FINAL REPORT FOR US DEPARTMENT OF STATE RESEARCH CRUISE F2017-113

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James A. Hooper V
Molly O. Baringer
Ryan H. Smith

Atlantic Oceanographic and Meteorological Laboratory
Miami, Florida
May 2020

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James A. Hooper V
University of Miami / Cooperative Institute for Marine and Atmospheric Studies
NOAA / Atlantic Oceanographic and Meteorological Laboratory
Miami, Florida

Molly O. Baringer
NOAA / Atlantic Oceanographic and Meteorological Laboratory
Miami, Florida

Ryan H. Smith
NOAA / Atlantic Oceanographic and Meteorological Laboratory
Miami, Florida

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U.S. Department of Commerce
Mr. Wilbur L. Ross, Jr.
Secretary

National Oceanic and Atmospheric Administration
Dr. Neil Jacobs
Undersecretary for Oceans and Atmosphere

Office of Oceanic and Atmospheric Research
Mr. Craig N. McLean
Assistant Administrator

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Abstract

This report presents final calibrated conductivity, temperature, depth (CTD) data collected during the Western Boundary Time Series project (WBTS) research cruise AB1802, which took place between February 23 and March 1, 2018, aboard the NOAA Ship *Ronald H. Brown*. Funded through the Climate Program Office (CPO) of the National Oceanic and Atmospheric Administration (NOAA), this WBTS survey was completed as part of a long term effort to monitor the temporal and spatial variability of the circulation and water mass properties at the western boundary of the North Atlantic Ocean. A brief narrative of all scientific operations conducted during AB1802 is also included.

1 Introduction

The "Abaco" oceanographic time series began in August 1984 when NOAA expanded its Straits of Florida program (now part of the WBTS project) to include in situ measurements east the Bahamas in the North Atlantic Ocean. Since then, 48 shipboard surveys have collected water mass property data, and many have collected current velocity data, along a zonal section east of Abaco Island, Bahamas at a nominal latitude of 26.5°N. Initially only extending across the Antilles Current and a portion of the Deep Western Boundary Current (DWBC), research cruises now reach farther eastward into the North Atlantic Subtropical Gyre interior capturing a portion of the DWBC recirculation. Observations associated with these surveys have typically been made using CTD hydrography methods, often augmented either initially with Pegasus (Spain et al., 1981), or later with lowered Acoustic doppler current profiler (LADCP; Firing, 1991) measurements to obtain ocean current velocity. Transient tracer (CFC) measurements have also been collected on eight of these sections.

In addition to shipboard surveys of the Abaco section, a moored current meter array was deployed by collaborators at the University of Miami from April 1986 to April 1997. This was followed in March 2004 by an international trans-basin instrument array (of which the Abaco section is a component), funded by the United Kingdom's Natural Environment Research Council and the United States' National Science Foundation. Current meter moorings along the Abaco section, funded through these programs, are maintained by partners at the University of Miami and at the National Oceanography Centre. Concurrently with these efforts, an array of pressure equipped inverted echo sounders (PIES) was also established along the Abaco section in September 2004 by NOAA.

As a result of the efforts mentioned above, a high-resolution record of water mass property and current velocity in the DWBC has been established, which for temperature and salinity can be reasonably constructed back to about 1985 (Vaughan and Molinari, 1997; Molinari et al., 1998). Events such as the intense convection period in the Labrador Sea and renewal of classical Labrador Sea Water in the 1980s are clearly reflected in the cooling and freshening of the DWBC waters off Abaco, as well as the arrival of a strong CFC pulse, approximately 10 years later (e.g. Fine and Molinari, 1988; van Sebille et al., 2011). These in situ efforts are unique in that the result is a sectional time series from which quantitative transports can be directly calculated. Additionally, the Abaco section is one of only a few multidecadal oceanographic times series maintained in the world's oceans today.

To achieve the goals of NOAA's strategic plan in terms of understanding the Atlantic Ocean's role in multidecadal climate variability, these continued time series measurements at Abaco serve three main purposes:

1. Monitoring of the DWBC for water mass and transport signatures related to changes in the strengths and regions of high latitude water mass formation in the North Atlantic. Monitoring water mass properties in the DWBC at key locations is one part of an effort to track decadal changes in large-scale water mass properties.

2. Serving as a western boundary endpoint of a subtropical Meridional Overturning Circulation (MOC) heat flux monitoring system. The system is designed to measure the interior dynamic height difference across the Atlantic basin and the associated baroclinic heat transport.

3. Monitoring the intensity of the Antilles current as an index (together with the Florida Current) of inter-annual variability in the strength of the subtropical gyre. Variations in the strength of the subtropical gyre in relation to the North Atlantic Oscillation (NAO) have been proposed as an important mechanism in the atmosphere-ocean feedback within coupled models (e.g. Latif and Barnett, 1996).

2 Summary of Operations Completed

The Western Boundary Time Series research cruise AB1802 was conducted in early 2018 aboard the NOAA Ship *Ronald H. Brown* (vessel cruise ID RB1801). The ship departed from Charleston, South Carolina on February 23, 2018 and surveyed repeat hydrographic sections along 26.5°N east of Abaco Island, Bahamas and in Northwest Providence Channel (NWPC), Bahamas and before arriving in Ft. Lauderdale, Florida on March 1, 2018. The AB1802 science team included participants from the Atlantic Oceanographic and Meteorological Laboratory (AOML), the University of Miami, the University of Puerto Rico, as well as a volunteer (Table 1). The research cruise was significantly shortened from its original plan, due to mechanical issues experienced by the ship prior to departure. As a result, only a portion of the Abaco section was completed.

Table 1: AB1802 – Cruise participants on the *Ronald H Brown*.

Name	Responsibility	Affiliation	Nationality
Ryan Smith	Chief Scientist	NOAA/AOML	USA
James Hooper	Co-Chief Scientist	UM/CIMAS	USA
Andrew Stefanick	Salinity analysis, LADCP operations	NOAA/AOML	USA
Grant Rawson	Oxygen analysis,	UM/CIMAS	USA
Pedro Pena	Oxygen analysis, IES operations	NOAA/AOML	USA
Diego Ugaz	Salinity analysis, LADCP operations	UM/CIMAS	USA
James Hooper IV	CTD watch	Volunteer	USA
Carla Meijas	CTD watch	UPR	USA
Omar Lopez	CTD watch	UPR	USA

Scientific operations included discrete station measurements of full-water-column profiles of temperature, salinity, dissolved oxygen, and current velocity. The instrumentation package used to collect these data included a Seabird Electronics Model 9/11+ Conductivity, Temperature, Depth (CTD) system configured with dual temperature, conductivity, and dissolved oxygen sensors and a 24-bottle water sampler (for use in collecting salinity and dissolved oxygen calibration samples). The package also incorporated two paired, internally recording, RD Instruments acoustic Doppler current profilers (ADCP) to record water velocity: a downward-facing 150 kHz Workhorse ADCP, and an upward-facing 300 kHz Workhorse ADCP. A total of 16 stations were occupied.

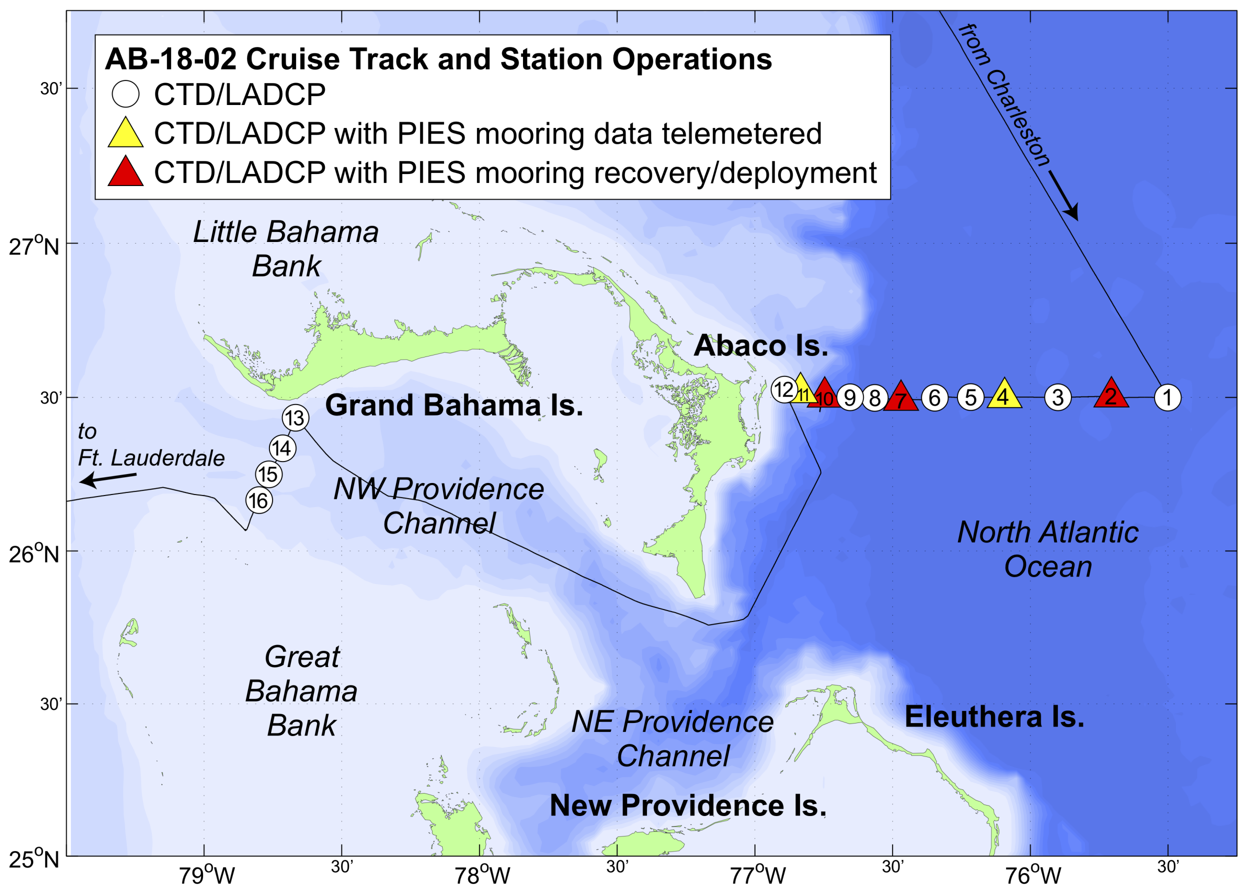

Figure 1: Completed science operations are shown above. CTD station locations completed along the Abaco and Northwest Providence Channel (NWPC) sections are number sequentially, indicated with a white circle. If PIES mooring operations were also conducted at the site, the location is marked with a colored triangle (yellow: telemetered data only, red: mooring recovery and deployment).

The locations of these stations are shown in Figure 1 and listed in Table 2. In addition to the profile data collected during the survey, five pressure-equipped inverted echo sounders (PIES) moorings, located on the 26.5°N section, were acoustically interrogated for data recovery. Three of the PIES instruments were found to have issues requiring physical recovery. At those locations, new instruments were deployed. PIES sites/operations are identified in Figure 1 and listed in Table 3.

Table 2: AB1802 – CTD Cast Summary

Station	Date	Time (GMT)	Latitude	Longitude	Corrected Depth	Depth
1	02/25/20	14:17:12	26.500N	75.500W	4686	4677
2	02/25/20	19:34:42	26.500N	75.703W	4691	4684
3	02/26/20	04:37:54	26.500N	75.900W	4743	4734
4	02/26/20	09:31:43	26.499N	76.092W	4826	4795
5	02/26/20	16:05:53	26.501N	76.217W	4815	4808
6	02/26/20	20:50:18	26.499N	76.347W	4864	4855
7	02/27/20	01:30:36	26.493N	76.476W	4833	4823
8	02/27/20	11:08:01	26.499N	76.565W	4831	4820
9	02/27/20	16:07:03	26.501N	76.655W	4607	4596
10	02/28/20	02:48:36	26.501N	76.747W	3857	3846
11	02/28/20	08:35:31	26.516N	76.832W	1095	1081
12	02/28/20	12:52:19	26.525N	76.893W	210	198
13	03/01/20	01:50:22	26.434N	78.668W	765	756
14	03/01/20	04:06:21	26.334N	78.714W	694	684
15	03/01/20	05:38:08	26.249N	78.764W	525	516
16	03/01/20	07:00:49	26.166N	78.800W	457	450

Table 3: AB1802 – Inverted echo-sounder locations and operation.

IES Site	Date	Type	Latitude	Longitude	Operation
A	2/28/18	PIES	026°30.945′ N	076°50.044′ W	Telemetry
A2	2/27/18	PIES	026°30.084′ N	076°44.779′ W	Recovery/Deployment
B	2/27/18	PIES	026°29.467′ N	076°28.187′ W	Recovery/Deployment
C	2/26/18	PIES	026°30.000′ N	076°05.600′ W	Telemetry
D	2/25/18	PIES	026°30.112′ N	075°42.318′ W	Recovery/Deployment

3 Standards and Pre-Cruise CTD Sensor Calibrations

The CTD system is a real-time data acquisition system with the data from a Sea-Bird Electronics, Inc. (SBE) 9plus underwater unit transmitted via a conducting cable to a SBE11plus deck unit (V2). The serial data from the underwater unit is sent to the deck unit in RS-232 NRZ format. The deck unit decodes the serial data and sends it to a networked Windows computer for display and data storage using Sea-Bird Seasave software (version 7.23.2).

The SBE911plus system transmits data from primary, secondary and auxiliary sensors in the form of binary numbers equivalent to the frequency or voltage outputs from those sensors. These are referred to as the raw data. The SBE software performs the calculations required to convert raw data to engineering units.

The SBE911plus system is electrically and mechanically compatible with the standard, unmodified carousel water sampler, also made by Sea-Bird Electronics, Inc. A modem and carousel interface allows the 911plus system to control the operations of the carousel directly without interrupting the flow of data from the CTD.

The SBE9plus underwater unit is configured with dual standard modular temperature (SBE3plus) and conductivity (SBE4) sensors, which are mounted near the lower end cap. The conductivity cell entrance is co-planar with the tip of the temperature sensor probe. The pressure sensor is mounted inside the underwater unit main housing. A centrifugal pump module flushes water through sensor tubing at a constant rate independent of the CTD's motion to improve dynamic performance. Dual dissolved oxygen sensors (SBE43) are added to the pumped sensor configuration following the temperature-conductivity (TC) pair. A reference temperature sensor is mounted to the SBE9plus. A list of sensors used during the cruise can be seen in Table 4.

Table 4: AB1802 – Equipment used during CTD casts.

Instrument	SN	Stations	Sensor Position	Comment
Black Frame		1-16		
Sea-Bird SBE32 24-palce Carousel Water Sampler	32 - 1090	1-3		
Sea-Bird SBE32 24-palce Carousel Water Sampler	3236257-0500	4-16		
Sea-Bird SBE9plus CTD	1335	1-4		
Paroscientific Digiquartz Pressure Sensor	135375			
Sea-Bird SBE9plus CTD	1292	5-16		
Paroscientific Digiquartz Pressure Sensor	136924			
Sea-Bird SBE3plus Temperature Sensor	5207	1-16	Primary	
Sea-Bird SBE3plus Temperature Sensor	5171	1-16	Secondary	
Sea-Bird SBE35 Reference Temperature Sensor	0097	1-5,12-16		
Sea-Bird SBE35 Reference Temperature Sensor	0083	9.		
Sea-Bird SBE4C Conductivity Sensor	3657	1-16	Primary	
Sea-Bird SBE4C Conductivity Sensor	4222	1-16	Secondary	
Sea-Bird SBE43 Dissolved Oxygen Sensor	2040	1-16	Primary	
Sea-Bird SBE43 Dissolved Oxygen Sensor	1348	1-16	Secondary	
Sea-Bird SBE5T Pump	9256	1-5	Primary	
Sea-Bird SBE5T Pump	7268	6-16	Primary.	
Sea-Bird SBE5T Pump	7742	0	Secondary	
Sea-Bird SBE5T Pump	1072	1-5	Secondary	
Sea-Bird SBE5T Pump	7889	6-16	Secondary	
Vale port VA 500 Altimeter	48591	1-16		Scale 15.0 Range - 100 m
Vale port VA 500 Altimeter	48592	1-5		Scale 15.0 Range - 250 m
RDI LADCP - 150 kHz Workhorse (AOML)	18145	1-16	Downward	
RDI LADCP - 300 kHz Workhorse (AOML)	24472	1-16	Upward	

3.1 Pressure

The Paroscientific series 4000 Digiquartz high pressure transducer uses a quartz crystal resonator whose frequency of oscillation varies with pressure induced stress measuring changes in pressure as small as 0.01 parts per million with an absolute range of 0 to 10,000 psia (0 to 6885 dbar). Repeatability, hysteresis and pressure conformance are 0.002% of full-scale. The nominal pressure frequency (0 to full scale) is 34 to 38 kHz. The nominal temperature frequency is 172 kHz ± 50 ppm/°C.

The pressure sensors utilized during AB1802 were serial number (s/n) 1335 and 1292. Pre-cruise sensor calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The calibration date and coefficients in Table 5 were entered into SEASAVE® using the configuration file.

Pressure coefficients are first formulated into:

$$\begin{aligned} c &= c_1 + c_2 * U + c_3 * U^2 \\ d &= d_1 + d_2 * U \\ t_0 &= t_1 + t_2 * U + t_3 * U^2 + t_4 * U^3 + t_5 * U^4 \end{aligned}$$

where U is temperature in degrees Celsius. Pressure is computed according to:

$$P\ (psia) = c * \left(1 - \frac{t_0^2}{t}\right) * \left[1 - d * \left(1 - \frac{t_0^2}{t}\right)\right]$$

where t is pressure period (μs). SEASAVE® automatically implements this equation.

Table 5: AB1802 – Pressure Calibration Date and Coefficients.

s/n 1335 September 17, 2017	s/n 1292 September 14, 2016
c_1 = -4.163434e+04	c_1 = -4.247898e+04
c_2 = -6.090208e-01	c_2 = -1.618984e-01
c_3 = 1.362600e-02	c_3 = 1.460220e-02
d_1 = 3.417500e-02	d_1 = 3.536900e-02
d_2 = 0.000000e+00	d_2 = 0.000000e+00
t_1 = 3.036781e+01	t_1 = 2.992804e+01
t_2 = -5.542870e-04	t_2 = -3.156950e-04
t_3 = 4.596360e-06	t_3 = 4.144500e-06
t_4 = 1.812390e-09	t_4 = 3.229580e-09
t_5 = 0.000000e+00	t_5 = 0.000000e+00
Slope = 1.00000000	Slope = 1.00000000
Offset = -0.35000	Offset = -0.24000
AD590M = 1.278870e-02	AD590M = 1.279960e-02
AD590B = -9.314130e+00	AD590B = -9.151060e+00

3.2 Temperature

The temperature-sensing element is a glass-coated thermistor bead, pressure protected by a stainless steel tube. The sensor output frequency ranges from 5–13 kHz corresponding to temperatures from -5 to 35°C. The output frequency is inversely proportional to the square root of the thermistor resistance, which controls the output of a patented Wien Bridge circuit. The thermistor resistance is exponentially related to temperature. The SBE3plus thermometer has a typical accuracy/stability of ±0.004°C per year and resolution of 0.0003°C at 24 samples per second. The SBE3plus thermometer has a fast response time of 0.070 seconds.

Two temperature sensors (SBE3plus) were used during AB1802, s/n 5207 and 5171. Precruise sensor calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The calibration dates and coefficients in Table 6 were entered into SEASAVE® using the configuration file. SEASAVE® automatically implements the equation below and converts between ITS-90 and IPTS-68 temperature scales as desired. The Temperature (ITS-90) is computed from g, h, i, j and f_0 and f is the instrument frequency (kHz) coefficients as follows:

$$T\ (^\circ C) = \frac{1}{\left\{g + h * \left[\ln\left(\frac{f_0}{f}\right)\right] + i * \left[\ln^2\left(\frac{f_0}{f}\right)\right] + j * \left[\ln^3\left(\frac{f_0}{f}\right)\right]\right\}} - 273.15$$

Table 6: AB1802 – Temperature Calibration Dates and Coefficients.

s/n 5207 January 27, 2018	s/n 5171 January 31, 2018
g = 4.32464593e-03	g = 4.39213838e-03
h = 6.34106918e-04	h = 6.44931386e-04
i = 2.11331215e-05	i = 2.26336117e-05
j = 1.86571590e-06	j = 2.06232456e-06
f_0 = 1000.0	f_0 = 1000.0

3.3 Conductivity

The flow-through conductivity-sensing element is a glass tube (cell) with three platinum electrodes (SBE4). The resistance measured between the center electrode and the end electrode pair is determined by the cell geometry and the specific conductance of the fluid within the cell, and controls the output frequency of a Wein Bridge circuit. The sensor has a frequency output of approximately 3 to 12 kHz corresponding to conductivity from 0 to 7 Siemens/meter (0 to 70 mmho/cm). The SBE4 has a typical accuracy/stability of ±0.0003 $S{\cdot}m^{-1}$/month and resolution of 0.00004 $S{\cdot}m^{-1}$ at 24 scans per second.

Two conductivity sensors were used during AB1802, s/n 3657 and 4222. Pre-cruise sensor calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The calibration dates and coefficients shown in Table 7 were entered into Seasave using the configuration file.

Conductivity calibration certificates show an equation containing the appropriate pressure-dependent correction term to account for the effect of hydrostatic loading (pressure) on the conductivity cell:

$$C\ (Siemens/meter) = \frac{(g + h * f^2 + i * f^3 + j * f^4)}{[10 * (1 + c_{t_{cor}} * t + c_{p_{cor}} * p)]}$$

where g, h, i, j, $c_{t_{cor}}$, and $c_{p_{cor}}$ are the calibrations coefficients shown above, f is the instrument frequency (kHz), t is the water temperature (degrees Celsius), and p is the water pressure (dbar). SEASAVE® automatically implements this equation.

Table 7: AB1802 – Conductivity Calibration Dates and Coefficients.

s/n 3657 January 26, 2018	s/n 4222 January 31, 2018
g = -9.90196836e+00	g = -9.94125293e+00
h = 1.40218946e+00	h = 1.39814709e+00
i = -2.98883644e-03	i = -2.58766639e-03
j = 2.95003167e-04	j = 2.52463655e-04
CPcor = -9.5700e-08	CPcor = -9.5700e-08
CTcor = 3.2500e-06	CTcor = 3.2500e-06

3.4 Dissolved Oxygen

The SBE43 dissolved oxygen sensor uses a membrane polarographic oxygen detector (MPOD). Oxygen sensors determine the dissolved oxygen concentration by counting the number of oxygen molecules per second (flux) that diffuse through a membrane. By knowing the flux of oxygen and the geometry of the diffusion path, the concentration of oxygen can be computed. The permeability of the membrane to oxygen is a function of temperature and ambient pressure. In order to minimize the errors in the oxygen measurement due to the temperature differences between the water and the oxygen sensor, a temperature compensation is calculated using a temperature measured near the active surface of the sensor. The interface electronics output voltages proportional to the temperature-compensated oxygen current. Initial computation of dissolved oxygen in engineering units is done in the software. The range for dissolved oxygen is 120% of surface saturation in all natural waters, fresh and salt, and the nominal accuracy is 2% of saturation.

Under extreme pressure, changes can occur in gas permeable Teflon membranes that affect their permeability characteristics. Some of these changes (plasticization and amorphous/crystalinity ratios) have long time constants and depend on the sensor's time-pressure history. These slow processes result in hysteresis in long, deep casts. The hysteresis correction algorithm operates through the entire data profile and corrects the oxygen voltage values for changes in membrane permeability as pressure varies. At each measurement, the correction to the membrane permeability is calculated based on the current pressure and how long the sensor spent at previous pressures.

Sea-Bird has implemented an optional hysteresis correction for dissolved oxygen data. The correction algorithm requires a continuous time series of data, with no temporal data gaps (although a continuous time series is necessary, a constant sampling interval is not required). Prior to processing, do not remove any data from the downcast or upcast (if to be used), other than a surface soak at the beginning of the downcast.

Oxygen sensors, s/n 2040 and 1348, were used during AB1802. The calibration dates and coefficients in Table 8 were entered into SEASAVE® using the configuration file.

Table 8: AB1802 – Oxygen Calibration Dates and Coefficients.

s/n 2040 October 27, 2017	s/n 1348 May 11, 2017
Soc = 0.49621	Soc = 0.33331
Voffset = -0.5059	Voffset = -0.5246
Tau20 = 1.27	Tau20 = 1.13
A = -4.3351e-03	A = -3.7397e-03
B = 1.9838e-04	B = 2.4614e-04
C = -2.5936e-06	C = -3.4224e-06
$E_{nominal}$ = 0.036	$E_{nominal}$ = 0.036

The use of these constants in linear equations of the form $I = mV + b$ and $T = kV + c$ yield sensor membrane current and temperature (with maximum error of about 0.5 °C) as a function of sensor output voltage.

Dissolved oxygen concentration is calculated according to:

$$O\ (ml/l) = \{Soc * (V + V_{offset} + tau(T,S) * \frac{\delta v}{\delta t}) + p1 * station\}$$
$$*(1.0 + A * T + B * T^2 + C * T^3) * OXSAT(T,S) * e^{E*(\frac{P}{K})}$$

where Soc, V_{offset}, tau, A, B, C, E and $p1$ are the calibration coefficients shown above and V is the instrument voltage (V). T, S and P are the temperature, salinity and pressure measured by the CTD. K is the temperature in the absolute scale (K), $\delta v/\delta t$ is the oxygen voltage time derivative, $station$ is the station number, and $OXSAT$ is the oxygen saturation value calculated according to (Weiss, 1970):

$$OXSAT(\theta,S) = \exp\left\{A_1 + A_2 * \left(\frac{100}{\theta}\right) + A_3 * \ln\left(\frac{\theta}{100}\right) + A_4 * \left(\frac{\theta}{100}\right)\right.$$
$$\left. + S * \left[B_1 + B_2 * \left(\frac{\theta}{100}\right) + B_3 * \left(\frac{\theta}{100}\right)^2\right]\right\}$$

where θ is the absolute temperature (K); and

$$\begin{aligned} A_1 &= -173.4292 & B_1 &= -0.033096 \\ A_2 &= 249.6339 & B_2 &= 0.014259 \\ A_3 &= 143.3483 & B_3 &= -0.00170 \\ A_4 &= -21.8492. \end{aligned}$$

SEASAVE® automatically implements this equation.

The hysteresis correction is calculated, using the oxygen voltages, with the following algorithm:

$$D = 1 + H_1 * (e^{\left(\frac{P(i)}{H2}\right)} - 1)$$

$$C = e(-1 * \left(\frac{Time(i) - Time(i-1))}{H3}\right)$$

$$O_V(i) = O_{volt}(i) + V_{offset}$$

$$O_{newvolts}(i) = a * \frac{a}{D}$$

$$O_{finalvolts}(i) = O_{newvolts}(i) - V_{offset}$$

Where:

i = indexing variable (must be a continuous time series to work; can be performed on bin averaged data), where i = 1:end (end is largest data index point plus 1).
$P(i)$ = pressure (decibars) at index point i .
$Time(i)$ = time (seconds) from start of index point i.
$O_{volt}(i)$ = SBE43 oxygen voltage output directly from sensor, with no calibration or hysteresis corrections, at index point i.
V_{offset} = correction for an electronic offset that is applied to voltage output of sensor. V_{offset} correction is always negative (see factory calibration sheet for this coefficient). V_{offset} is added to raw voltages prior to hysteresis correction. At end of hysteresis corrections, V_{offset} is removed prior to data conversion using SBE43 calibration equation (see $O_{finalvolts}(i)$).
$O_V(i)$ = dissolved oxygen voltage value with V_{offset} correction (made prior to hysteresis correction) at index point i.
D and C are temporary variables used to simplify expression in processing loop.
$H1$ = amplitude of hysteresis correction function. Default = -0.033, range = -0.02 to -0.05 (varies from sensor to sensor).
$H2$ = function constant or curvature function for hysteresis. Default = 5000.
$H3$ = time constant for hysteresis (seconds). Default = 1450, range = 1200 to 2000 (varies from sensor to sensor).
$O_{newvolts}(i)$ = hysteresis-corrected oxygen value at index point i.
$O_{finalvolts}(i)$ = hysteresis-corrected oxygen value at index point i with V_{offset} removed.

This step is necessary prior to computing oxygen concentration using SBE43 calibration equation.

3.5 Reference Temperature

The SBE35RT is an accurate, ocean-range temperature sensor that is capable of measuring temperature in the ocean to depths of 6800 meters (22,300 ft). The SBE35RT communicates via a standard RS-232 interface at 300 baud, 8 data bits, no parity. The SBE35RT makes a temperature measurement each time a bottle fire confirmation is received, and stores the value in EEPROM. Each stored value contains the time and bottle position in addition to the temperature data, allowing comparison of the SBE35RT record with CTD and water bottle data. Using one SBE35RT eliminates the need for reversing thermometers, and provides higher accuracy temperature readings at lower cost. Calibration coefficients stored in EEPROM allow the SBE35RT to transmit data in engineering units (Table 9). When configured in a real-time system, the SBE35RT can use the system modem channel for two-way communications; it is not necessary to change cable connections to communicate with and retrieve data from the SBE35RT. Retrieved from http://www.seabird.com/sites/default/files/documents/35RT_013.pdf (2015, February 12).

The sensor measurement ranges from -5 to 35°C. The SBE35RT digital reversing thermometer has a typical accuracy/stability of ±0.001°C per year and resolution of 0.000025°C.

Table 9: AB1802 – Reference Temperature Calibration Date and Coefficients.

s/n 0097 August 21, 2014	s/n 0083 August 21, 2014
A0 = 4.214343e-03	A0 = 5.106189e-03
A1 = -1.115737e-03	A1 = -1.397178e-03
A2 = 1.719186e-04	A2 = 2.043958e-04
A3 = -9.611143e-06	A3 = -1.128435e-05
A4 = 2.0623e-07	A4 = 2.384084e-07
Slope = 1.0000	Slope = 1.0000
Offset = 0.0000	Offset = 0.0000

4 CTD Data Acquisition

CTD casts were performed with a package consisting of a 24-place, 12-liter rosette frame (AOML's black frame), a 24-place water sampler pylon (SBE32) and 24, 12-liter Bullister-style Niskin bottles. This package was deployed on all casts. Underwater electronic components consisted of a SBE 9plus CTD with dual pumps and the following sensors: dual temperature (SBE3plus), dual conductivity (SBE4), dual dissolved oxygen (SBE43), reference temperature (SBE35), and a Valeport VA500 altimeter. The additional underwater electronic components consisted of two RDI LADCPs, a 300 kHz upward facing instrument and a 150 kHz downward facing instrument to measure water velocities. A total of 16 CTD casts were conducted during AB1802, usually to within 10 m of the bottom.

The CTD's supplied a standard Sea-Bird format data stream at a data rate of 24 frames/second. The SBE9 plus CTD was connected to the SBE32 24-place pylon providing for single-conductor sea cable operations. Power to the SBE9plus CTD, SBE32 pylon, auxiliary sensors, and altimeter was provided through the sea cable from the SBE11plus deck unit in the computer lab. The CTD frame was suspended from a UNOLS-standard three-conductor 0.322" electro-mechanical sea cable.

The CTD was mounted vertically attached to the bottom center of the rosette frame. All SBE4 conductivity and SBE3plus temperature sensors and their respective pumps were mounted vertically as recommended by SBE, outboard of the CTD. The CTD was outfitted with dual pumps. Primary temperature, conductivity, and dissolved oxygen were plumbed on one pump and secondary temperature, conductivity, and dissolved oxygen on the other. Pump exhausts were attached to outside corners of the CTD cage and directed downward. The two altimeters were mounted on the inside of the support struts adjacent to the bottom frame ring. The LADCP's were vertically mounted inside the bottle rings with one 150 kHz pointing down, the other 300 kHz transducer pointing up. Both of the NOAA Ship *Ronald H Brown's* winches, aft and forward, were used to deploy the CTD frame with the starboard boom. The aft winch (primary winch) was used for the test cast and station 1. The forward winch was used for the remaining stations. O-rings were changed as necessary and Niskin bottle maintenance was performed each day to insure proper closure and sealing. Valves were inspected for leaks and repaired or replaced as needed.

4.1 System Problems

The aft winch was used for the test cast and station 1, where several modulo errors were observed. Communication with the CTD became increasingly problematic and the winch was unable to be used for subsequent casts. The CTD package was moved to the forward winch for the remainder of the trip.

The forward winch also had communication problems, resulting in several modulo errors on the next few casts as well as unsupported modem errors, which caused problems when trying to fire Niskin bottles through the Seasave software. Manual firing of the bottles from the deck unit was required.

To try to diagnose the problem we replaced the SBE32 before station 4, and we replaced the SBE9plus before station 5. Before station 6, the deck unit (SBE11plus) and the reference temperature sensor (35RT) were replaced. Before station 7, both CTD pumps and the pump cable were replaced. None of these changes fixed the errors observed and manual firing from the deck unit was necessary. Before station 8, the winch wire was re-terminated and an additional grounding strap was secured to the winch. Though modem errors and modulo errors continued, the bottles were fired successfully through Seasave. Prior to station 9, the modem com port was moved from the deck unit directly to the CTD acquisition computer. This did no improve things, however, and no Niskin bottles were successfully fired during station 9. Before station 10, the winch wire was re-terminated and the j-box on the winch drum was rewired. The deck unit was also moved from the ships UPS power supply to clean power supply. During the cast, 19 of the first 20 bottles fired properly, but not the last 4. Before station 11, the deck unit was connected to a new UPS, which was connected to the ship's clean power. This finally seemed to fix the issue and there were no problems firing bottles during the remainder of the casts.

On the last station of the NWPC section the forward winch wire was damaged (bird nested) while picking up the CTD package for deployment. As a result, due to time constraints, this last station was not completed.

4.2 CTD Operations

Prior to each cast, the deck watch prepared the CTD rosette for sampling. All valves, vents, and lanyards were checked for proper orientation. Niskin bottles were cocked, and all hardware and connections rechecked. Fifteen minutes or so prior to station, the deck unit was powered on and an on-deck pre-cast pressure was obtained. Once on station, the syringes were removed from the CTD sensor intake ports. Tag lines were necessary for both deployments and recoveries during this cruise. As directed by the deck watch leader, the CTD was lowered to 10 m for a 2-minute soak to remove any air bubble from the sensor lines and to make sure the sensors were behaving appropriately. The CTD was then brought back to just below the surface, with the console operator recording a Mark Scan just prior to beginning the descent. The profiling rate was no more than 30 m/min to 50 m, 45 m/min to 200 m, and no more than 60 m/min deeper than 200 m. Upon recovery, the CTD deck unit was turned off once the on-deck pressure was recorded. The CTD frame was left on deck for sampling. The bottles and rosette were examined before samples were taken and anything unusual was noted on the sample log.

A console operator monitored the progress of the deployment and quality of the CTD data through interactive graphics and operational displays of the Seasave software. Additionally, the operator created a sample log for each cast, to be used later used to record the correspondence between rosette bottles and analytical samples taken. The altimeter channel, CTD pressure, wire-out and bathymetric depth were all monitored to determine the distance of the CTD package from the bottom, usually allowing a safe approach to within 10 m.

On the up-cast, the winch operator stopped at each predetermined bottle trip depth following instructions from the CTD console operator. The CTD console operator then waited 30 seconds before closing a bottle and 5 seconds afterwards to allow the reference temperature sensor to sample. The data acquisition system responded with trip confirmation messages and the corresponding CTD data in a rosette bottle trip window on the display. All tripping attempts were noted on the console log. The console operator then directed the winch operator to raise the package up to the next bottle trip location. After the last bottle was tripped, the console operator directed the deck watch to bring the CTD package back on deck.

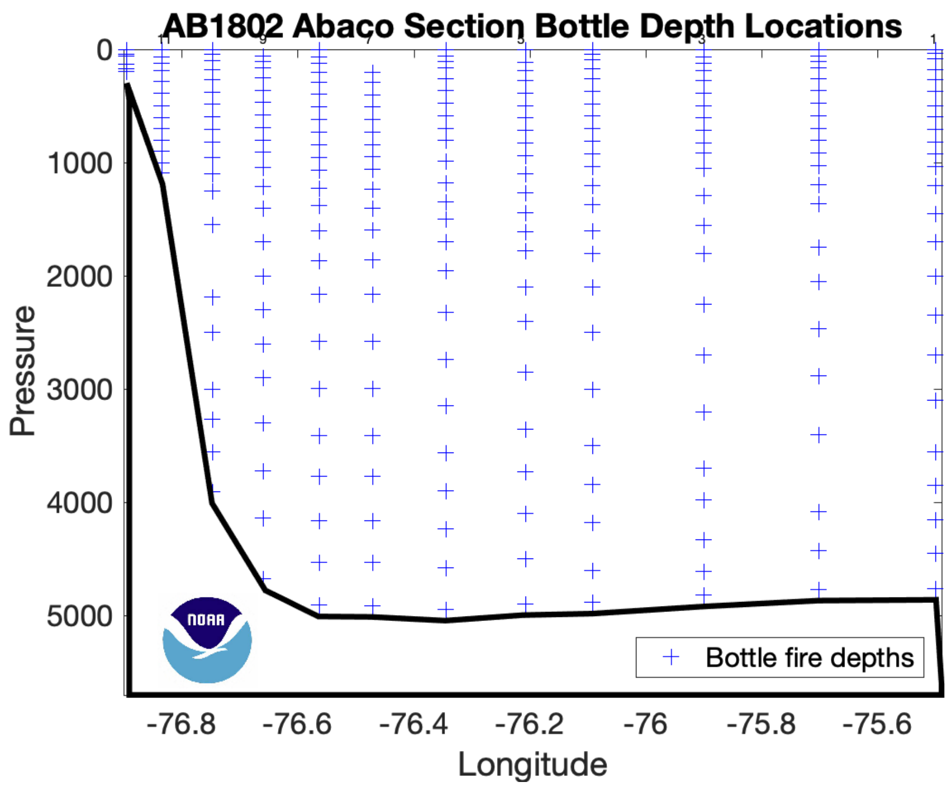

Figure 2: Bottle locations for 26.5°N Deep Western Boundary Current section east of Abaco Island.

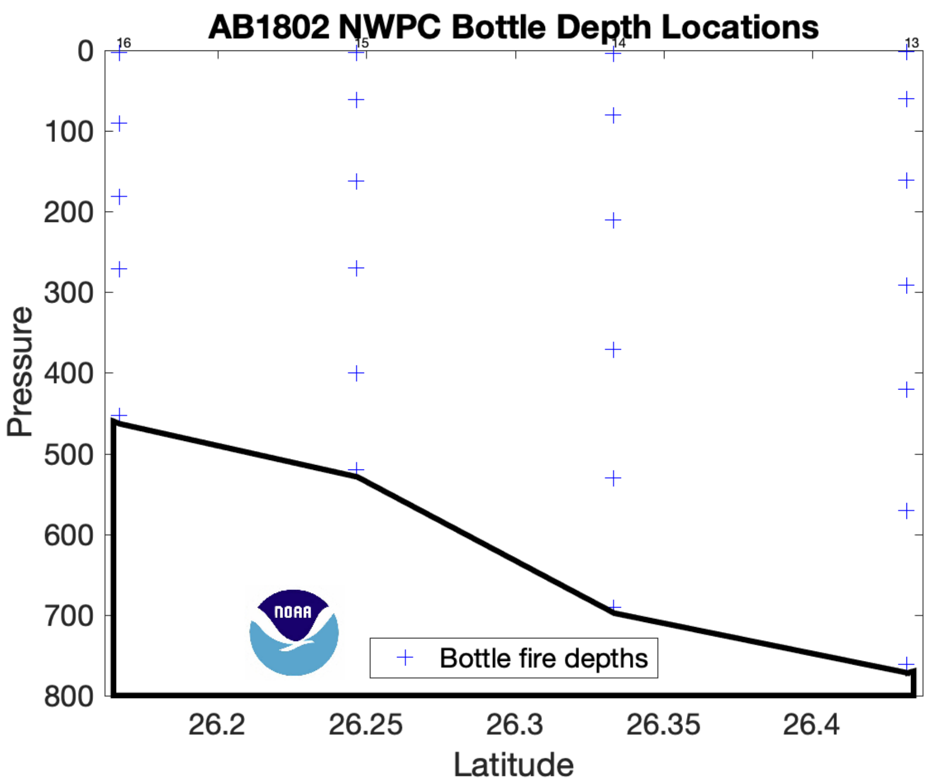

Figure 3: Bottle locations for along the Northwest Providence Channel section.

4.3 Shipboard CTD Data Processing

Shipboard CTD data processing was performed automatically at the end of each deployment using SEABIRD SBE Data Processing version 7.26.7.214 and AOML Matlab processing software. The raw CTD data and bottle trips acquired by SBE Seasave on the Windows 10 workstation were copied onto the CTD-PROC workstation, and processed to a 1-dbar series and a 1-second time series. Bottle trip values were extracted and a 1-decibar (dbar) down cast pressure series created.

Raw data are acquired from the instruments and are stored unmodified. The conversion module DATCNV uses the instrument configuration and pre-cruise factory calibration coefficients to create a converted engineering unit data file that is utilized by all SBEDataProc® post processing modules. Unless otherwise noted, all calibration parameters given are factory default values recommended by Sea Bird Electronics, Inc. The following is the SBEDataProc® processing module sequence and specifications for calibrated data (1 dbar averages) in order for reduction of CTD/O2 data from this cruise:

1. DATCNV converts raw data into engineering units and creates a .ROS bottle file. Both down and up casts were processed for scan, elapsed time(s), depth, pressure, t0 ITS-90 C, t1 ITS-90 C, c0 S/m, c1 S/m, salinity (PSU), salinity 2 (PSU), oxygen voltage V, oxygen 2 voltage V, altimeter, oxygen μmol/kg, oxygen 2 μmol/kg, oxygen mll/l, oxygen 2 ml/l, oxygen dv/dt, oxygen dv/dt 2, latitude, and longitude. The scan range offset is 0 seconds and the scan range duration is 5.5 seconds. MARKSCAN was used to determine the number of scans acquired on deck and while priming the system to exclude these scans from processing.

2. ALIGNCTD aligns temperature, conductivity, and oxygen measurements in time relative to pressure to ensure that derived parameters are made using measurements from the same parcel of water. Primary and secondary conductivity are automatically advanced by 0.073 seconds. Both oxygen are advanced by 1.073 seconds.

3. WILDEDIT computes the standard deviation of 100 point bins, and then makes two passes through the data. The first pass flags points that differ from the mean by more than 2 standard deviations. A new standard deviation is computed excluding the flagged points and the second pass marks bad values greater than 20 standard deviations from the mean. For this data set, data were kept within a distance of 0.005 of the mean (i.e., all data).

4. FILTER applies a low pass filter to pressure with a time constant of 0.15 seconds. In order to produce zero phase (no time shift), the filter is first run forward through the file and then run backwards through the file.

5. LOOPEDIT removes scans associated with pressure slowdowns and reversals. If the CTD velocity is less than 0.25 m/s or the pressure is not greater than the previous maximum scan, the scan is omitted.

6. CELLTM uses a recursive filter to remove conductivity cell thermal mass effects from measured conductivity. In areas with steep temperature gradients the thermal mass correction is on the order of 0.005 PSS-78. In other areas the correction is negligible. The value used for the thermal anomaly amplitude (alpha) was 0.03°C. The value used for the thermal anomaly time constant (1/beta) was 7.0°C.

7. BOTTLESUM creates a summary of the bottle data. Bottle position, date, and time were output automatically. Pressure, temperature, conductivity, salinity, oxygen voltage and preliminary oxygen values were averaged over a 5 second interval.

8. DERIVE uses pressure, temperature, and conductivity to compute primary and secondary salinities, potential temperatures and densities. Oxygen voltage is used to calculate oxygen concentrations.

9. BINAVG averages the data into 1 dbar bins. Each bin is centered on an integer pressure value, e.g., the 1 dbar bin averages scans where pressure is between 0.5 dbar and 1.5 dbar. There is no surface bin. The number of points averaged in each bin is included in the data file.

10. TRANS converts the binary data file into ASCII format.

11. SPLIT separates the cast into upcast and downcast values.

CTD data were examined at the completion of each deployment for clean corrected sensor response and any calibration shifts. As bottle salinity and oxygen results became available, they were used to refine shipboard conductivity and oxygen sensor calibrations.

A total of 16 casts were processed.

4.4 CTD Calibration Procedures

Laboratory calibrations of the CTD pressure, temperature, conductivity, and dissolved oxygen sensors were all performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The calibration dates are listed in Table 4.

A dual sensor configuration was employed on the CTD for temperature (T), conductivity (C), and dissolved oxygen (DO2). The secondary sensor set served as a calibration check for the primary sensors. During every cast, in-situ salinity and DO2 bottle samples were collected for use in calibrating both the primary and secondary C and O2 sensors. During this particular cruise, it was determined that the secondary temperature, conductivity and dissolved oxygen sensors each behaved more stably than their primary counterparts.

4.4.1 Salinity Analysis

A single Guildline Autosal, model 8400B laboratory salinometer (s/n 61664, nicknamed *Miller Freeman*), located in a climate-controlled room aboard the vessel dedicated for salinity analysis, was used to determine the salinity of all water samples collected. Salinometer data output was logged to a computer file using Ocean Scientific International's (OSI) logging hardware and software interface. As a standard operating practice, the Autosal's water bath temperature was maintained at 24°C. In conjunction with this, to help further stabilize the Autosal and to improve measurement accuracy, the climate-controlled laboratory temperature was maintained at 1 to 2 degrees below 24°C. This ambient condition was monitored continuously with a digital thermometer. Once drawn, salinity samples were allowed to equilibrate to room temperature in the climate-controlled laboratory for approximately 12 hours prior to analysis. The salinometer was routinely *standardized* for each group of salinity samples analyzed (usually 2 casts, up to 52 samples) using two bottles of standard seawater: one at the beginning, and one at the end of each group of samples. For each calibration standard, the salinometer cell was initially flushed 6 times before a set of conductivity ratio reading was taken. For each salinity sample, the salinometer cell was initially flushed at least 3 times before a set of conductivity ratio readings were taken. The analyst flushed the cell of the Autosal and changed samples as prompted by the OSI software. If an extended period of time elapsed between analysis sessions (or *runs*), a sub-standard flush of the Autosal, with approximately 200 ml of seawater, was performed prior to the standardization mentioned above. This assured that any deionized water that may have been stored in the cell of the Autosal between extended periods of inactivity was completely flushed from the system.

IAPSO Standard Seawater Batch P-159 was used to standardize all casts (Table 10).

Table 10: AB1802 – Nominal values for the batches of IAPSO standard seawater.

P-159
K15: 0.99988
Salinity: 34.995

Salinity samples were collected in 200 ml Kimax high-alumina borosilicate bottles that had been rinsed at least three times with sample water prior to filling. The bottles were sealed with polypropylene screw caps fitted with *Polyseal* poly cone inserts to prevent sample evaporation. PSS-78 salinity [UNES81] was calculated for each sample from the measured conductivity ratios. The offset between the initial standard seawater value and its reference value was applied to each sample. Then the difference (if any) between the initial and final vials of standard seawater was applied to each sample as a linear function of elapsed run time. The corrected salinity data was then incorporated into the cruise dataset. When duplicate measurements were deemed to have been collected and run properly, they were averaged and submitted with a quality flag of 6. On WBTS - AB1802, 259 salinity samples were taken, including 24 duplicates, and approximately 10 vials of standard seawater were used. Up to two duplicate samples were drawn from most casts to determine total analytical precision.

The running standard calibration values are shown in Figure 4. Over the course of the cruise, the conductivity ratio of the Autosal standards changed by 1.20×10^{-4} (corresponding to approximately 0.0035 PSU in salinity). The precision of the salinity measurements during the cruise were estimated by using the duplicate samples. From the 24 duplicate samples (Table 11), which corresponds to 9.3% of the total samples collected during this cruise, the average residual for the duplicates was 1.98×10^{-4} PSU with and standard deviation of 0.0025 PSU (Figure 4).

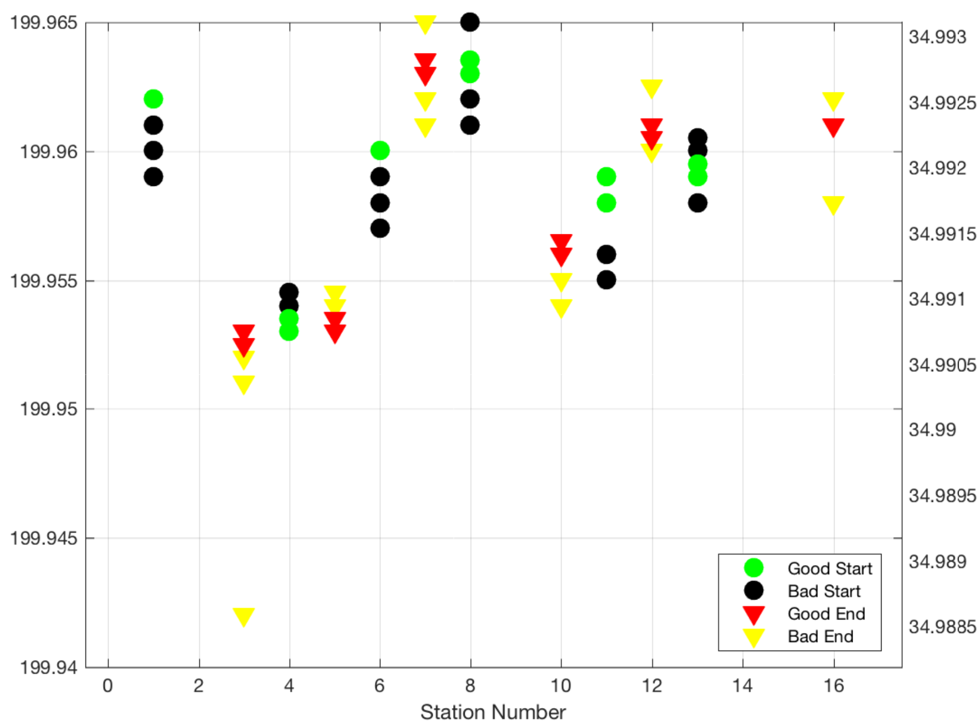

Figure 4: Standard vial calibrations throughout the cruise before and after each Autosal run. The green dots and red triangles are the good values used before and after each run to calculate salinity and drift corrections, respectively. The black dots and yellow triangles are the bad values not used.

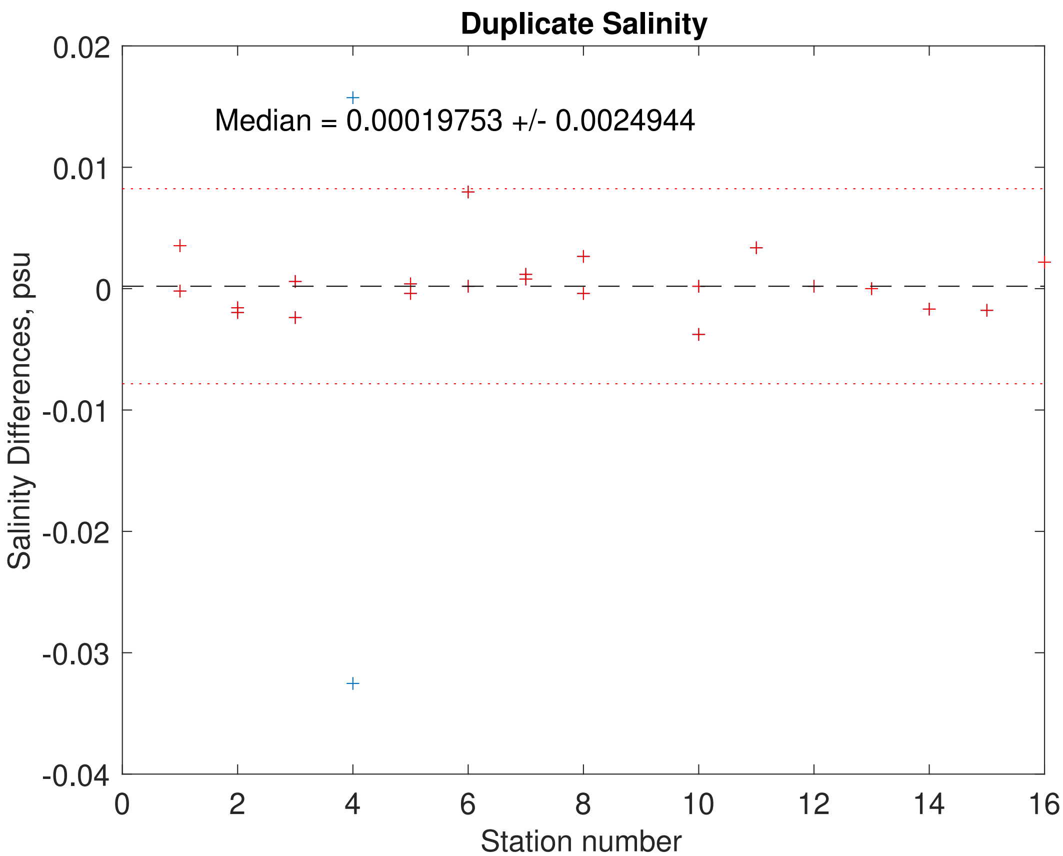

Figure 5: Salinity residuals of the duplicate samples.

Table 11: AB1802 – Duplicate salinity samples collected during the cruise.

Station	Niskin	Salinity1	Salinity2	Differences
1	2	34.878	34.882	-0.004
1	17	35.898	35.897	0.000
2	4	34.893	34.891	0.002
2	13	35.080	35.078	0.002
3	1	34.867	34.868	-0.001
3	22	36.798	36.796	0.002
4	3	34.885	34.900	-0.016
4	24	36.752	36.719	0.033
5	8	34.948	34.948	-0.000
5	15	35.233	35.232	0.000
6	6	34.907	34.915	-0.008
6	20	36.689	36.689	-0.000
7	1	34.879	34.880	-0.001
7	17	35.647	35.648	-0.001
8	10	34.976	34.979	-0.003
8	19	36.353	36.352	0.000
10	5	34.944	34.944	-0.000
10	18	36.915	36.911	0.004
11	8	36.459	36.462	-0.003
12	2	36.802	36.802	-0.000
13	7	36.679	36.679	0.000
14	6	36.620	36.618	0.002
15	5	36.768	36.766	0.002
16	3	36.857	36.859	-0.002

4.4.2 Oxygen Analysis

Dissolved oxygen samples were drawn from Niskin bottles into calibrated 125 iodine titration flasks using silicon tubing. Bottles were rinsed three times and filled from the bottom via the tubing, overflowing three volumes while taking care not to entrain any bubbles. 1 ml of $MnCl_2$ and 1 ml of $NaOH/NaI$ were added immediately after drawing the sample was concluded using a ThermoScientific REPIPET II. The flasks were then stoppered and well shaken. Deionized water was added to the neck of each flask to create a water seal. 257 oxygen samples were collected during AB1802, including 23 duplicate samples (up to two duplicates taken randomly during each cast). Samples were stored in the shipboard oxygen analysis lab in plastic totes at room temperature for 1.5 hours before analysis.

Dissolved oxygen analyses were performed with an automated titrator using amperometric end-point detection (Langdon, 2010). The titrator was interfaced with a computer running LabView software customized by Ulises Rivero (NOAA/AOML). The software handled the sample titration and data logging; it also provided a graphical display of the data for the analyst. Thiosulfate (17.5 g per 500 ml) was dispensed by a 2 ml Gilmont burette driven with a stepper motor controlled by the titrator. The titration methodology follows techniques outlined by Carpenter (1965) and Culberson et al. (1991). Four replicate 10 ml iodate standards were run every 3-4 days, or when new thiosulfate was added to the system, or once the thiosulfate bottle had reached half its volume, which ever came first. The reagent blank (the difference between thiosulfate volumes required to titrate two 1 ml aliquots of the iodate standard) was determined twice during the research cruise: once at the beginning of the survey and once midway through the cruise. Thiosulfate normality was calculated from the laboratory temperature for each sample run. The dispenser used for the standard solution (SOCOREX Calibrex 520) and the burette were calibrated gravimetrically immediately prior to the cruise. Oxygen flask volumes were also determined gravimetrically with degassed deionized water at AOML prior to use.

The data collected from the oxygen titrations performed were incorporated into the cruise dataset shortly after analysis.

The precision of the oxygen measurements during the cruise were estimated by using the duplicate samples. From the 23 duplicate samples (12), which corresponds to 8.9% of the total samples collected during this cruise, the average residual for the duplicates was 0.084 μmol/kg with and standard deviation of 0.43 μmol/kg (6).

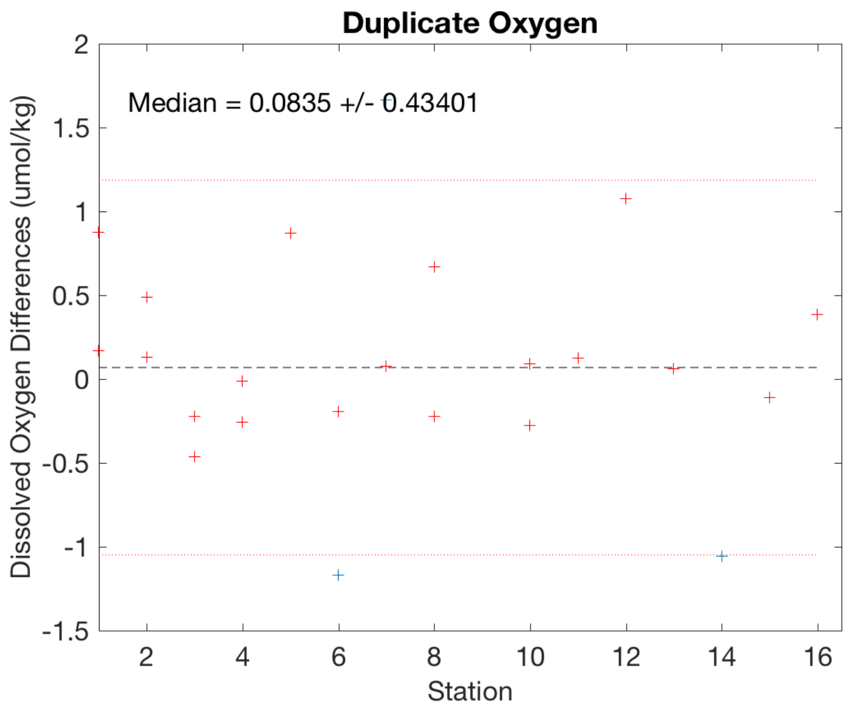

Figure 6: Oxygen residuals of the duplicate samples .

Table 12: AB1802 – Duplicate dissolved oxygen samples collected during the cruise (values in μmol/kg).

Station	Niskin	Oxygen1	Oxygen2	Differences
1	3	263.6	263.8	-0.169
1	8	266.9	267.8	-0.876
2	4	271.3	271.8	-0.488
2	10	263.7	263.8	-0.128
3	7	274.5	274.3	0.224
3	17	153.3	152.8	0.465
4	4	272.2	272.2	0.010
4	13	187.0	186.8	0.260
5	15	141.9	142.7	-0.870
6	4	271.3	270.1	1.171
6	15	139.0	138.8	0.192
7	7	267.4	269.0	-1.663
7	15	147.3	147.4	-0.074
8	2	266.4	267.0	-0.671
8	14	191.3	191.1	0.224
10	3	273.0	273.1	-0.093
10	18	200.1	199.8	0.278
11	7	161.9	162.0	-0.125
12	1	189.1	190.2	-1.076
13	3	174.2	174.2	-0.063
14	3	182.3	181.2	1.059
15	1	159.3	159.2	0.110
16	4	209.4	209.8	-0.387

5 Post-Cruise Calibrations

Post cruise sensor calibrations were done at Sea-Bird Electronics, Inc. Secondary temperature, conductivity and dissolved oxygen sensors served as calibration checks for the reported primary sensors. In-situ salinity and dissolved oxygen samples collected during each cast were used to calibrate the conductivity and dissolved oxygen sensors. The digital reverse thermometer was used to monitor the temperature sensors for pressure dependencies or offsets. Secondary T/C pair, s/n 5171/4222, was selected for final data reduction. Secondary oxygen sensor, s/n 1348, was used for the final data reduction.

5.1 CTD Data Processing

In addition to the Seasave processing modules, a group of Matlab script files collectively referred to as the AOML/CTDCAL Toolbox were used. These scripts are based on earlier work of different groups and modern statistical tools. They cover all the steps of the CTD data processing, from the preliminary comparisons between sensors or bottle samples, to data reductions and final sensors calibrations.

- FILL_SURFACE was used to copy the first good value of salinity, potential temperature, oxygen and oxygen current back to the surface. The program then calculated temperature and conductivity, and zeroed doc/dt of oxygen current for those records.
- DESPIKE1 removed spikes from primary temperature, salinity and oxygen data. Data were linearly interpolated over de-spiked records. Conductivity was back calculated, and sigma-theta and potential temperature were recomputed for the interpolated records.
- DESPIKE2 removed spikes from secondary sensors in the same method as DESPIKE1.
- CTD package slowdowns and reversals due to ship roll can move mixed water in tow in front of the CTD sensors. This mixture can create artificial density inversions and other artifacts. In addition to the Seasave module LOOPEDIT, DELOOP, computes values of density locally referenced between every 1 dbar of pressure to compute $N^2 = (- g/p)\ (dp/dz)$ and linearly interpolated measured parameters over those records where $N^2 \leq -1.0\ e\ {-05}\ s^{-2}$.

Final calibrations are applied to delooped data files. ITS-90 temperature, PSS-78 salinity, and oxygen are computed, and WOCE quality flags are created (these flags and other CTD processing standards were established during the World Ocean Circulation Experiment in the 1990's).

5.2 CTD Pressure

The Seabird pre-cruise pressure sensor calibration coefficients were applied to raw pressure data during each cast. Residual pressure offsets (the difference between the first and last submerged pressures) were examined to check for calibration shifts (see Figure 7 and Table 13). Pressure sensor s/n 1335 was used for stations 1-4 of the cruise with a precruise pressure offset of -0.35 dbar applied to the configuration file for a total offset of -0.35. On deck pressures before the start of each cast were recorded and plotted in Figure 7. The on deck pressures before and after the cast were stable at -0.16 ± 0.08 dbar and -0.24 ± 0.06 dbar, respectively (median ± standard deviation). Pressure sensor s/n 1292 was used for stations 5-16 of the cruise with an initial pressure offset of -0.58 dbar applied to the configuration file for a total offset of -0.58. On deck pressures before the start of each cast were recorded and plotted in Figure 7. The on deck pressures before and after the cast were stable at -0.07 ± 0.08 dbar and -0.18 ± 0.09 dbar, respectively (median ± standard deviation). No further offset correction was necessary for the pressure sensors used. The pressure sensor, s/n 1335, was swapped out during troubleshooting, but was found not to be the problem. Both pressure sensors function normally.

Near surface pressure values (which are taken as the near-surface pressure at the markscan and the last fired bottle pressure) showed no remarkable trends throughout the cruise. Pressure sensor, s/n 1335, was stable with near surface pressures prior to the downcast and following the upcast of 3.09 ± 0.58 dbar and 2.43 ± 0.76 dbar, respectively (median ± standard deviation). Pressure sensor, s/n 1292, was stable with near surface pressures prior to the downcast and following the upcast of 3.30 ± 0.82 dbar and 2.92 ± 0.60 dbar, respectively (median ± standard deviation).

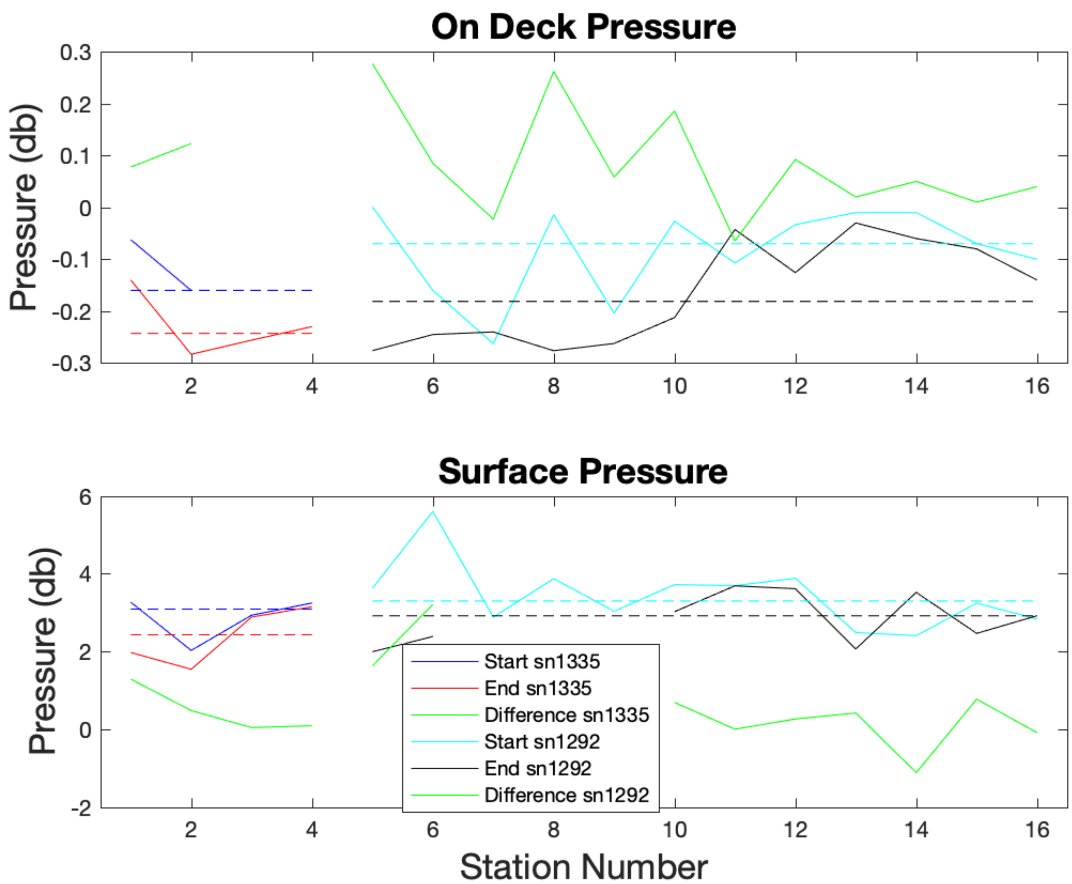

Figure 7: Top panel are the pressures (s/n 1335,s/n 1292) measured on deck before the cast (blue,cyan), at the end of the upcast (red,black) and the difference (green). Bottom panel are the near sea surface pressure values measured at the start of the downcast (blue,cyan), at the end of the upcast (red,black) and the difference (green).

Table 13: AB1802 – Near surface pressure values and scan number used to remove surface soak and on-deck values (-999's are data not recorded).

Station	Markscan	Deck Prs Start	Deck Prs End	Sfc Prs Start	Sfc Prs End
1	19759	-0.0623	-0.1400	3.2679	1.9760
2	13900	-0.1600	-0.2830	2.0292	1.5450
3	9548	-999	-0.2558	2.9340	2.8860
4	11497	-0.2243	-0.2297	3.2476	3.1520
5	16538	0.0010	-0.2760	3.6291	1.9950
6	10010	-0.1600	-0.2450	5.5973	2.3870
7	12350	-0.2627	-0.2400	2.8838	-999
8	11046	-0.0143	-0.2761	3.8729	3.1440
9	14715	-0.2039	-0.2622	3.0354	-999
10	12691	-0.0268	-0.2123	3.7187	3.0240
11	10082	-0.1071	-0.0427	3.6939	3.6880
12	13764	-0.0333	-0.1256	3.8839	3.6150
13	19339	-0.0100	-0.0300	2.4895	2.0670
14	15516	-0.0100	-0.0600	2.4076	3.5210
15	13015	-0.0700	-0.0800	3.2436	2.4670
16	7361	-0.1000	-0.1400	2.8369	2.9200

5.3 CTD Temperature

The Seabird pre-cruise temperature sensor calibration coefficients were applied to raw primary and secondary temperature data during each cast. Data accuracy, reproducibility and stability were examined by comparing the differences between the two different temperature sensors over a range of pressures (bottle trip locations) for each cast. These comparisons are summarized in Figure 8, which shows a median temperature difference between the two sensors of -0.0006 °C (-0.0008 °C below 1000 m) and a standard deviation of 0.003 °C (0.0008 °C below 1000 m). The sensors behaved well, compared with one another with minimal offset or pressure dependence prior to any reference temperature correction.

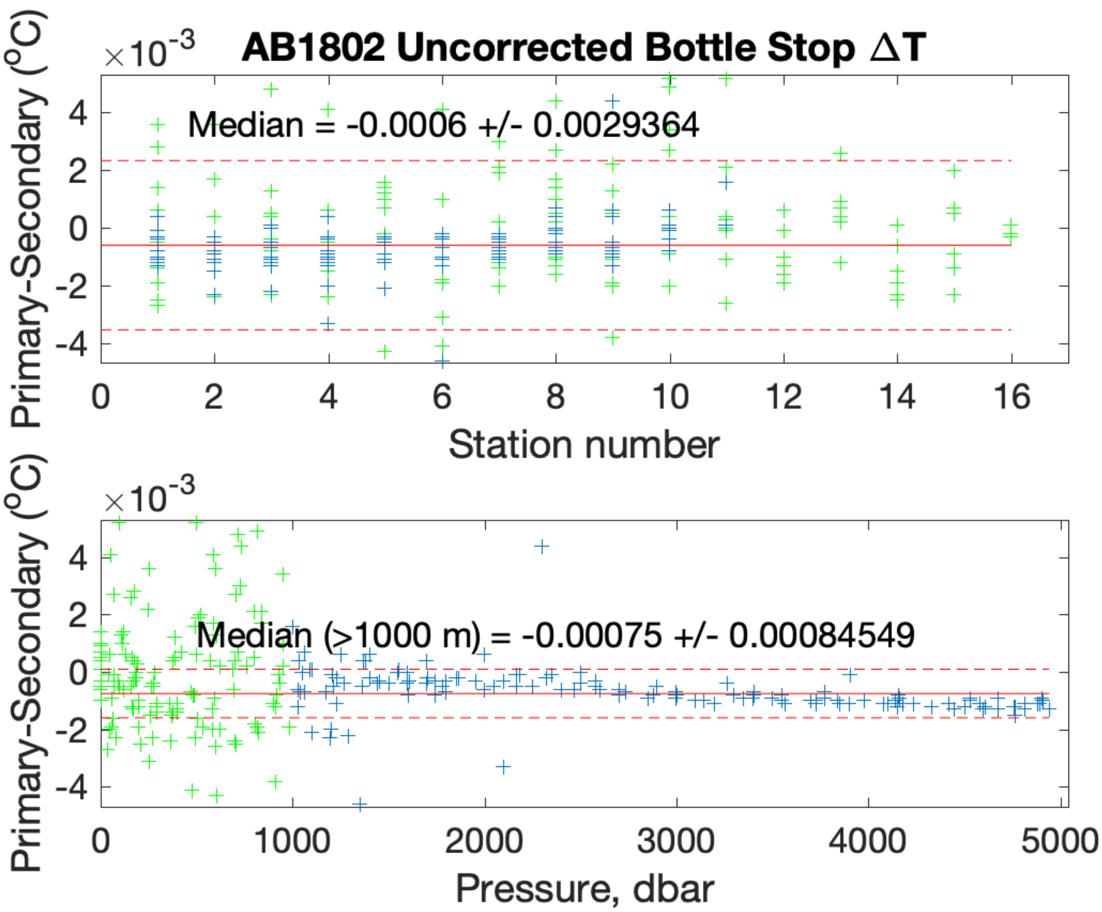

Figure 8: Temperature upcast bottle stop differences (before reference temperature correction) between sensors by station number (top) and pressure (bottom). The green crosses represents the surface data down to 1000 dbar. The blue crosses represents data below 1000 dbar. In both plots, the red solid line represents the median value with the red dashed line representing the standard deviation.

A SBE 35RT reference temperature was used during the cruise as a check to monitor the behavior of the primary and secondary temperature sensors. This allows for corrections to be made if there is any significant pressure dependence or offset seen in the sensors throughout the cruise. The bottle and instrument differences are compared to a normal distribution using 2.8 $\times$ standard deviation to find clear outliers. After these procedures, 123 data points (82.0 %) were used in the final calculations. Both primary and secondary sensors had a strong pressure dependence and both were corrected by using the reference temperature. The secondary sensor, used for calibration, was approximately 0.0015 °C at 4800 dbar (Figure 9). This sensor, s/n 5171, was used for all the final data values.

In order to calibrate the CTD temperature data against the reference temperature we derived the slope correction, m, and offset correction, b, using a least squares fit. This was done as a function of CTD pressure and delta T, where delta T is the CTD temperature minus the reference temperature. The corrections for the slope and offset are then applied to the CTD pressure, P_{CTD}, to calculate the temperature correction (T_{cor})

$$T_{cor} = [m * P_{CTD} + b]$$

and T_{cor} is applied to calculate the calibrated CTD temperature

$$T_{new} = T_{CTD} - T_{cor}$$

where T_{CTD} is the CTD temperature and T_{new} is the calibrated CTD temperature.

Table 14: AB1802 – Temperature coefficients.

	Secondary - s/n 5171 Sta 1-16
m	3.89695672e-07
b	0.00029875

The temperature coefficients used are shown in Table 14. Stations 1-16 were used to derive the coefficients. The corrected secondary temperature sensor is summarized in Figures 10 - 13, which shows a median temperature difference between the two sensors of -4.04 $\times 10^{-5}$ °C (-5.78 $\times 10^{-6}$ °C below 1000 m) and a standard deviation of 0.001 °C (0.0002 °C below 1000 m). Also, 87.0% of the residuals for the data are within the confidence limits determined by the WOCE standard ($\pm$ 0.002 °C) and this number increases to 100.0% if we consider only the data below 1000 dbar. The corrected temperature sensor differences between the primary and secondary can be seen in Figure 14.

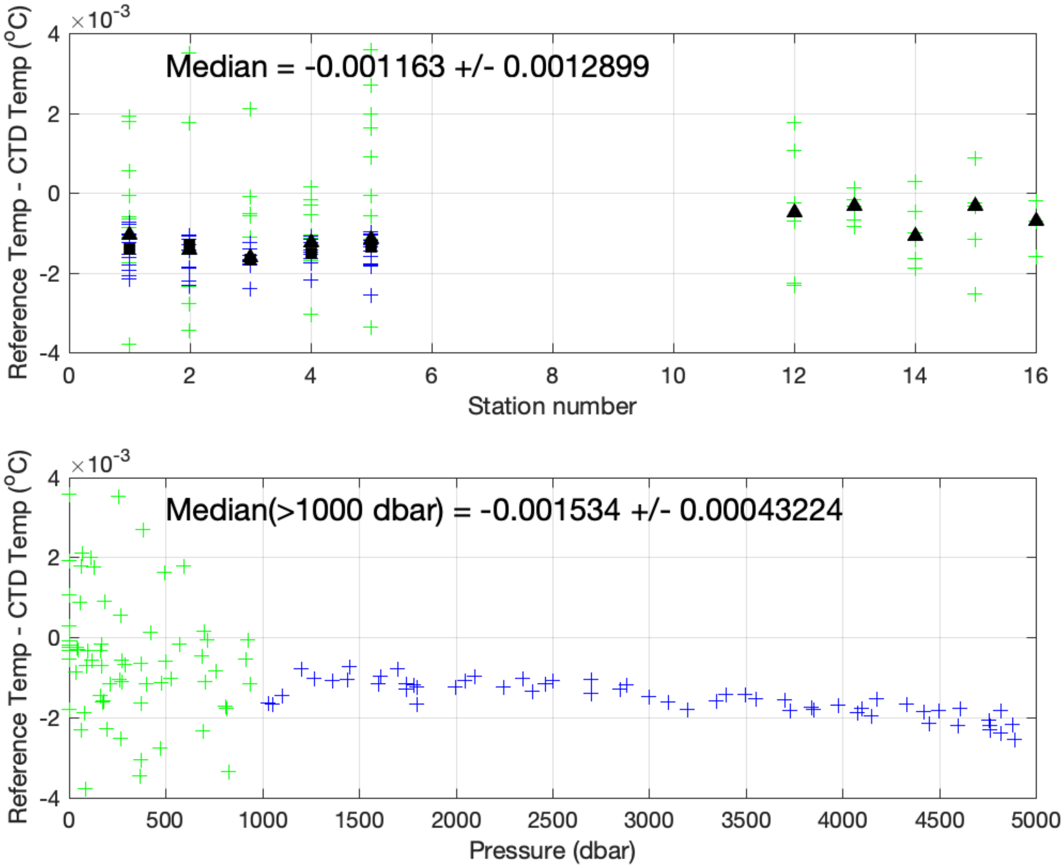

Figure 9: Reference temperature and uncalibrated secondary CTD temperature differences plotted by station number (top) and pressure (bottom). The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The black squares are the median of the data points below 1000 m and the triangles are the median of the data points above 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

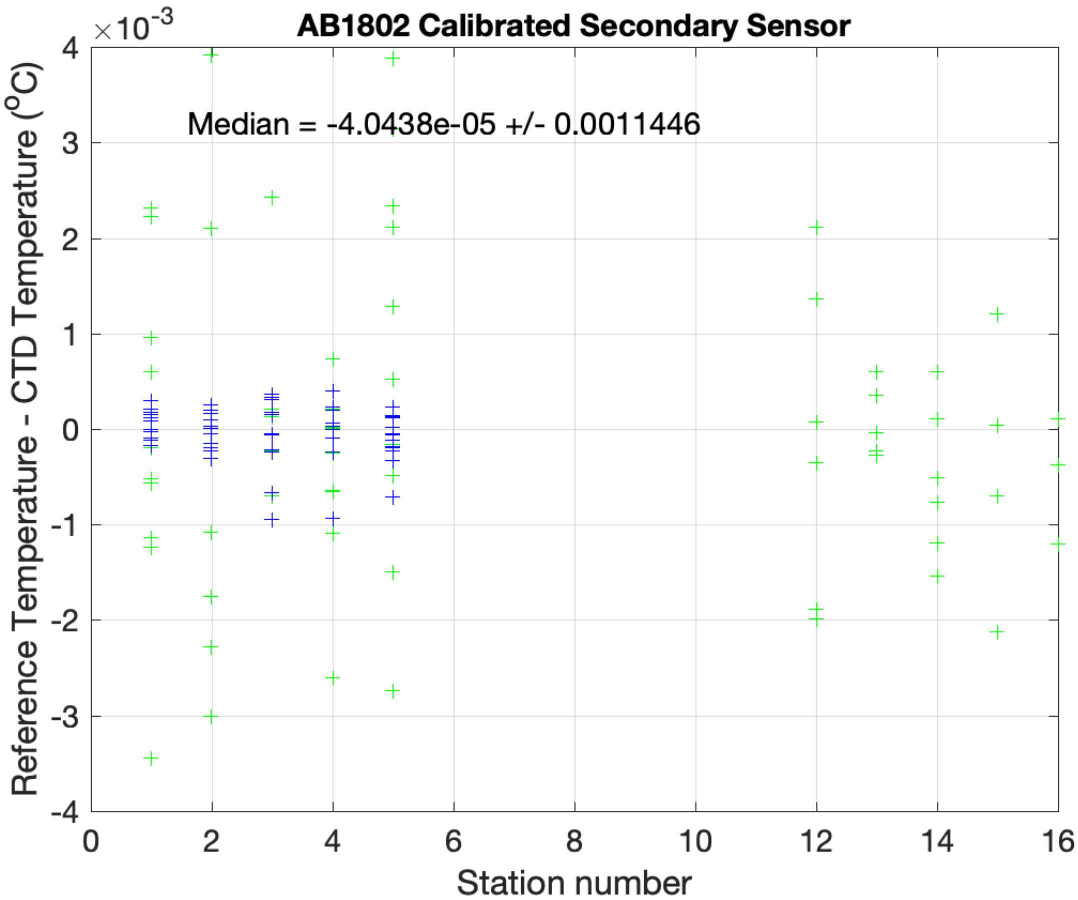

Figure 10: Reference temperature and calibrated secondary CTD temperature differences plotted vs. station. The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The median values shown were calculated using all data.

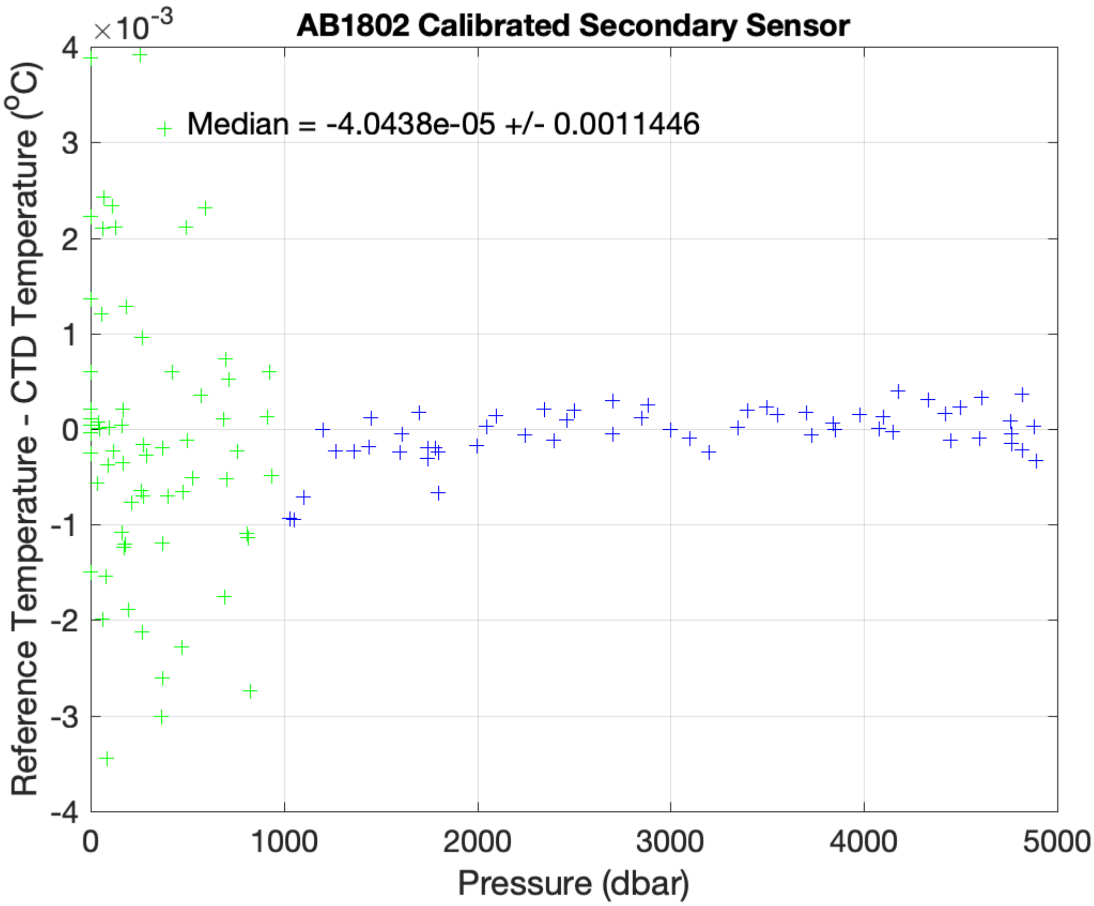

Figure 11: Reference temperature and calibrated secondary CTD temperature differences plotted vs. pressure. The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The median values shown were calculated using all data.

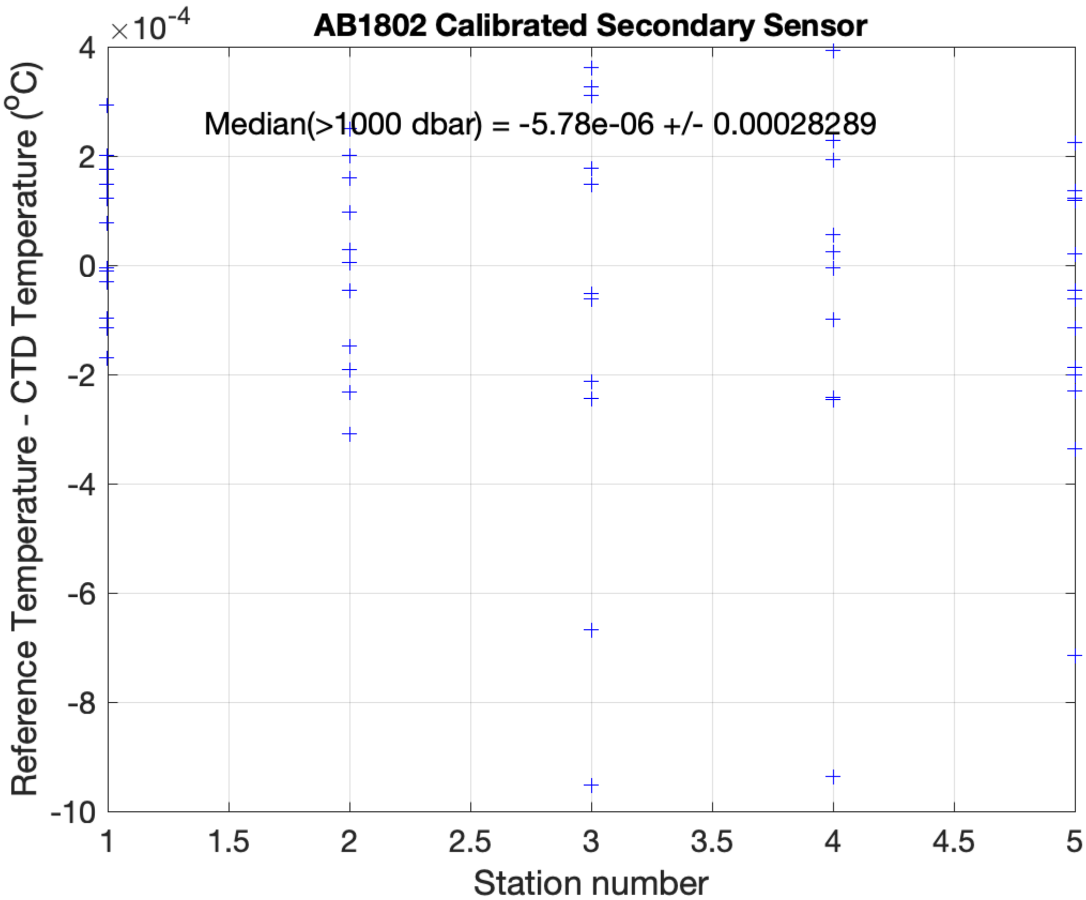

Figure 12: Reference temperature and calibrated secondary CTD temperature differences (blue crosses) plotted vs. station below 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

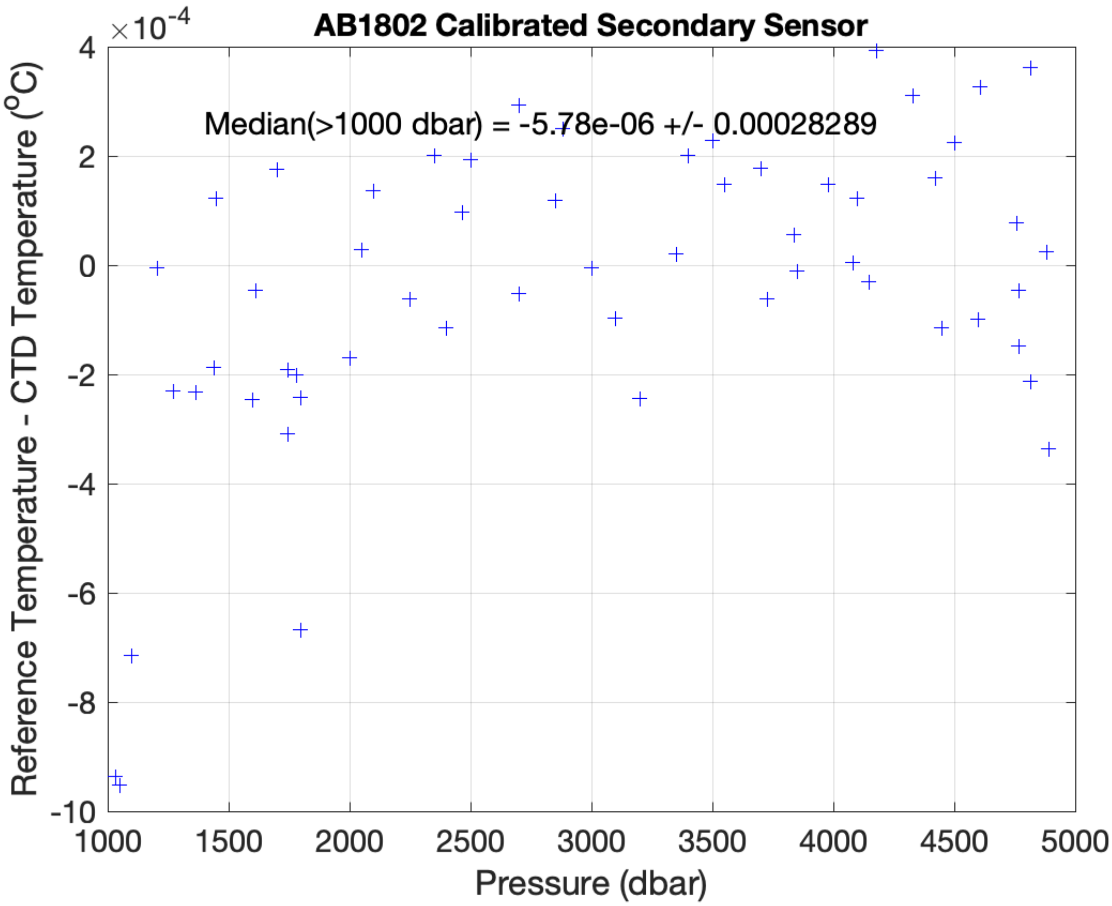

Figure 13: Reference temperature and calibrated secondary CTD temperature differences (blue crosses) plotted vs. pressure below 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

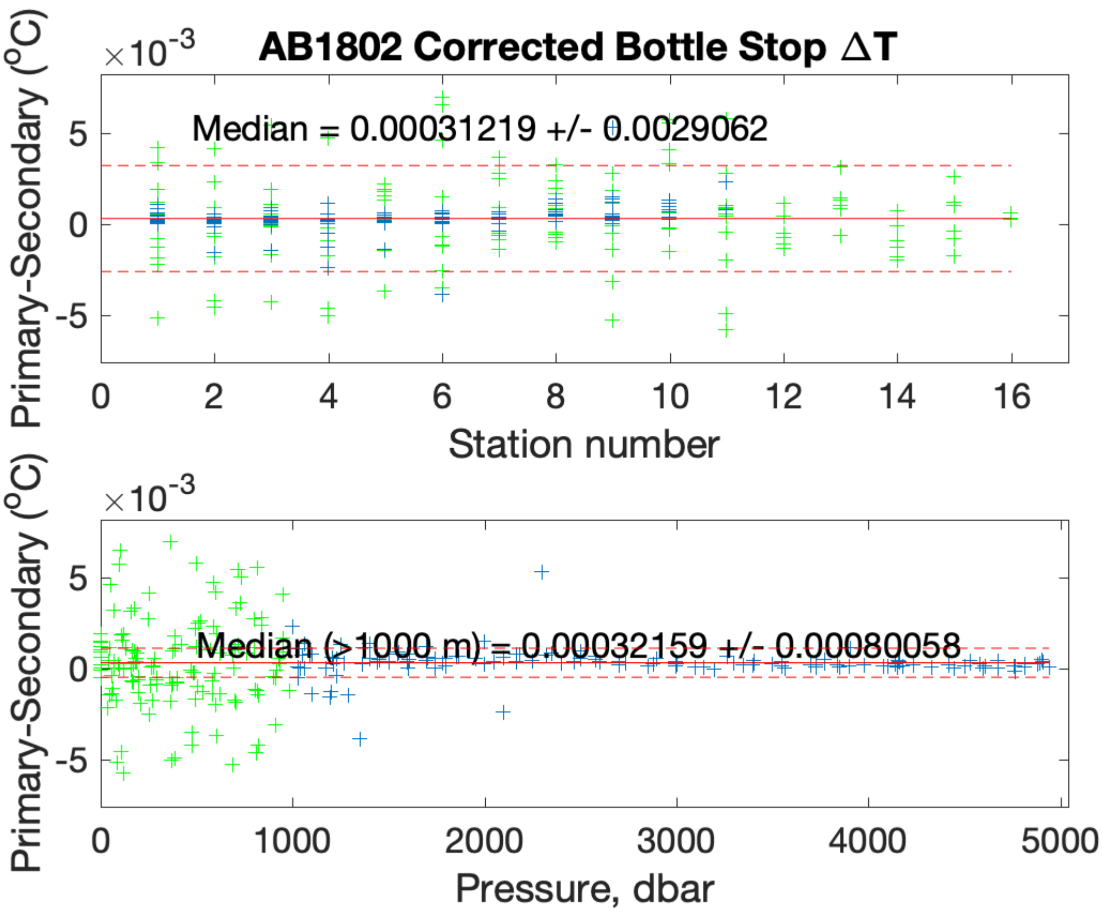

Figure 14: Temperature sensor differences (after reference temperature corrections) between sensors by station number (top) and pressure (bottom). The green crosses represents the surface data down to 1000 dbar. The blue crosses represents data below 1000 dbar. In both plots, the red solid line represents the median value with the red dashed representing the standard deviation (same for top and bottom).

5.4 Conductivity

The Seabird pre-cruise conductivity sensor calibration coefficients were applied to raw primary and secondary conductivity data during each cast. Comparisons between the primary and secondary sensors and between each of the sensors to conductivity calculated from bottle salinities were used to derive conductivity corrections. Uncorrected differences between the primary and secondary conductivity sensors (C1-C2) are shown in Figure 15 to help identify sensor drift. The sensors show a median difference of 9.1 $\times 10^{-4}$ mS/cm (6.9 $\times 10^{-4}$ mS/cm for the data below 1000 dbar), with a standard deviation of 0.003 mS/cm (0.0008 mS/cm for the data below 1000 dbar). The uncalibrated secondary sensor comparison with the bottle salinities show a better residual with a median of 1.18 $\times 10^{-4}$ psu and a standard deviation of 0.003 psu (Figure 16). Therefore the secondary sensor, s/n 4222, was used for all the final data values. The bottle and instrument differences are compared to a normal distribution using 2.1 $\times$ standard deviation to find clear outliers. After these procedures, 208 data points (88.5 %) were used in the final calculations.

In order to calibrate the CTD conductivity data against the sample conductivity we assume a constant additive correction (offset), multiplicative correction (slope), time drift correction (represented by station number) and where needed, a linear pressure-dependent term. A non-linear function is used to derive these coefficients which are then applied to

$$C_{new} = [m * C_{CTD} + (p_1 * station) + b + pcor * P]$$

with

Table 15: AB1802 – Conductivity coefficients.

Secondary - s/n 4222 Stations 1-16	
m	0.9999065
p_1	5.1863102e-05
b	0.0038777
$pcor$	-3.306985e-07

where C_{CTD} is pre-cruise calibrated CTD conductivity (mS/cm), m is the conductivity slope, b is the offset (mS/cm), P is the pressure, $pcor$ is the pressure correction coefficient, $station$ is the station number and p_1 is the polynomial coefficient. The fit is also weighted in such way that the final solution is preferentially forced to fit the data below a specified depth, in this case 1000 dbar. The stations used are chosen by looking at residual trends between the sensor and bottle data. Stations 1-16 were used to derive the coefficients.

The coefficients estimated by the equation above were then applied to the CTD conductivities and the final results (Figure 17 to Figure 20) show a residual of -4.77 $\times 10^{-5}$ psu (4.23 $\times 10^{-5}$ psu for the data below 1000 dbar) and a standard deviation of 0.003 psu (0.002 psu for the data below 1000 dbar). Additionally, 61.1% of the residuals for the data are within the confidence limits determined by the WOCE standard (± 0.002 psu), and this number increases to 77.0% if we consider only the data below 1000 dbar.

Temperature and salinity data collected during AB1802 were also compared with historical project data (Figure 21 and Figure 22). Water mass properties are very stable for deeper layers of the ocean. By comparison, one can asses the relative characteristics of the AB1802 data set, and more easily identify irregularities or inconsistencies in the θ - S diagrams.

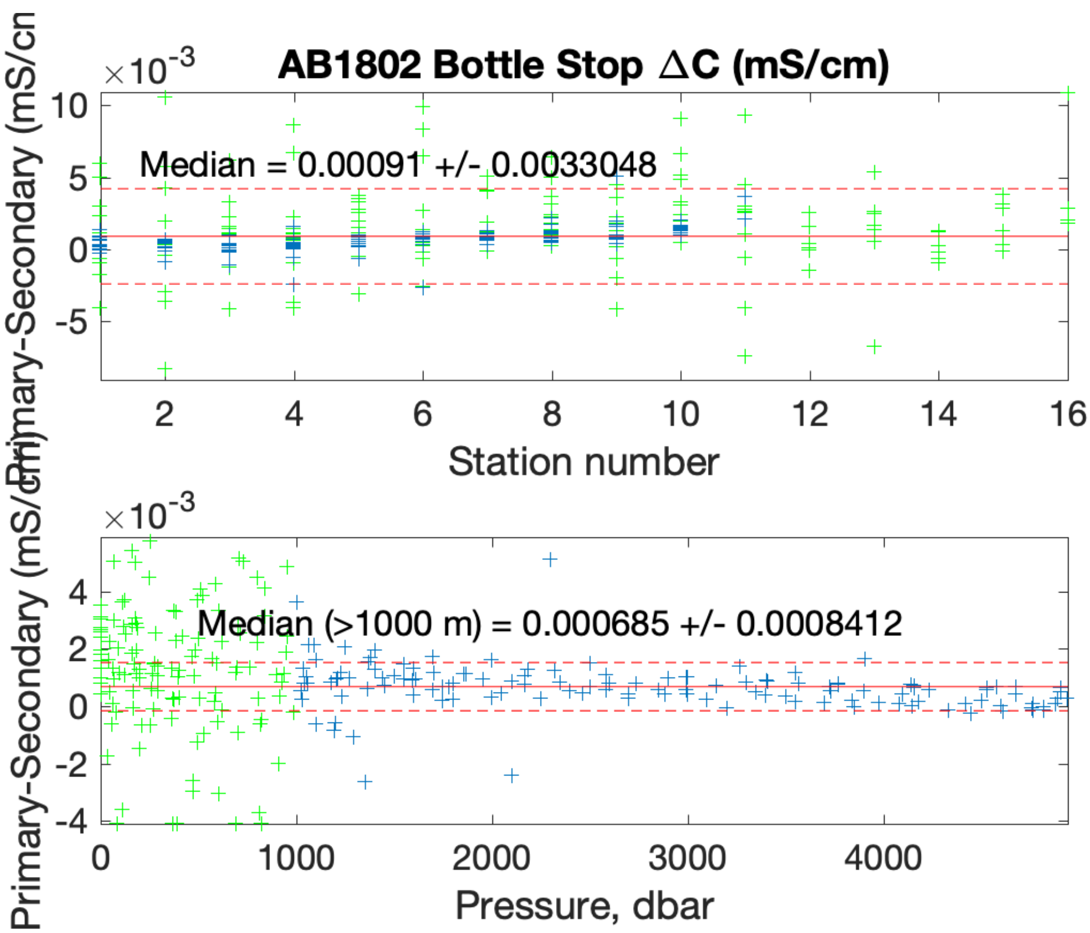

Figure 15: Conductivity upcast bottle stop (mS/cm) differences between sensors by station (top) and pressure (bottom). The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The red solid line represents the median with the red dashed representing the standard deviation.

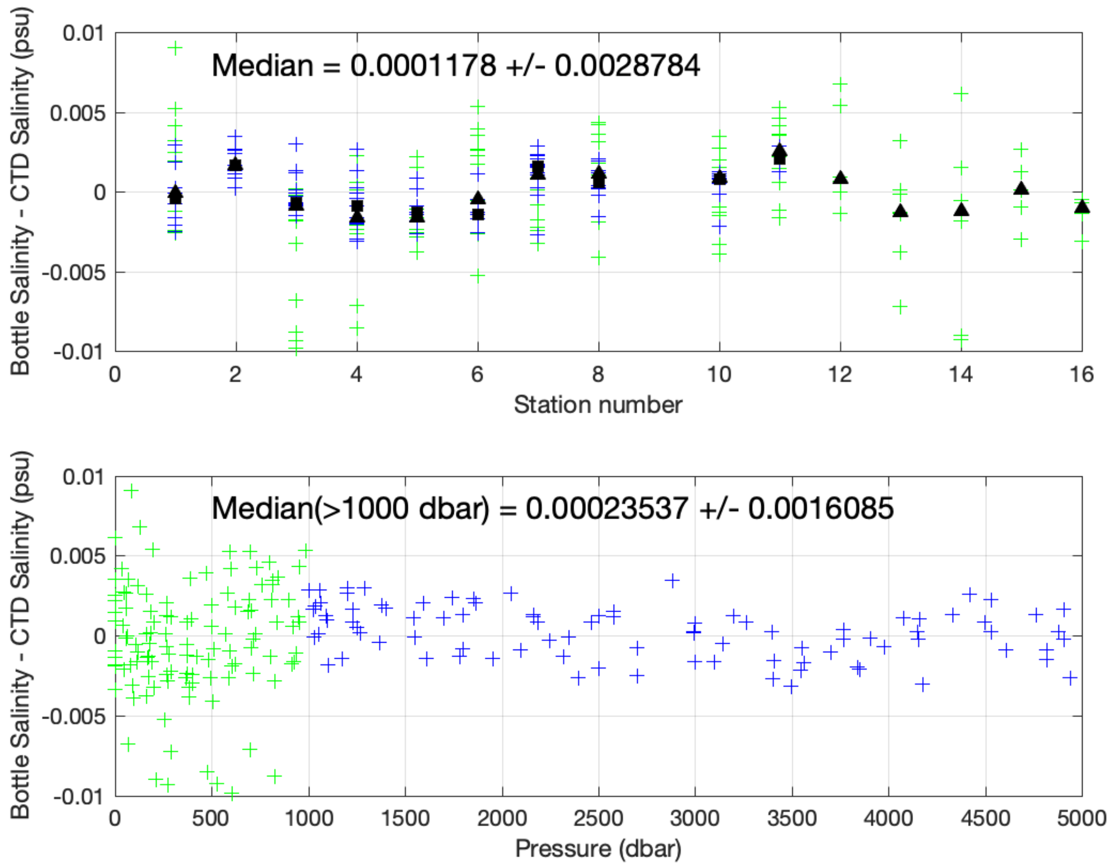

Figure 16: Bottle and uncalibrated secondary CTD salinity differences plotted by station (top) and pressure (bottom). The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The black squares are the median of the data points below 1000 m and the triangles are the median of the data points above 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

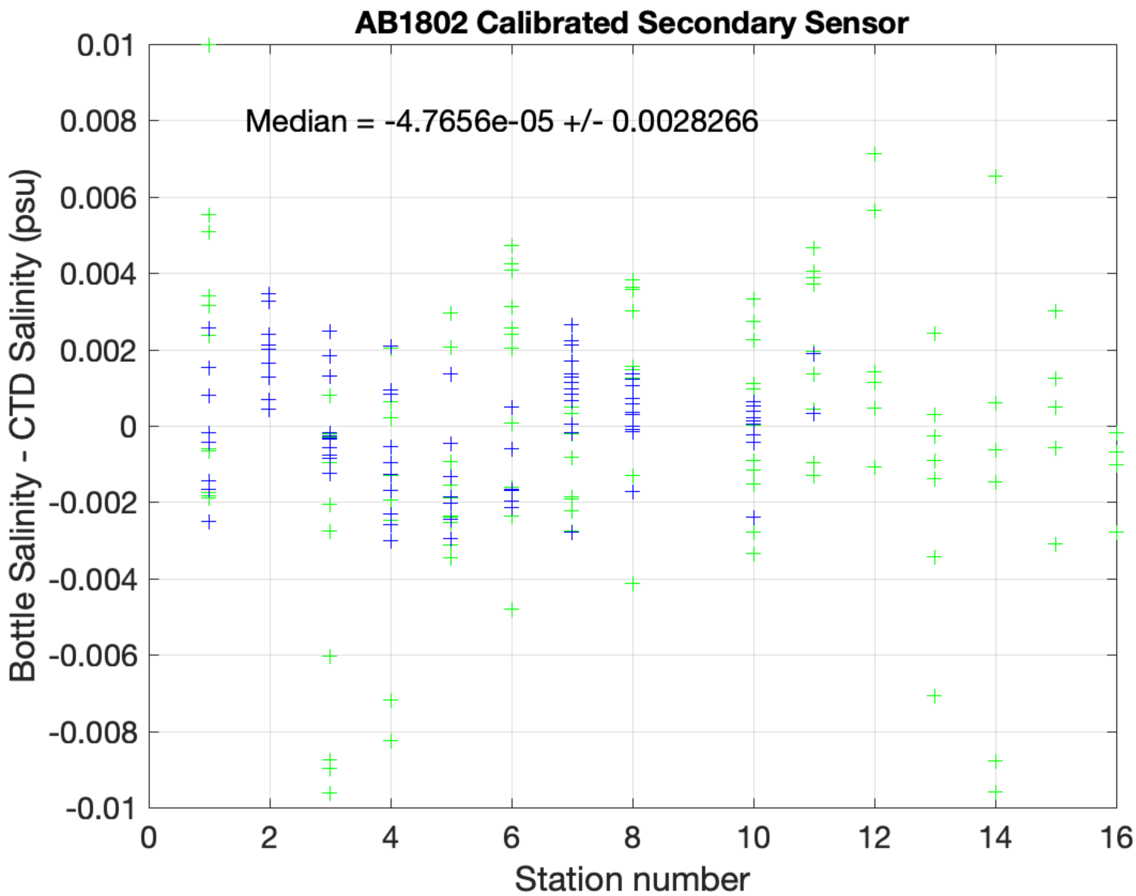

Figure 17: Bottle and calibrated secondary CTD salinity differences plotted vs. station. The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The median values shown were calculated using all data.

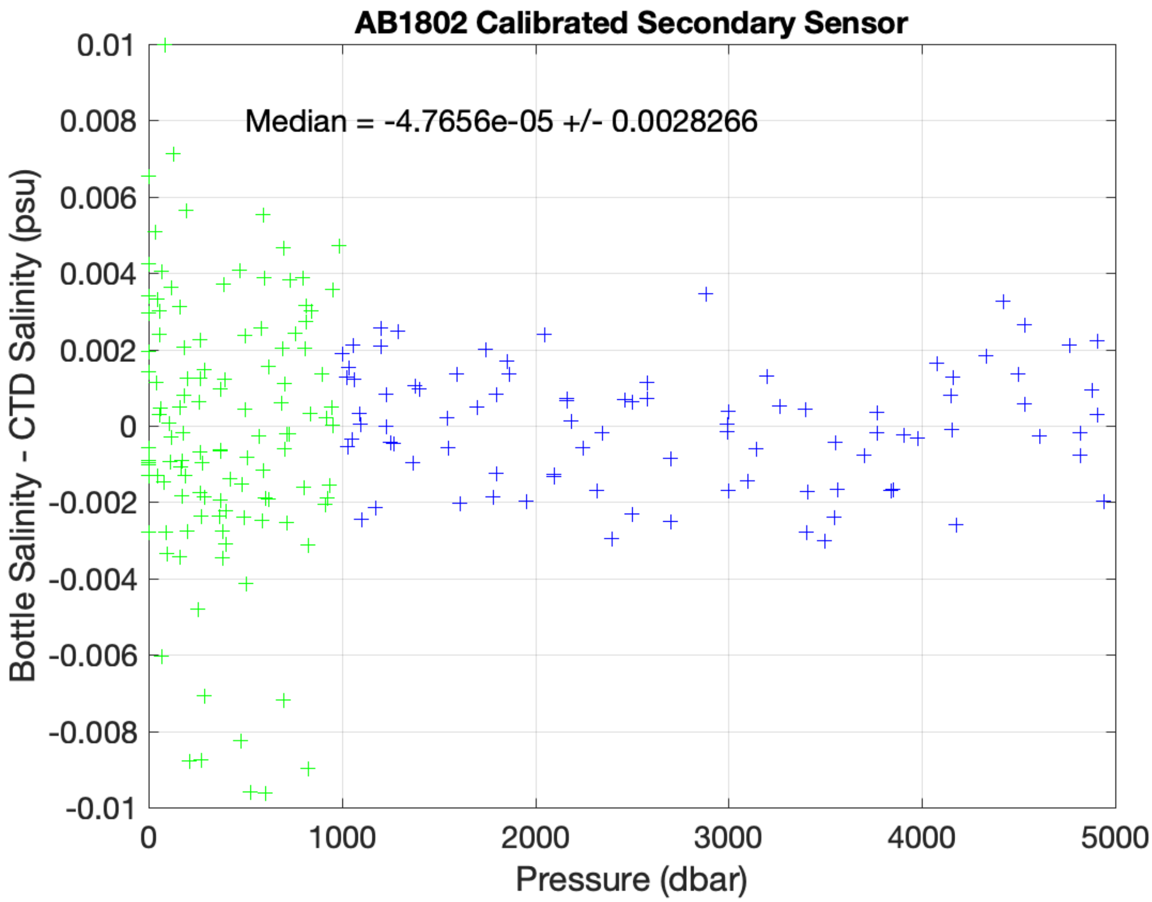

Figure 18: Bottle and calibrated secondary CTD salinity differences plotted vs. pressure. The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The median values shown were calculated using all data.

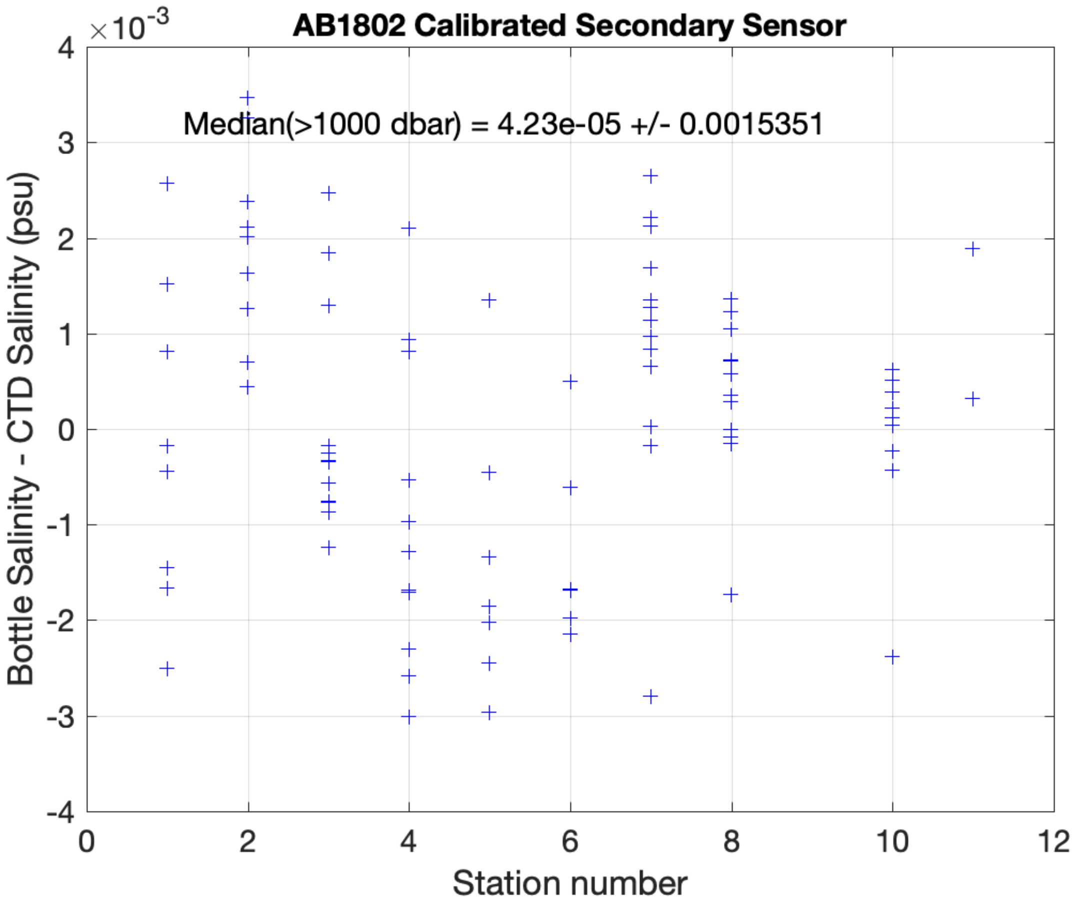

Figure 19: Bottle and calibrated secondary CTD salinity differences (blue crosses) plotted vs. station below 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

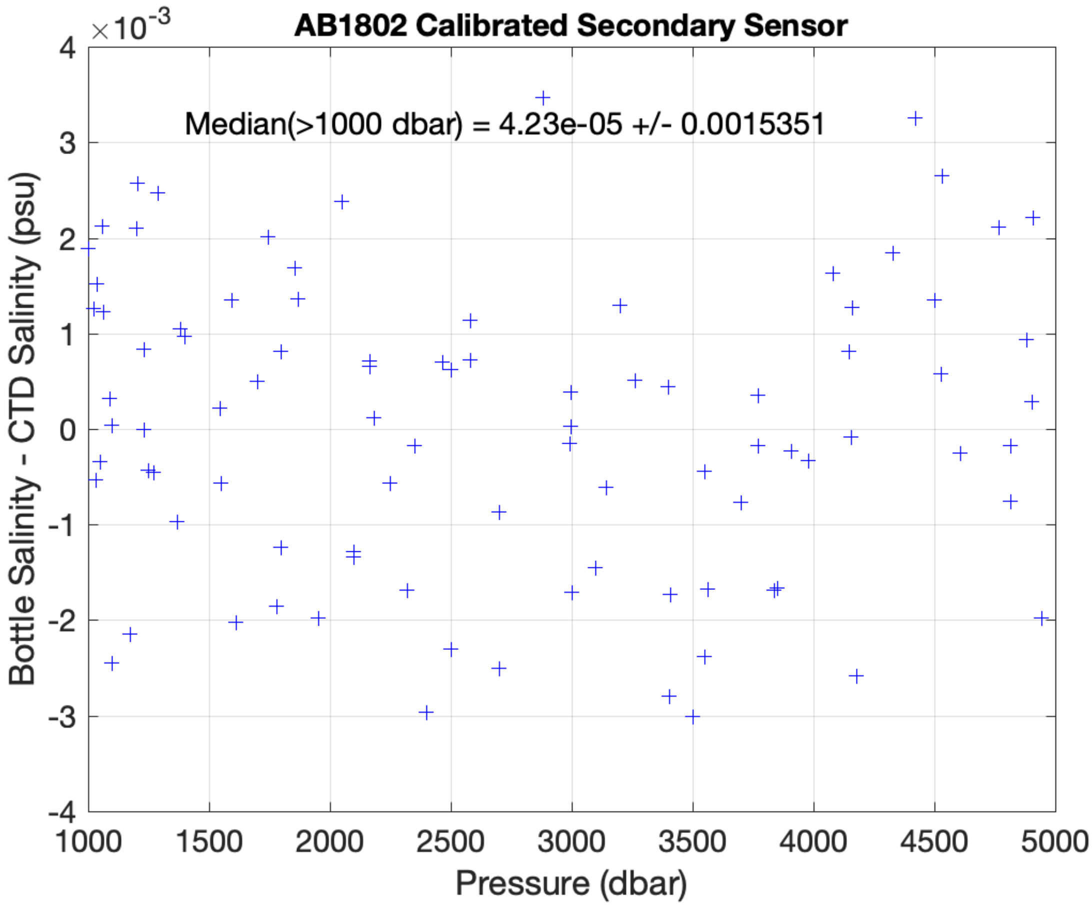

Figure 20: Bottle and calibrated secondary CTD salinity differences (blue crosses) plotted vs. pressure below 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

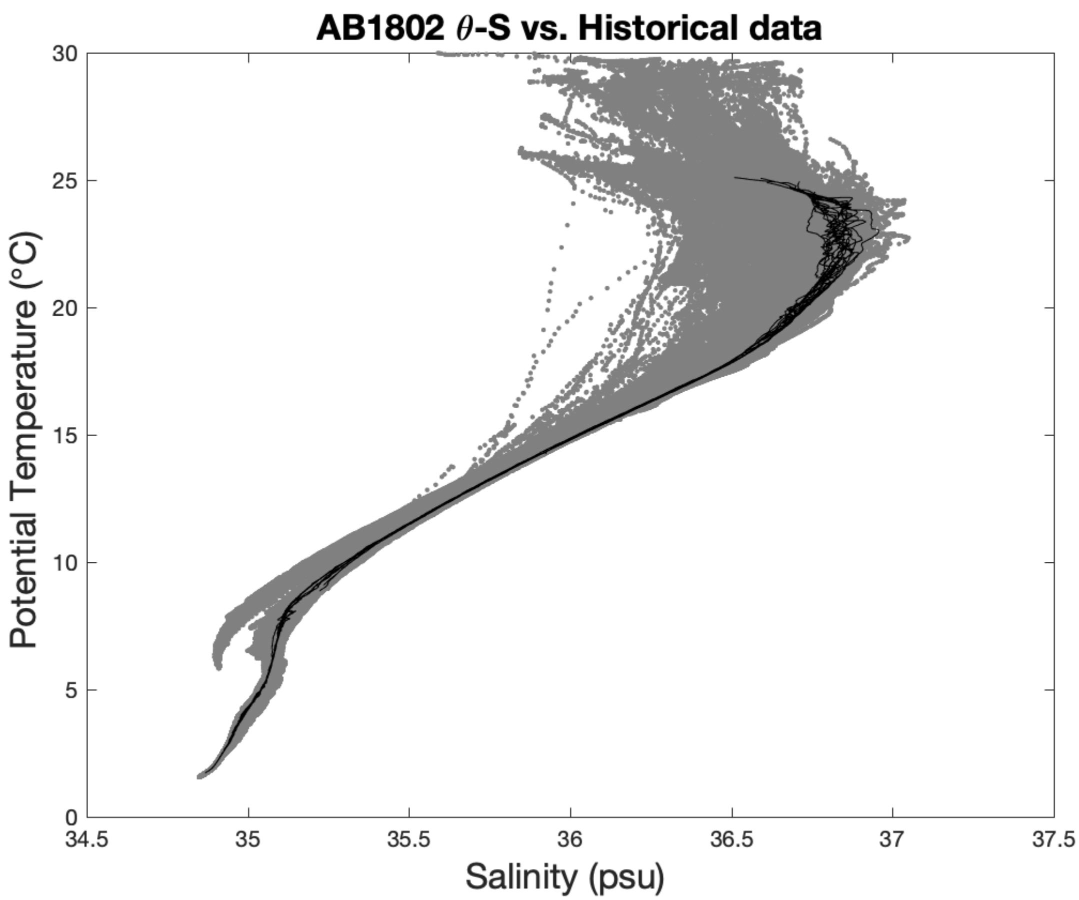

Figure 21: Potential Temperature (θ) - Salinity diagram for all stations. The solid black lines represent AB1802 data. Solid gray lines are historical data collected during the project.

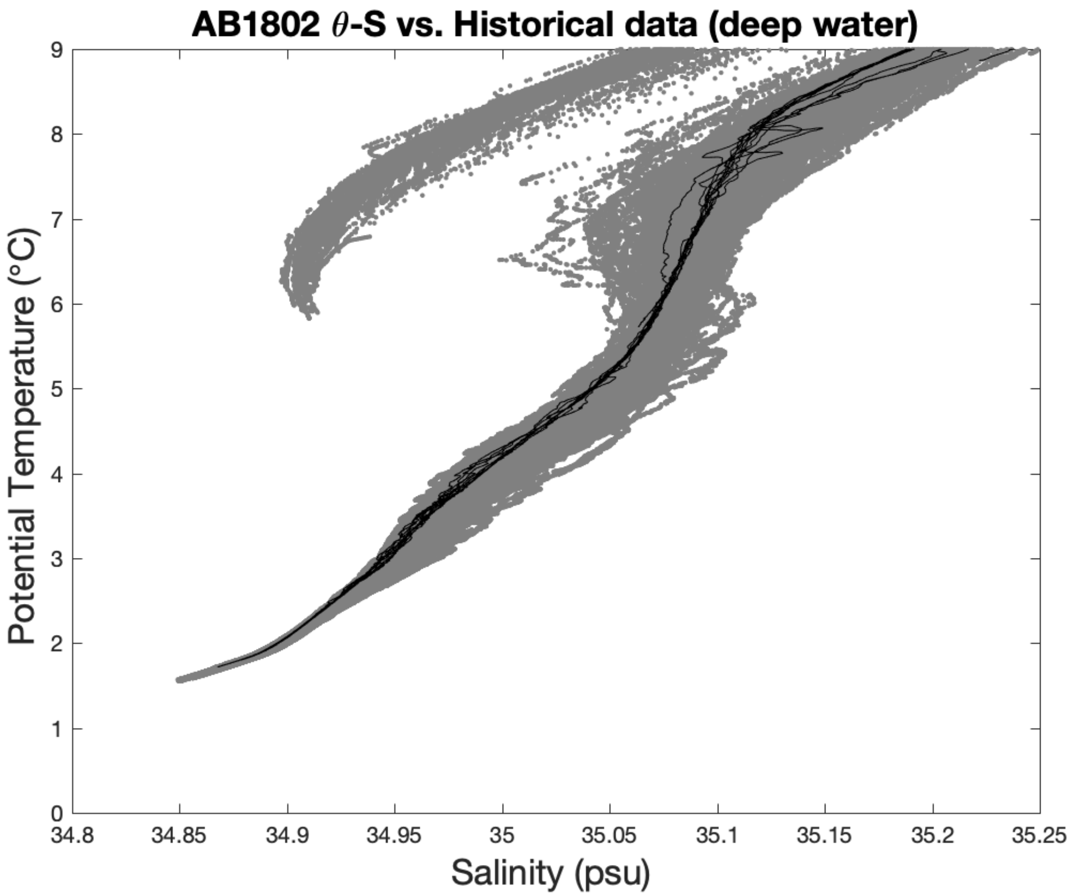

Figure 22: Potential Temperature (θ) - Salinity diagram for all stations (deep water). The solid black lines represent AB1802 data. Solid gray lines are historical data collected during the project.

5.5 Dissolved Oxygen

Oxygen sensor calibration coefficients derived from the pre-cruise calibrations were applied to raw primary and secondary oxygens. The sensors were calibrated to dissolved oxygen bottle samples by matching up cast bottle trips to down cast CTD data along neutral density surfaces, calculating CTD dissolved O_2, and then minimizing the residuals using a non-linear least-squares fitting procedure.

The algorithm used for converting oxygen sensor current and probe temperature measurements as described, requires a non-linear least squares regression technique in order to determine the best fit coefficients of the model for oxygen sensor behavior to the water sample observations. A non-linear least squares regression using the Gauss-Newton algorithm with Levenberg-Marquardt modifications for global convergence is used to fit profiles to the bottle data. This algorithm is independent of the first coefficients estimation and demonstrates improved convergence. Additionally, the routine includes an optional time drift term (related with the station number), allowing all stations to be calibrated without breaking them into discrete groupings. The Owens and Millard (1985) algorithm was modified as follows:

$$O\ (ml/l) = \{Soc * (V + V_{offset} + tau(T,S) * \frac{\delta v}{\delta t}) + p1 * station\}$$
$$*(1.0 + A * T + B * T^2 + C * T^3) * OXSAT(T,S) * e^{E*(\frac{P}{K})}$$

with

Table 16: AB1802 – Oxygen coefficients.

Secondary - s/n 1348 Stations 1-16	
Soc	0.32936750
V_offset	-0.49754474
tau	1.70
A	-0.0006276
B	7.7561826e-05
C	-1.055708e-05
E	0.0396228
$p1$	0.0

where Soc, tau, V_{offset}, A, B, C, E and $p1$ are the calibration coefficients shown above and V is the instrument voltage (V). T, S and P are the temperature, salinity and pressure measured by the CTD. K is the temperature in the absolute scale, $station$ is the station number, and $OXSAT$ is the oxygen saturation.

A comparison between the primary and secondary sensors (Figure 23) was evaluated. The sensors show a median difference of -2.81 μmol/kg and a standard deviation of 0.72 μmol/kg. The the secondary sensor, s/n 1348, was used for all the final data values (Figure 24).

The oxygen coefficients used to correct the secondary oxygen are shown in Table 16. Stations 1-16 were used to derive the coefficients. Also, as with the conductivity, the data were compared with a normal distribution using 2.8 $\times$ standard deviation to remove outliers. After these procedures, 202 data points (73.5%) were used in the final calculations.

To minimize the differences between the oxygen samples and the CTD oxygen values estimated from the equation described in this section, the new coefficients above were calculated and then applied to the original CTD data (Figure 25 to Figure 28). The residual was found to be 0.02 μmol/kg (0.03 μmol/kg for the data below 1000 dbar) with a standard deviation of 0.89 μmol/kg (0.77 μmol/kg for the data below 1000 dbar). Additionally, 100.0% of the oxygen residuals are within the WOCE confidence limits ($\pm$ 1% of the dissolved O_2 measured).

As with the salinity data, the final dissolved oxygen data were compared with historical oxygen data from the project to asses the relative characteristics of the collected data set and to identify any anomalous signatures in the θ - dissolved O_2 diagrams (Figure 29 & Figure 30).

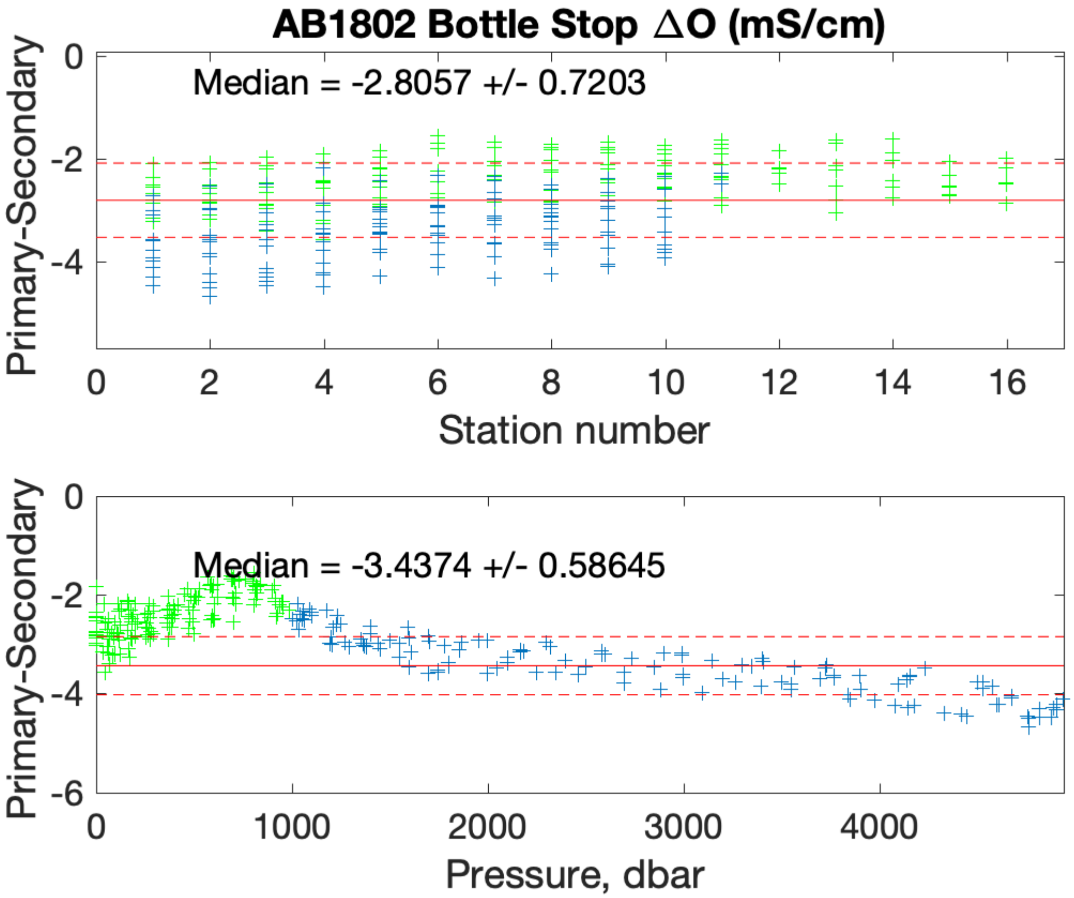

Figure 23: Dissolved oxygen upcast bottle stop differences between sensors by station (top) and by pressure (bottom). The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The red solid line represents the median with the red dashed representing the standard deviation.

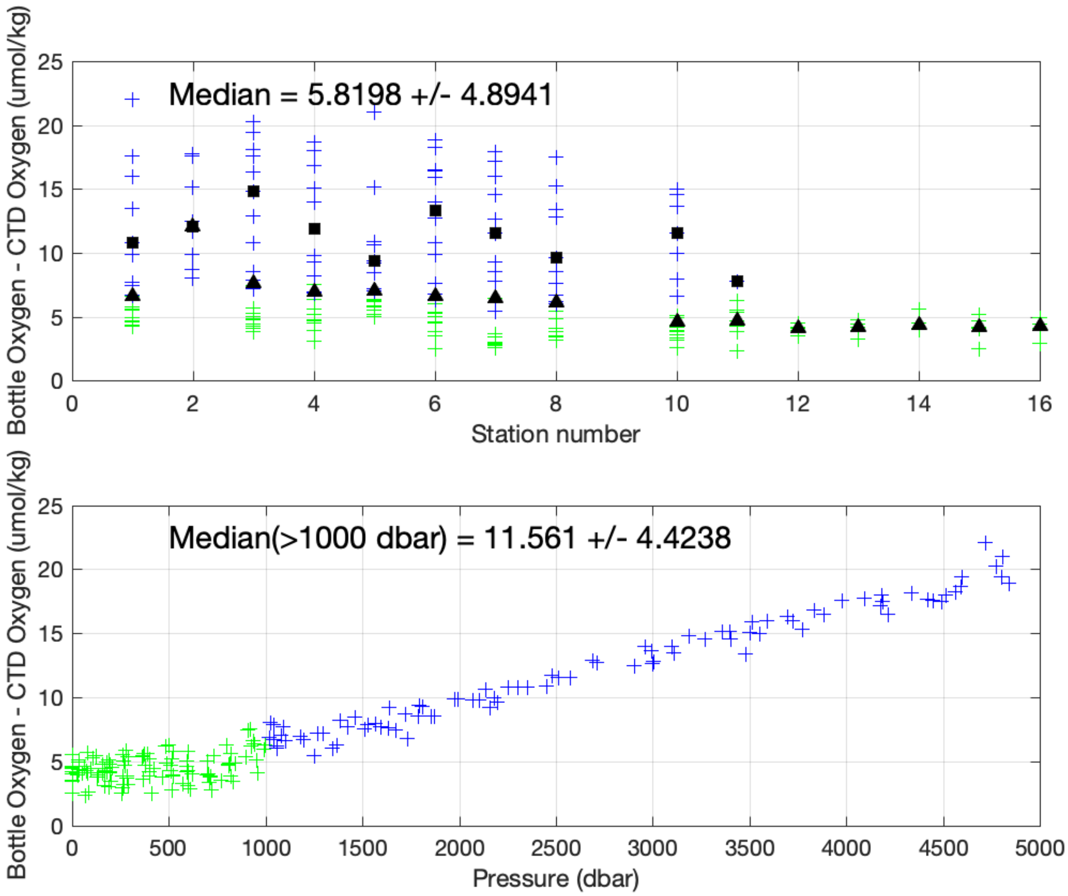

Figure 24: Bottle and uncalibrated secondary CTD oxygen differences plotted by station (top) and by pressure (bottom). The green crosses represent all data points and the blue crosses are the data points below 1000 dbar. The black squares are the median of the data points below 1000 m and the triangles are the median of the data points above 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

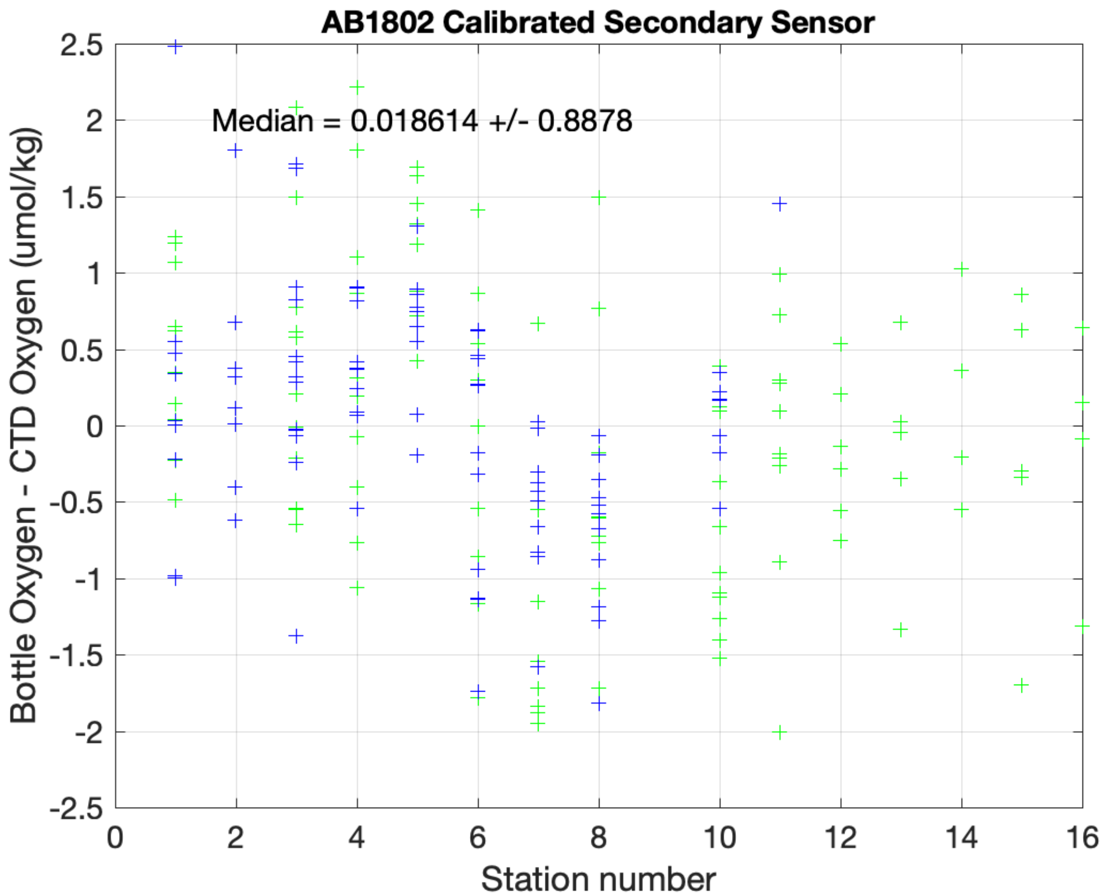

Figure 25: Bottle and calibrated secondary CTD oxygen differences plotted vs. station. The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The median values shown were calculated using all data.

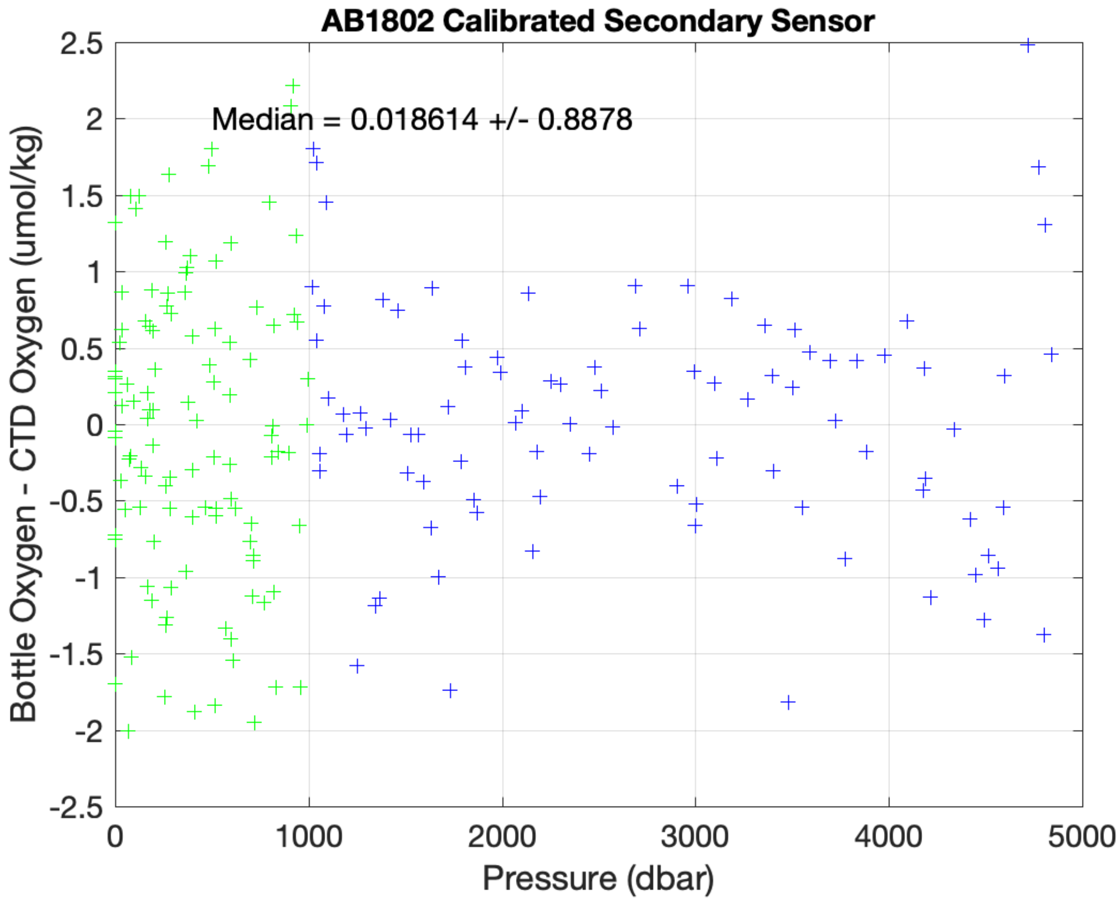

Figure 26: Bottle and calibrated secondary CTD oxygen differences plotted vs. pressure. The green crosses represent data points above 1000 dbar and the blue crosses are the data points below 1000 dbar. The median values shown were calculated using all data.

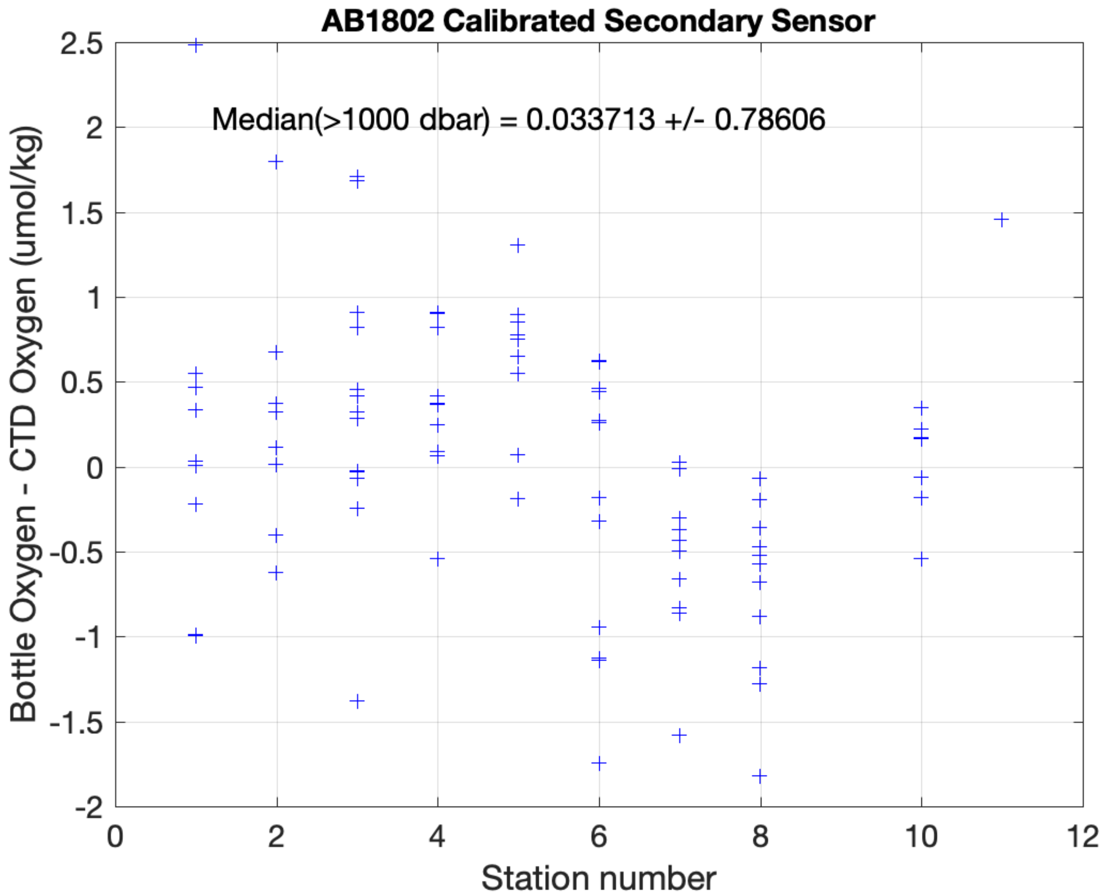

Figure 27: Bottle and calibrated secondary CTD oxygen differences (blue crosses) plotted vs. station below 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

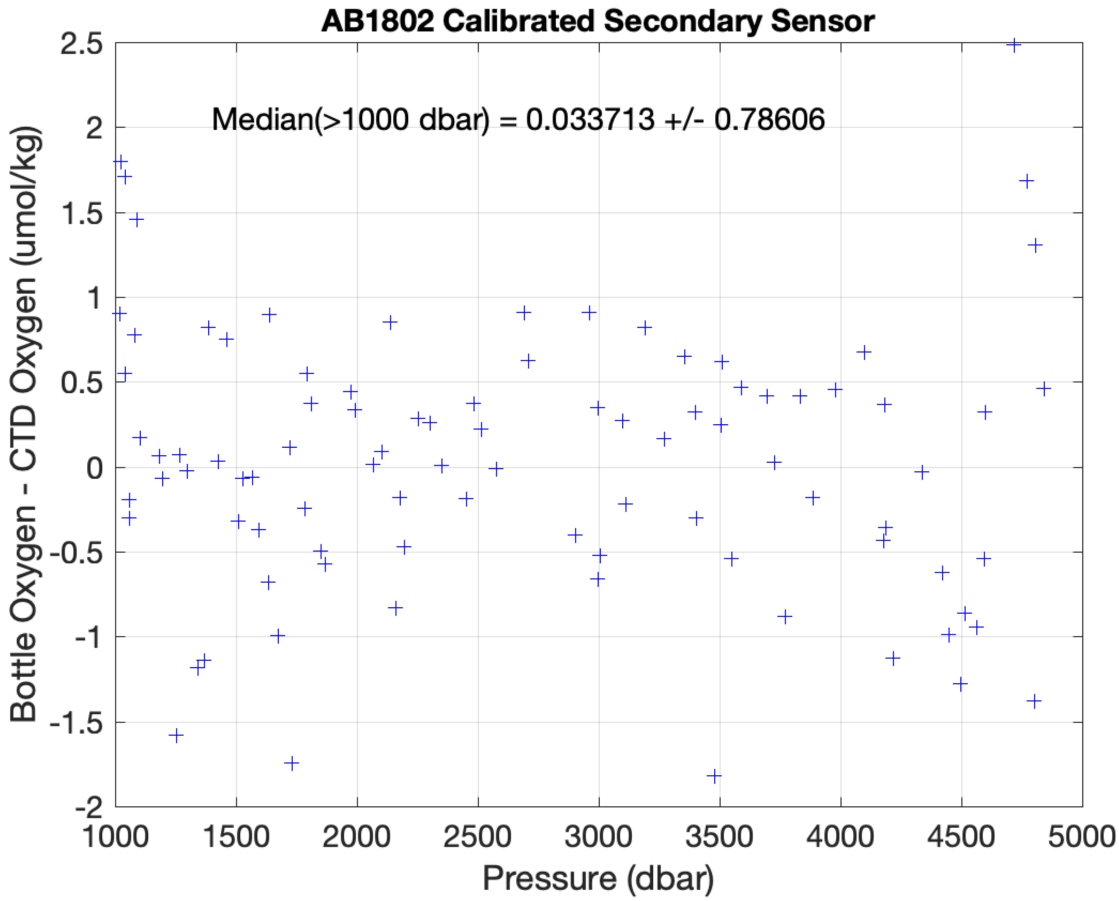

Figure 28: Bottle and calibrated secondary CTD oxygen differences (blue crosses) plotted vs. pressure below 1000 dbar. The median values shown were calculated only using data below 1000 dbar.

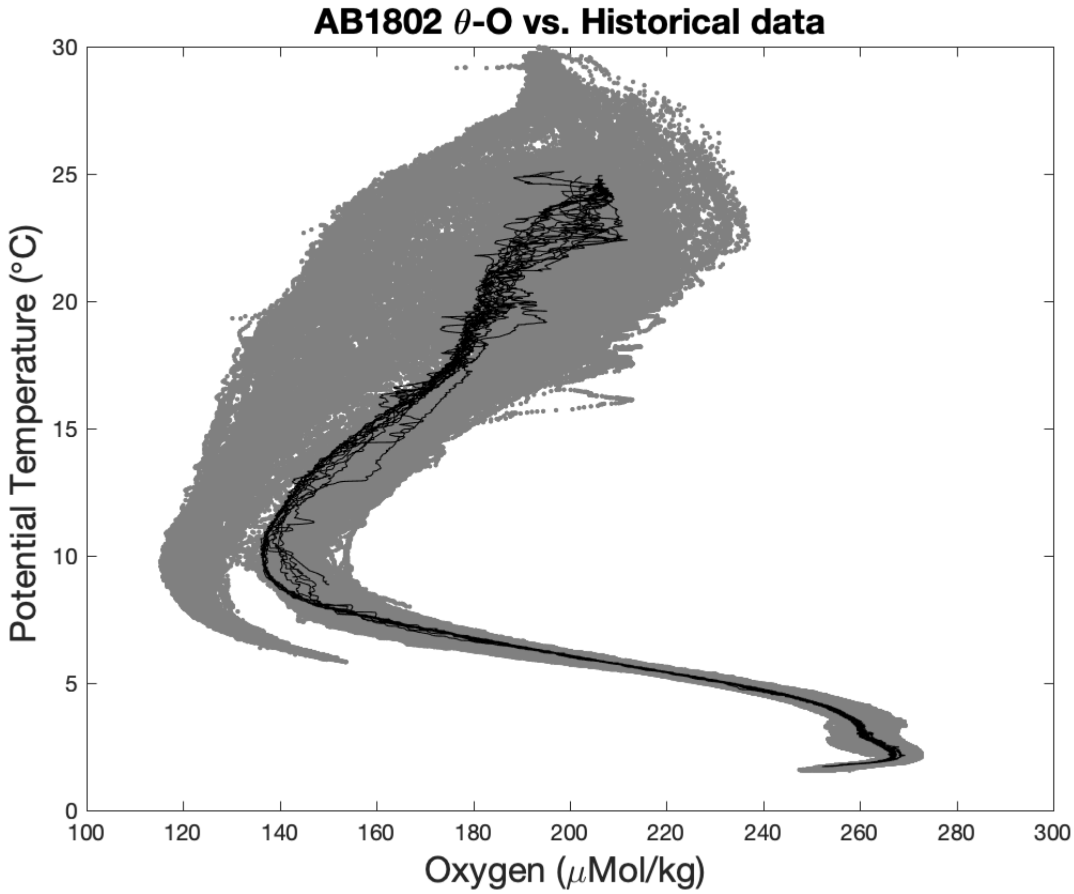

Figure 29: Potential Temperature (θ) - Oxygen diagram for all stations. The solid black lines represent AB1802 data. Solid gray lines are historical data collected during the project.

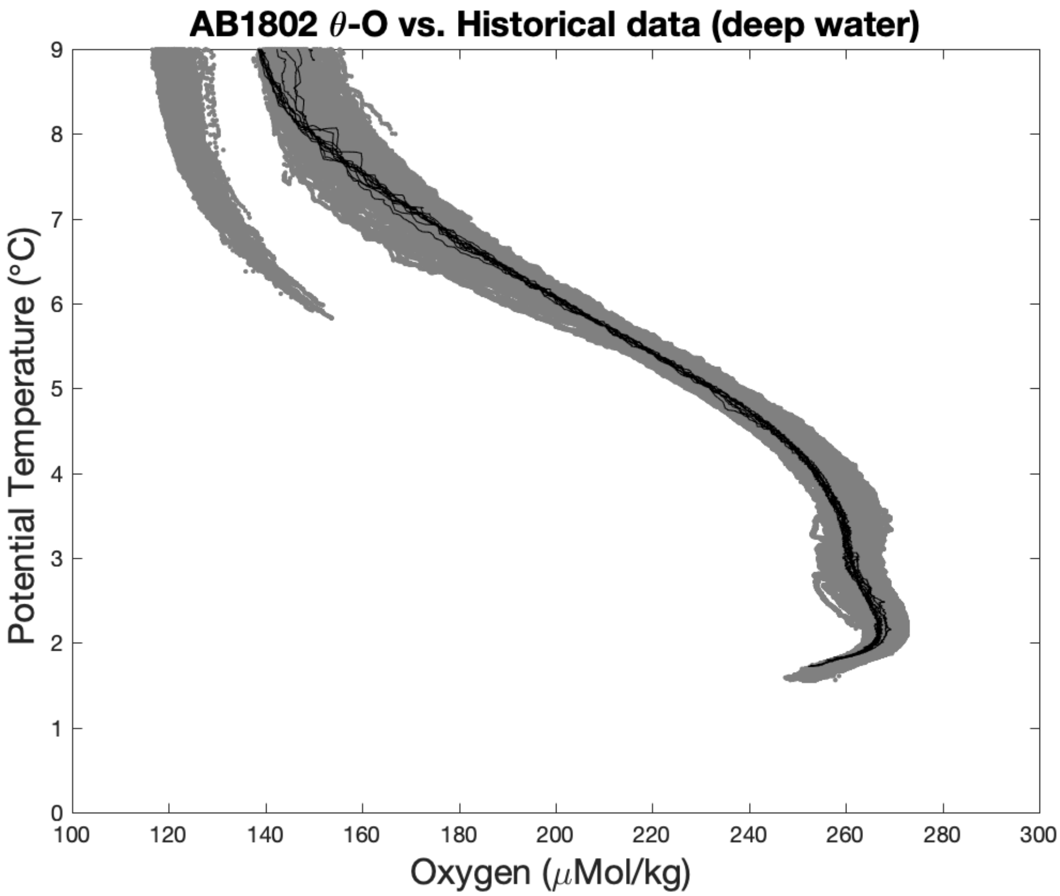

Figure 30: Potential Temperature (θ) - Oxygen diagram for all stations (deep water). The solid black lines represent AB1802 data. Solid gray lines are historical data collected during the project.

6 *Final CTD Data Presentation*

Post-cruise calibrations, determined from bottle data, were applied to CTD data associated with bottle data using Matlab sub-routines (`apply_calibration.m`). WOCE quality flags were appended to bottle data records. “bad values” (WOCE quality control value = 4) were flagged if the bottle samples failed the initial quality control and were not used for the calibration (which meant they fell outside 2.57 standard deviations of the difference between samples and uncalibrated CTD values). A second pass was applied, using the value of 2.5 times the standard deviation of the difference between calibrated CTD values and bottle samples, where bottle values may be flagged as “bad values”.

The final calibrated CTD data files were used to produce the section plots that follow and the tables and station profile plots presented in the appendices. Vertical sections of potential temperature, CTD salinity, neutral density, and CTD oxygen are contoured for NWPC and Abaco sections conducted during AB1802 in Figures 31 through 38 (refer to Figure 1 for geographical locations of sections). For the Abaco section, nominal vertical exaggerations are 400:1 below 1000 dbar (lower panels) and 200:1 above 1000 dbar (upper panels).

In Appendix A, for each CTD station, the upper table presents “standard depths” of the CTD cast, while the lower table lists the bottle CTD trip depths for the cast. Following the two tables, a page of 4 plots illustrate the data collected of the stations. Niskin bottle depths are indicated on the right side of the larger profile plot and bottle salinity and oxygen values are plotted as points in the three smaller plots. A WOCE formatted CTD cast summary file is shown in Appendix B. It lists information regarding the beginning, middle (bottom of the cast), and end of each CTD cast. Finally, a bottle summary file (WOCE formatted) is presented in Appendix C. This table lists the specific details associated with each Niskin bottle trip over the course of the entire cruise. The -999’s in the tables represent missing data.

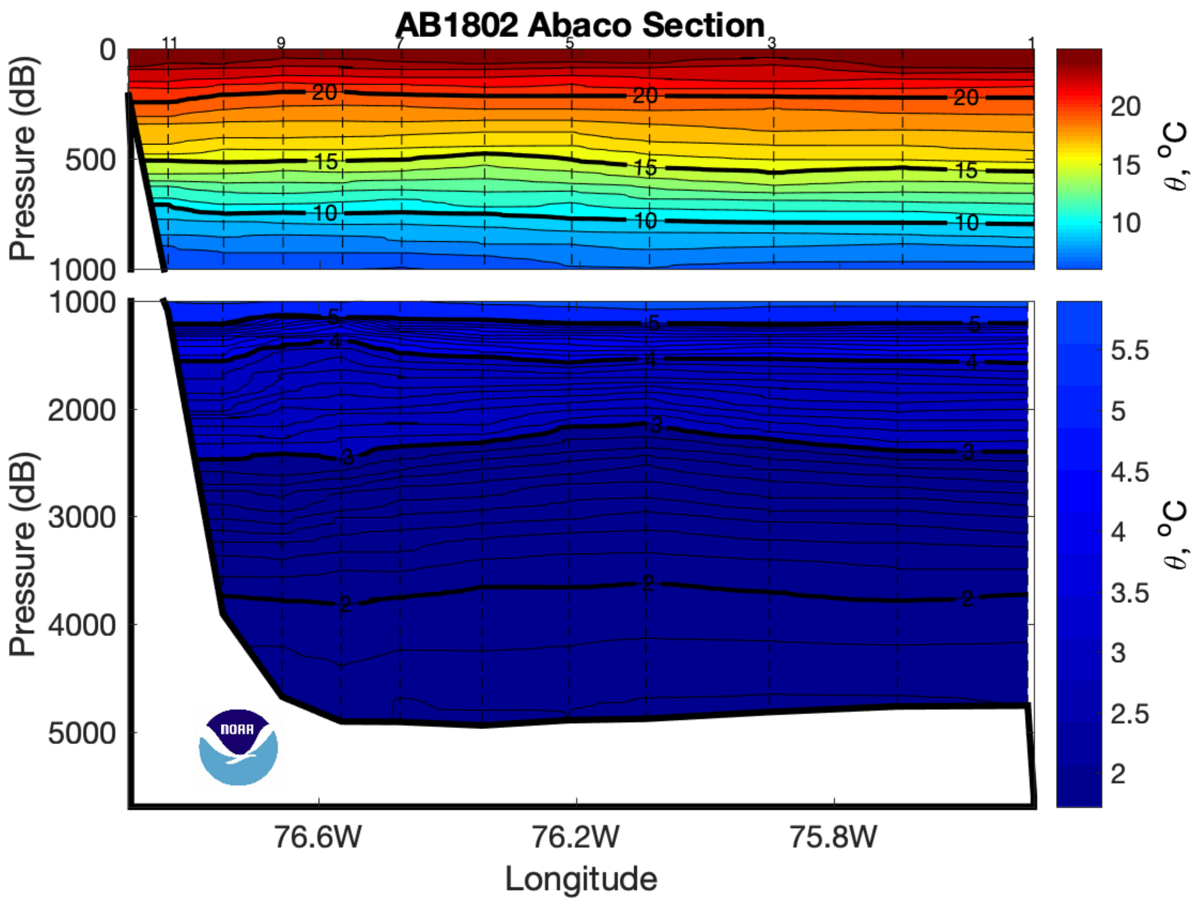

Figure 31: Potential Temperature (°C) section for the Abaco Section. Dashed vertical lines are the CTD station locations.

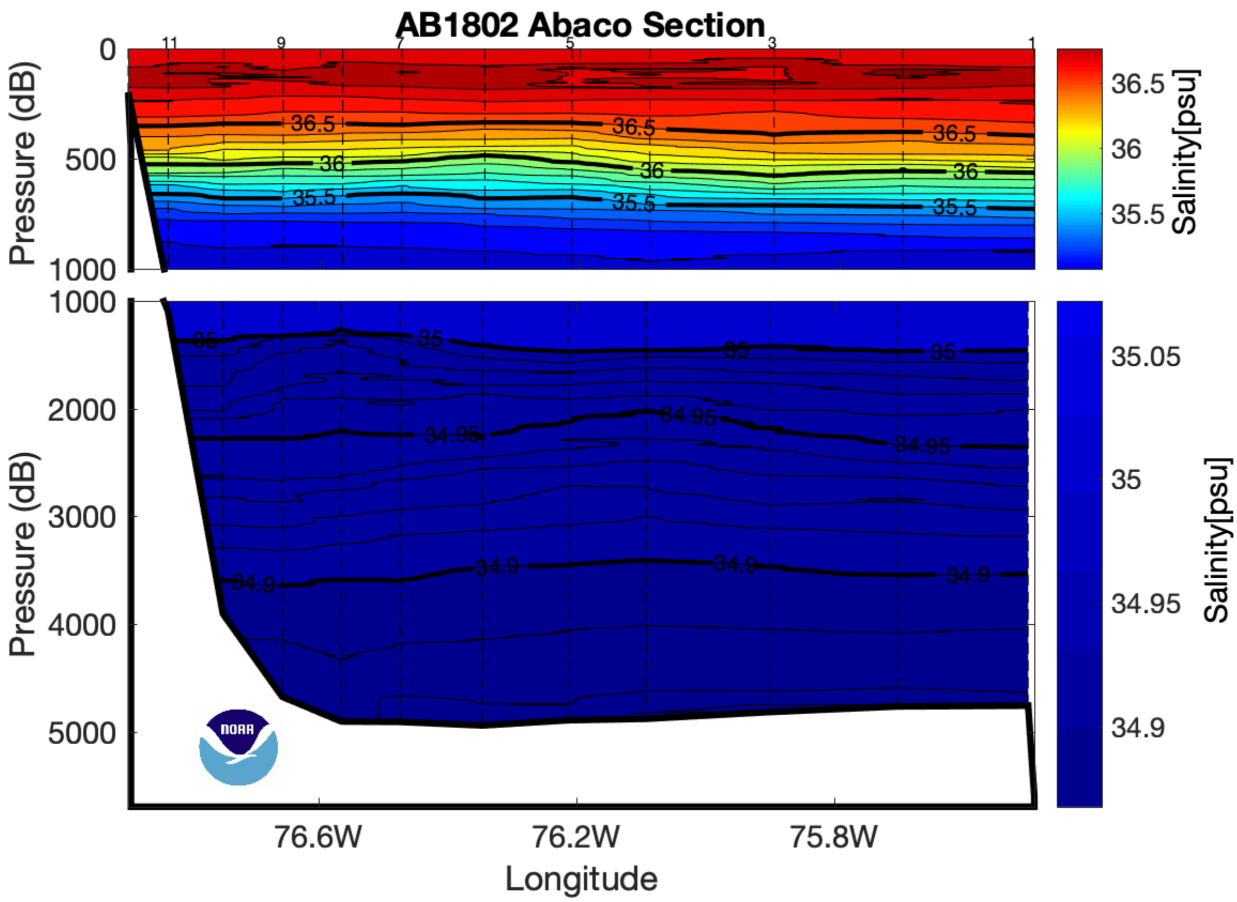

Figure 32: Salinity (PSS 78) section for the Abaco section. Dashed vertical lines are the CTD station locations.

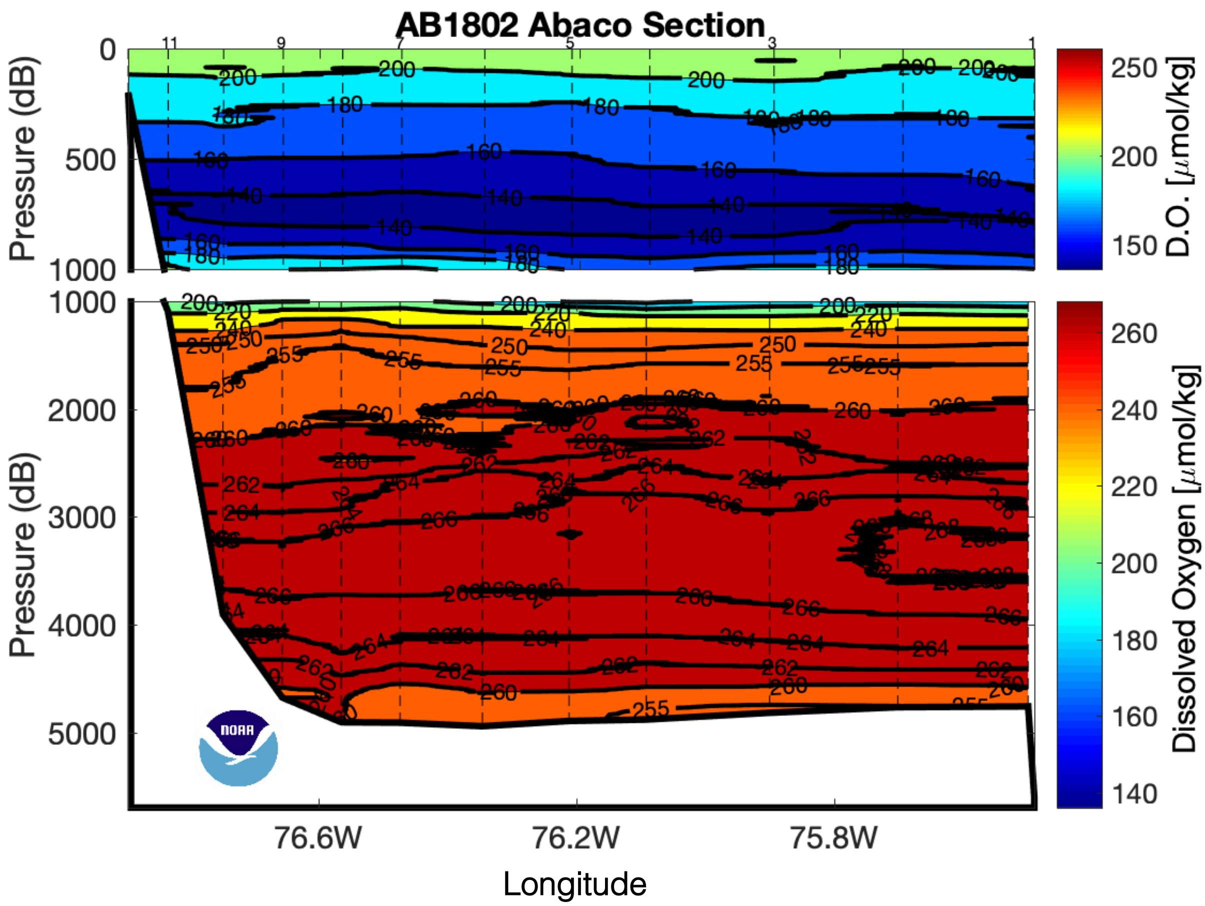

Figure 33: Dissolved Oxygen (μmol/kg) section for the Abaco Section. Dashed vertical lines are the CTD station locations.

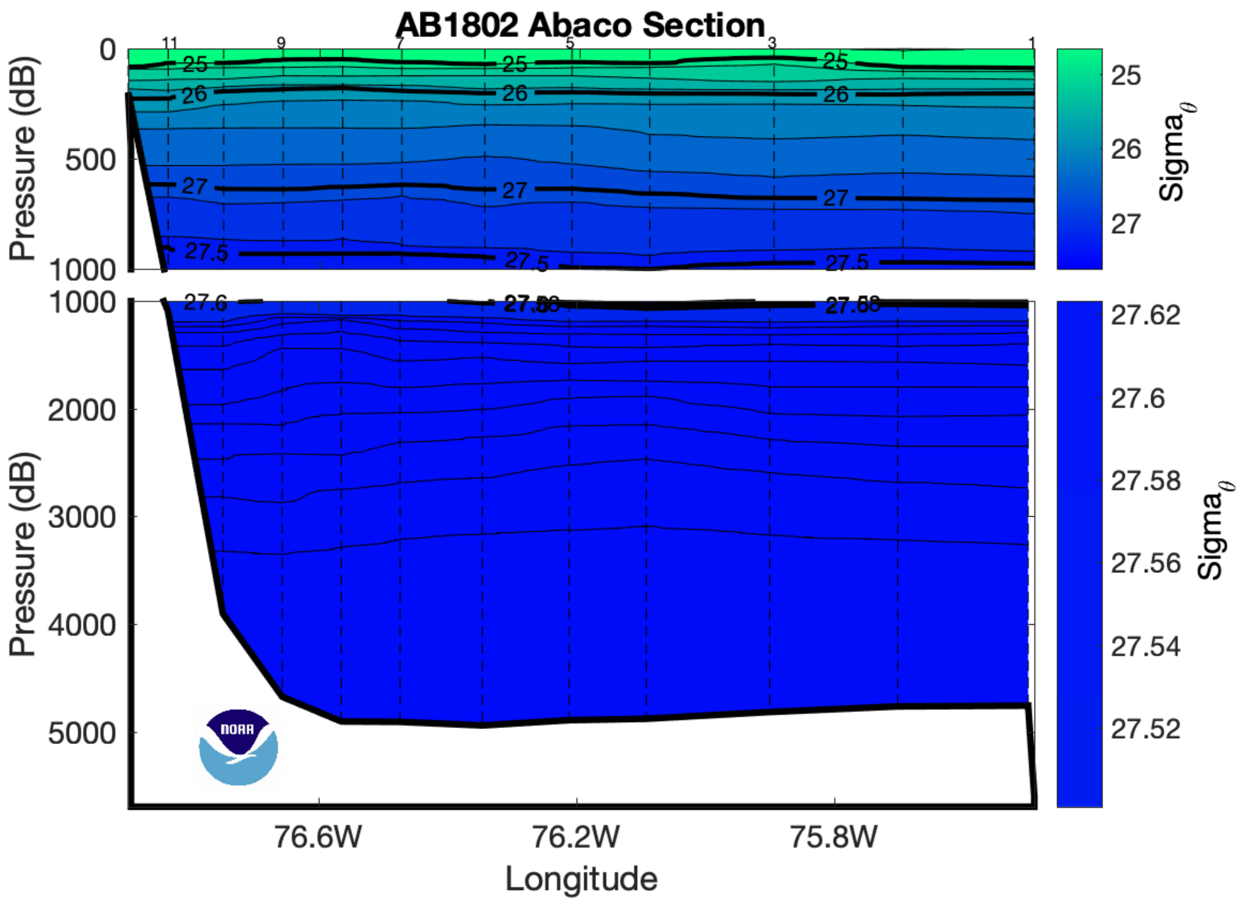

Figure 34: Neutral density (kg/m3) section for the Abaco Section. Dashed vertical lines are the CTD station locations.

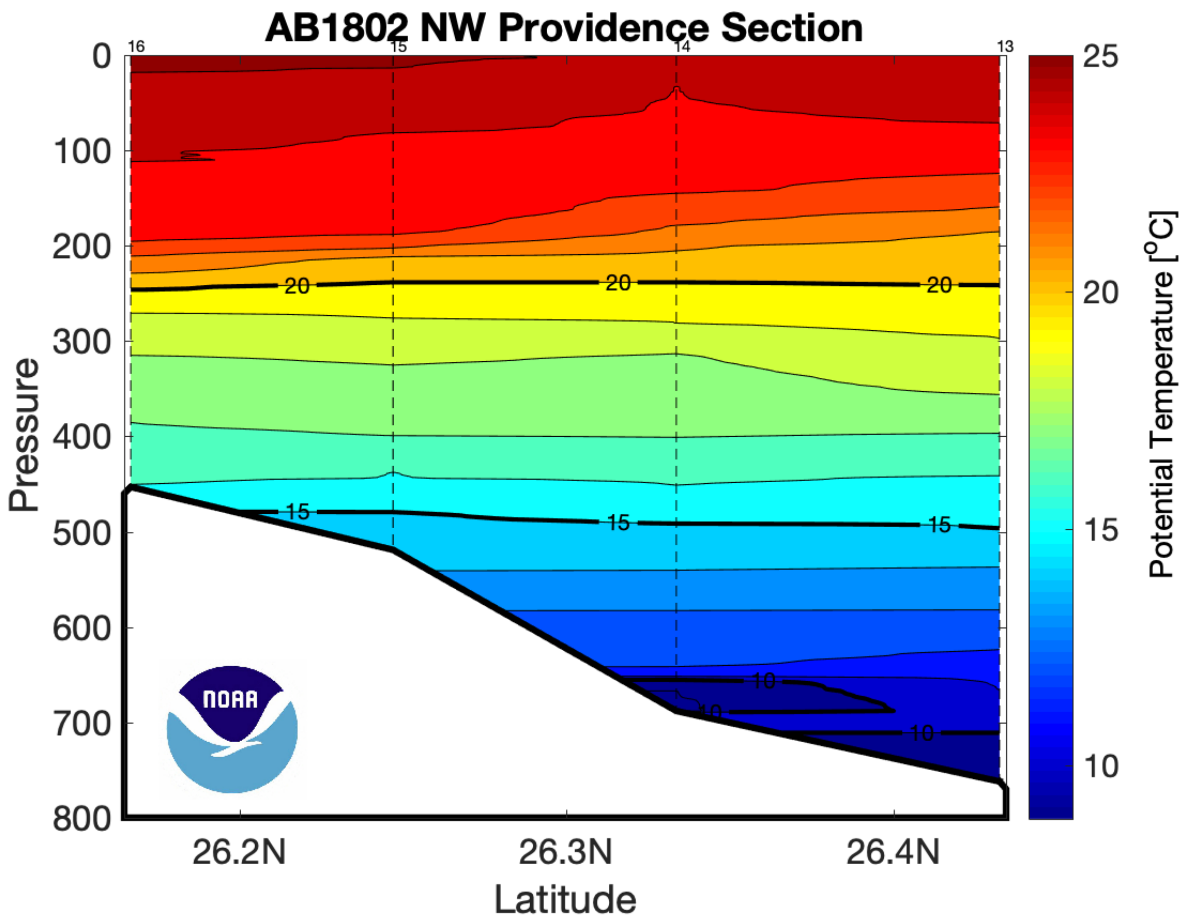

Figure 35: Potential Temperature (°C) section for the Northwest Providence Channel section. Dashed vertical lines are the CTD station locations.

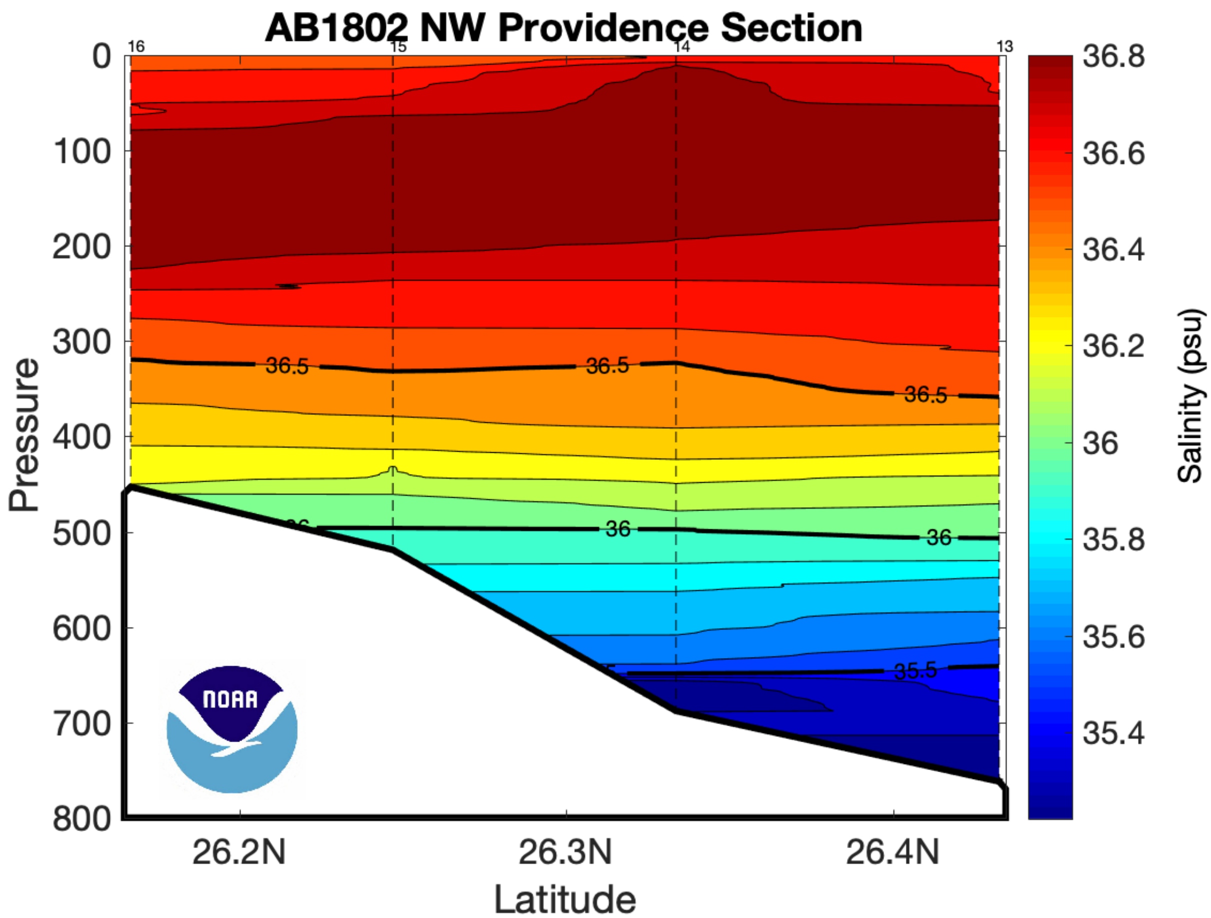

Figure 36: Salinity (PSS 78) section for the Northwest Providence Channel section. Dashed vertical lines are the CTD station locations.

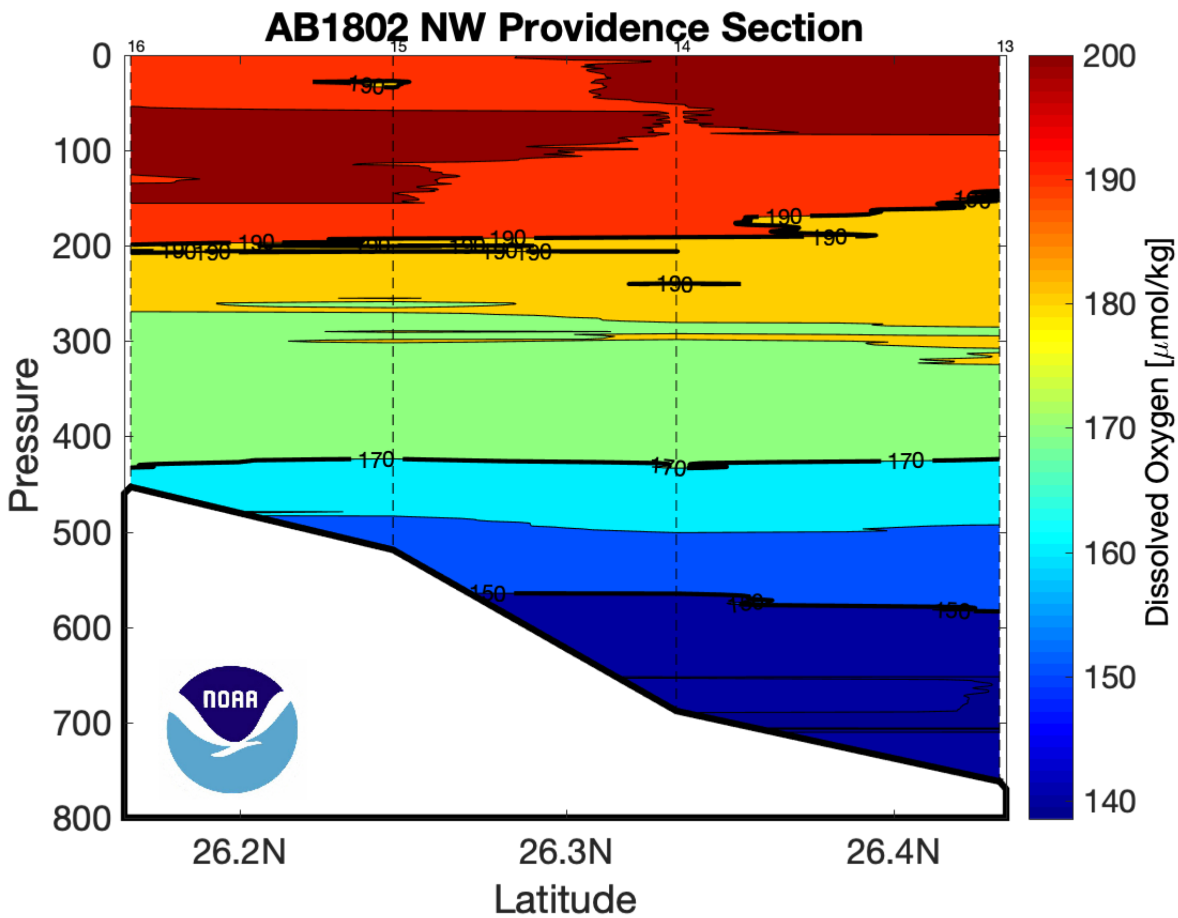

Figure 37: Dissolved Oxygen (μmol/kg) section for the Northwest Providence Channel section. Dashed vertical lines are the CTD station locations.

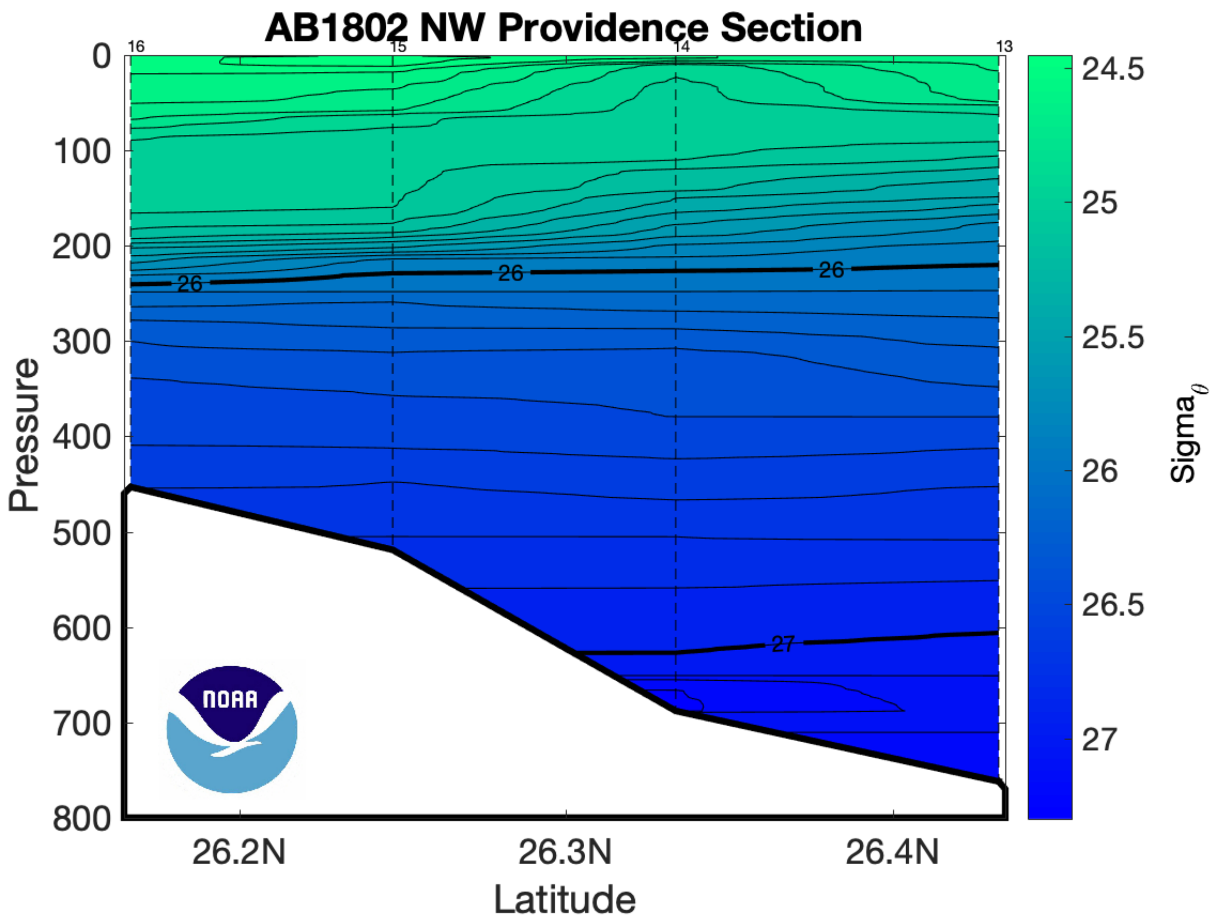

Figure 38: Neutral density (kg/m3) section for the Northwest Providence Channel section. Dashed vertical lines are the CTD station locations.

7 Acknowledgements

The successful completion of cruise AB1802 relied on dedicated assistance from many individuals both on shore and aboard the NOAA ship *Ronald H. Brown*. Investigators and members of the Western Boundary Time Series project and the RAPID/MOC programs were instrumental in planning and executing the cruise. Seagoing cruise participants exhibited dedication and camaraderie during their 10 days at sea. We also thank the officers and crew of the NOAA ship *Ronald H. Brown* for their professionalism and assistance in accomplishing the mission.

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A portion of this research was conducted within the jurisdictional waters of the Bahamas. Bahamian research clearance was obtained prior to the AB1802 survey with a waiver of port entry. We thank the Bahamian government for providing this request of research clearance.

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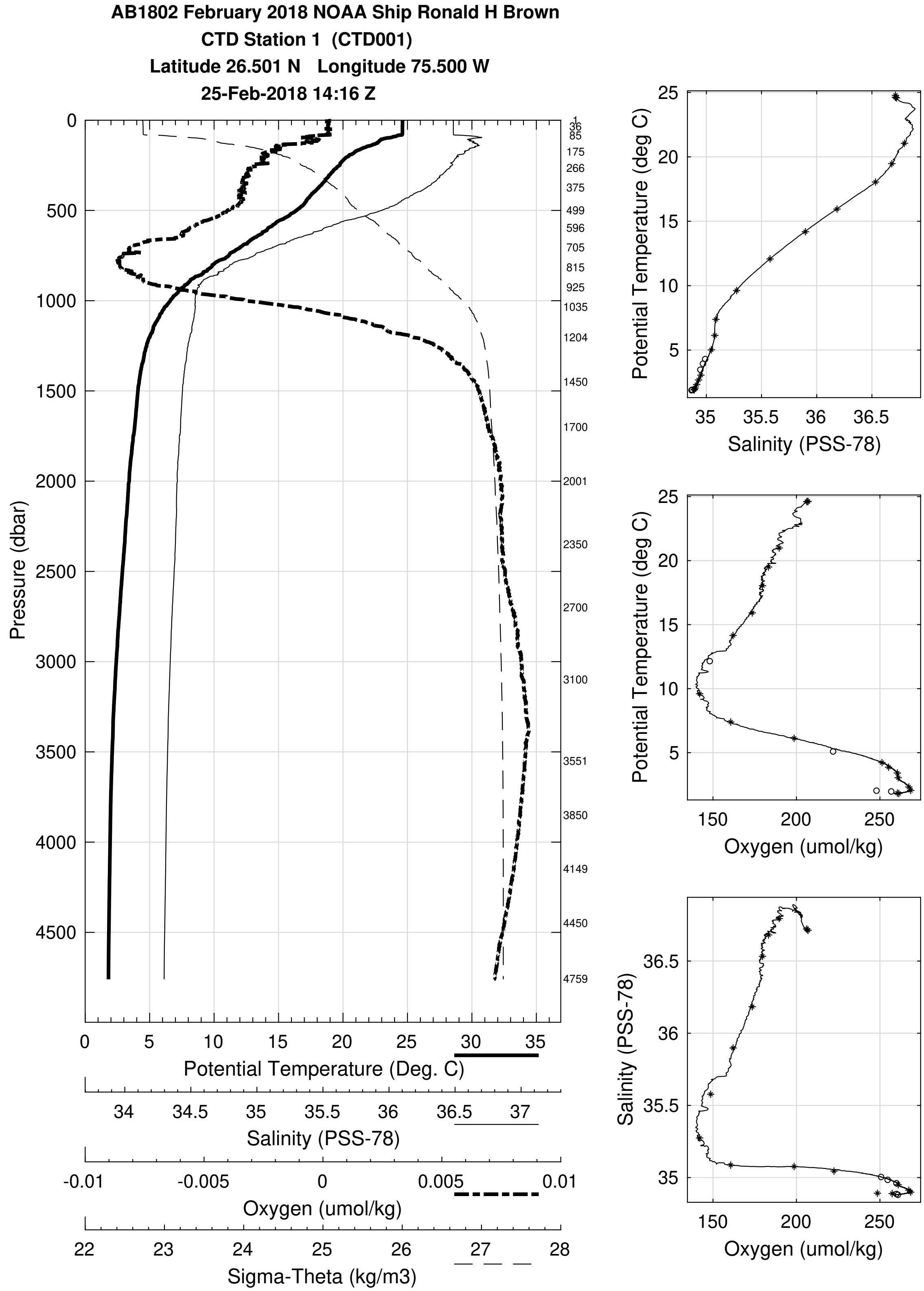
A Hydrographic - CTD Data

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 1 (CTD001)
Latitude 26.501N Longitude 75.500W
25-Feb-2018 14:16Z

Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$	DynHt $m^2 \cdot s^{-2}$	SigT $kg \cdot m^{-3}$
1	24.627	24.627	36.712	206.4	0.003	24.749
10	24.619	24.617	36.711	206.3	0.032	24.752
20	24.622	24.618	36.711	205.7	0.064	24.752
30	24.618	24.612	36.711	205.9	0.096	24.753
50	24.622	24.611	36.711	207.4	0.160	24.754
75	24.626	24.609	36.711	205.8	0.240	24.754
100	23.334	23.313	36.840	202.1	0.315	25.238
125	22.700	22.674	36.840	200.9	0.382	25.425
150	21.769	21.739	36.850	188.9	0.443	25.698
200	20.441	20.403	36.733	186.8	0.554	25.976
250	19.781	19.735	36.703	183.4	0.655	26.132
300	19.062	19.008	36.643	180.8	0.750	26.276
400	17.789	17.720	36.480	180.3	0.927	26.476
500	16.479	16.397	36.258	174.4	1.091	26.623
600	14.247	14.158	35.888	162.6	1.240	26.840
700	12.201	12.106	35.580	144.7	1.371	27.020
800	10.014	9.918	35.301	141.4	1.485	27.201
900	8.120	8.024	35.116	149.2	1.581	27.362
1000	6.702	6.605	35.075	180.3	1.660	27.532
1100	5.746	5.646	35.066	213.3	1.724	27.650
1200	5.122	5.018	35.043	232.6	1.780	27.707
1300	4.695	4.585	35.022	244.1	1.831	27.740
1400	4.402	4.287	35.006	250.4	1.880	27.761
1500	4.213	4.090	34.995	253.7	1.928	27.773
1750	3.874	3.732	34.976	257.5	2.047	27.795
2000	3.570	3.409	34.963	260.2	2.162	27.817
2500	3.090	2.889	34.942	261.8	2.386	27.849
3000	2.654	2.411	34.917	266.9	2.601	27.872
3500	2.385	2.095	34.901	268.2	2.811	27.885
4000	2.274	1.932	34.891	265.7	3.024	27.889
4500	2.238	1.839	34.882	261.4	3.245	27.890

Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$
4759	1	2.239	1.809	34.874	261.3
4450	2	2.239	1.846	34.880	260.5
4150	3	2.258	1.900	34.889	257.3
3851	4	2.289	1.963	34.892	248.5
3551	5	2.352	2.058	34.899	268.4
3100	6	2.575	2.324	34.912	267.3
2701	7	2.896	2.678	34.929	−999.0
2350	8	3.240	3.050	34.950	260.9
2001	9	3.563	3.402	34.954	260.5
1700	10	4.007	3.868	34.978	255.2
1450	11	4.348	4.229	34.998	251.2
1205	12	5.121	5.017	35.045	222.5
1035	13	6.233	6.136	35.077	198.6
926	14	7.476	7.381	35.087	160.6
815	15	9.717	9.621	35.274	142.0
705	16	12.173	12.077	35.577	148.6
597	17	14.277	14.187	35.898	162.0
500	18	16.028	15.947	36.184	173.5
375	19	18.112	18.047	36.533	179.6
266	20	19.521	19.472	36.681	183.3
176	21	21.089	21.055	36.794	189.7
85	22	24.595	24.577	36.722	206.2
36	23	24.637	24.629	36.713	206.9
2	24	24.779	24.779	36.714	206.8



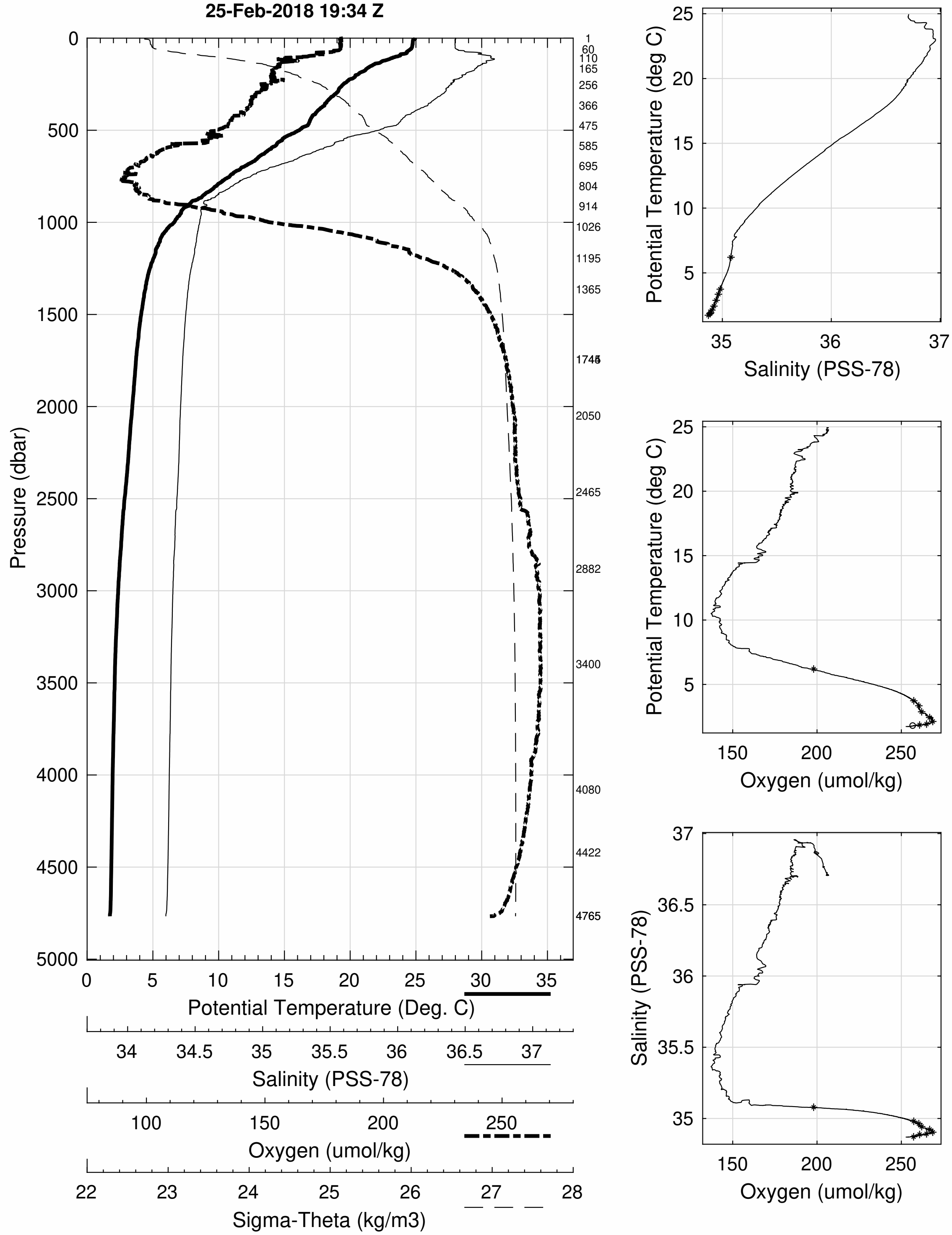
AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 1 (CTD001)
Latitude 26.501 N Longitude 75.500 W
25-Feb-2018 14:16 Z
Pressure (dbar)
Potential Temperature (Deg. C)
Salinity (PSS-78)
Oxygen (umol/kg)
Sigma-Theta (kg/m3)
1
36
85
175
266
375
499
596
705
815
925
1035
1204
1450
1700
2001
2350
2700
3100
3551
3850
4149
4450
4759
Potential Temperature (deg C)
Salinity (PSS-78)
Potential Temperature (deg C)
Oxygen (umol/kg)
Salinity (PSS-78)
Oxygen (umol/kg)

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 2 (CTD002)
Latitude 26.501N Longitude 75.702W
25-Feb-2018 19:34Z

Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$	DynHt $m^2 \cdot s^{-2}$	SigT $kg \cdot m^{-3}$
1	24.926	24.926	36.711	206.3	0.003	24.658
10	24.782	24.780	36.706	205.8	0.033	24.699
20	24.767	24.763	36.707	206.2	0.065	24.704
30	24.762	24.756	36.707	206.2	0.097	24.706
50	24.710	24.699	36.707	206.3	0.162	24.724
75	24.312	24.296	36.787	203.6	0.241	24.906
100	23.523	23.502	36.934	195.7	0.314	25.254
125	22.463	22.438	36.904	192.0	0.379	25.541
150	21.649	21.620	36.856	186.9	0.439	25.736
200	20.490	20.452	36.751	185.3	0.549	25.977
250	19.527	19.481	36.685	181.2	0.650	26.185
300	18.973	18.919	36.632	180.3	0.744	26.290
400	17.529	17.460	36.445	175.8	0.918	26.513
500	16.210	16.128	36.222	167.7	1.079	26.659
600	14.089	14.000	35.872	152.0	1.224	26.862
700	11.927	11.834	35.544	142.1	1.352	27.044
800	9.962	9.866	35.298	141.9	1.464	27.208
900	7.893	7.799	35.113	154.9	1.559	27.393
1000	6.708	6.611	35.085	184.2	1.635	27.539
1100	5.645	5.546	35.064	217.5	1.698	27.660
1200	5.123	5.019	35.043	233.3	1.753	27.707
1300	4.700	4.590	35.020	244.1	1.804	27.738
1400	4.443	4.327	35.007	249.2	1.854	27.757
1500	4.231	4.109	34.996	252.9	1.902	27.772
1750	3.855	3.713	34.976	257.6	2.020	27.797
2000	3.597	3.435	34.963	259.8	2.135	27.814
2500	3.047	2.847	34.940	262.1	2.360	27.851
3000	2.603	2.360	34.914	268.0	2.573	27.874
3500	2.386	2.096	34.901	268.4	2.781	27.885
4000	2.281	1.939	34.891	265.6	2.994	27.890
4500	2.236	1.837	34.882	260.8	3.215	27.890

Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$
4766	1	2.162	8.643	−999.000	−999.0
4766	2	2.162	1.734	34.872	257.3
4422	3	2.245	1.855	34.888	260.8
4081	4	2.273	1.922	34.892	265.0
3400	5	2.408	2.128	34.904	268.6
2882	6	2.667	2.436	34.922	266.8
2465	7	3.079	2.881	34.943	262.1
2050	8	3.519	3.354	34.964	260.4
1745	9	3.884	6.582	−999.000	−999.0
1745	10	3.885	3.744	34.981	257.4
1366	11	4.548	6.665	−999.000	−999.0
1195	12	5.159	6.995	−999.000	−999.0
1026	13	6.304	6.207	35.079	198.0
915	14	7.683	9.000	−999.000	−999.0
805	15	9.884	10.964	−999.000	−999.0
695	16	12.095	12.959	−999.000	−999.0
586	17	14.351	15.019	−999.000	−999.0
476	18	16.749	17.239	−999.000	−999.0
366	19	18.069	18.425	−999.000	−999.0
256	20	19.496	19.728	−999.000	−999.0
166	21	21.254	21.390	−999.000	−999.0
111	22	22.856	22.939	−999.000	−999.0
61	23	24.446	24.487	−999.000	−999.0
2	24	24.863	24.864	−999.000	−999.0

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 2 (CTD002)
Latitude 26.501 N Longitude 75.702 W
25-Feb-2018 19:34 Z

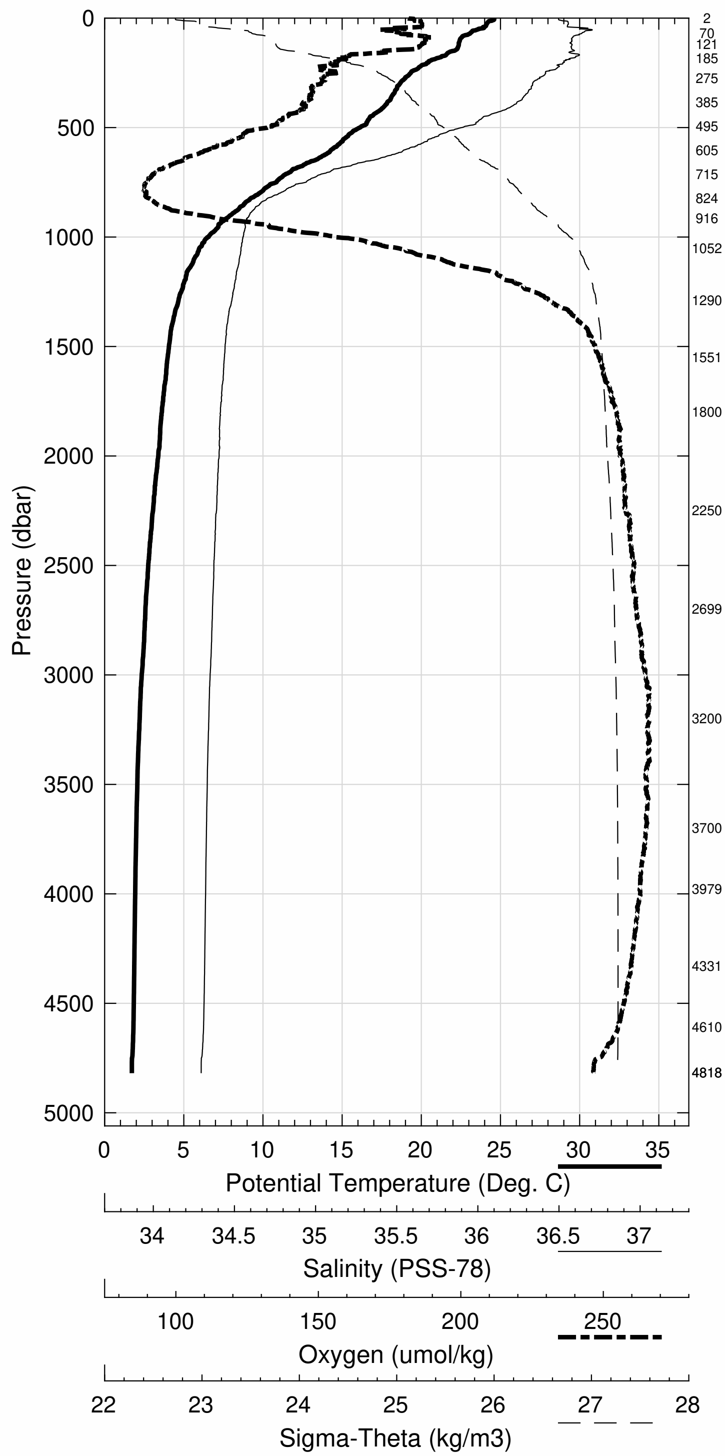


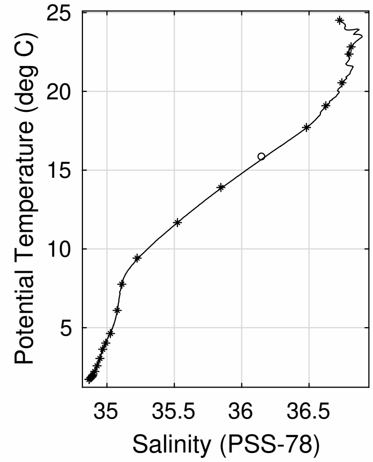
AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 3 (CTD003)
Latitude 26.500N Longitude 75.900W
26-Feb-2018 04:37Z

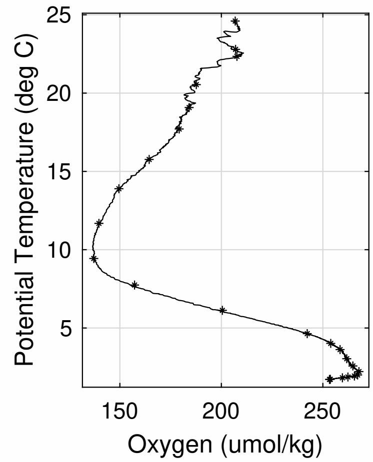
Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	24.599	24.599	36.720	205.1	0.003	24.764
10	24.509	24.507	36.730	206.8	0.032	24.800
20	24.193	24.189	36.769	208.4	0.062	24.925
30	24.110	24.104	36.767	208.8	0.092	24.949
50	23.633	23.622	36.846	204.3	0.151	25.152
75	22.967	22.952	36.825	206.2	0.219	25.333
100	22.459	22.439	36.789	209.9	0.284	25.453
125	22.385	22.359	36.788	208.3	0.348	25.475
150	22.038	22.008	36.797	197.8	0.411	25.582
200	20.502	20.464	36.748	186.1	0.524	25.971
250	19.382	19.337	36.651	186.4	0.624	26.196
300	18.690	18.637	36.585	182.6	0.717	26.326
400	17.769	17.700	36.483	178.7	0.891	26.482
500	16.202	16.121	36.218	168.7	1.053	26.657
600	14.434	14.344	35.928	153.4	1.199	26.831
700	11.867	11.774	35.538	140.5	1.330	27.051
800	9.847	9.752	35.273	137.5	1.441	27.207
900	8.047	7.952	35.118	151.0	1.536	27.374
1000	6.623	6.527	35.084	186.2	1.614	27.550
1100	5.748	5.648	35.065	213.2	1.677	27.649
1200	5.149	5.045	35.044	231.4	1.733	27.705
1300	4.748	4.639	35.024	242.5	1.785	27.736
1400	4.371	4.256	35.002	250.3	1.834	27.760
1500	4.183	4.061	34.992	253.5	1.882	27.773
1750	3.832	3.691	34.973	257.8	1.999	27.797
2000	3.550	3.389	34.961	259.9	2.114	27.817
2500	2.953	2.754	34.934	263.4	2.334	27.855
3000	2.584	2.342	34.914	266.6	2.544	27.875
3500	2.354	2.065	34.900	266.7	2.751	27.886
4000	2.274	1.932	34.891	265.1	2.963	27.890
4500	2.241	1.842	34.883	260.8	3.184	27.890

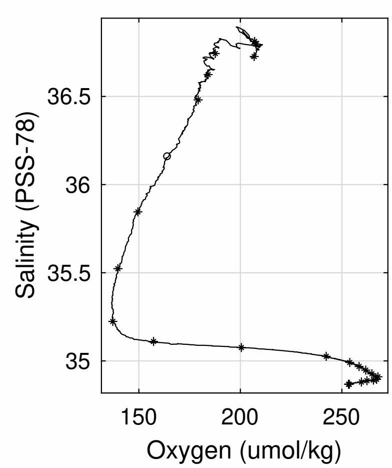
Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
4818	1	2.155	1.720	34.867	253.7
4818	2	2.156	1.720	34.868	253.3
4610	3	2.232	1.820	34.880	259.6
4331	4	2.251	1.871	34.888	262.3
3980	5	2.276	1.936	34.891	265.5
3701	6	2.314	2.004	34.895	267.1
3201	7	2.480	2.220	34.910	267.8
2700	8	2.797	2.582	34.927	264.8
2251	9	3.226	3.046	34.948	261.8
1800	10	3.775	3.630	34.968	258.5
1552	11	4.150	4.024	34.991	253.9
1291	12	4.739	4.630	35.026	242.3
1052	13	6.195	6.097	35.076	200.5
916	14	7.856	7.760	35.110	157.2
825	15	9.513	9.416	35.224	137.1
715	16	11.765	11.670	35.523	139.7
606	17	13.991	13.902	35.845	149.5
496	18	15.876	15.796	36.155	164.4
386	19	17.775	17.708	36.481	179.2
276	20	19.138	19.088	36.624	184.1
186	21	20.580	20.545	36.743	187.6
121	22	22.392	22.368	36.797	207.7
71	23	22.840	22.825	36.812	207.0
3	24	24.514	24.513	36.727	206.8

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 3 (CTD003)
Latitude 26.500 N Longitude 75.900 W
26-Feb-2018 04:37 Z







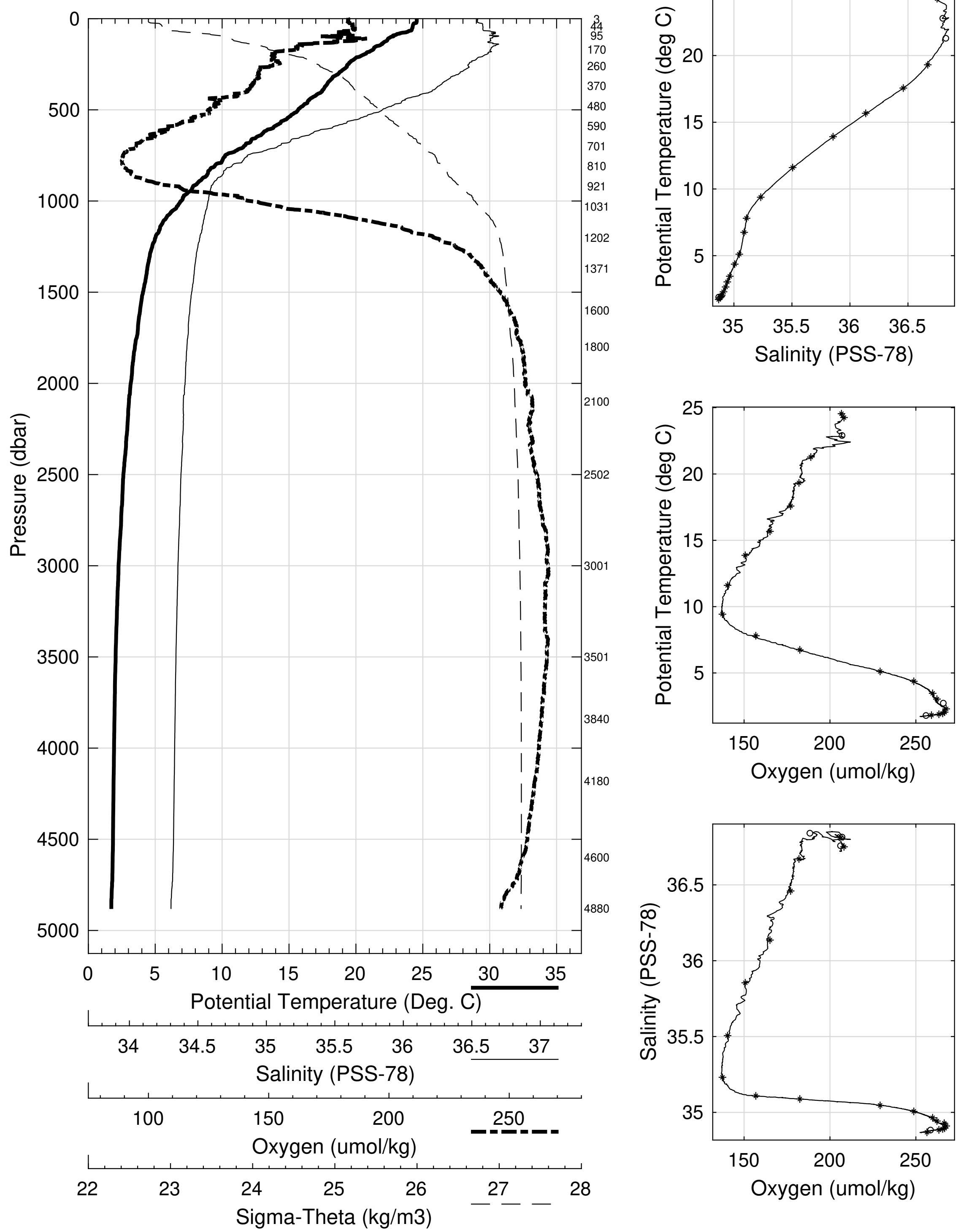


AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 4 (CTD004)
Latitude 26.500N Longitude 76.091W
26-Feb-2018 09:31Z

Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$	DynHt $m^2 \cdot s^{-2}$	SigT $kg \cdot m^{-3}$
1	24.546	24.546	36.724	206.3	0.003	24.783
10	24.548	24.546	36.722	206.2	0.032	24.782
20	24.535	24.531	36.723	206.7	0.063	24.787
30	24.306	24.299	36.754	207.9	0.094	24.880
50	24.241	24.231	36.756	207.3	0.156	24.902
75	23.770	23.755	36.832	202.9	0.231	25.102
100	22.635	22.614	36.815	203.0	0.298	25.422
125	22.227	22.202	36.795	201.4	0.362	25.525
150	21.577	21.548	36.819	191.2	0.422	25.728
200	20.526	20.487	36.765	183.2	0.533	25.978
250	19.462	19.416	36.668	184.7	0.633	26.189
300	18.775	18.721	36.614	178.6	0.726	26.327
400	17.521	17.452	36.441	175.5	0.897	26.511
500	15.758	15.678	36.146	163.4	1.054	26.704
600	13.905	13.817	35.842	150.4	1.197	26.877
700	11.719	11.627	35.515	141.3	1.322	27.061
800	9.617	9.523	35.243	137.4	1.431	27.223
900	8.294	8.197	35.126	147.1	1.527	27.343
1000	7.035	6.935	35.093	176.2	1.609	27.501
1100	5.859	5.759	35.067	209.5	1.676	27.637
1200	5.130	5.026	35.043	232.3	1.733	27.706
1300	4.706	4.597	35.021	243.5	1.784	27.738
1400	4.469	4.353	35.008	248.2	1.834	27.754
1500	4.206	4.084	34.993	252.9	1.882	27.772
1750	3.757	3.617	34.969	258.2	1.999	27.801
2000	3.330	3.172	34.953	260.5	2.109	27.831
2500	2.815	2.619	34.928	263.8	2.320	27.862
3000	2.499	2.259	34.910	267.3	2.525	27.878
3500	2.331	2.043	34.898	266.9	2.729	27.887
4000	2.265	1.923	34.890	264.5	2.940	27.890
4500	2.244	1.845	34.883	261.0	3.161	27.890

Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$
4881	1	2.163	1.720	34.869	256.4
4600	2	2.233	1.822	34.877	259.1
4181	3	2.249	1.887	34.885	263.4
3841	4	2.279	1.955	34.891	265.6
3501	5	2.333	2.045	34.896	266.7
3002	6	2.536	2.295	34.910	267.6
2502	7	2.854	2.657	34.929	266.5
2100	8	3.200	3.036	34.943	262.3
1800	9	3.602	3.459	34.964	259.8
1601	10	3.976	6.466	−999.000	−999.0
1372	11	4.481	4.367	35.007	248.8
1202	12	5.217	5.112	35.046	229.2
1032	13	6.849	6.748	35.088	182.4
921	14	7.903	7.806	35.109	156.8
811	15	9.476	9.382	35.231	137.4
701	16	11.695	11.603	35.506	140.4
591	17	14.003	13.916	35.854	150.7
481	18	15.748	15.672	36.136	165.1
371	19	17.626	17.563	36.460	177.1
261	20	19.355	19.307	36.671	181.9
171	21	21.256	21.223	36.834	188.8
95	22	22.738	22.719	36.809	207.6
45	23	24.268	24.258	36.751	208.2
3	24	24.603	24.603	36.752	206.7

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 4 (CTD004)
Latitude 26.500 N Longitude 76.091 W
26-Feb-2018 09:31 Z



AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 5 (CTD005)
Latitude 26.500N Longitude 76.211W
26-Feb-2018 16:05Z

Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$	DynHt $m^2 \cdot s^{-2}$	SigT $kg \cdot m^{-3}$
1	24.453	24.453	36.749	206.6	0.003	24.830
10	24.414	24.412	36.748	206.7	0.031	24.842
20	24.388	24.384	36.749	206.3	0.062	24.851
30	24.197	24.190	36.754	208.2	0.093	24.913
50	24.158	24.148	36.752	207.4	0.154	24.925
75	23.406	23.391	36.818	203.9	0.227	25.199
100	22.755	22.735	36.781	206.9	0.295	25.362
125	21.890	21.866	36.791	198.4	0.358	25.618
150	21.302	21.273	36.783	190.2	0.416	25.777
200	20.334	20.296	36.750	183.0	0.524	26.018
250	19.462	19.416	36.685	178.8	0.623	26.202
300	18.507	18.454	36.580	178.8	0.715	26.369
400	16.713	16.647	36.309	171.1	0.881	26.604
500	15.117	15.039	36.040	158.9	1.031	26.766
600	13.328	13.242	35.754	145.9	1.167	26.928
700	11.058	10.969	35.425	138.0	1.287	27.113
800	9.456	9.364	35.226	137.7	1.395	27.236
900	7.975	7.879	35.112	152.1	1.489	27.380
1000	6.898	6.800	35.088	178.5	1.569	27.516
1100	5.550	5.452	35.060	218.9	1.632	27.669
1200	5.122	5.018	35.043	231.9	1.687	27.707
1300	4.697	4.587	35.021	243.4	1.739	27.739
1400	4.416	4.301	35.006	248.9	1.788	27.759
1500	4.234	4.111	34.996	251.6	1.837	27.771
1750	3.776	3.635	34.972	257.6	1.954	27.802
2000	3.386	3.227	34.955	259.9	2.065	27.828
2500	2.888	2.690	34.932	262.6	2.278	27.859
3000	2.559	2.318	34.913	266.2	2.485	27.876
3500	2.346	2.057	34.899	267.0	2.690	27.886
4000	2.269	1.928	34.891	264.4	2.901	27.890
4500	2.257	1.858	34.885	261.5	3.123	27.891

Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$
4894	1	2.249	1.801	34.873	258.2
4501	2	2.257	1.857	34.886	265.0
4100	3	2.263	1.910	34.882	229.6
3730	4	2.294	1.982	34.892	269.9
3350	5	2.370	2.097	34.898	267.2
2850	6	2.612	2.385	34.912	242.7
2400	7	2.934	2.745	34.933	261.9
2101	8	3.223	3.058	34.948	260.7
1781	9	3.698	3.556	34.966	258.6
1611	10	3.977	3.847	34.979	255.9
1441	11	4.308	4.190	34.993	251.1
1271	12	4.836	4.728	35.028	240.3
1101	13	5.716	5.616	35.063	214.7
935	14	7.753	7.655	35.105	157.8
825	15	9.529	9.433	35.233	139.0
715	16	11.106	11.015	35.430	138.4
605	17	13.282	13.196	35.743	147.2
496	18	15.373	15.295	36.080	161.8
386	19	17.268	17.203	36.399	175.6
275	20	18.986	18.936	36.635	179.9
186	21	20.657	20.621	36.778	185.1
116	22	22.449	22.426	36.795	205.8
2	23	24.631	24.632	−999.000	−999.0
2	24	24.633	24.633	36.751	207.9

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 5 (CTD005)
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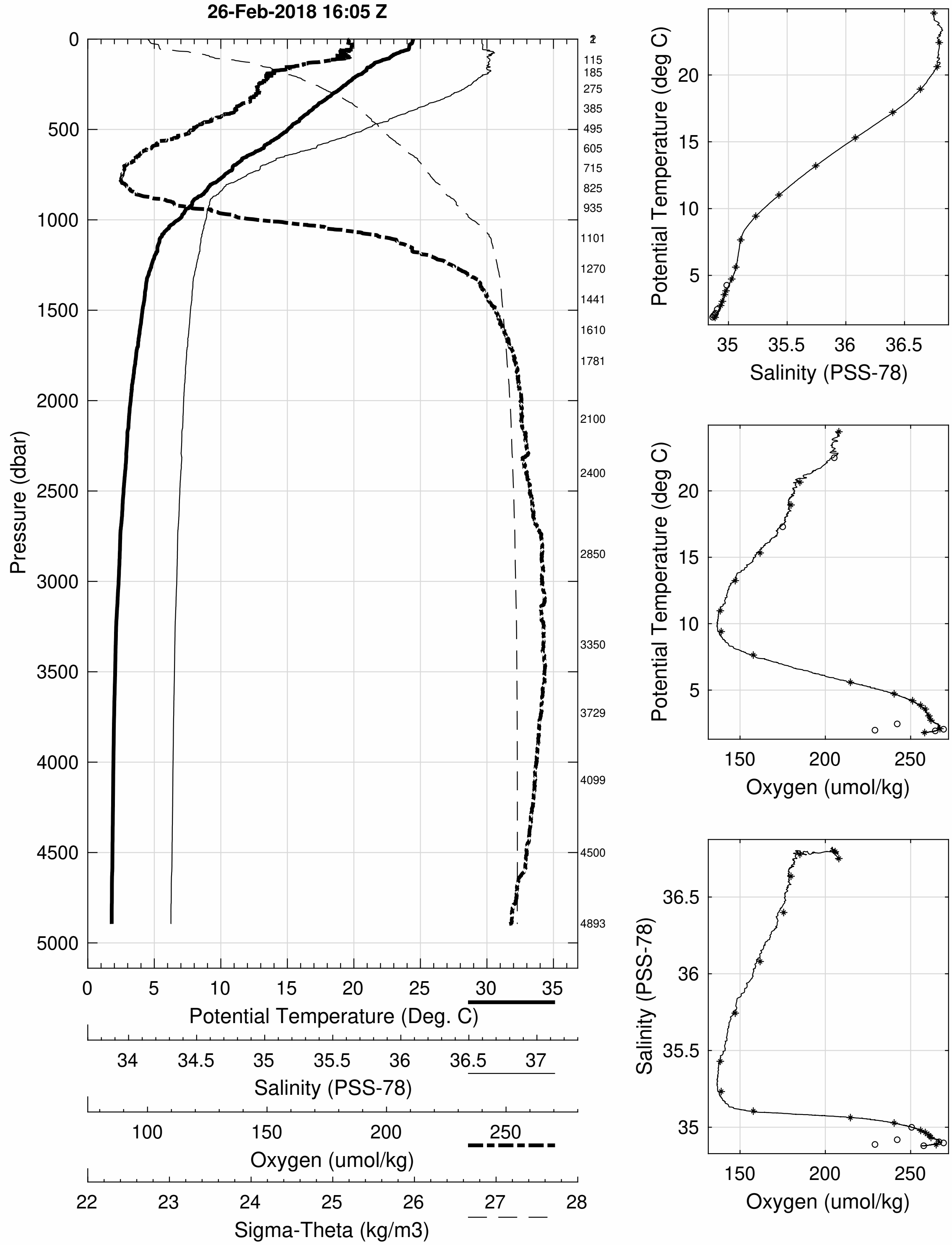
26-Feb-2018 16:05 Z



AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 6 (CTD006)
Latitude 26.496N Longitude 76.345W
26-Feb-2018 20:50Z

Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$	DynHt $m^2 \cdot s^{-2}$	SigT $kg \cdot m^{-3}$
1	24.451	24.451	36.763	207.2	0.003	24.841
10	24.311	24.308	36.760	207.2	0.031	24.882
20	24.251	24.246	36.764	207.8	0.061	24.904
30	24.234	24.228	36.763	208.1	0.092	24.909
50	24.221	24.210	36.761	207.9	0.153	24.912
75	23.787	23.771	36.783	206.4	0.229	25.060
100	22.903	22.883	36.843	201.7	0.297	25.366
125	22.143	22.118	36.878	187.5	0.360	25.612
150	21.584	21.555	36.840	186.9	0.419	25.742
200	20.525	20.487	36.774	181.1	0.529	25.985
250	19.604	19.558	36.692	181.2	0.629	26.169
300	18.542	18.489	36.588	177.9	0.721	26.366
400	16.801	16.734	36.328	169.7	0.886	26.597
500	14.465	14.390	35.935	153.7	1.035	26.827
600	12.856	12.773	35.681	144.1	1.167	26.967
700	11.403	11.312	35.473	138.6	1.287	27.087
800	9.209	9.118	35.203	138.3	1.393	27.258
900	7.911	7.816	35.112	153.5	1.484	27.389
1000	6.323	6.229	35.078	195.3	1.558	27.585
1100	5.588	5.490	35.062	218.7	1.618	27.666
1200	4.960	4.857	35.035	236.8	1.672	27.720
1300	4.659	4.550	35.018	244.4	1.723	27.741
1400	4.359	4.244	35.002	249.9	1.772	27.762
1500	4.165	4.042	34.993	252.9	1.819	27.776
1750	3.812	3.671	34.973	257.3	1.935	27.799
2000	3.457	3.297	34.952	260.7	2.049	27.819
2500	2.974	2.774	34.936	261.8	2.268	27.854
3000	2.592	2.350	34.915	266.0	2.479	27.875
3500	2.337	2.048	34.899	266.6	2.686	27.887
4000	2.278	1.936	34.892	264.6	2.897	27.890
4500	2.257	1.857	34.885	261.4	3.119	27.891

Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$
4943	1	2.243	1.790	34.875	254.7
4581	2	2.256	1.847	34.880	259.8
4235	3	2.273	1.905	34.885	262.0
3901	4	2.287	1.956	34.889	264.8
3565	5	2.342	2.046	34.897	267.2
3145	6	2.541	2.285	34.911	266.8
2736	7	2.793	2.574	34.915	265.2
2321	8	3.196	3.010	34.947	259.8
1956	9	3.506	3.350	34.956	260.8
1701	10	3.841	3.704	34.977	255.4
1501	11	4.137	4.015	34.995	252.7
1351	12	4.427	4.316	35.001	247.5
1176	13	5.055	4.954	35.038	225.9
986	14	6.407	6.314	35.085	192.8
806	15	9.692	9.597	35.252	135.6
696	16	11.133	11.044	35.438	137.6
585	17	12.932	12.850	35.696	144.7
475	18	15.350	15.276	36.086	158.9
365	19	17.246	17.184	36.390	175.9
255	20	19.541	19.494	36.689	179.8
165	21	21.139	21.107	36.811	168.9
105	22	22.702	22.680	36.879	195.4
55	23	24.103	24.091	36.765	208.2
2	24	24.406	24.405	36.765	207.5

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 6 (CTD006)
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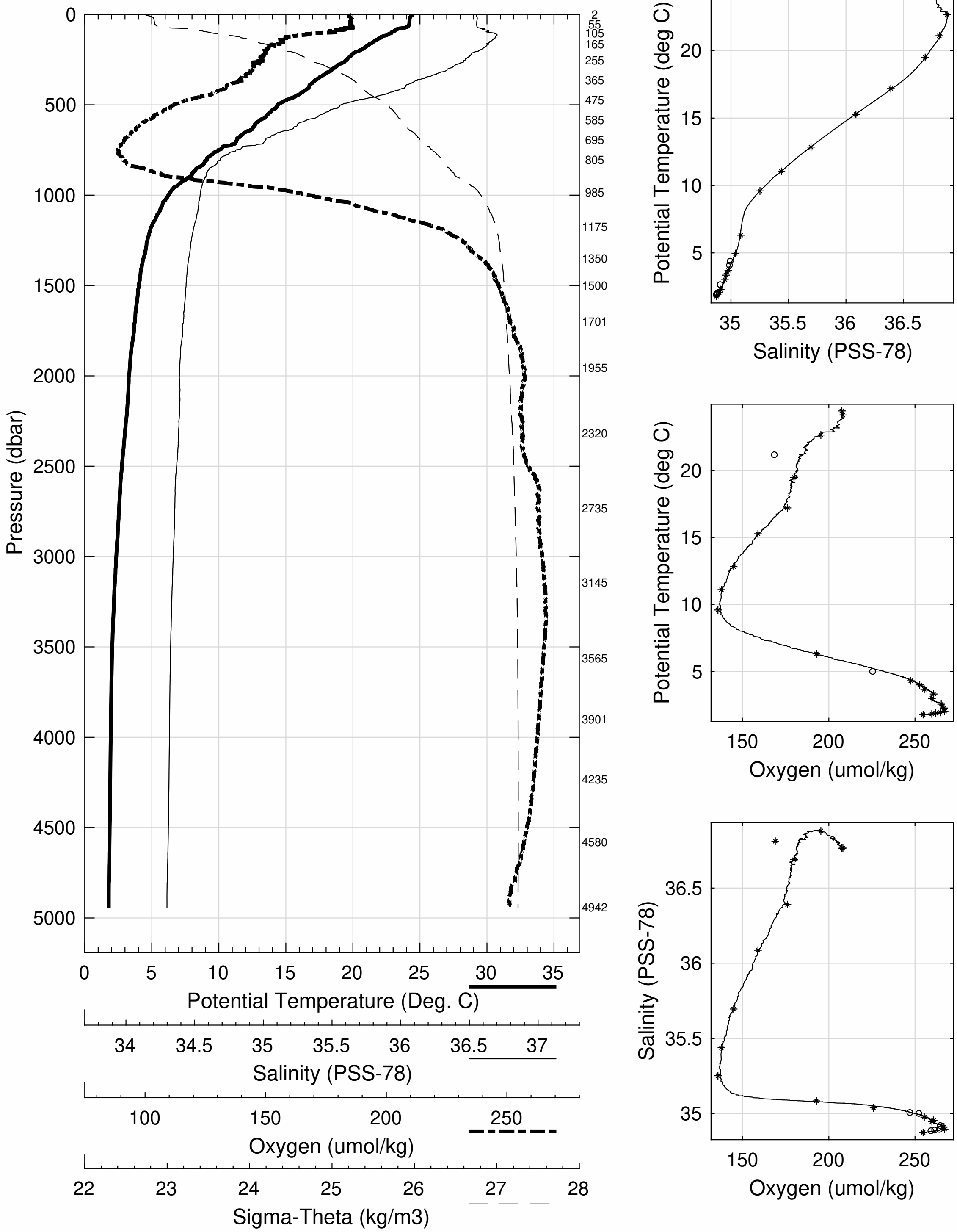
26-Feb-2018 20:50 Z



AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 7 (CTD007)
Latitude 26.490N Longitude 76.473W
27-Feb-2018 01:30Z

Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	$\mu mol \cdot kg^{-1}$	$m^2 \cdot s^{-2}$	$kg \cdot m^{-3}$
1	24.533	24.532	36.760	206.2	0.003	24.814
10	24.534	24.532	36.759	206.4	0.031	24.814
20	24.384	24.379	36.755	207.4	0.063	24.857
30	24.279	24.272	36.750	207.1	0.093	24.885
50	24.234	24.224	36.750	208.4	0.155	24.900
75	23.526	23.510	36.824	202.3	0.229	25.168
100	22.809	22.789	36.897	194.8	0.296	25.434
125	22.145	22.120	36.872	188.7	0.359	25.607
150	21.371	21.342	36.843	183.7	0.418	25.804
200	20.244	20.206	36.749	181.3	0.525	26.042
250	19.166	19.120	36.648	181.7	0.622	26.250
300	18.445	18.392	36.577	177.9	0.712	26.382
400	16.993	16.926	36.354	171.2	0.880	26.572
500	15.171	15.093	36.050	157.6	1.032	26.761
600	12.869	12.785	35.683	144.2	1.167	26.966
700	10.766	10.679	35.388	136.9	1.284	27.136
800	9.037	8.947	35.183	138.7	1.387	27.270
900	7.737	7.644	35.102	156.2	1.475	27.407
1000	5.991	5.899	35.073	204.1	1.545	27.623
1100	5.350	5.253	35.057	224.4	1.601	27.691
1200	4.908	4.806	35.038	236.8	1.654	27.728
1300	4.467	4.360	35.004	248.2	1.704	27.751
1400	4.215	4.101	34.987	253.0	1.752	27.766
1500	4.101	3.979	34.983	254.3	1.799	27.775
1750	3.790	3.650	34.968	257.8	1.915	27.797
2000	3.543	3.382	34.958	259.5	2.030	27.815
2500	3.062	2.861	34.942	260.8	2.252	27.851
3000	2.640	2.397	34.917	265.6	2.465	27.873
3500	2.398	2.108	34.903	266.6	2.675	27.885
4000	2.279	1.937	34.892	264.5	2.888	27.890
4500	2.248	1.848	34.884	260.7	3.109	27.891

Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	$\mu mol \cdot kg^{-1}$
4910	1	2.245	1.795	34.880	259.1
4532	2	2.249	1.846	34.887	259.4
4161	3	2.275	1.915	34.892	263.1
3771	4	2.326	2.009	34.897	265.9
3406	5	2.442	2.161	34.903	266.6
2996	6	2.642	2.399	34.918	264.9
2581	7	3.000	2.792	34.940	260.9
2166	8	3.352	3.178	34.954	259.1
1856	9	3.710	3.560	34.967	258.1
1596	10	3.962	3.833	34.979	254.8
1401	11	4.224	4.110	34.988	254.9
1231	12	4.724	4.621	35.028	240.6
1060	13	5.522	5.428	35.063	219.1
951	14	6.758	6.666	35.087	182.0
841	15	8.353	8.262	35.130	143.9
730	16	10.413	10.323	35.341	134.6
620	17	12.632	12.546	35.647	141.4
511	18	14.796	14.718	35.987	155.6
400	19	16.732	16.666	36.304	165.8
290	20	18.716	18.665	36.605	177.5
200	21	20.499	20.461	36.768	181.3

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 7 (CTD007)
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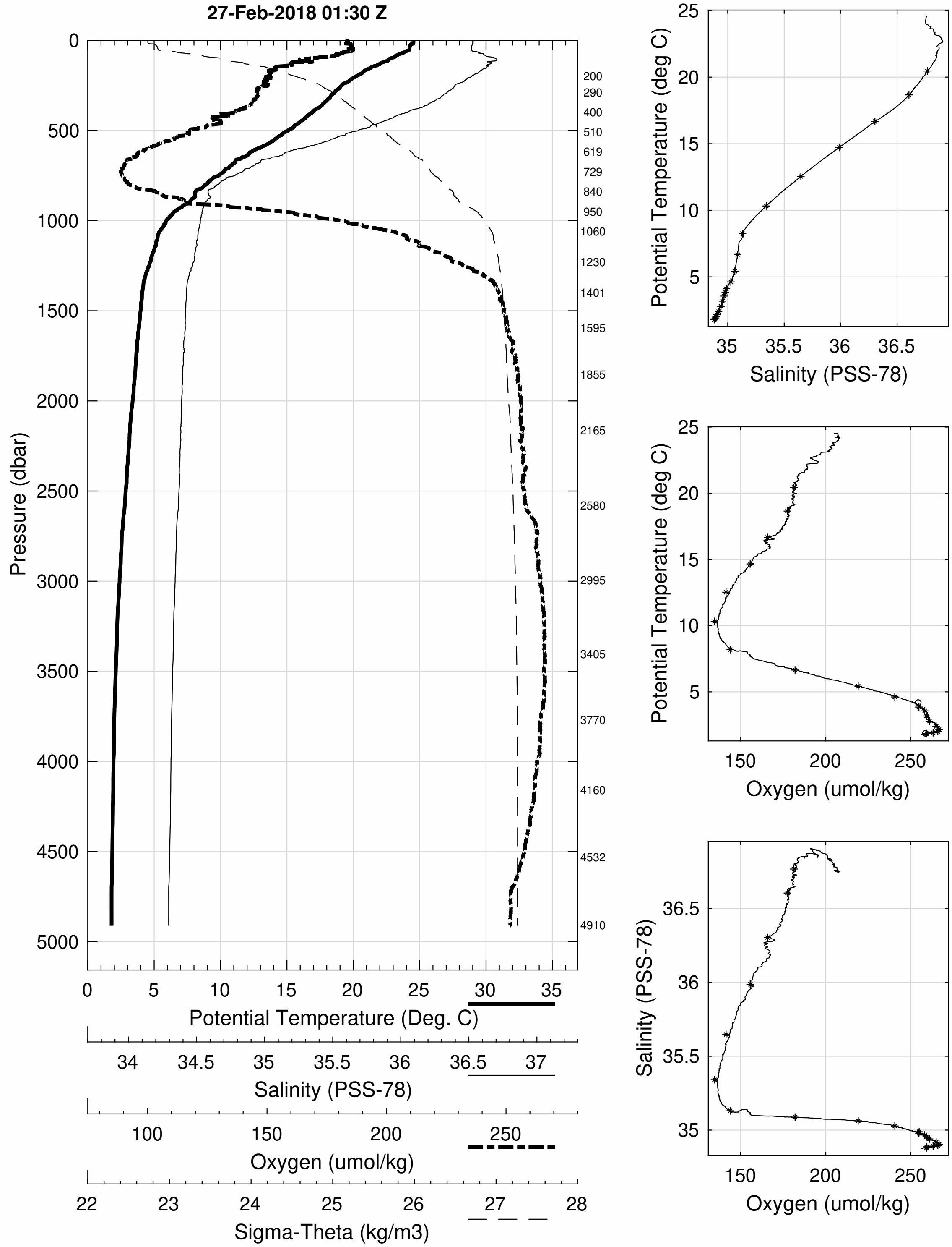
27-Feb-2018 01:30 Z

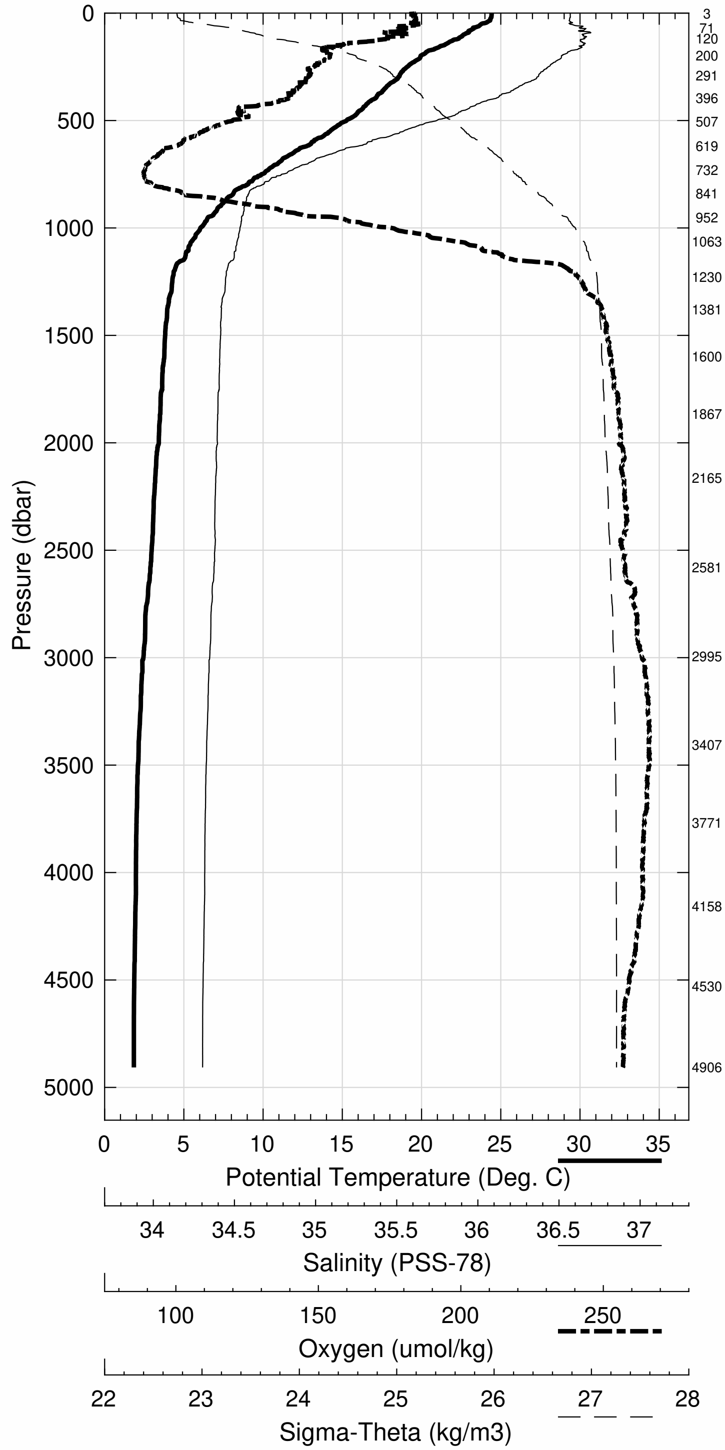


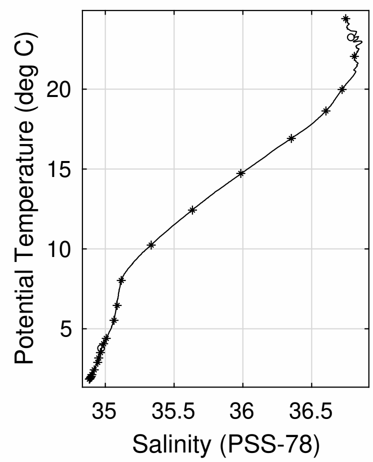
AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 8 (CTD008)
Latitude 26.499N Longitude 76.564W
27-Feb-2018 11:07Z

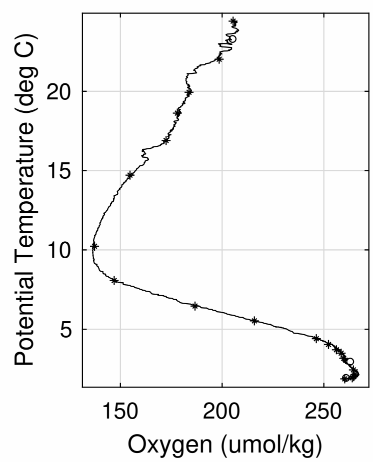
Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	$\mu mol \cdot kg^{-1}$	$m^2 \cdot s^{-2}$	$kg \cdot m^{-3}$
1	24.424	24.424	36.760	206.3	0.003	24.848
10	24.422	24.420	36.761	206.6	0.031	24.849
20	24.412	24.408	36.761	205.9	0.062	24.853
30	24.343	24.337	36.757	207.3	0.093	24.871
50	23.799	23.789	36.760	206.9	0.153	25.038
75	23.221	23.206	36.836	201.7	0.224	25.267
100	22.675	22.655	36.825	204.7	0.291	25.418
125	22.029	22.004	36.812	196.6	0.354	25.594
150	21.426	21.397	36.826	186.6	0.413	25.775
200	19.976	19.939	36.716	184.5	0.518	26.087
250	19.131	19.085	36.649	180.3	0.614	26.260
300	18.565	18.512	36.589	178.7	0.705	26.361
400	17.069	17.002	36.366	173.2	0.872	26.563
500	15.347	15.268	36.079	159.4	1.026	26.745
600	13.158	13.073	35.727	146.4	1.163	26.941
700	11.028	10.939	35.423	137.7	1.282	27.116
800	9.044	8.954	35.186	139.0	1.386	27.271
900	7.319	7.229	35.097	165.5	1.472	27.463
1000	6.136	6.043	35.075	200.4	1.542	27.606
1100	5.385	5.288	35.054	223.6	1.600	27.684
1200	4.484	4.386	35.006	246.5	1.651	27.750
1300	4.311	4.206	34.997	250.8	1.698	27.762
1400	4.050	3.939	34.979	254.9	1.744	27.776
1500	3.939	3.820	34.976	255.9	1.790	27.786
1750	3.764	3.624	34.968	257.9	1.904	27.800
2000	3.582	3.421	34.960	259.6	2.018	27.813
2500	3.171	2.968	34.946	260.1	2.243	27.845
3000	2.689	2.445	34.920	265.0	2.461	27.871
3500	2.396	2.106	34.902	266.8	2.672	27.885
4000	2.319	1.976	34.895	265.2	2.885	27.889
4500	2.270	1.870	34.887	261.7	3.109	27.891

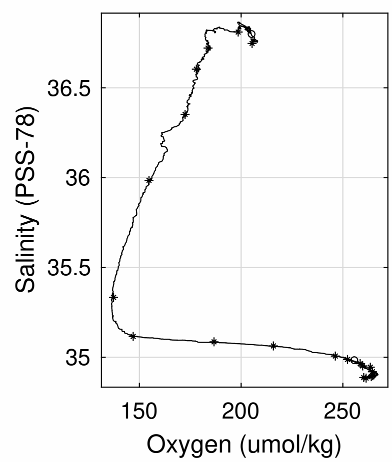
Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	$\mu mol \cdot kg^{-1}$
4907	1	2.297	1.846	34.884	261.4
4531	2	2.275	1.871	34.887	260.3
4158	3	2.300	1.939	34.892	264.0
3771	4	2.330	2.013	34.897	264.7
3407	5	2.410	2.129	34.902	265.2
2995	6	2.674	2.430	34.920	264.5
2581	7	3.105	2.895	34.945	263.5
2166	8	3.346	3.172	34.952	259.8
1868	9	3.657	3.507	34.965	258.5
1600	10	3.842	3.714	34.978	256.2
1381	11	4.176	4.064	34.988	252.3
1230	12	4.499	4.398	35.007	246.3
1064	13	5.623	5.528	35.063	215.9
952	14	6.552	6.461	35.086	186.7
842	15	8.114	8.024	35.116	146.9
733	16	10.328	10.238	35.334	137.3
620	17	12.513	12.428	35.633	79.2
507	18	14.801	14.724	35.985	154.7
396	19	16.981	16.914	36.352	172.5
292	20	18.687	18.635	36.604	178.0
200	21	20.016	19.979	36.721	183.7
121	22	22.075	22.051	36.811	198.5
71	23	23.191	23.176	36.793	205.7
3	24	24.415	24.414	36.747	205.4

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 8 (CTD008)
Latitude 26.499 N Longitude 76.564 W
27-Feb-2018 11:07 Z







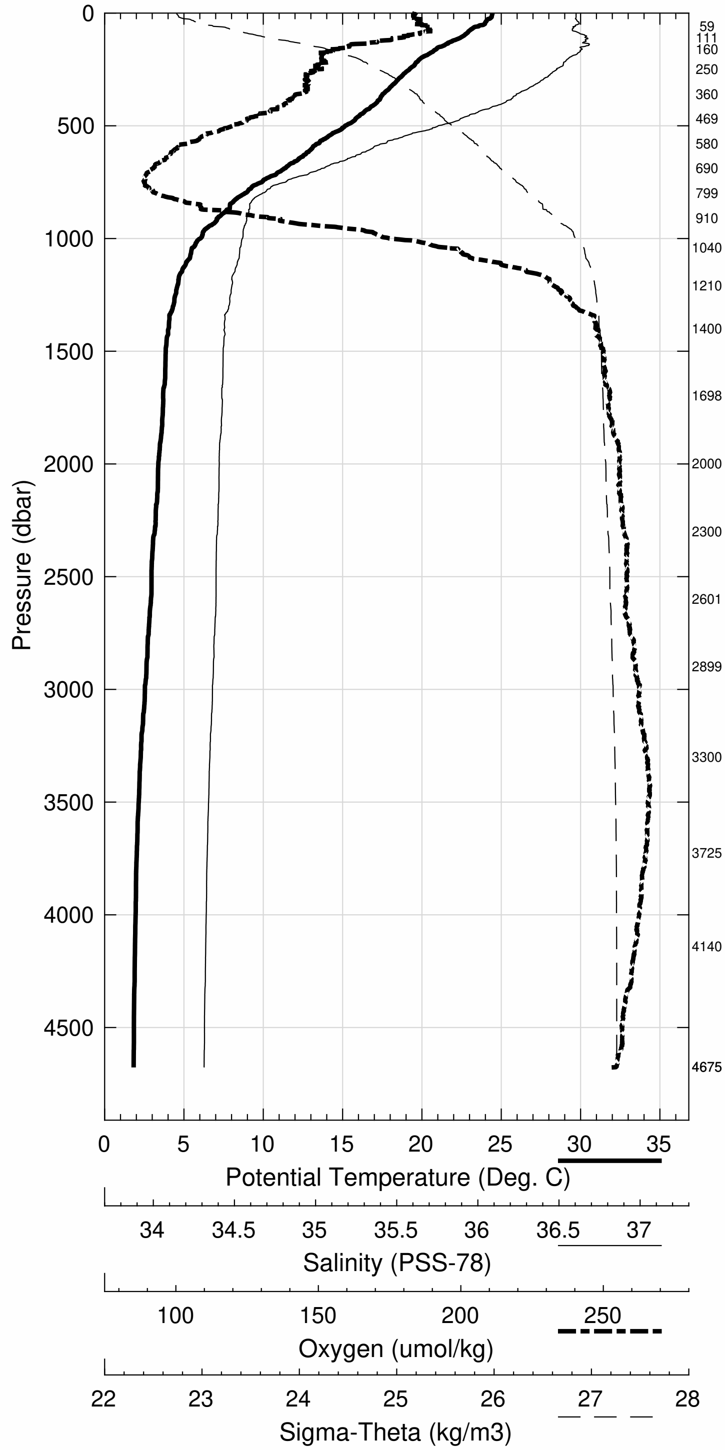


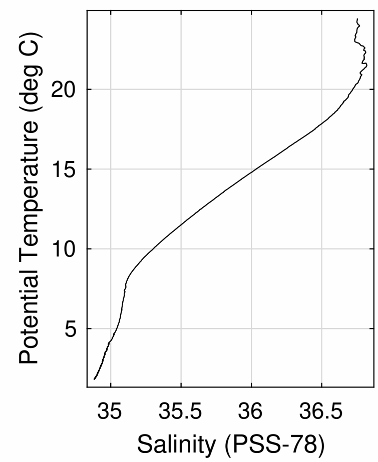
AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 9 (CTD009)
Latitude 26.498N Longitude 76.656W
27-Feb-2018 16:06Z

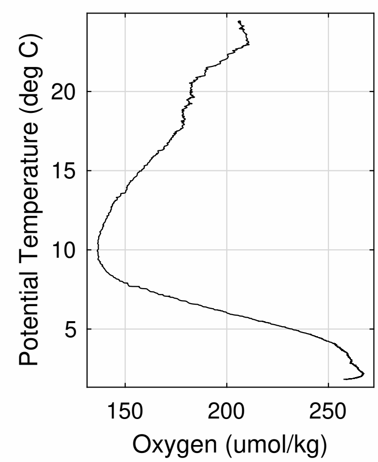
Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	24.442	24.442	36.755	206.3	0.003	24.838
10	24.414	24.412	36.754	205.6	0.031	24.846
20	24.358	24.354	36.753	206.2	0.062	24.863
30	24.123	24.117	36.756	207.6	0.093	24.937
50	23.929	23.918	36.762	208.3	0.152	25.000
75	23.057	23.042	36.735	209.9	0.223	25.238
100	22.671	22.650	36.802	205.1	0.290	25.402
125	21.929	21.904	36.804	196.9	0.353	25.617
150	21.143	21.113	36.780	189.1	0.411	25.818
200	19.978	19.941	36.717	181.8	0.517	26.088
250	19.259	19.213	36.658	181.1	0.613	26.234
300	18.468	18.415	36.576	179.1	0.704	26.376
400	17.173	17.105	36.387	173.0	0.871	26.554
500	15.230	15.152	36.059	159.2	1.025	26.755
600	13.152	13.067	35.728	145.0	1.161	26.943
700	11.215	11.125	35.448	137.5	1.282	27.101
800	8.918	8.828	35.175	139.8	1.385	27.283
900	7.371	7.280	35.100	165.1	1.471	27.458
1000	6.121	6.028	35.074	199.9	1.540	27.608
1100	5.298	5.202	35.051	225.7	1.597	27.692
1200	4.736	4.635	35.025	241.6	1.648	27.737
1300	4.420	4.313	35.006	247.9	1.697	27.758
1400	4.141	4.028	34.984	253.4	1.744	27.771
1500	3.971	3.852	34.978	255.3	1.790	27.784
1750	3.814	3.673	34.973	256.6	1.905	27.798
2000	3.547	3.387	34.958	259.2	2.021	27.815
2500	3.158	2.955	34.942	261.4	2.248	27.843
3000	2.785	2.539	34.924	264.6	2.471	27.866
3500	2.440	2.149	34.905	267.0	2.687	27.883
4000	2.295	1.953	34.893	264.5	2.900	27.889
4500	2.244	1.845	34.884	260.0	3.121	27.891

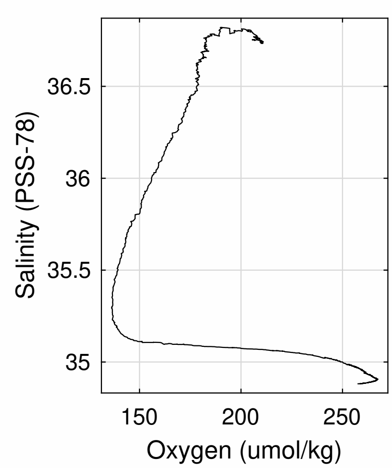
Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
4676	1	2.249	8.625	−999.000	−999.0
4676	2	2.249	8.625	−999.000	−999.0
4141	3	2.275	8.098	−999.000	−999.0
3726	4	2.342	7.701	−999.000	−999.0
3301	5	2.534	7.375	−999.000	−999.0
2900	6	2.884	7.195	−999.000	−999.0
2601	7	3.139	7.046	−999.000	−999.0
2301	8	3.352	6.848	−999.000	−999.0
2000	9	3.584	6.657	−999.000	−999.0
1698	10	3.866	6.500	−999.000	−999.0
1401	11	4.135	6.330	−999.000	−999.0
1210	12	4.669	6.556	−999.000	−999.0
1041	13	5.734	7.319	−999.000	−999.0
910	14	7.268	8.597	−999.000	−999.0
800	15	8.897	10.009	−999.000	−999.0
690	16	11.388	12.270	−999.000	−999.0
581	17	13.676	14.357	−999.000	−999.0
470	18	15.746	16.253	−999.000	−999.0
361	19	17.646	18.004	−999.000	−999.0
250	20	19.420	19.648	−999.000	−999.0
161	21	20.869	21.004	−999.000	−999.0
111	22	22.319	22.405	−999.000	−999.0
60	23	23.757	23.799	−999.000	−999.0

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 9 (CTD009)
Latitude 26.498 N Longitude 76.656 W
27-Feb-2018 16:06 Z







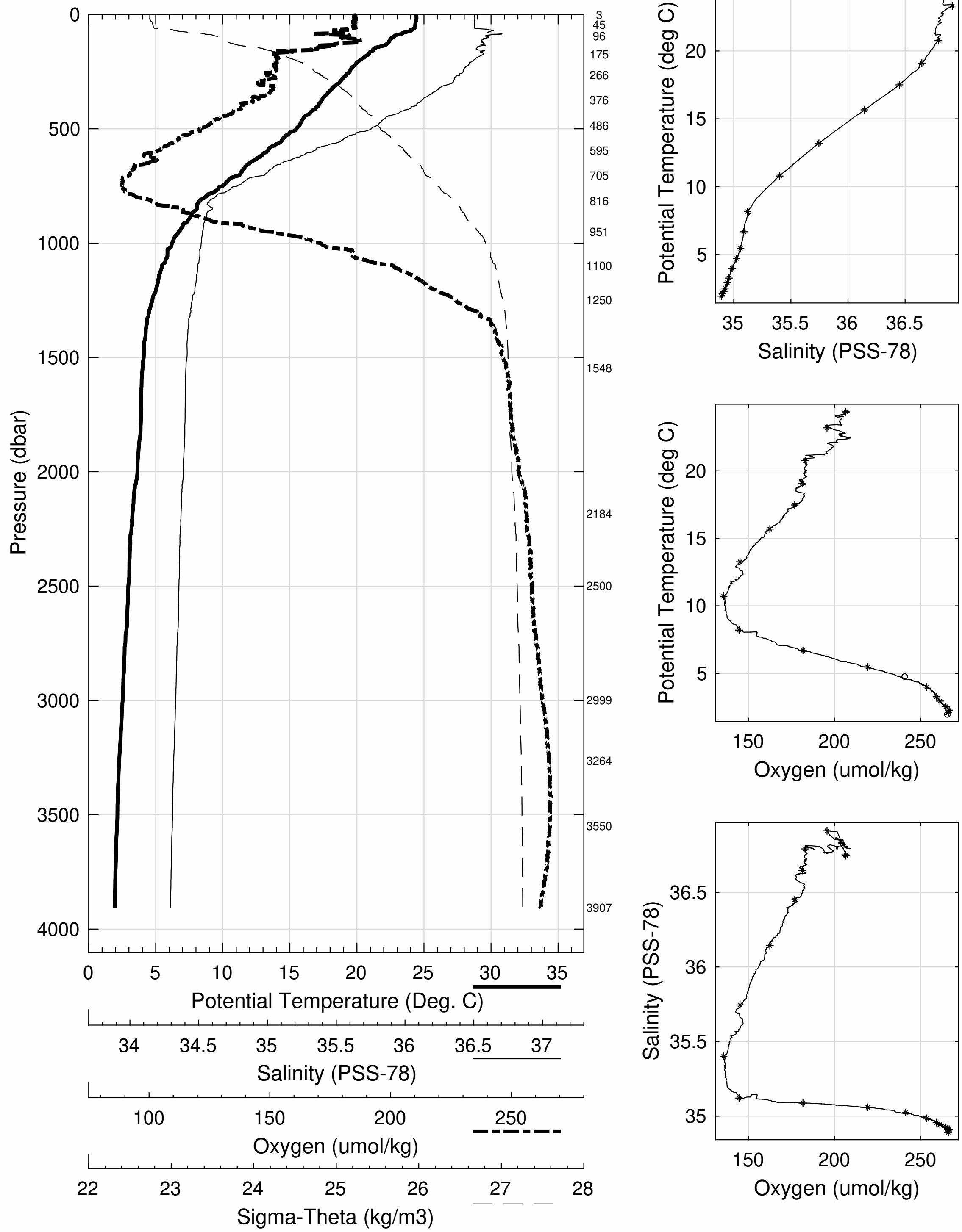


AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 10 (CTD010)
Latitude 26.502N Longitude 76.747W
28-Feb-2018 02:48Z

Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$	DynHt $m^2 \cdot s^{-2}$	SigT $kg \cdot m^{-3}$
1	24.431	24.431	36.749	206.9	0.003	24.837
10	24.441	24.439	36.751	206.8	0.031	24.836
20	24.442	24.438	36.751	206.9	0.062	24.836
30	24.393	24.386	36.750	206.8	0.093	24.851
50	24.352	24.342	36.748	207.1	0.155	24.863
75	23.815	23.799	36.843	203.3	0.231	25.097
100	22.672	22.651	36.822	205.0	0.298	25.417
125	22.360	22.335	36.805	202.1	0.362	25.495
150	21.293	21.264	36.762	196.1	0.423	25.764
200	20.268	20.230	36.745	182.6	0.531	26.032
250	19.519	19.473	36.681	181.9	0.629	26.184
300	18.734	18.681	36.614	177.3	0.722	26.337
400	17.185	17.117	36.388	172.9	0.891	26.552
500	15.565	15.486	36.117	159.8	1.044	26.725
600	13.361	13.275	35.758	146.6	1.183	26.925
700	11.358	11.267	35.469	138.6	1.303	27.092
800	8.758	8.670	35.163	140.9	1.407	27.299
900	7.511	7.419	35.103	163.1	1.492	27.441
1000	6.303	6.209	35.079	196.6	1.563	27.588
1100	5.566	5.468	35.059	219.0	1.624	27.666
1200	5.133	5.029	35.041	230.9	1.679	27.704
1300	4.622	4.513	35.016	244.3	1.731	27.744
1400	4.356	4.241	34.997	250.1	1.780	27.758
1500	4.227	4.104	34.992	252.1	1.828	27.769
1750	4.040	3.896	34.981	254.6	1.948	27.782
2000	3.802	3.637	34.971	257.1	2.069	27.801
2500	3.155	2.952	34.943	261.1	2.298	27.844
3000	2.780	2.534	34.924	264.2	2.519	27.866
3500	2.431	2.140	34.904	266.5	2.733	27.884

Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen $\mu mol \cdot kg^{-1}$
3908	1	2.272	1.940	34.891	266.0
3551	2	2.408	2.112	34.900	266.1
3265	3	2.540	2.272	34.912	266.5
3000	4	2.782	2.536	34.925	264.6
2501	5	3.148	2.945	34.944	261.1
2185	6	3.447	3.270	34.957	259.1
1548	7	4.112	3.986	34.985	253.4
1251	8	4.816	4.710	35.024	241.2
1101	9	5.548	5.450	35.059	219.2
952	10	6.777	6.684	35.087	181.6
816	11	8.255	8.167	35.121	144.6
706	12	10.875	10.786	35.401	135.6
596	13	13.287	13.202	35.745	145.1
486	14	15.739	15.662	36.143	162.4
376	15	17.568	17.504	36.450	176.9
266	16	19.155	19.106	36.646	181.2
176	17	20.792	20.758	36.791	182.9
96	18	23.337	23.317	36.913	195.6
45	19	24.390	24.381	36.751	206.4
3	20	24.382	24.381	36.746	206.5

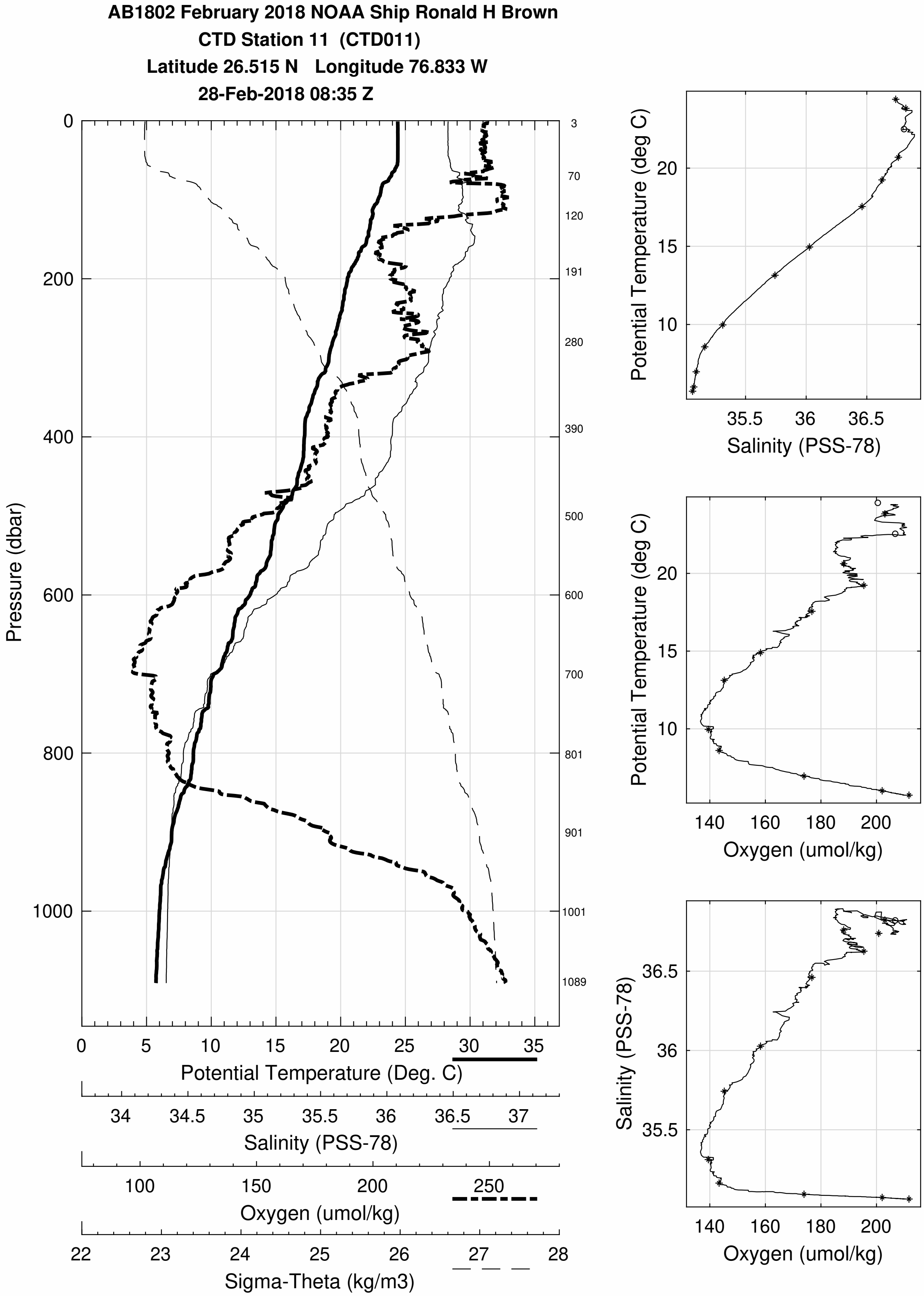
AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 10 (CTD010)
Latitude 26.502 N Longitude 76.747 W
28-Feb-2018 02:48 Z



AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 11 (CTD011)
Latitude 26.515N Longitude 76.833W
28-Feb-2018 08:35Z

Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	24.410	24.410	36.735	206.6	0.003	24.832
10	24.421	24.419	36.734	205.8	0.031	24.829
20	24.423	24.419	36.734	206.3	0.062	24.829
30	24.422	24.416	36.733	206.1	0.094	24.830
50	24.421	24.410	36.745	206.1	0.156	24.840
75	23.710	23.694	36.831	201.6	0.232	25.119
100	22.898	22.878	36.816	208.4	0.300	25.347
125	22.351	22.326	36.838	195.3	0.364	25.522
150	22.049	22.019	36.892	186.0	0.426	25.651
200	20.560	20.522	36.742	187.5	0.538	25.951
250	19.970	19.923	36.684	190.4	0.643	26.067
300	19.145	19.090	36.619	191.0	0.741	26.236
400	17.270	17.202	36.400	175.3	0.912	26.540
500	15.239	15.161	36.058	161.2	1.070	26.753
600	13.073	12.989	35.711	144.9	1.208	26.946
700	10.263	10.178	35.327	137.7	1.324	27.177
800	8.708	8.619	35.165	143.8	1.423	27.308
900	7.031	6.942	35.092	175.0	1.506	27.500
1000	6.091	5.998	35.072	202.4	1.573	27.610

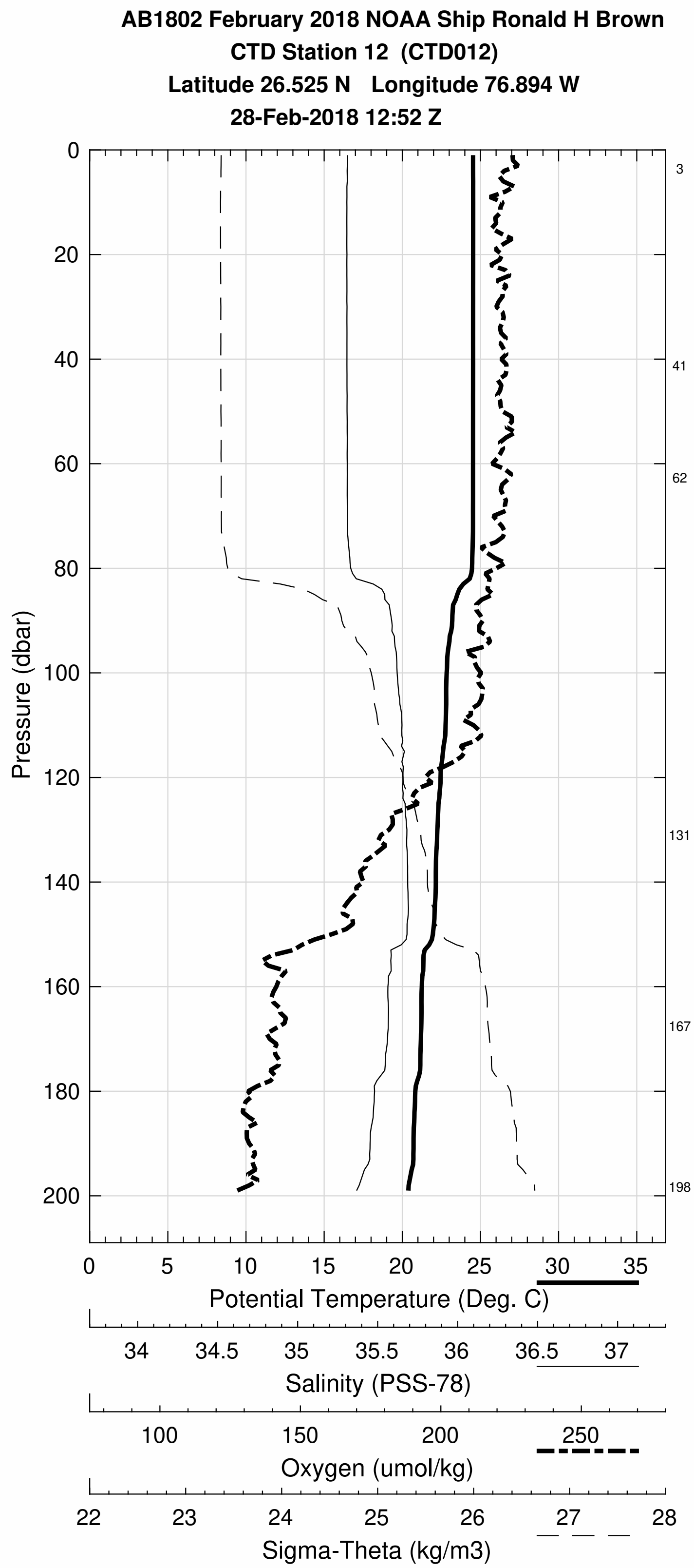
Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
1090	1	5.832	5.733	35.063	211.7
1001	2	6.099	6.006	35.073	202.0
901	3	7.065	6.976	35.093	173.9
802	4	8.660	8.571	35.164	143.3
701	5	10.058	9.974	35.312	139.5
601	6	13.233	13.148	35.743	145.2
500	7	15.031	14.953	36.027	158.2
390	8	17.611	17.544	36.461	176.7
280	9	19.298	19.246	36.626	195.4
191	10	20.732	20.696	36.760	188.2
120	11	22.457	22.433	36.814	207.1
70	12	23.837	23.822	36.822	203.0
4	13	24.402	24.402	36.738	200.8

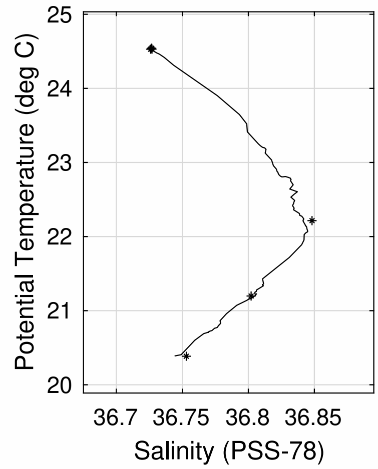

AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 11 (CTD011)
Latitude 26.515 N Longitude 76.833 W
28-Feb-2018 08:35 Z
Pressure (dbar)
Potential Temperature (Deg. C)
Salinity (PSS-78)
Oxygen (umol/kg)
Sigma-Theta (kg/m3)
Potential Temperature (deg C)
Salinity (PSS-78)
Potential Temperature (deg C)
Oxygen (umol/kg)
Salinity (PSS-78)
Oxygen (umol/kg)

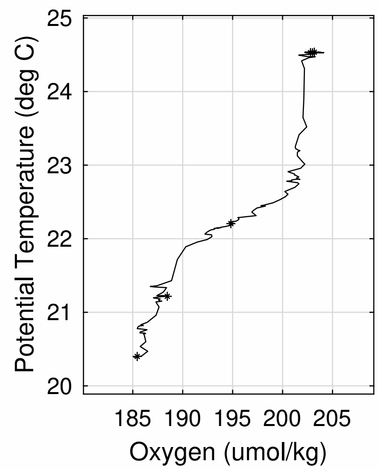
AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 12 (CTD012)
Latitude 26.525N Longitude 76.894W
28-Feb-2018 12:52Z

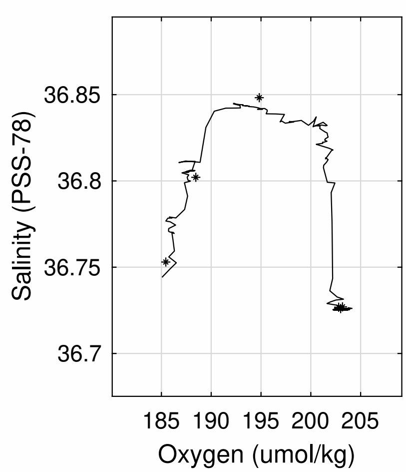
Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	24.530	24.530	36.727	203.7	0.003	24.790
10	24.536	24.534	36.725	203.1	0.032	24.788
20	24.537	24.532	36.725	203.0	0.063	24.788
30	24.537	24.530	36.726	202.7	0.095	24.789
50	24.540	24.530	36.726	203.1	0.158	24.789
75	24.523	24.506	36.728	202.6	0.237	24.798
100	22.859	22.839	36.823	201.6	0.309	25.364
125	22.339	22.314	36.839	197.4	0.374	25.526
150	21.984	21.955	36.842	191.5	0.435	25.631

Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
198	1	20.423	20.385	36.753	185.4
168	2	21.231	21.198	36.802	188.5
131	3	22.241	22.215	36.848	194.8
63	4	24.543	24.529	36.726	203.0
41	5	24.538	24.529	36.727	203.2
4	6	24.543	24.543	36.727	202.8


AB1802 February 2018 NOAA Ship Ronald H Brown
CTD Station 12 (CTD012)
Latitude 26.525 N Longitude 76.894 W
28-Feb-2018 12:52 Z
Pressure (dbar)
Potential Temperature (Deg. C)
Salinity (PSS-78)
Oxygen (umol/kg)
Sigma-Theta (kg/m3)
3
41
62
131
167
198


Potential Temperature (deg C)
Salinity (PSS-78)


Potential Temperature (deg C)
Oxygen (umol/kg)

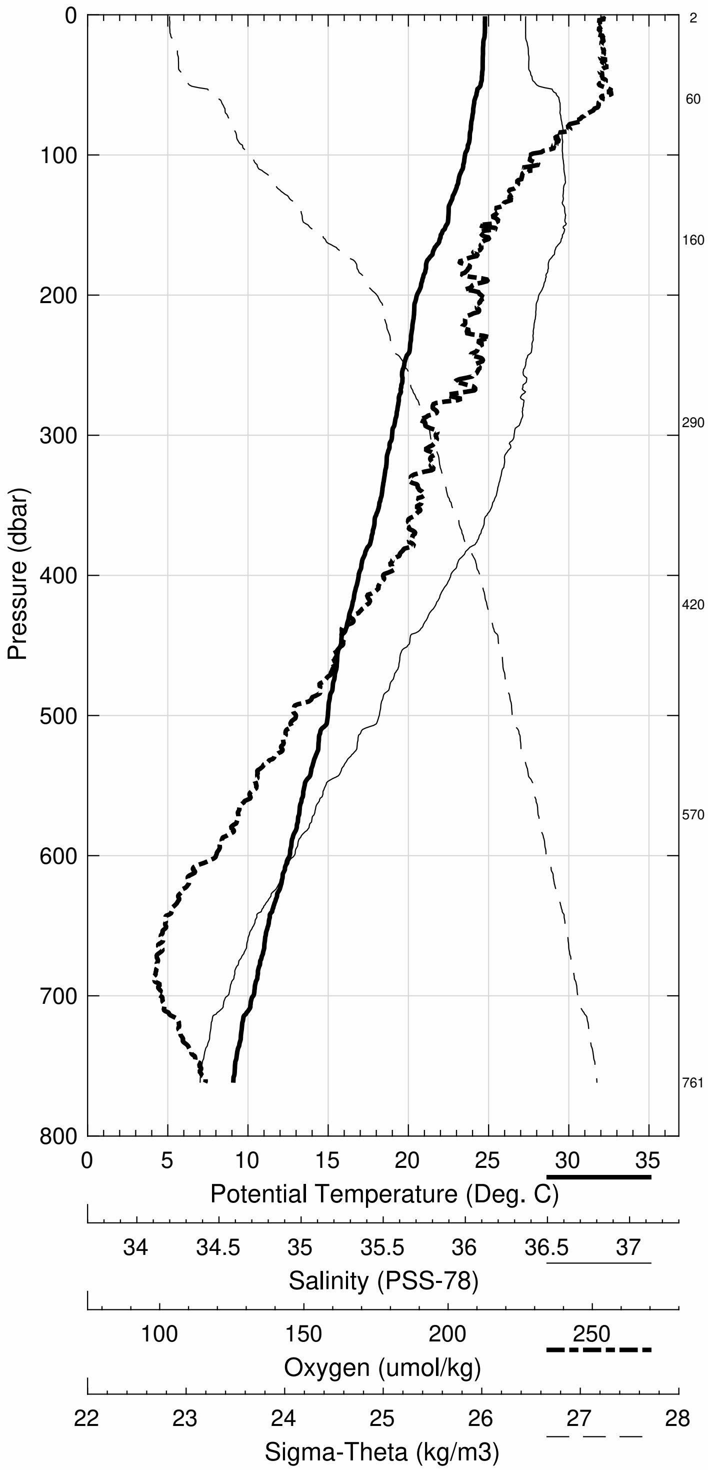

Salinity (PSS-78)
Oxygen (umol/kg)

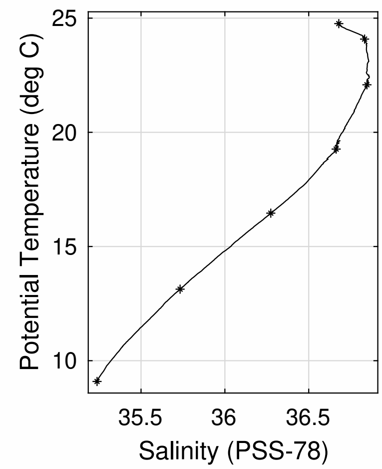
AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 13 (CTD013)
Latitude 26.432N Longitude 78.669W
01-Mar-2018 01:50Z

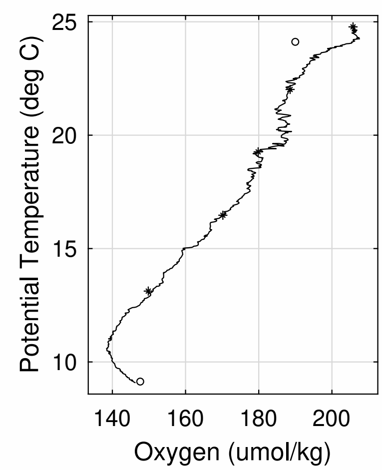
Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	24.778	24.778	36.682	206.0	0.003	24.681
10	24.775	24.772	36.681	205.4	0.033	24.682
20	24.675	24.671	36.688	205.8	0.065	24.718
30	24.645	24.639	36.696	205.7	0.097	24.734
50	24.515	24.504	36.730	205.5	0.161	24.800
75	23.971	23.955	36.840	202.3	0.236	25.048
100	23.555	23.534	36.846	195.1	0.308	25.178
125	22.970	22.944	36.850	192.0	0.377	25.354
150	22.399	22.369	36.859	187.4	0.441	25.526
200	20.574	20.536	36.740	187.8	0.556	25.946
250	19.788	19.741	36.681	187.0	0.660	26.113
300	19.038	18.983	36.630	180.9	0.756	26.272
400	16.969	16.902	36.349	172.9	0.929	26.573
500	15.058	14.980	36.031	159.8	1.080	26.772
600	12.678	12.595	35.653	147.8	1.212	26.980
700	10.420	10.334	35.357	139.4	1.326	27.173

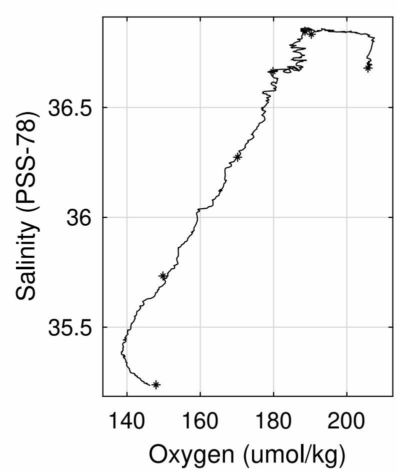
Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
762	1	9.177	9.090	35.238	147.9
571	2	13.213	13.132	35.733	149.8
421	3	16.529	16.460	36.274	170.2
291	4	19.319	19.266	36.664	179.8
161	5	22.114	22.082	36.847	188.6
60	6	24.095	24.082	36.833	190.3
2	7	24.761	24.760	36.679	205.8

AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 13 (CTD013)
Latitude 26.432 N Longitude 78.669 W
01-Mar-2018 01:50 Z







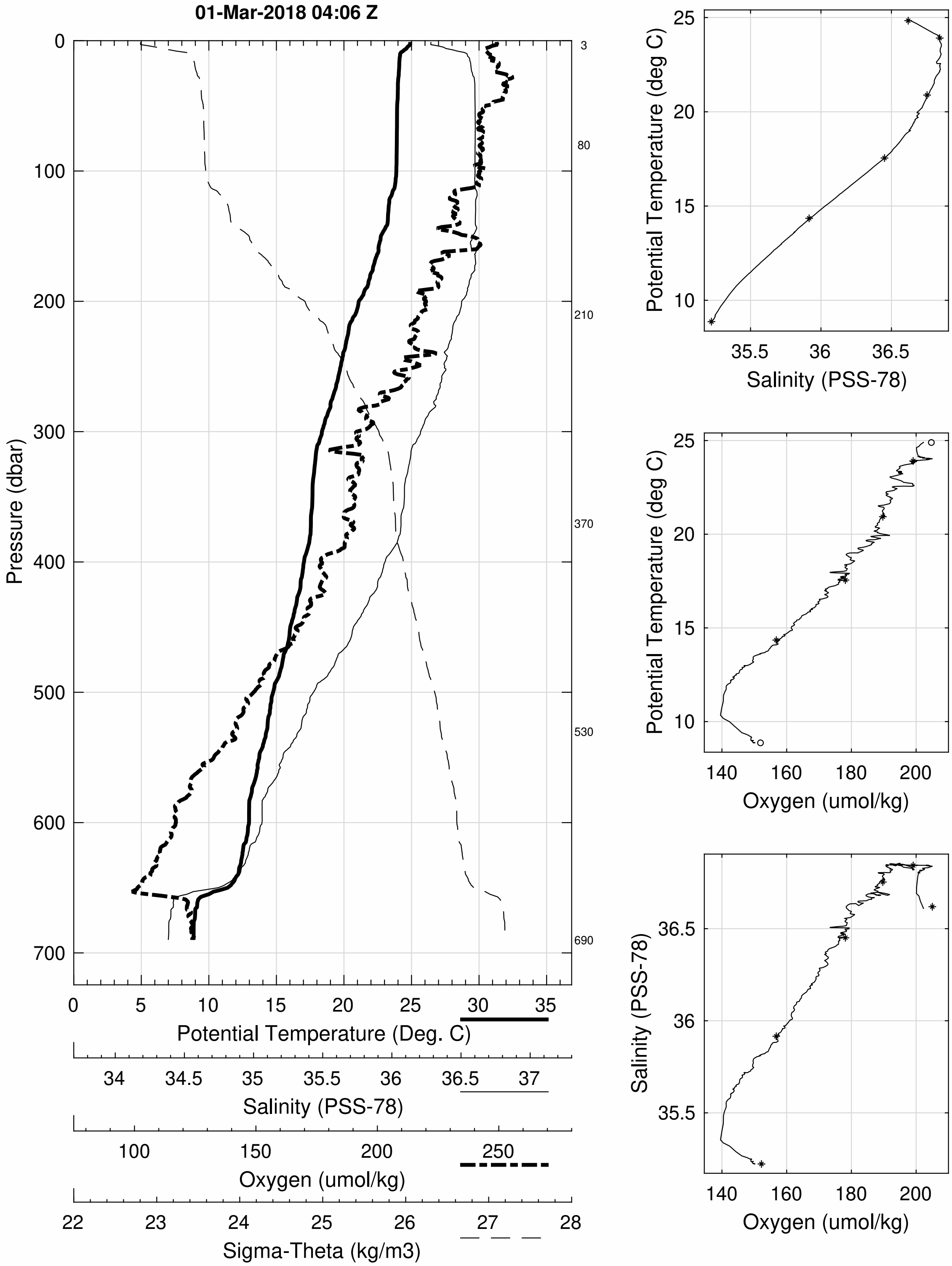


AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 14 (CTD014)
Latitude 26.333N Longitude 78.714W
01-Mar-2018 04:06Z

Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	24.905	24.905	36.611	202.1	0.003	24.588
10	24.160	24.158	36.801	200.7	0.032	24.959
20	24.093	24.089	36.823	202.2	0.062	24.996
30	24.017	24.010	36.841	203.6	0.091	25.033
50	23.948	23.937	36.844	200.1	0.150	25.057
75	23.929	23.913	36.845	199.4	0.223	25.065
100	23.899	23.878	36.844	199.1	0.296	25.075
125	23.369	23.343	36.847	195.2	0.367	25.235
150	22.763	22.732	36.830	197.6	0.436	25.400
200	21.136	21.097	36.773	190.1	0.559	25.818
250	19.807	19.760	36.684	188.5	0.664	26.111
300	18.425	18.372	36.556	178.1	0.758	26.371
400	17.109	17.041	36.368	172.0	0.926	26.555
500	14.832	14.755	35.989	160.4	1.078	26.789
600	13.051	12.967	35.717	147.1	1.211	26.955

Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
691	1	8.943	8.866	35.222	152.2
530	2	14.428	14.348	35.916	156.8
371	3	17.611	17.548	36.451	178.1
210	4	20.927	20.886	36.753	189.7
80	5	23.928	23.911	36.843	199.1
4	6	24.836	24.835	36.619	205.0

AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 14 (CTD014)
Latitude 26.333 N Longitude 78.714 W
01-Mar-2018 04:06 Z

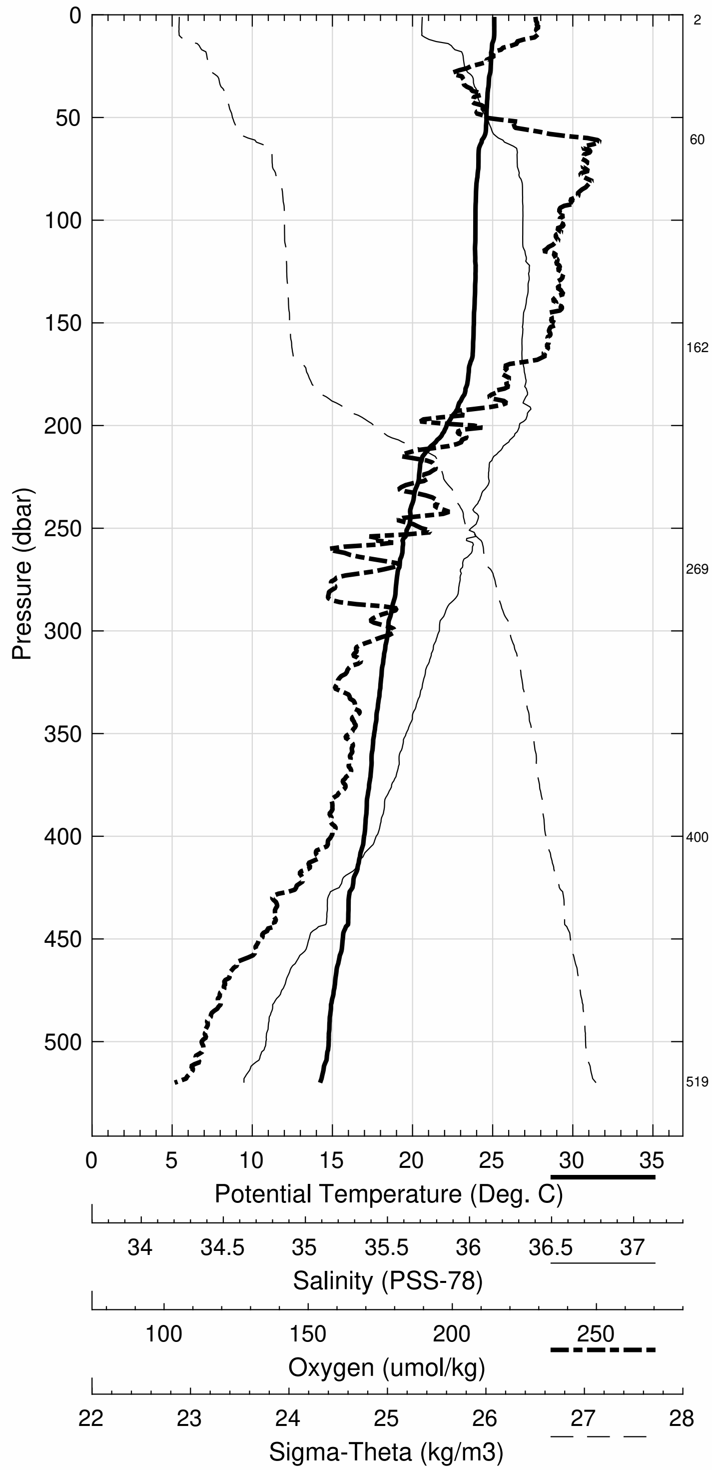


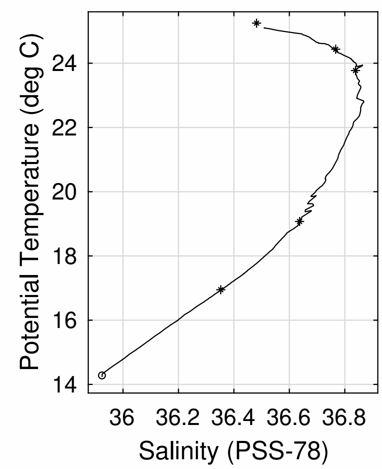
AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 15 (CTD015)
Latitude 26.247N Longitude 78.763W
01-Mar-2018 05:37Z

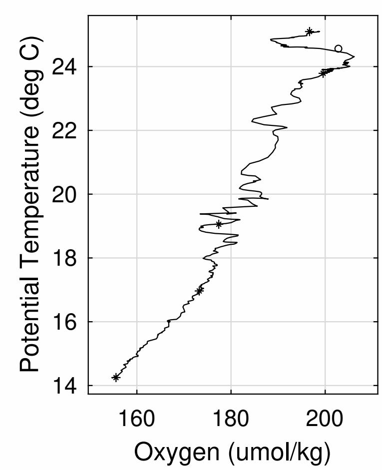
Pressure dbar	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen μmol·kg^{-1}	DynHt m^2·s^{-2}	SigT kg·m^{-3}
1	25.099	25.099	36.511	198.3	0.003	24.454
10	25.099	25.097	36.510	198.5	0.035	24.453
20	24.917	24.912	36.646	193.4	0.068	24.612
30	24.792	24.785	36.676	189.5	0.102	24.674
50	24.620	24.609	36.719	192.1	0.166	24.760
75	24.120	24.104	36.827	204.4	0.243	24.994
100	23.948	23.927	36.843	201.3	0.317	25.059
125	23.961	23.935	36.863	201.5	0.390	25.072
150	23.860	23.828	36.843	200.7	0.463	25.089
200	22.167	22.127	36.831	190.9	0.603	25.574
250	19.742	19.695	36.672	184.6	0.711	26.118
300	18.538	18.485	36.568	181.3	0.804	26.352
400	17.040	16.973	36.360	173.6	0.971	26.565
500	14.843	14.766	35.997	157.9	1.120	26.792

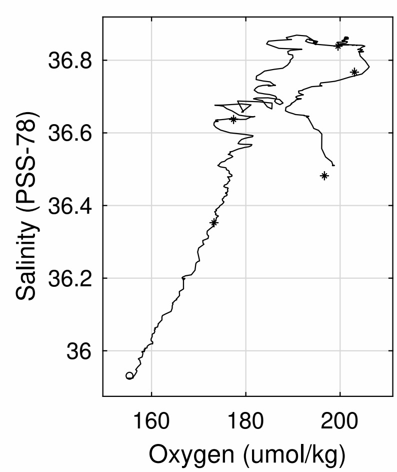
Pressure dbar	Niskin	Temp90 °C	PoTemp90 °C	Salinity PSS-78	Oxygen μmol·kg^{-1}
520	1	14.322	14.244	35.928	155.6
401	2	17.015	16.948	36.353	173.3
270	3	19.122	19.073	36.637	177.4
162	4	23.807	23.772	36.839	199.6
61	5	24.449	24.436	36.767	203.0
2	6	25.249	25.248	36.482	196.7

AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 15 (CTD015)
Latitude 26.247 N Longitude 78.763 W
01-Mar-2018 05:37 Z







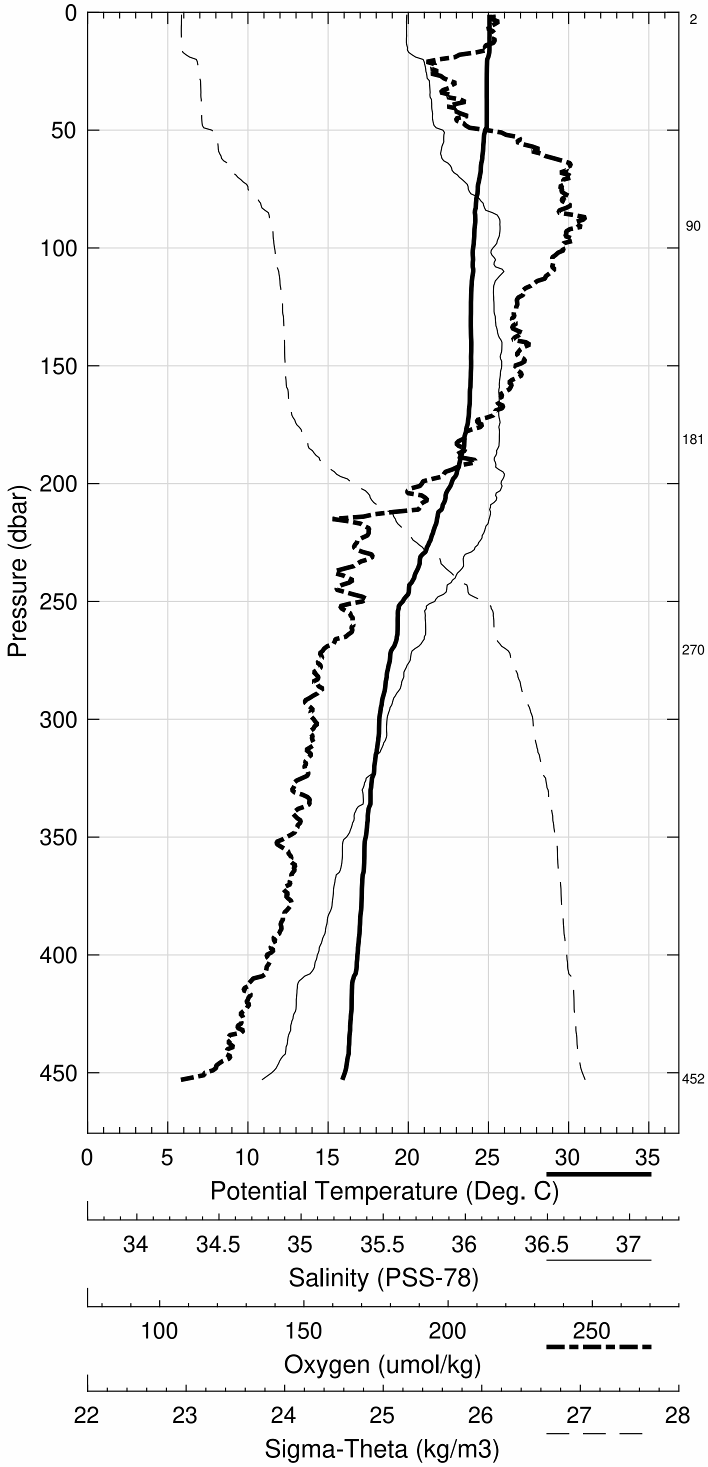


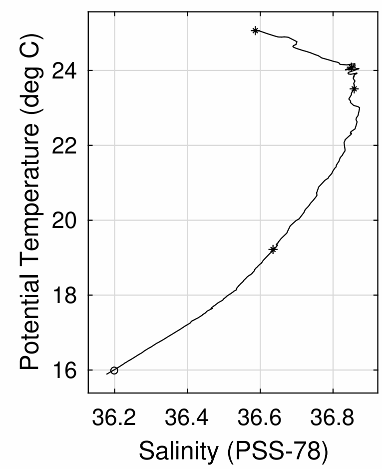
AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 16 (CTD016)
Latitude 26.167N Longitude 78.800W
01-Mar-2018 07:00Z

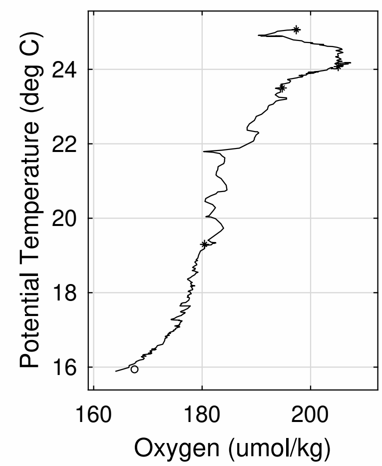
Pressure	Temp90	PoTemp90	Salinity	Oxygen	DynHt	SigT
dbar	°C	°C	PSS-78	μmol·kg^{-1}	m^2·s^{-2}	kg·m^{-3}
1	25.065	25.064	36.593	197.5	0.003	24.526
10	25.069	25.067	36.592	197.7	0.034	24.525
20	24.925	24.921	36.640	191.6	0.068	24.605
30	24.899	24.893	36.658	193.5	0.101	24.628
50	24.802	24.791	36.696	196.8	0.167	24.688
75	24.352	24.336	36.769	204.9	0.247	24.881
100	24.064	24.043	36.840	205.0	0.322	25.022
125	23.934	23.907	36.843	200.0	0.396	25.065
150	23.950	23.918	36.865	199.8	0.470	25.079
200	22.728	22.687	36.863	189.8	0.613	25.438
250	19.703	19.656	36.673	183.5	0.727	26.129
300	18.247	18.195	36.536	178.2	0.819	26.401
400	16.894	16.827	36.336	173.2	0.983	26.582

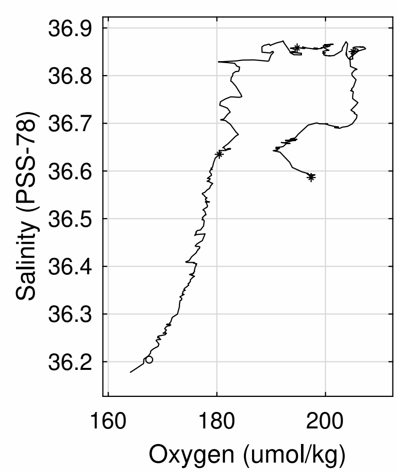
Pressure	Niskin	Temp90	PoTemp90	Salinity	Oxygen
dbar		°C	°C	PSS-78	μmol·kg^{-1}
453	1	16.029	15.956	36.202	167.7
271	2	19.270	19.221	36.635	180.4
181	3	23.548	23.510	36.858	194.8
91	4	24.106	24.087	36.850	205.1
3	5	25.065	25.064	36.586	197.4

AB1802 March 2018 NOAA Ship Ronald H Brown
CTD Station 16 (CTD016)
Latitude 26.167 N Longitude 78.800 W
01-Mar-2018 07:00 Z









B WOCE Summary File

Table 17: AB1802 – WOCE Summary File

SHIP/CRS EXPOCODE	WOCE SECT	STN	CAST	CAST TYPE	CAST DATE	UTC TIME	EVENT CODE	LAT	LON	NAV	UNC DPH	HT ABV BTM	WIRE OUT	MAX PRS	NO. BTLS	PARA-METERS	COMMENTS
WBTSRHB	AB1802	1	1	ROS	02/25/2018	14:17	BE	26.500N	75.500W	GPS							
WBTSRHB	AB1802	1	1	ROS	02/25/2018	15:52	BO	26.501N	75.500W	GPS	4676	10	4758	4760	24	1,2	Niskin 7 no sample, niskin 23 bottom cap
WBTSRHB	AB1802	1	1	ROS	02/25/2018	17:52	EN	26.503N	75.497W	GPS							
WBTSRHB	AB1802	2	1	ROS	02/25/2018	19:34	BE	26.500N	75.703W	GPS							
WBTSRHB	AB1802	2	1	ROS	02/25/2018	21:11	BO	26.502N	75.701W	GPS	61	1	4846	4767	24	1,2	Niskin 3 vent cap leak
WBTSRHB	AB1802	2	1	ROS	02/25/2018	23:11	EN	26.503N	75.700W	GPS							
WBTSRHB	AB1802	3	1	ROS	02/26/2018	04:37	BE	26.500N	75.900W	GPS							
WBTSRHB	AB1802	3	1	ROS	02/26/2018	06:11	BO	26.500N	75.900W	GPS	2224	8	4902	4819	24	1,2	
WBTSRHB	AB1802	3	1	ROS	02/26/2018	08:13	EN	26.500N	75.900W	GPS							
WBTSRHB	AB1802	4	1	ROS	02/26/2018	09:31	BE	26.499N	76.092W	GPS							
WBTSRHB	AB1802	4	1	ROS	02/26/2018	11:07	BO	26.500N	76.092W	GPS	2961	32	4984	4882	24	1,2	Niskin 10 lanyard caught
WBTSRHB	AB1802	4	1	ROS	02/26/2018	13:07	EN	26.500N	76.091W	GPS							
WBTSRHB	AB1802	5	1	ROS	02/26/2018	16:05	BE	26.501N	76.217W	GPS							
WBTSRHB	AB1802	5	1	ROS	02/26/2018	17:45	BO	26.500N	76.207W	GPS	4807	8	4992	4895	24	1,2	
WBTSRHB	AB1802	5	1	ROS	02/26/2018	19:50	EN	26.494N	76.197W	GPS							
WBTSRHB	AB1802	6	1	ROS	02/26/2018	20:50	BE	26.499N	76.347W	GPS							
WBTSRHB	AB1802	6	1	ROS	02/26/2018	22:22	BO	26.493N	76.344W	GPS	4854	10	5031	4944	24	1,2	
WBTSRHB	AB1802	6	1	ROS	02/27/2018	00:30	EN	26.482N	76.331W	GPS							
WBTSRHB	AB1802	7	1	ROS	02/27/2018	01:30	BE	26.493N	76.476W	GPS							
WBTSRHB	AB1802	7	1	ROS	02/27/2018	03:05	BO	26.489N	76.470W	GPS	4823	11	5048	4911	21	1,2	
WBTSRHB	AB1802	7	1	ROS	02/27/2018	05:12	EN	26.477N	76.465W	GPS							
WBTSRHB	AB1802	8	1	ROS	02/27/2018	11:08	BE	26.499N	76.565W	GPS							
WBTSRHB	AB1802	8	1	ROS	02/27/2018	12:42	BO	26.500N	76.563W	GPS	503	4	5121	4907	24	1,2	
WBTSRHB	AB1802	8	1	ROS	02/27/2018	14:48	EN	26.500N	76.555W	GPS							
WBTSRHB	AB1802	9	1	ROS	02/27/2018	16:07	BE	26.501N	76.655W	GPS							
WBTSRHB	AB1802	9	1	ROS	02/27/2018	17:40	BO	26.495N	76.658W	GPS	1031	6	4768	4677	23	1,2	No bottles fired
WBTSRHB	AB1802	9	1	ROS	02/27/2018	19:42	EN	26.492N	76.666W	GPS							
WBTSRHB	AB1802	10	1	ROS	02/28/2018	02:48	BE	26.501N	76.747W	GPS							
WBTSRHB	AB1802	10	1	ROS	02/28/2018	04:08	BO	26.501N	76.747W	GPS	3847	12	3983	3907	20	1,2	
WBTSRHB	AB1802	10	1	ROS	02/28/2018	05:51	EN	26.499N	76.751W	GPS							
WBTSRHB	AB1802	11	1	ROS	02/28/2018	08:35	BE	26.516N	76.832W	GPS							
WBTSRHB	AB1802	11	1	ROS	02/28/2018	09:03	BO	26.515N	76.833W	GPS	795	1	1122	1091	13	1,2	
WBTSRHB	AB1802	11	1	ROS	02/28/2018	09:44	EN	26.511N	76.834W	GPS							
WBTSRHB	AB1802	12	1	ROS	02/28/2018	12:52	BE	26.525N	76.893W	GPS							
WBTSRHB	AB1802	12	1	ROS	02/28/2018	13:06	BO	26.525N	76.895W	GPS	197	12	200	199	6	1,2	
WBTSRHB	AB1802	12	1	ROS	02/28/2018	13:23	EN	26.526N	76.895W	GPS							
WBTSRHB	AB1802	13	1	ROS	03/01/2018	01:50	BE	26.434N	78.668W	GPS							
WBTSRHB	AB1802	13	1	ROS	03/01/2018	02:20	BO	26.432N	78.669W	GPS	756	10	782	762	7	1,2	
WBTSRHB	AB1802	13	1	ROS	03/01/2018	02:48	EN	26.431N	78.669W	GPS							
WBTSRHB	AB1802	14	1	ROS	03/01/2018	04:06	BE	26.334N	78.714W	GPS							
WBTSRHB	AB1802	14	1	ROS	03/01/2018	04:31	BO	26.333N	78.714W	GPS	3	5	708	690	6	1,2	
WBTSRHB	AB1802	14	1	ROS	03/01/2018	04:55	EN	26.331N	78.716W	GPS							
WBTSRHB	AB1802	15	1	ROS	03/01/2018	05:38	BE	26.249N	78.764W	GPS							
WBTSRHB	AB1802	15	1	ROS	03/01/2018	06:00	BO	26.247N	78.761W	GPS	516	9	533	520	6	1,2	
WBTSRHB	AB1802	15	1	ROS	03/01/2018	06:19	EN	26.248N	78.761W	GPS							
WBTSRHB	AB1802	16	1	ROS	03/01/2018	07:00	BE	26.166N	78.800W	GPS							
WBTSRHB	AB1802	16	1	ROS	03/01/2018	07:16	BO	26.167N	78.801W	GPS	90	1	463	453	5	1,2	
WBTSRHB	AB1802	16	1	ROS	03/01/2018	07:33	EN	26.168N	78.801W	GPS							

Note:Parameter 1 - salinity sampled, Parameter 2 - oxygen sampled

C WOCE Bottle Summary File

Table 18: AB1802 – WOCE Bottle Summary File

SHIP/CRS EXPOCODE	WOCE SECT	STN	CAST	BTL#	BTL# Flag	DATE	UTC TIME	LAT	LON	DEPTH	CTD PRS	CTD TMP	CTD SAL	SAL FLAG	BTL SAL	SAL FLAG	CTD OXY	OXY FLAG	BTL OXY	OXY FLAG
WBTSRHB	AB1802	1	1	1	2	20180225	1554	26.501N	75.499W	4676	4759	2.239	34.880	2	34.874	4	258.8	2	261.3	2
WBTSRHB	AB1802	1	1	2	2	20180225	1601	26.501N	75.499W	4375	4450	2.239	34.884	2	34.880	4	261.5	2	260.5	2
WBTSRHB	AB1802	1	1	3	2	20180225	1607	26.501N	75.499W	4083	4150	2.258	34.888	2	34.889	2	246.7	2	257.3	4
WBTSRHB	AB1802	1	1	4	2	20180225	1614	26.501N	75.500W	3791	3851	2.289	34.893	2	34.892	2	249.8	2	248.5	4
WBTSRHB	AB1802	1	1	5	2	20180225	1620	26.501N	75.500W	3499	3551	2.352	34.899	2	34.899	2	267.9	2	268.4	2
WBTSRHB	AB1802	1	1	6	2	20180225	1629	26.501N	75.500W	3057	3100	2.575	34.914	2	34.912	2	267.5	2	267.3	2
WBTSRHB	AB1802	1	1	7	2	20180225	1637	26.501N	75.500W	2666	2701	2.896	34.932	2	34.929	2	252.1	2	-999.0	9
WBTSRHB	AB1802	1	1	8	2	20180225	1645	26.501N	75.500W	2322	2350	3.239	34.951	2	34.950	2	260.9	2	260.9	2
WBTSRHB	AB1802	1	1	9	2	20180225	1652	26.501N	75.500W	1979	2001	3.562	34.961	2	34.954	4	260.1	2	260.5	2
WBTSRHB	AB1802	1	1	10	2	20180225	1659	26.501N	75.499W	1682	1700	4.007	34.983	2	34.978	4	256.2	2	255.2	2
WBTSRHB	AB1802	1	1	11	2	20180225	1705	26.501N	75.499W	1436	1450	4.348	35.002	2	34.998	4	251.2	2	251.2	2
WBTSRHB	AB1802	1	1	12	2	20180225	1710	26.501N	75.499W	1193	1205	5.121	35.043	2	35.045	2	225.7	2	222.5	4
WBTSRHB	AB1802	1	1	13	2	20180225	1714	26.501N	75.498W	1026	1035	6.232	35.075	2	35.077	2	198.0	2	198.6	2
WBTSRHB	AB1802	1	1	14	2	20180225	1717	26.501N	75.498W	918	926	7.475	35.089	2	35.087	2	159.4	2	160.6	2
WBTSRHB	AB1802	1	1	15	2	20180225	1721	26.501N	75.498W	808	815	9.718	35.271	2	35.274	2	141.4	2	142.0	2
WBTSRHB	AB1802	1	1	16	2	20180225	1725	26.501N	75.498W	699	705	12.174	35.578	2	35.577	2	139.7	2	148.6	4
WBTSRHB	AB1802	1	1	17	2	20180225	1728	26.502N	75.497W	592	597	14.272	35.892	2	35.898	6	162.5	2	162.0	2
WBTSRHB	AB1802	1	1	18	2	20180225	1732	26.502N	75.498W	496	500	16.026	36.182	2	36.184	2	172.4	2	173.5	2
WBTSRHB	AB1802	1	1	19	2	20180225	1736	26.502N	75.498W	372	375	18.113	36.534	2	36.533	2	179.5	2	179.6	2
WBTSRHB	AB1802	1	1	20	2	20180225	1739	26.502N	75.498W	264	266	19.521	36.683	2	36.681	2	182.1	2	183.3	2
WBTSRHB	AB1802	1	1	21	2	20180225	1742	26.502N	75.497W	174	176	21.085	36.796	2	36.794	2	189.6	2	189.7	2
WBTSRHB	AB1802	1	1	22	2	20180225	1745	26.502N	75.497W	85	85	24.600	36.712	2	36.722	2	206.4	2	206.2	2
WBTSRHB	AB1802	1	1	23	2	20180225	1748	26.502N	75.497W	36	36	24.639	36.708	2	36.713	2	206.3	2	206.9	2
WBTSRHB	AB1802	1	1	24	2	20180225	1750	26.503N	75.497W	2	2	24.777	36.710	2	36.714	2	206.5	2	206.8	2
WBTSRHB	AB1802	2	1	1	2	20180225	2110	26.502N	75.701W	4682	4766	2.162	34.870	2	-999.000	9	234.3	2	-999.0	9
WBTSRHB	AB1802	2	1	2	2	20180225	2111	26.502N	75.701W	4682	4766	2.163	34.869	2	34.872	2	234.3	2	257.3	4
WBTSRHB	AB1802	2	1	3	2	20180225	2119	26.502N	75.701W	4348	4422	2.245	34.884	2	34.888	2	261.5	2	260.8	2
WBTSRHB	AB1802	2	1	4	2	20180225	2127	26.502N	75.701W	4016	4081	2.273	34.890	2	34.892	6	264.3	2	265.0	2
WBTSRHB	AB1802	2	1	5	2	20180225	2140	26.502N	75.700W	3351	3400	2.407	34.903	2	34.904	2	268.3	2	268.6	2
WBTSRHB	AB1802	2	1	6	2	20180225	2150	26.501N	75.699W	2844	2882	2.667	34.919	2	34.922	2	267.2	2	266.8	2
WBTSRHB	AB1802	2	1	7	2	20180225	2158	26.502N	75.699W	2435	2465	3.078	34.943	2	34.943	2	261.7	2	262.1	2
WBTSRHB	AB1802	2	1	8	2	20180225	2207	26.502N	75.700W	2027	2050	3.518	34.961	2	34.964	2	260.4	2	260.4	2
WBTSRHB	AB1802	2	1	9	2	20180225	2213	26.502N	75.700W	1727	1745	3.884	34.978	2	-999.000	9	248.6	2	-999.0	9
WBTSRHB	AB1802	2	1	10	2	20180225	2214	26.502N	75.700W	1726	1745	3.885	34.979	2	34.981	2	257.3	2	257.4	2
WBTSRHB	AB1802	2	1	11	2	20180225	2222	26.503N	75.700W	1353	1366	4.548	35.012	2	-999.000	9	239.9	2	-999.0	9
WBTSRHB	AB1802	2	1	12	2	20180225	2227	26.504N	75.701W	1184	1195	5.160	35.045	2	-999.000	9	225.1	2	-999.0	9
WBTSRHB	AB1802	2	1	13	2	20180225	2231	26.504N	75.701W	1017	1026	6.304	35.078	2	35.079	6	196.2	2	198.0	2
WBTSRHB	AB1802	2	1	14	2	20180225	2235	26.504N	75.701W	907	915	7.683	35.103	2	-999.000	9	154.5	2	-999.0	9
WBTSRHB	AB1802	2	1	15	2	20180225	2239	26.504N	75.701W	798	805	9.893	35.290	2	-999.000	9	137.2	2	-999.0	9
WBTSRHB	AB1802	2	1	16	2	20180225	2242	26.504N	75.701W	690	695	12.074	35.564	2	-999.000	9	138.5	2	-999.0	9
WBTSRHB	AB1802	2	1	17	2	20180225	2245	26.504N	75.701W	581	586	14.349	35.913	2	-999.000	9	149.1	2	-999.0	9
WBTSRHB	AB1802	2	1	18	2	20180225	2249	26.504N	75.701W	472	476	16.753	36.309	2	-999.000	9	166.6	2	-999.0	9
WBTSRHB	AB1802	2	1	19	2	20180225	2252	26.504N	75.701W	363	366	18.071	36.528	2	-999.000	9	173.6	2	-999.0	9
WBTSRHB	AB1802	2	1	20	2	20180225	2256	26.504N	75.701W	254	256	19.492	36.682	2	-999.000	9	178.4	2	-999.0	9
WBTSRHB	AB1802	2	1	21	2	20180225	2259	26.504N	75.700W	165	166	21.254	36.834	2	-999.000	9	180.9	2	-999.0	9
WBTSRHB	AB1802	2	1	22	2	20180225	2301	26.504N	75.700W	110	111	22.861	36.932	2	-999.000	9	183.1	2	-999.0	9
WBTSRHB	AB1802	2	1	23	2	20180225	2305	26.503N	75.700W	61	61	24.435	36.736	2	-999.000	9	200.8	2	-999.0	9
WBTSRHB	AB1802	2	1	24	2	20180225	2308	26.503N	75.700W	2	2	24.862	36.708	2	-999.000	9	223.6	2	-999.0	9
WBTSRHB	AB1802	3	1	1	2	20180226	0612	26.500N	75.900W	4733	4818	2.155	34.868	2	34.867	6	252.0	2	253.7	2
WBTSRHB	AB1802	3	1	2	2	20180226	0613	26.500N	75.900W	4733	4818	2.155	34.868	2	34.868	2	254.6	2	253.3	2
WBTSRHB	AB1802	3	1	3	2	20180226	0618	26.500N	75.900W	4531	4610	2.232	34.880	2	34.880	2	259.3	2	259.6	2
WBTSRHB	AB1802	3	1	4	2	20180226	0624	26.500N	75.900W	4260	4331	2.251	34.886	2	34.888	2	262.4	2	262.3	2
WBTSRHB	AB1802	3	1	5	2	20180226	0632	26.500N	75.900W	3917	3980	2.276	34.892	2	34.891	2	265.1	2	265.5	2
WBTSRHB	AB1802	3	1	6	2	20180226	0639	26.501N	75.900W	3645	3701	2.313	34.896	2	34.895	2	266.7	2	267.1	2
WBTSRHB	AB1802	3	1	7	2	20180226	0649	26.501N	75.900W	3156	3201	2.480	34.909	2	34.910	2	267.0	2	267.8	2
WBTSRHB	AB1802	3	1	8	2	20180226	0659	26.501N	75.900W	2665	2700	2.797	34.928	2	34.927	2	263.9	2	264.8	2
WBTSRHB	AB1802	3	1	9	2	20180226	0709	26.501N	75.900W	2224	2251	3.226	34.948	2	34.948	2	261.5	2	261.8	2
WBTSRHB	AB1802	3	1	10	2	20180226	0718	26.500N	75.900W	1781	1800	3.775	34.970	2	34.968	2	258.7	2	258.5	2
WBTSRHB	AB1802	3	1	11	2	20180226	0725	26.500N	75.900W	1536	1552	4.150	34.992	2	34.991	2	253.9	2	253.9	2
WBTSRHB	AB1802	3	1	12	2	20180226	0732	26.500N	75.900W	1278	1291	4.741	35.023	2	35.026	2	242.3	2	242.3	2
WBTSRHB	AB1802	3	1	13	2	20180226	0737	26.500N	75.900W	1043	1052	6.194	35.076	2	35.076	2	198.8	2	200.5	2
WBTSRHB	AB1802	3	1	14	2	20180226	0742	26.500N	75.900W	908	916	7.856	35.112	2	35.110	2	155.1	2	157.2	2

WBTSRHB	AB1802	3	1	15	2	20180226	0744	26.500N	75.900W	817	825	9.517	35.233	2	35.224	2	137.2	2	137.1	2
WBTSRHB	AB1802	3	1	16	2	20180226	0747	26.500N	75.900W	709	715	11.759	35.523	2	35.523	2	140.3	2	139.7	2
WBTSRHB	AB1802	3	1	17	2	20180226	0750	26.500N	75.900W	601	606	13.989	35.855	2	35.845	2	150.1	2	149.5	2
WBTSRHB	AB1802	3	1	18	2	20180226	0753	26.500N	75.900W	492	496	15.877	36.168	2	36.155	4	164.6	2	164.4	2
WBTSRHB	AB1802	3	1	19	2	20180226	0756	26.500N	75.900W	383	386	17.773	36.483	2	36.481	2	178.6	2	179.2	2
WBTSRHB	AB1802	3	1	20	2	20180226	0800	26.500N	75.900W	274	276	19.138	36.633	2	36.624	2	183.4	2	184.1	2
WBTSRHB	AB1802	3	1	21	2	20180226	0802	26.500N	75.900W	184	186	20.580	36.743	2	36.743	2	187.0	2	187.6	2
WBTSRHB	AB1802	3	1	22	2	20180226	0804	26.500N	75.900W	120	121	22.392	36.797	2	36.797	6	208.2	2	207.7	2
WBTSRHB	AB1802	3	1	23	2	20180226	0807	26.500N	75.900W	70	71	22.840	36.818	2	36.812	2	205.5	2	207.0	2
WBTSRHB	AB1802	3	1	24	2	20180226	0810	26.500N	75.900W	3	3	24.513	36.728	2	36.727	2	206.6	2	206.8	2
WBTSRHB	AB1802	4	1	1	2	20180226	1107	26.500N	76.092W	4794	4881	2.163	34.868	2	34.869	2	233.4	2	256.4	4
WBTSRHB	AB1802	4	1	2	2	20180226	1114	26.500N	76.091W	4521	4600	2.233	34.881	2	34.877	4	259.6	2	259.1	2
WBTSRHB	AB1802	4	1	3	2	20180226	1122	26.500N	76.091W	4113	4181	2.249	34.887	2	34.885	2	263.0	2	263.4	2
WBTSRHB	AB1802	4	1	4	2	20180226	1129	26.500N	76.092W	3781	3841	2.279	34.893	2	34.891	2	265.2	2	265.6	2
WBTSRHB	AB1802	4	1	5	2	20180226	1136	26.500N	76.091W	3450	3501	2.333	34.899	2	34.896	2	266.5	2	266.7	2
WBTSRHB	AB1802	4	1	6	2	20180226	1146	26.500N	76.091W	2961	3002	2.536	34.912	2	34.910	2	266.7	2	267.6	2
WBTSRHB	AB1802	4	1	7	2	20180226	1156	26.500N	76.091W	2471	2502	2.854	34.931	2	34.929	2	252.0	2	266.5	4
WBTSRHB	AB1802	4	1	8	2	20180226	1204	26.500N	76.091W	2076	2100	3.203	34.944	2	34.943	2	262.2	2	262.3	2
WBTSRHB	AB1802	4	1	9	2	20180226	1211	26.500N	76.091W	1781	1800	3.602	34.964	2	34.964	2	259.4	2	259.8	2
WBTSRHB	AB1802	4	1	10	2	20180226	1216	26.500N	76.091W	1584	1601	3.976	34.980	2	-999.000	9	247.7	2	-999.0	9
WBTSRHB	AB1802	4	1	11	2	20180226	1221	26.500N	76.091W	1358	1372	4.480	35.008	2	35.007	2	248.0	2	248.8	2
WBTSRHB	AB1802	4	1	12	2	20180226	1225	26.500N	76.091W	1191	1202	5.218	35.044	2	35.046	2	229.1	2	229.2	2
WBTSRHB	AB1802	4	1	13	2	20180226	1230	26.500N	76.091W	1022	1032	6.850	35.089	2	35.088	2	181.5	2	182.4	2
WBTSRHB	AB1802	4	1	14	2	20180226	1233	26.500N	76.091W	913	921	7.894	35.109	2	35.109	2	154.6	2	156.8	2
WBTSRHB	AB1802	4	1	15	2	20180226	1237	26.500N	76.091W	804	811	9.480	35.229	2	35.231	2	137.5	2	137.4	2
WBTSRHB	AB1802	4	1	16	2	20180226	1240	26.500N	76.091W	695	701	11.697	35.513	2	35.506	2	141.2	2	140.4	2
WBTSRHB	AB1802	4	1	17	2	20180226	1243	26.500N	76.091W	586	591	13.998	35.857	2	35.854	2	150.5	2	150.7	2
WBTSRHB	AB1802	4	1	18	2	20180226	1246	26.500N	76.091W	477	481	15.748	36.144	2	36.136	2	163.3	2	165.1	2
WBTSRHB	AB1802	4	1	19	2	20180226	1250	26.500N	76.091W	368	371	17.631	36.462	2	36.460	2	176.0	2	177.1	2
WBTSRHB	AB1802	4	1	20	2	20180226	1253	26.500N	76.092W	259	261	19.355	36.670	2	36.671	2	182.3	2	181.9	2
WBTSRHB	AB1802	4	1	21	2	20180226	1256	26.500N	76.091W	169	171	21.256	36.800	2	36.834	4	189.9	2	188.8	2
WBTSRHB	AB1802	4	1	22	2	20180226	1259	26.500N	76.091W	94	95	22.738	36.798	2	36.809	4	197.2	2	207.6	4
WBTSRHB	AB1802	4	1	23	2	20180226	1302	26.500N	76.091W	44	45	24.267	36.752	2	36.751	2	207.3	2	208.2	2
WBTSRHB	AB1802	4	1	24	2	20180226	1306	26.500N	76.091W	3	3	24.603	36.721	2	36.752	4	206.4	2	206.7	2
WBTSRHB	AB1802	5	1	1	2	20180226	1745	26.499N	76.207W	4807	4894	2.248	34.879	2	34.873	4	256.9	2	258.2	2
WBTSRHB	AB1802	5	1	2	2	20180226	1754	26.499N	76.207W	4425	4501	2.257	34.885	2	34.886	2	242.6	2	265.0	4
WBTSRHB	AB1802	5	1	3	2	20180226	1802	26.499N	76.206W	4034	4100	2.263	34.890	2	34.882	4	246.4	2	229.6	4
WBTSRHB	AB1802	5	1	4	2	20180226	1810	26.499N	76.205W	3673	3730	2.294	34.895	2	34.892	4	249.7	2	269.9	4
WBTSRHB	AB1802	5	1	5	2	20180226	1818	26.498N	76.204W	3302	3350	2.370	34.902	2	34.898	4	266.5	2	267.2	2
WBTSRHB	AB1802	5	1	6	2	20180226	1828	26.498N	76.204W	2812	2850	2.612	34.917	2	34.912	4	253.3	2	242.7	4
WBTSRHB	AB1802	5	1	7	2	20180226	1837	26.498N	76.203W	2371	2400	2.934	34.936	2	34.933	2	262.1	2	261.9	2
WBTSRHB	AB1802	5	1	8	2	20180226	1844	26.497N	76.203W	2077	2101	3.223	34.950	2	34.948	6	259.8	2	260.7	2
WBTSRHB	AB1802	5	1	9	2	20180226	1851	26.497N	76.202W	1762	1781	3.698	34.968	2	34.966	2	258.1	2	258.6	2
WBTSRHB	AB1802	5	1	10	2	20180226	1855	26.497N	76.202W	1594	1611	3.976	34.981	2	34.979	2	255.0	2	255.9	2
WBTSRHB	AB1802	5	1	11	2	20180226	1900	26.496N	76.202W	1427	1441	4.307	34.999	2	34.993	4	250.4	2	251.1	2
WBTSRHB	AB1802	5	1	12	2	20180226	1904	26.496N	76.201W	1259	1271	4.835	35.028	2	35.028	2	240.3	2	240.3	2
WBTSRHB	AB1802	5	1	13	2	20180226	1908	26.496N	76.201W	1091	1101	5.717	35.065	2	35.063	2	213.9	2	214.7	2
WBTSRHB	AB1802	5	1	14	2	20180226	1913	26.496N	76.200W	927	935	7.752	35.107	2	35.105	2	157.0	2	157.8	2
WBTSRHB	AB1802	5	1	15	2	20180226	1916	26.496N	76.200W	818	825	9.531	35.236	2	35.233	6	137.5	2	139.0	2
WBTSRHB	AB1802	5	1	16	2	20180226	1920	26.495N	76.200W	709	715	11.104	35.432	2	35.430	2	138.0	2	138.4	2
WBTSRHB	AB1802	5	1	17	2	20180226	1923	26.495N	76.199W	600	605	13.286	35.745	2	35.743	2	146.0	2	147.2	2
WBTSRHB	AB1802	5	1	18	2	20180226	1927	26.495N	76.199W	492	496	15.371	36.082	2	36.080	2	160.1	2	161.8	2
WBTSRHB	AB1802	5	1	19	2	20180226	1930	26.495N	76.199W	383	386	17.266	36.403	2	36.399	2	168.6	2	175.6	4
WBTSRHB	AB1802	5	1	20	2	20180226	1933	26.495N	76.198W	273	275	18.986	36.638	2	36.635	2	178.2	2	179.9	2
WBTSRHB	AB1802	5	1	21	2	20180226	1937	26.495N	76.198W	184	186	20.656	36.776	2	36.778	2	184.2	2	185.1	2
WBTSRHB	AB1802	5	1	22	2	20180226	1940	26.494N	76.198W	115	116	22.448	36.796	2	36.795	2	199.0	2	205.8	4
WBTSRHB	AB1802	5	1	23	2	20180226	1947	26.494N	76.197W	2	2	24.629	36.748	2	-999.000	9	202.4	2	-999.0	9
WBTSRHB	AB1802	5	1	24	2	20180226	1947	26.494N	76.197W	2	2	24.633	36.748	2	36.751	2	206.6	2	207.9	2
WBTSRHB	AB1802	6	1	1	2	20180226	2225	26.492N	76.343W	4854	4943	2.243	34.877	2	34.875	2	254.3	2	254.7	2
WBTSRHB	AB1802	6	1	2	2	20180226	2234	26.492N	76.343W	4502	4581	2.256	34.884	2	34.880	4	260.7	2	259.8	2
WBTSRHB	AB1802	6	1	3	2	20180226	2242	26.491N	76.342W	4166	4235	2.273	34.890	2	34.885	4	263.1	2	262.0	2
WBTSRHB	AB1802	6	1	4	2	20180226	2248	26.491N	76.342W	3840	3901	2.287	34.894	2	34.889	4	265.0	2	264.8	2
WBTSRHB	AB1802	6	1	5	2	20180226	2256	26.490N	76.341W	3512	3565	2.342	34.899	2	34.897	2	266.6	2	267.2	2
WBTSRHB	AB1802	6	1	6	2	20180226	2304	26.489N	76.340W	3101	3145	2.541	34.912	2	34.911	6	266.5	2	266.8	2
WBTSRHB	AB1802	6	1	7	2	20180226	2312	26.489N	76.339W	2700	2736	2.793	34.925	2	34.915	4	264.6	2	265.2	2
WBTSRHB	AB1802	6	1	8	2	20180226	2321	26.488N	76.338W	2293	2321	3.195	34.949	2	34.947	2	259.6	2	259.8	2

WBTSRHB	AB1802	6	1	9	2	20180226	2329	26.488N	76.338W	1934	1956	3.505	34.958	2	34.956	2	260.4	2	260.8	2
WBTSRHB	AB1802	6	1	10	2	20180226	2335	26.487N	76.337W	1683	1701	3.840	34.976	2	34.977	2	257.1	2	255.4	2
WBTSRHB	AB1802	6	1	11	2	20180226	2340	26.486N	76.337W	1486	1501	4.136	34.992	2	34.995	4	253.1	2	252.7	2
WBTSRHB	AB1802	6	1	12	2	20180226	2344	26.486N	76.336W	1338	1351	4.431	35.006	2	35.001	4	248.7	2	247.5	2
WBTSRHB	AB1802	6	1	13	2	20180226	2349	26.486N	76.336W	1165	1176	5.055	35.040	2	35.038	2	227.0	2	225.9	4
WBTSRHB	AB1802	6	1	14	2	20180226	2353	26.485N	76.335W	977	986	6.408	35.080	2	35.085	2	192.8	2	192.8	2
WBTSRHB	AB1802	6	1	15	2	20180226	2358	26.485N	76.335W	799	806	9.693	35.254	2	35.252	2	136.8	2	135.6	2
WBTSRHB	AB1802	6	1	16	2	20180227	0002	26.484N	76.335W	690	696	11.133	35.436	2	35.438	2	138.5	2	137.6	2
WBTSRHB	AB1802	6	1	17	2	20180227	0005	26.484N	76.334W	581	585	12.933	35.693	2	35.696	2	144.2	2	144.7	2
WBTSRHB	AB1802	6	1	18	2	20180227	0009	26.484N	76.334W	472	475	15.353	36.082	2	36.086	2	159.4	2	158.9	2
WBTSRHB	AB1802	6	1	19	2	20180227	0012	26.484N	76.333W	363	365	17.239	36.392	2	36.390	2	175.1	2	175.9	2
WBTSRHB	AB1802	6	1	20	2	20180227	0016	26.483N	76.333W	254	255	19.544	36.693	2	36.689	6	181.6	2	179.8	2
WBTSRHB	AB1802	6	1	21	2	20180227	0019	26.483N	76.333W	164	165	21.120	36.808	2	36.811	2	180.1	2	168.9	4
WBTSRHB	AB1802	6	1	22	2	20180227	0021	26.483N	76.332W	105	105	22.695	36.879	2	36.879	2	193.9	2	195.4	2
WBTSRHB	AB1802	6	1	23	2	20180227	0025	26.483N	76.332W	55	55	24.098	36.763	2	36.765	2	207.9	2	208.2	2
WBTSRHB	AB1802	6	1	24	2	20180227	0029	26.482N	76.331W	2	2	24.404	36.760	2	36.765	2	207.2	2	207.5	2
WBTSRHB	AB1802	7	1	1	2	20180227	0308	26.489N	76.470W	4823	4910	2.244	34.878	2	34.880	6	236.9	2	259.1	4
WBTSRHB	AB1802	7	1	2	2	20180227	0316	26.489N	76.470W	4455	4532	2.249	34.884	2	34.887	2	260.2	2	259.4	2
WBTSRHB	AB1802	7	1	3	2	20180227	0324	26.488N	76.469W	4094	4161	2.275	34.890	2	34.892	2	263.5	2	263.1	2
WBTSRHB	AB1802	7	1	4	2	20180227	0332	26.487N	76.469W	3713	3771	2.326	34.897	2	34.897	2	265.8	2	265.9	2
WBTSRHB	AB1802	7	1	5	2	20180227	0340	26.486N	76.469W	3357	3406	2.441	34.906	2	34.903	2	266.9	2	266.6	2
WBTSRHB	AB1802	7	1	6	2	20180227	0349	26.485N	76.469W	2955	2996	2.641	34.918	2	34.918	2	265.5	2	264.9	2
WBTSRHB	AB1802	7	1	7	2	20180227	0357	26.483N	76.469W	2548	2581	2.999	34.939	2	34.940	2	261.0	2	260.9	2
WBTSRHB	AB1802	7	1	8	2	20180227	0406	26.483N	76.468W	2140	2166	3.351	34.953	2	34.954	2	260.0	2	259.1	2
WBTSRHB	AB1802	7	1	9	2	20180227	0413	26.482N	76.467W	1835	1856	3.709	34.965	2	34.967	2	258.6	2	258.1	2
WBTSRHB	AB1802	7	1	10	2	20180227	0419	26.482N	76.467W	1579	1596	3.962	34.977	2	34.979	2	255.1	2	254.8	2
WBTSRHB	AB1802	7	1	11	2	20180227	0424	26.481N	76.467W	1388	1401	4.223	34.987	2	34.988	2	245.1	2	254.9	4
WBTSRHB	AB1802	7	1	12	2	20180227	0428	26.481N	76.467W	1219	1231	4.725	35.027	2	35.028	2	242.2	2	240.6	2
WBTSRHB	AB1802	7	1	13	2	20180227	0433	26.480N	76.467W	1051	1060	5.522	35.060	2	35.063	2	219.4	2	219.1	2
WBTSRHB	AB1802	7	1	14	2	20180227	0436	26.480N	76.466W	942	951	6.757	35.087	2	35.087	2	181.3	2	182.0	2
WBTSRHB	AB1802	7	1	15	2	20180227	0440	26.479N	76.466W	833	841	8.350	35.130	2	35.130	2	145.6	2	143.9	2
WBTSRHB	AB1802	7	1	16	2	20180227	0443	26.479N	76.466W	724	730	10.409	35.341	2	35.341	2	136.6	2	134.6	2
WBTSRHB	AB1802	7	1	17	2	20180227	0447	26.479N	76.466W	615	620	12.633	35.649	2	35.647	6	143.0	2	141.4	2
WBTSRHB	AB1802	7	1	18	2	20180227	0450	26.479N	76.466W	507	511	14.794	35.988	2	35.987	2	157.4	2	155.6	2
WBTSRHB	AB1802	7	1	19	2	20180227	0453	26.479N	76.466W	397	400	16.732	36.306	2	36.304	2	167.6	2	165.8	2
WBTSRHB	AB1802	7	1	20	2	20180227	0457	26.478N	76.465W	288	290	18.717	36.607	2	36.605	2	178.0	2	177.5	2
WBTSRHB	AB1802	7	1	21	2	20180227	0500	26.478N	76.465W	199	200	20.500	36.770	2	36.768	2	182.4	2	181.3	2
WBTSRHB	AB1802	8	1	1	2	20180227	1244	26.500N	76.563W	4819	4907	2.297	34.884	2	34.884	2	240.2	2	261.4	4
WBTSRHB	AB1802	8	1	2	2	20180227	1252	26.500N	76.562W	4454	4531	2.274	34.886	2	34.887	2	261.5	2	260.3	2
WBTSRHB	AB1802	8	1	3	2	20180227	1259	26.500N	76.562W	4091	4158	2.299	34.892	2	34.892	2	264.3	2	264.0	2
WBTSRHB	AB1802	8	1	4	2	20180227	1307	26.500N	76.561W	3714	3771	2.330	34.897	2	34.897	2	265.5	2	264.7	2
WBTSRHB	AB1802	8	1	5	2	20180227	1315	26.500N	76.561W	3358	3407	2.409	34.904	2	34.902	2	267.0	2	265.2	2
WBTSRHB	AB1802	8	1	6	2	20180227	1323	26.499N	76.560W	2955	2995	2.673	34.920	2	34.920	2	265.0	2	264.5	2
WBTSRHB	AB1802	8	1	7	2	20180227	1332	26.499N	76.560W	2549	2581	3.104	34.944	2	34.945	2	248.9	2	263.5	4
WBTSRHB	AB1802	8	1	8	2	20180227	1340	26.499N	76.559W	2140	2166	3.345	34.951	2	34.952	2	260.2	2	259.8	2
WBTSRHB	AB1802	8	1	9	2	20180227	1347	26.499N	76.559W	1847	1868	3.656	34.963	2	34.965	2	259.1	2	258.5	2
WBTSRHB	AB1802	8	1	10	2	20180227	1354	26.498N	76.558W	1584	1600	3.841	34.973	2	34.978	4	256.9	2	256.2	2
WBTSRHB	AB1802	8	1	11	2	20180227	1359	26.498N	76.558W	1368	1381	4.174	34.987	2	34.988	2	253.5	2	252.3	2
WBTSRHB	AB1802	8	1	12	2	20180227	1403	26.499N	76.558W	1219	1230	4.498	35.007	2	35.007	2	246.4	2	246.3	2
WBTSRHB	AB1802	8	1	13	2	20180227	1408	26.499N	76.558W	1054	1064	5.622	35.062	2	35.063	2	216.0	2	215.9	2
WBTSRHB	AB1802	8	1	14	2	20180227	1411	26.499N	76.557W	944	952	6.550	35.082	2	35.086	2	188.4	2	186.7	2
WBTSRHB	AB1802	8	1	15	2	20180227	1415	26.499N	76.557W	835	842	8.111	35.113	2	35.116	2	147.1	2	146.9	2
WBTSRHB	AB1802	8	1	16	2	20180227	1418	26.499N	76.557W	727	733	10.323	35.330	2	35.334	2	136.5	2	137.3	2
WBTSRHB	AB1802	8	1	17	2	20180227	1422	26.499N	76.557W	615	620	12.512	35.632	2	35.633	2	137.9	2	79.2	4
WBTSRHB	AB1802	8	1	18	2	20180227	1425	26.499N	76.557W	503	507	14.802	35.989	2	35.985	2	155.3	2	154.7	2
WBTSRHB	AB1802	8	1	19	2	20180227	1428	26.500N	76.556W	393	396	16.981	36.351	2	36.352	6	173.1	2	172.5	2
WBTSRHB	AB1802	8	1	20	2	20180227	1431	26.500N	76.556W	290	292	18.688	36.602	2	36.604	2	179.1	2	178.0	2
WBTSRHB	AB1802	8	1	21	2	20180227	1434	26.500N	76.556W	199	200	20.017	36.720	2	36.721	2	184.5	2	183.7	2
WBTSRHB	AB1802	8	1	22	2	20180227	1438	26.500N	76.556W	120	121	22.073	36.807	2	36.811	2	197.0	2	198.5	2
WBTSRHB	AB1802	8	1	23	2	20180227	1440	26.500N	76.556W	71	71	23.187	36.807	2	36.793	4	198.1	2	205.7	4
WBTSRHB	AB1802	8	1	24	2	20180227	1444	26.500N	76.556W	3	3	24.414	36.749	2	36.747	2	206.1	2	205.4	2
WBTSRHB	AB1802	9	1	1	2	20180227	1741	26.495N	76.658W	4595	4676	2.248	34.882	2	-999.000	9	238.9	2	-999.0	9
WBTSRHB	AB1802	9	1	2	2	20180227	1742	26.495N	76.658W	4595	4676	2.249	34.882	2	-999.000	9	239.5	2	-999.0	9
WBTSRHB	AB1802	9	1	3	2	20180227	1753	26.494N	76.659W	4074	4141	2.275	34.890	2	-999.000	9	245.9	2	-999.0	9
WBTSRHB	AB1802	9	1	4	2	20180227	1801	26.494N	76.660W	3669	3726	2.342	34.898	2	-999.000	9	250.0	2	-999.0	9
WBTSRHB	AB1802	9	1	5	2	20180227	1810	26.494N	76.660W	3254	3301	2.534	34.911	2	-999.000	9	252.2	2	-999.0	9

WBTSRHB	AB1802	9	1	6	2	20180227	1819	26.494N	76.661W	2861	2900	2.883	34.929	2	-999.000	9	250.5	2	-999.0	9
WBTSRHB	AB1802	9	1	7	2	20180227	1825	26.494N	76.661W	2568	2601	3.139	34.942	2	-999.000	9	249.2	2	-999.0	9
WBTSRHB	AB1802	9	1	8	2	20180227	1832	26.494N	76.661W	2273	2301	3.347	34.950	2	-999.000	9	249.8	2	-999.0	9
WBTSRHB	AB1802	9	1	9	2	20180227	1838	26.494N	76.662W	1978	2000	3.583	34.960	2	-999.000	9	249.9	2	-999.0	9
WBTSRHB	AB1802	9	1	10	2	20180227	1845	26.493N	76.662W	1680	1698	3.864	34.972	2	-999.000	9	248.1	2	-999.0	9
WBTSRHB	AB1802	9	1	11	2	20180227	1852	26.493N	76.662W	1387	1401	4.134	34.982	2	-999.000	9	245.8	2	-999.0	9
WBTSRHB	AB1802	9	1	12	2	20180227	1857	26.493N	76.662W	1199	1210	4.669	35.020	2	-999.000	9	236.2	2	-999.0	9
WBTSRHB	AB1802	9	1	13	2	20180227	1901	26.493N	76.663W	1031	1041	5.734	35.065	2	-999.000	9	205.8	2	-999.0	9
WBTSRHB	AB1802	9	1	14	2	20180227	1905	26.492N	76.663W	902	910	7.271	35.096	2	-999.000	9	162.8	2	-999.0	9
WBTSRHB	AB1802	9	1	15	2	20180227	1909	26.492N	76.663W	793	800	8.895	35.172	2	-999.000	9	134.9	2	-999.0	9
WBTSRHB	AB1802	9	1	16	2	20180227	1912	26.492N	76.664W	685	690	11.394	35.471	2	-999.000	9	134.0	2	-999.0	9
WBTSRHB	AB1802	9	1	17	2	20180227	1915	26.492N	76.664W	576	581	13.677	35.807	2	-999.000	9	144.4	2	-999.0	9
WBTSRHB	AB1802	9	1	18	2	20180227	1919	26.492N	76.664W	466	470	15.746	36.147	2	-999.000	9	158.1	2	-999.0	9
WBTSRHB	AB1802	9	1	19	2	20180227	1923	26.492N	76.665W	358	361	17.646	36.465	2	-999.000	9	172.4	2	-999.0	9
WBTSRHB	AB1802	9	1	20	2	20180227	1926	26.492N	76.665W	248	250	19.417	36.675	2	-999.000	9	177.3	2	-999.0	9
WBTSRHB	AB1802	9	1	21	2	20180227	1929	26.492N	76.665W	159	161	20.869	36.759	2	-999.000	9	181.9	2	-999.0	9
WBTSRHB	AB1802	9	1	22	2	20180227	1932	26.492N	76.665W	110	111	22.318	36.810	2	-999.000	9	196.5	2	-999.0	9
WBTSRHB	AB1802	9	1	23	2	20180227	1936	26.492N	76.666W	60	60	23.758	36.765	2	-999.000	9	204.1	2	-999.0	9
WBTSRHB	AB1802	10	1	1	2	20180228	0409	26.501N	76.746W	3847	3908	2.271	34.891	2	34.891	2	235.8	2	266.0	4
WBTSRHB	AB1802	10	1	2	2	20180228	0416	26.501N	76.746W	3498	3551	2.407	34.902	2	34.900	2	266.6	2	266.1	2
WBTSRHB	AB1802	10	1	3	2	20180228	0422	26.501N	76.746W	3218	3265	2.539	34.911	2	34.912	2	266.3	2	266.5	2
WBTSRHB	AB1802	10	1	4	2	20180228	0428	26.501N	76.746W	2959	3000	2.782	34.924	2	34.925	2	264.2	2	264.6	2
WBTSRHB	AB1802	10	1	5	2	20180228	0437	26.502N	76.746W	2470	2501	3.147	34.943	2	34.944	6	260.9	2	261.1	2
WBTSRHB	AB1802	10	1	6	2	20180228	0444	26.502N	76.747W	2159	2185	3.446	34.957	2	34.957	2	259.3	2	259.1	2
WBTSRHB	AB1802	10	1	7	2	20180228	0500	26.502N	76.747W	1532	1548	4.111	34.985	2	34.985	2	253.5	2	253.4	2
WBTSRHB	AB1802	10	1	8	2	20180228	0508	26.502N	76.747W	1239	1251	4.814	35.025	2	35.024	2	231.8	2	241.2	4
WBTSRHB	AB1802	10	1	9	2	20180228	0514	26.502N	76.748W	1090	1101	5.547	35.059	2	35.059	2	219.1	2	219.2	2
WBTSRHB	AB1802	10	1	10	2	20180228	0518	26.501N	76.748W	943	952	6.773	35.087	2	35.087	2	182.3	2	181.6	2
WBTSRHB	AB1802	10	1	11	2	20180228	0522	26.501N	76.748W	809	816	8.249	35.118	2	35.121	2	145.7	2	144.6	2
WBTSRHB	AB1802	10	1	12	2	20180228	0525	26.501N	76.749W	700	706	10.871	35.400	2	35.401	2	136.7	2	135.6	2
WBTSRHB	AB1802	10	1	13	2	20180228	0529	26.501N	76.749W	591	596	13.288	35.746	2	35.745	2	146.5	2	145.1	2
WBTSRHB	AB1802	10	1	14	2	20180228	0532	26.501N	76.749W	483	486	15.739	36.145	2	36.143	2	162.0	2	162.4	2
WBTSRHB	AB1802	10	1	15	2	20180228	0535	26.501N	76.749W	373	376	17.567	36.449	2	36.450	2	177.8	2	176.9	2
WBTSRHB	AB1802	10	1	16	2	20180228	0538	26.501N	76.749W	264	266	19.146	36.644	2	36.646	2	182.5	2	181.2	2
WBTSRHB	AB1802	10	1	17	2	20180228	0542	26.500N	76.750W	174	176	20.791	36.792	2	36.791	2	182.8	2	182.9	2
WBTSRHB	AB1802	10	1	18	2	20180228	0545	26.500N	76.750W	96	96	23.332	36.916	2	36.913	6	197.1	2	195.6	2
WBTSRHB	AB1802	10	1	19	2	20180228	0547	26.499N	76.750W	45	45	24.392	36.748	2	36.751	2	206.8	2	206.4	2
WBTSRHB	AB1802	10	1	20	2	20180228	0550	26.499N	76.751W	3	3	24.381	36.749	2	36.746	2	206.4	2	206.5	2
WBTSRHB	AB1802	11	1	1	2	20180228	0905	26.515N	76.833W	1080	1090	5.831	35.063	2	35.063	2	210.2	2	211.7	2
WBTSRHB	AB1802	11	1	2	2	20180228	0908	26.514N	76.833W	992	1001	6.097	35.071	2	35.073	2	201.7	2	202.0	2
WBTSRHB	AB1802	11	1	3	2	20180228	0911	26.514N	76.834W	893	901	7.066	35.092	2	35.093	2	174.1	2	173.9	2
WBTSRHB	AB1802	11	1	4	2	20180228	0914	26.514N	76.834W	795	802	8.657	35.160	2	35.164	2	143.6	2	143.3	2
WBTSRHB	AB1802	11	1	5	2	20180228	0918	26.513N	76.834W	695	701	10.057	35.307	2	35.312	2	140.4	2	139.5	2
WBTSRHB	AB1802	11	1	6	2	20180228	0920	26.513N	76.834W	596	601	13.235	35.739	2	35.743	2	145.5	2	145.2	2
WBTSRHB	AB1802	11	1	7	2	20180228	0924	26.513N	76.834W	497	500	15.025	36.027	2	36.027	2	158.0	2	158.2	2
WBTSRHB	AB1802	11	1	8	2	20180228	0927	26.513N	76.834W	387	390	17.616	36.457	2	36.461	6	175.7	2	176.7	2
WBTSRHB	AB1802	11	1	9	2	20180228	0930	26.512N	76.834W	278	280	19.297	36.627	2	36.626	2	194.7	2	195.4	2
WBTSRHB	AB1802	11	1	10	2	20180228	0933	26.512N	76.834W	190	191	20.731	36.761	2	36.760	2	188.1	2	188.2	2
WBTSRHB	AB1802	11	1	11	2	20180228	0936	26.512N	76.834W	119	120	22.463	36.825	2	36.814	4	198.9	2	207.1	4
WBTSRHB	AB1802	11	1	12	2	20180228	0938	26.512N	76.834W	70	70	23.836	36.818	2	36.822	2	205.0	2	203.0	2
WBTSRHB	AB1802	11	1	13	2	20180228	0941	26.511N	76.834W	4	4	24.401	36.736	2	36.738	2	216.9	2	200.8	4
WBTSRHB	AB1802	12	1	1	2	20180228	1308	26.525N	76.895W	197	198	20.424	36.747	2	36.753	2	185.6	2	185.4	2
WBTSRHB	AB1802	12	1	2	2	20180228	1310	26.525N	76.895W	166	168	21.232	36.803	2	36.802	6	188.2	2	188.5	2
WBTSRHB	AB1802	12	1	3	2	20180228	1312	26.525N	76.894W	130	131	22.240	36.841	2	36.848	2	195.1	2	194.8	2
WBTSRHB	AB1802	12	1	4	2	20180228	1316	26.525N	76.894W	62	63	24.544	36.726	2	36.726	2	203.5	2	203.0	2
WBTSRHB	AB1802	12	1	5	2	20180228	1318	26.525N	76.894W	41	41	24.538	36.726	2	36.727	2	202.6	2	203.2	2
WBTSRHB	AB1802	12	1	6	2	20180228	1321	26.525N	76.895W	4	4	24.544	36.725	2	36.727	2	203.6	2	202.8	2
WBTSRHB	AB1802	13	1	1	2	20180301	0221	26.432N	78.669W	756	762	9.176	35.235	2	35.238	2	141.2	2	147.9	4
WBTSRHB	AB1802	13	1	2	2	20180301	0226	26.432N	78.668W	566	571	13.212	35.733	2	35.733	2	151.1	2	149.8	2
WBTSRHB	AB1802	13	1	3	2	20180301	0230	26.432N	78.668W	418	421	16.528	36.275	2	36.274	2	170.2	2	170.2	2
WBTSRHB	AB1802	13	1	4	2	20180301	0234	26.432N	78.668W	289	291	19.320	36.671	2	36.664	2	180.2	2	179.8	2
WBTSRHB	AB1802	13	1	5	2	20180301	0239	26.432N	78.668W	160	161	22.111	36.851	2	36.847	2	187.9	2	188.6	2
WBTSRHB	AB1802	13	1	6	2	20180301	0242	26.431N	78.668W	60	60	24.103	36.833	2	36.833	2	201.1	2	190.3	4
WBTSRHB	AB1802	13	1	7	2	20180301	0246	26.431N	78.669W	2	2	24.759	36.680	2	36.679	6	205.8	2	205.8	2
WBTSRHB	AB1802	14	1	1	2	20180301	0433	26.333N	78.715W	685	691	8.942	35.222	2	35.222	2	133.4	2	152.2	4
WBTSRHB	AB1802	14	1	2	2	20180301	0437	26.333N	78.715W	526	530	14.429	35.926	2	35.916	2	157.3	2	156.8	2

WBTSRHB	AB1802	14	1	3	2	20180301	0441	26.332N	78.715W	368	371	17.612	36.452	2	36.451	2	177.1	2	178.1	2
WBTSRHB	AB1802	14	1	4	2	20180301	0445	26.332N	78.715W	209	210	20.929	36.762	2	36.753	2	189.4	2	189.7	2
WBTSRHB	AB1802	14	1	5	2	20180301	0449	26.332N	78.716W	80	80	23.930	36.844	2	36.843	2	199.3	2	199.1	2
WBTSRHB	AB1802	14	1	6	2	20180301	0453	26.332N	78.716W	3	4	24.836	36.613	2	36.619	6	197.6	2	205.0	4
WBTSRHB	AB1802	15	1	1	2	20180301	0601	26.247N	78.761W	516	520	14.319	35.912	2	35.928	4	154.9	2	155.6	2
WBTSRHB	AB1802	15	1	2	2	20180301	0604	26.246N	78.761W	398	401	17.016	36.356	2	36.353	2	173.5	2	173.3	2
WBTSRHB	AB1802	15	1	3	2	20180301	0607	26.247N	78.761W	268	270	19.124	36.636	2	36.637	2	176.5	2	177.4	2
WBTSRHB	AB1802	15	1	4	2	20180301	0611	26.247N	78.761W	161	162	23.806	36.838	2	36.839	2	199.9	2	199.6	2
WBTSRHB	AB1802	15	1	5	2	20180301	0614	26.247N	78.761W	60	61	24.449	36.764	2	36.767	6	196.0	2	203.0	4
WBTSRHB	AB1802	15	1	6	2	20180301	0617	26.248N	78.761W	2	2	25.248	36.482	2	36.482	2	198.4	2	196.7	2
WBTSRHB	AB1802	16	1	1	2	20180301	0717	26.167N	78.801W	449	453	16.020	36.189	2	36.202	4	160.2	2	167.7	4
WBTSRHB	AB1802	16	1	2	2	20180301	0722	26.167N	78.801W	269	271	19.257	36.636	2	36.635	2	181.8	2	180.4	2
WBTSRHB	AB1802	16	1	3	2	20180301	0725	26.167N	78.800W	180	181	23.548	36.858	2	36.858	6	194.1	2	194.8	2
WBTSRHB	AB1802	16	1	4	2	20180301	0728	26.167N	78.800W	90	91	24.106	36.853	2	36.850	2	204.9	2	205.1	2
WBTSRHB	AB1802	16	1	5	2	20180301	0731	26.167N	78.801W	3	3	25.064	36.587	2	36.586	2	197.4	2	197.4	2