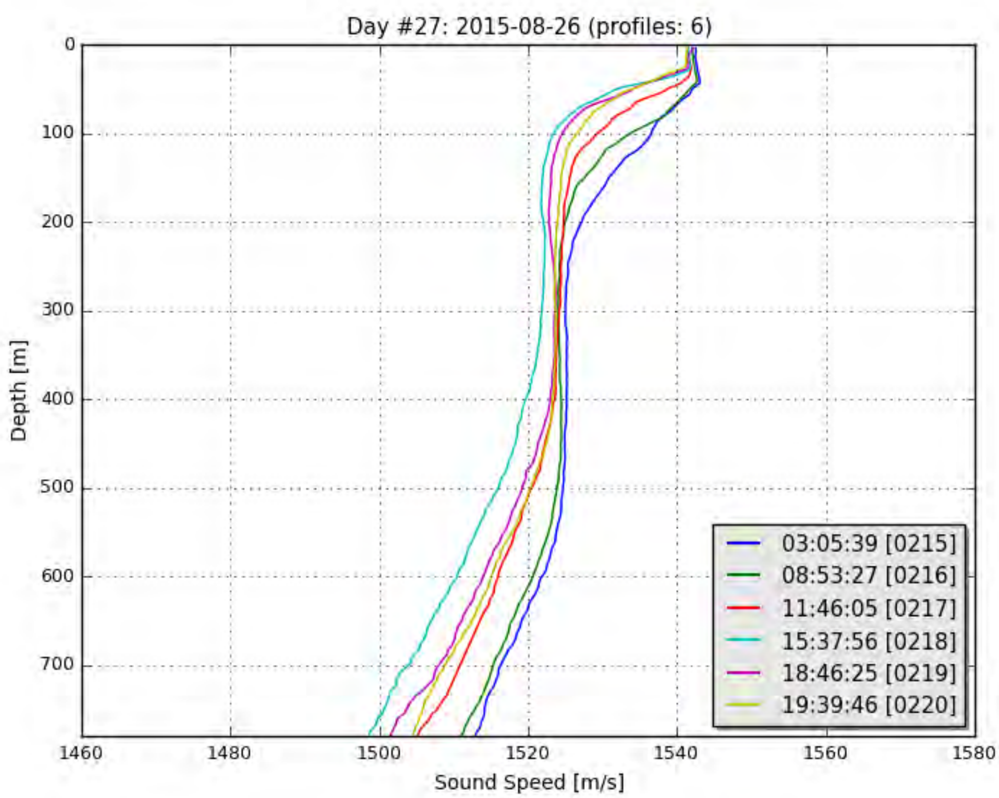

Day #22: 2015-08-21 (profiles: 4)
Depth [m]
Sound Speed [m/s]
04:20:44 [0191]
09:48:43 [0192]
15:54:11 [0193]
21:39:37 [0194]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580

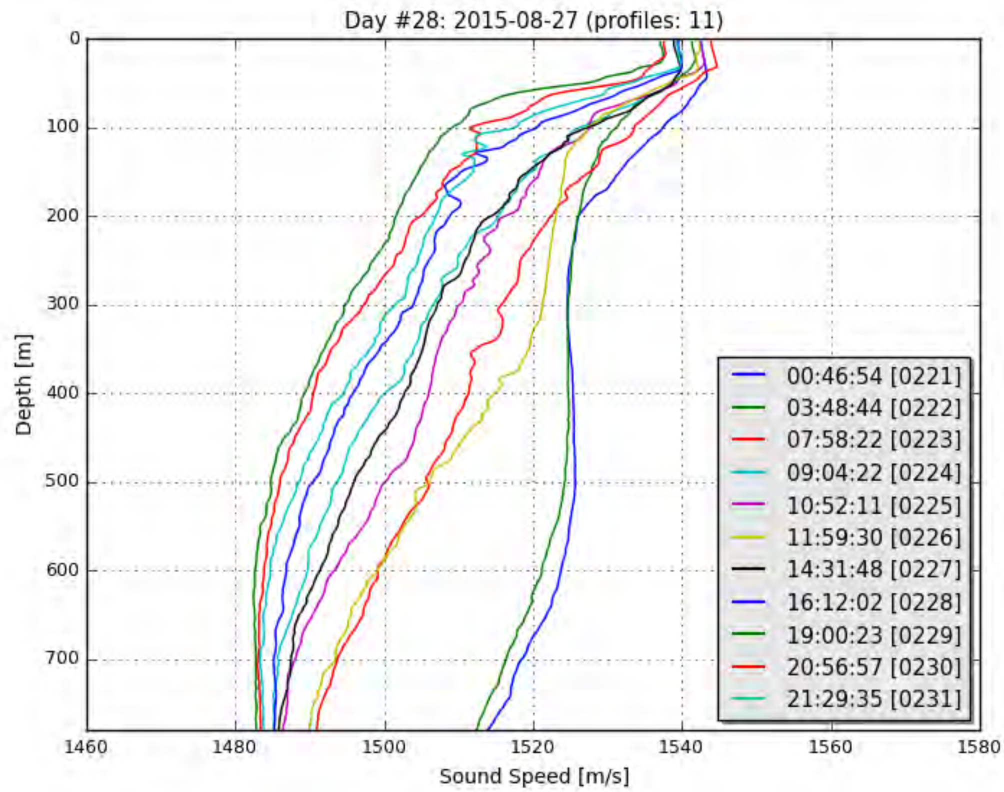

Day #23: 2015-08-22 (profiles: 6)
Depth [m]
Sound Speed [m/s]
03:45:26 [0195]
08:47:55 [0196]
11:36:30 [0197]
15:00:58 [0198]
20:47:08 [0199]
23:15:27 [0200]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580


Day #24: 2015-08-23 (profiles: 4)
Depth [m]
Sound Speed [m/s]
05:19:01 [0201]
09:30:47 [0202]
15:06:45 [0203]
20:53:52 [0204]

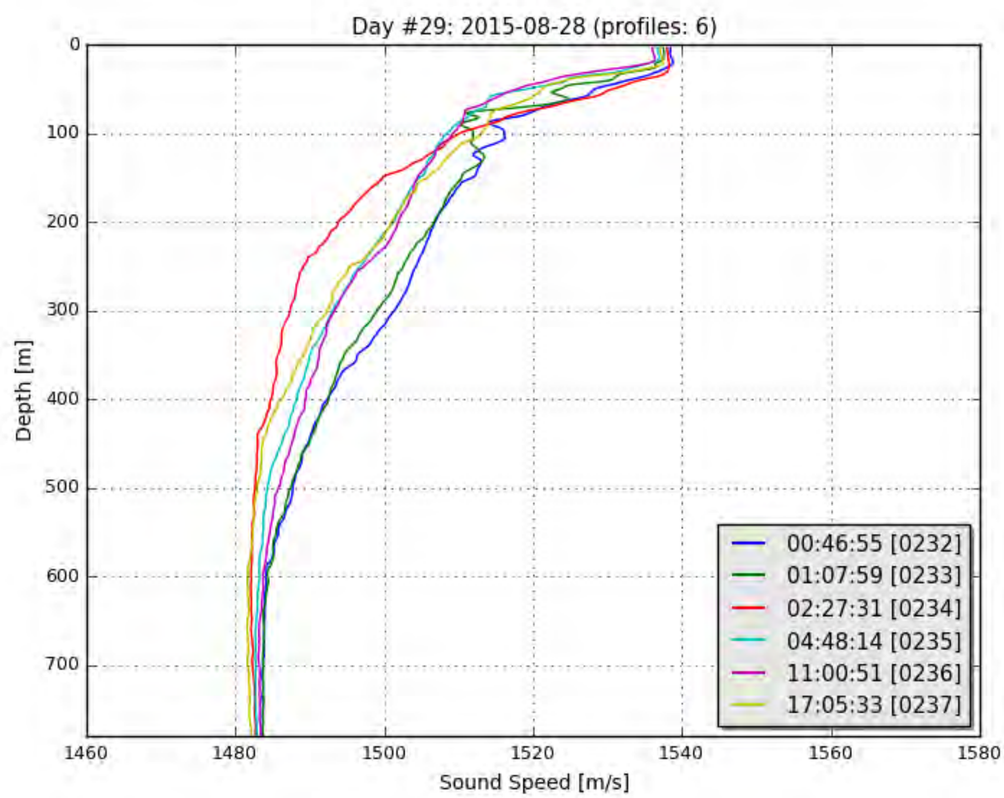

Day #25: 2015-08-24 (profiles: 5)
Depth [m]
Sound Speed [m/s]
03:09:53 [0206]
08:22:32 [0207]
11:47:01 [0208]
17:38:42 [0209]
23:41:57 [0210]


Day #26: 2015-08-25 (profiles: 4)
Depth [m]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
Sound Speed [m/s]
03:56:59 [0211]
09:09:50 [0212]
15:05:35 [0213]
20:46:56 [0214]

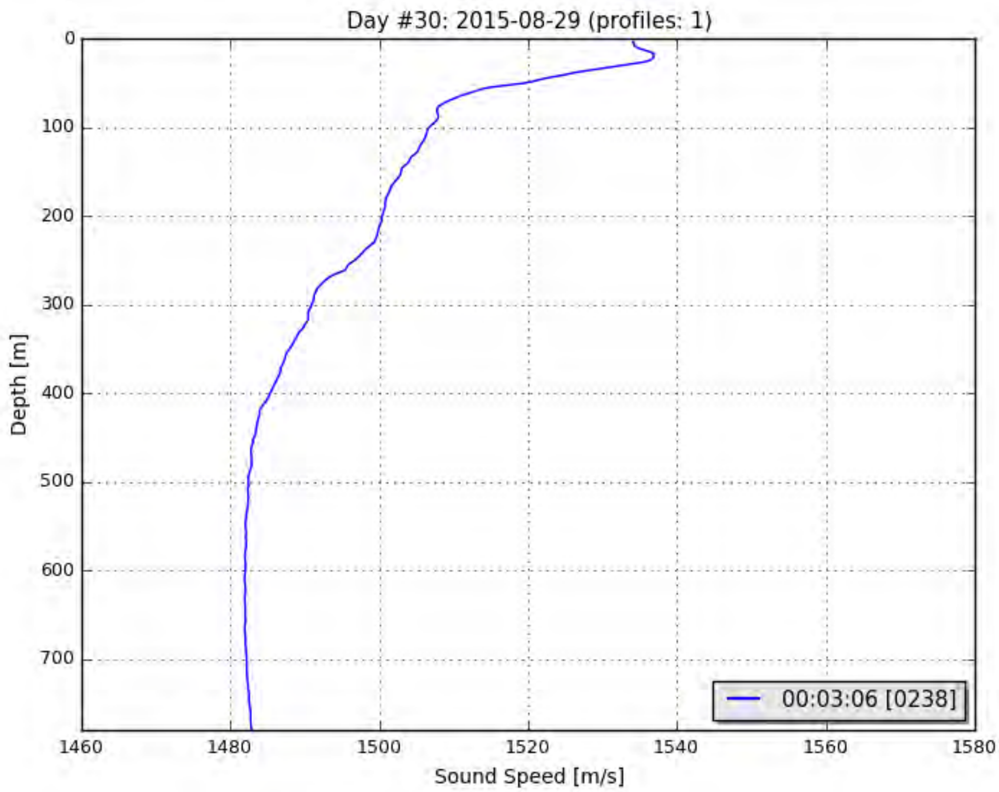

Day #27: 2015-08-26 (profiles: 6)
Depth [m]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
Sound Speed [m/s]
03:05:39 [0215]
08:53:27 [0216]
11:46:05 [0217]
15:37:56 [0218]
18:46:25 [0219]
19:39:46 [0220]



Day #28: 2015-08-27 (profiles: 11)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:46:54 [0221]
03:48:44 [0222]
07:58:22 [0223]
09:04:22 [0224]
10:52:11 [0225]
11:59:30 [0226]
14:31:48 [0227]
16:12:02 [0228]
19:00:23 [0229]
20:56:57 [0230]
21:29:35 [0231]



Day #29: 2015-08-28 (profiles: 6)
Depth [m]
Sound Speed [m/s]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
00:46:55 [0232]
01:07:59 [0233]
02:27:31 [0234]
04:48:14 [0235]
11:00:51 [0236]
17:05:33 [0237]



Day #30: 2015-08-29 (profiles: 1)
Depth [m]
0
100
200
300
400
500
600
700
1460
1480
1500
1520
1540
1560
1580
Sound Speed [m/s]
00:03:06 [0238]

13 Data Consistency Analyses

13.1 Introduction

In order to assess the consistency of the soundings being measured with the EM122, the data collected on main-scheme lines were compared with the cross lines, and data from previous legs of the mission. Although this does not assess the true uncertainty of the soundings, it does estimate the consistency. The cross-lines were Kongsberg lines 0076 and 0077.

13.2 Method

The data collected were ingested into CARIS HIPS from Kongsberg Maritime "raw" format and processed as described in Section 3.2. The main-scheme and cross-lines were made separately into gridded products, and the cross-check analysis was then conducted in CARIS BASE Editor by surface comparison. Data from the previous legs of the mission were exported as ASCII position/depth triplets from the Fledermaus SD objects archived for those cruises, and then ingested into BASE Editor.

13.3 Results

The analyses of all of the crossing in the dataset are presented in the digital version of the dataset. Comparison of the data collected during leg 8 using the main-scheme and cross-lines (Figure 20) showed that the differences were limited to the range [-54, 45] m with mean -0.3 m and standard deviation 4.7 m, approximately 0.1% of water depth in the area (Figure 21). The area of overlap between leg 8 data and previous legs of the campaign (Figure 22) compares the data against three different sources of data (EM120 data from leg 6, EM121 data from legs 4-5, and EM302 data from the NOAA Ship *Okeanos Explorer*). The differences (Figure 23) show a range of [-215, 274] m, with mean -0.8 m and standard deviation 11.6 m, approximately 0.2% of the water depth in the area (Figure 24).

13.4 Summary

The results show that in almost all cases, the data meet (and generally exceeds) the requirements of being within 0.5% of the water depth in the area at the 95% confidence level. The data are therefore all within the specification required for this survey.

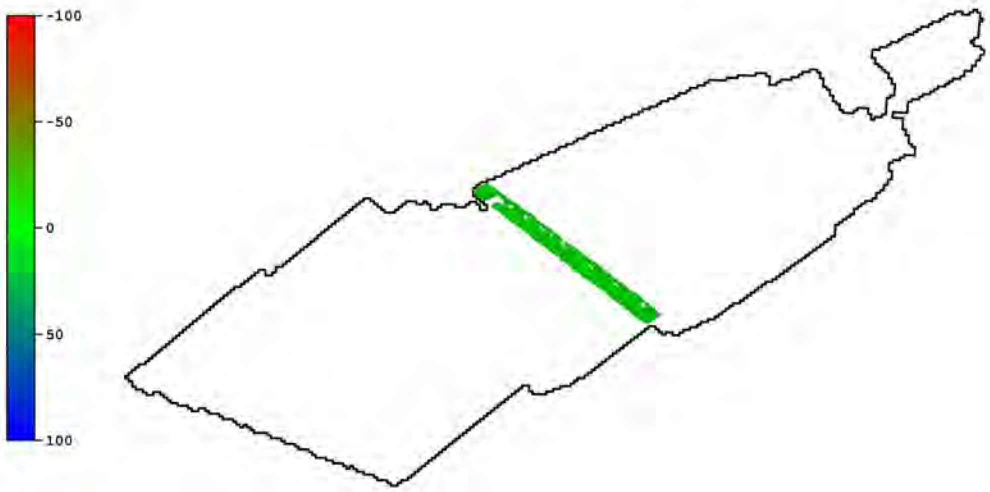


Figure 20: Surface difference between main-scheme and cross lines from leg 8, with survey outline. The differences range from -54m to 45m, with mean -0.3m and standard deviation 4.7m.

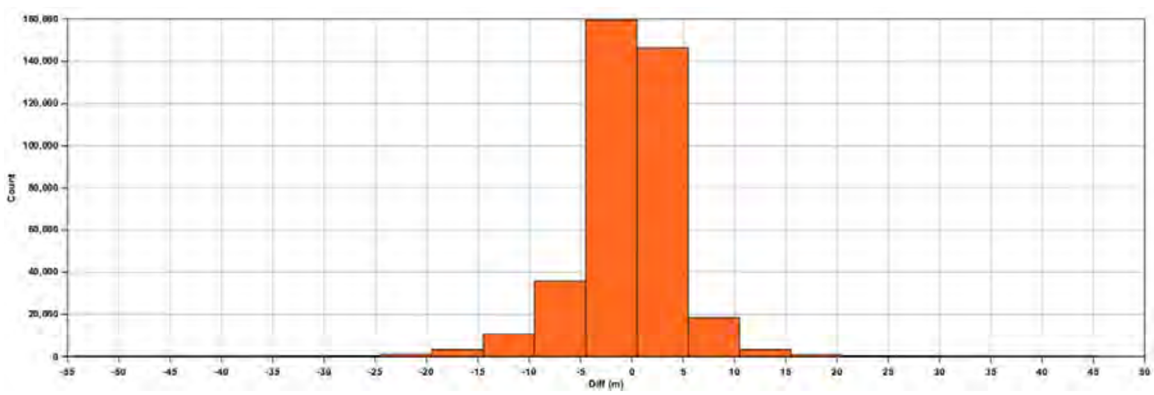


Figure 21: Histogram of surface differences between main-scheme and cross lines from leg 8.

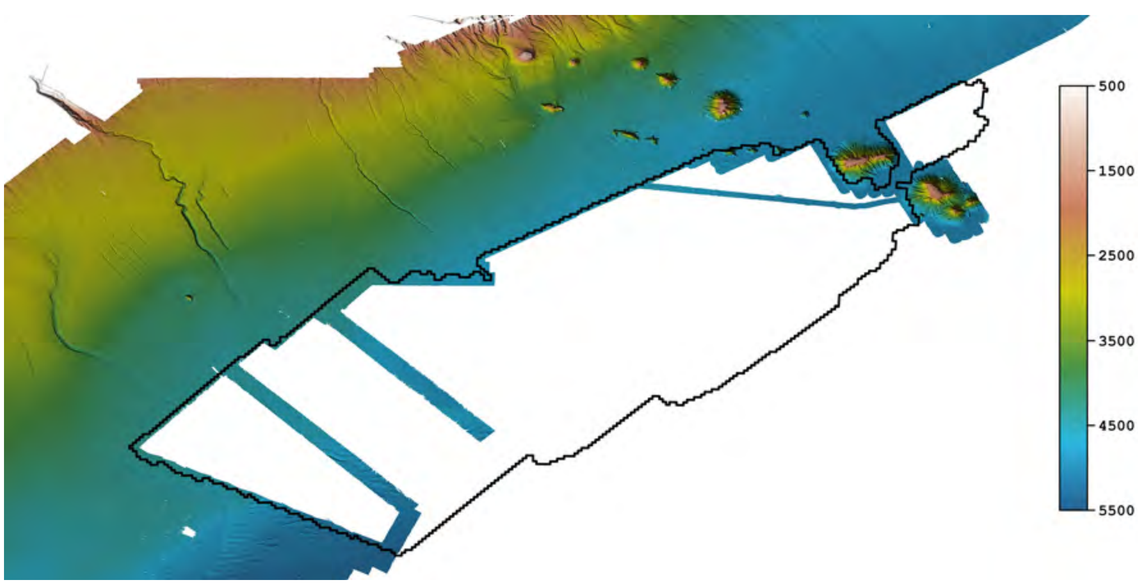


Figure 22: Region of overlap between previous legs of the U.S. east coast mapping campaign, *Okeanos Explorer* EX13-03, and leg 8 (black outline).

Figure 23: Surface differences between previous legs of the U.S. east coast mapping campaign, Okeanos Explorer EX13-03, and leg 8 (black outline). Differences range between -215m and 274m, with mean -0.8m and standard deviation 11.6m.

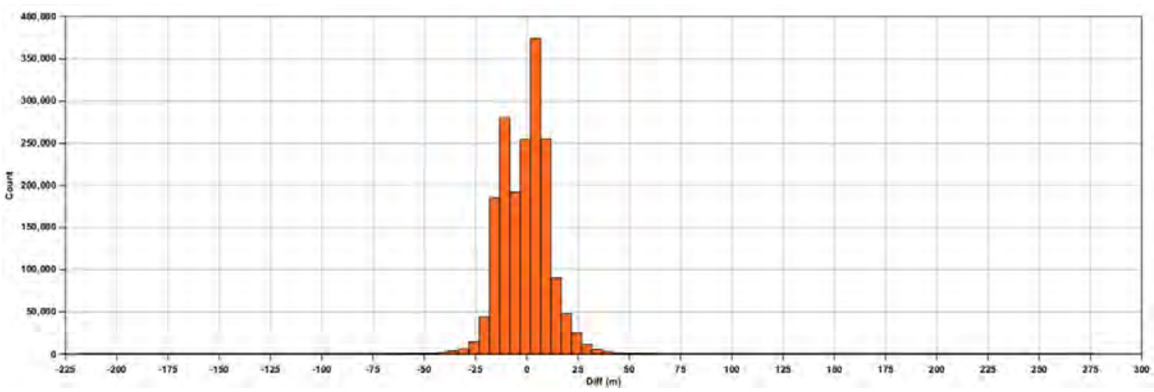


Figure 24: Histogram of surface differences between previous legs of the U.S. east coast mapping campaign, Okeanos Explorer EX13-03, and leg 8.