CTD Calibration Report
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## Cruise Summary

Ship: RV Neil Armstrong
Project Name: OSNAP West
Dates: August 19 – September 24, 2022
Ports: Reykjavik, Iceland – Nuuk, Greenland

## Included Files

*AR69_03_CTD_Calibration_Report.pdf*
This document in .pdf format

****_profile_upcast.nc, ***_profile_downcast.nc*
Final CTD data of cast ***, including final Autosal-corrected conductivity and Winkler-corrected oxygen, for the upcast and downcast arranged as 2 dbar pressure series. Data is stored as a netCDF file with unit information available in the data attributes. These files contain the following measurements: Station number, NMEA time stamp, latitude, longitude, SBE9 pressure, SBE3 temperature (primary and secondary), SBE3 flags (WOCE, below), SBE4C conductivity (primary and secondary), primary salinity, salinity flags, SIO-ODF oxygen, oxygen flags, raw CTD oxygen, CTD oxygen voltage, altimeter, ECO-FL fluorometer readings, turbidity voltage, transmissometer voltage, CDOM fluorometer voltage.

****_profile_complete.nc*
Final CTD data of cast ***, including final Autosal-corrected conductivity and Winkler-corrected oxygen, for the upcast and downcast combined into a single file as a 24 Hz series. Data is stored as a netCDF file with unit information available in the data attributes. These data contain the same measurements as the upcast and downcast netCDFs.

*bottle_data.csv, .nc*
Final CTD bottle data for all of AR69-03, including final Autosal-corrected conductivity and Winkler-corrected oxygen. Data are pulled and averaged from when a bottle is fired during the upcast and are fit to the downcast. Measurement types are identical to those of the time and pressure series, though an additional SSSCC is provided to demarcate cast number. Data is provided as a CSV in addition to netCDF.

## Variable Definitions

| | |
|---|---|
| SSSCC | Station cast number, ***, exclusive to bottle_data. |
| BTLNBR | Niskin bottle number, exclusive to bottle_data. |
| DateTime | NMEA UNIX serial time stamp (seconds since Jan 1, 1970). |
| GPSLAT | Station latitude in decimal degrees. |
| GPSLON | Station longitude in decimal degrees. |
| CTDPRS | Pressure in dbar. |
| CTDTMP1 | Primary line SBE3 temperature in ºC (ITS-90). |

| | |
|---|---|
| CTDTMP2 | Secondary line SBE3 temperature in ºC (ITS-90). |
| CTDTMP_FLAG_W | WOCE flags between CTDTMP1 and CTDTMP2 |
| CTDCOND1 | Primary line SBE4C conductivity in mS/cm. |
| CTDCOND2 | Secondary line SBE4C conductivity in mS/cm. |
| CTDSAL | Salinity derived from primary line in PSU (PSS-78). |
| CTDSAL_FLAG_W | WOCE flags for CTD salinity. |
| CTDOXY_SIO | SIO-ODF derived SBE43 oxygen in µmol/kg. |
| CTDOXY1 | SBE43 oxygen derived from primary line in mL/L. |
| CTDOXYVOLTS | SBE43 voltage in 0-5 VDC. |
| ALT | Altimeter reading in meters. |
| CTDFLUOR | ECO-FL fluorometer reading in $mg/m^3$. |
| TURBIDITY | ECO-NTU voltage in 0-5 VDC. |
| CTDXMISS | Transmissometer voltage in 0-5 VDC. |
| FLUOR_CDOM | CDOM fluorometer voltage in 0-5 VDC. |

WOCE quality flags applied to temperature*, conductivity, and oxygen are as follows:
1 = Not calibrated with water samples
2 = Acceptable measurement
3 = Questionable measurement
4 = Bad measurement
9 = Not sampled

*SBE3 sensors were referenced to each other rather than a SBE35 for flagging.

**CTD Configuration**

CTD data for 214 casts were acquired using a SBE911+ CTD and deck unit. Data were visualized and the SBE 32 carousel was controlled remotely using SeaBird Scientific's SeaSave v7.26.7.107 software. Timestamps were made available from a shipboard NMEA device and by scan number. Within SeaSave, the CTD was configured with the following sensor channels:

| Channel Index | A/D Voltage # | Equipment | S/N | Cal Date | Stations |
|---|---|---|---|---|---|
| 1 | - | Primary SBE 3 | 4491 | 30 July 2021 | 001 – 214 |
| 2 | - | Primary SBE 4C | 3009 | 30 July 2021 | 001 – 214 |
| 3 | - | SBE 9 | 0383 | 15 July 2021 | 001 – 214 |
| 4 | - | Secondary SBE 3 | 4492 | 30 July 2021 | 001 – 214 |
| 5 | - | Secondary SBE 4C | 3521 | 29 July 2021 | 001 – 214 |
| 6 | 0 | Valeport 500 | 46506 | 2018 | 001 – 214 |
| 7 | 1 | SBE 43 | 1960 | 31 July 2021 | 001 – 214 |
| 8 | 2 | ECO-FL | 0969 | 9 May 2019 | 001 – 214 |
| 9 | 3 | ECO-NTU | 0969 | 9 May 2019 | 001 – 214 |
| 10 | 4 | PAR (QSP200L) | 4550 | 14 May 2014 | 001 – 214 |
| 11 | 5 | C-Star Xmiss | 1116DR | 22 May 2019 | 001 – 214 |
| 12 | 6 | ECO CDOM | 1964 | 18 November 2016 | 001 – 214 |
| 13 | 7 | *Free* | | | |

| | | | | | |
|---|---|---|---|---|---|
| 14 | - | SPAR voltage | - | - | - |
| 15 | - | SPAR | - | - | - |

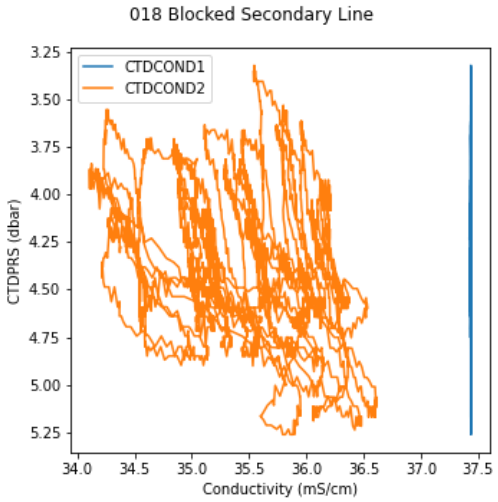
See Appendix A for more information on CTD configuration. For a general CTD configuration description, see the "CTDO" section of the AR69-03 cruise report.

## Summary of Events and Problems

001: At the test station (cast number 001), the CTD configuration did not correctly account for the removal of niskin bottles 14 – 17 and as such bottle 13 was not fired. This was corrected by cast 002.

011: During cast 011, the winch wire was identified off the track and the upcast was paused at 2300 m to reseat the wire.

018: Biofouling was identified at the end of cast 017, though it did not cause issues with data and the CTD package was cleaned at recovery. However, the secondary conductivity sensor was irregular at the beginning of cast 018 with readings in excess of 1 mS/cm off from the primary SBE4C and large variability. The cast was aborted at the surface and the CTD was recovered for additional flushing of the primary and secondary lines. There were no issues during the second deployment of cast 018.

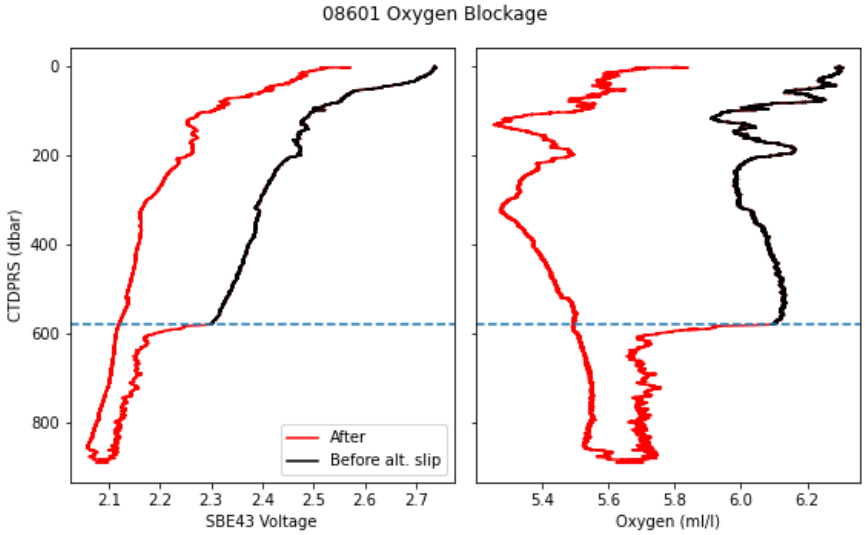



031: Bottle 9 at the surface of cast 031 was rushed for the ship to move away from approaching ice.

057: Prior to the downcast of 057, the winch wire out reading was identified as negative at a depth of around 10 m. The CTD was recovered for the winch, scoreboard controllers, and LC190 controllers to be reset. The CTD was redeployed as cast 057 and the winch issues were resolved.

086: During cast 086, the altimeter slipped during the downcast and tape blocked the plumbing intake to the primary sensor line. Without reliable oxygen or conductivity readings, the upcast was abandoned and fired bottles were not sampled. The CTD was recovered and the altimeter was

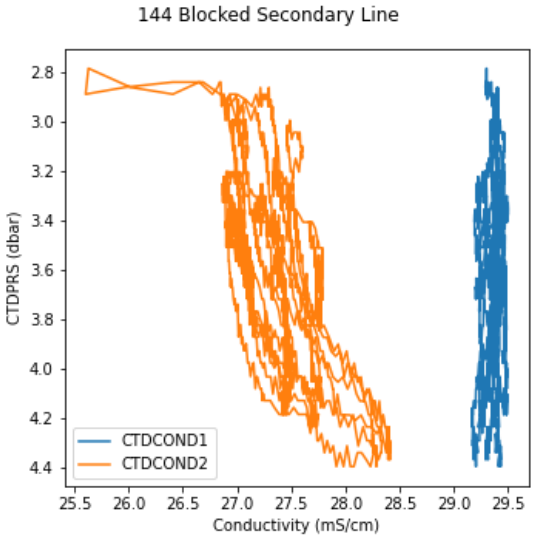
refastened to the rosette, then redeployed with the second deployment of cast 086 used for data and bottle sampling.




105: At the conclusion of cast 105, data acquisition was shut down prematurely on the deck box and the final scan of 105 was incomplete. To prevent errors in data processing, the final scan was removed from the 105 hex file.

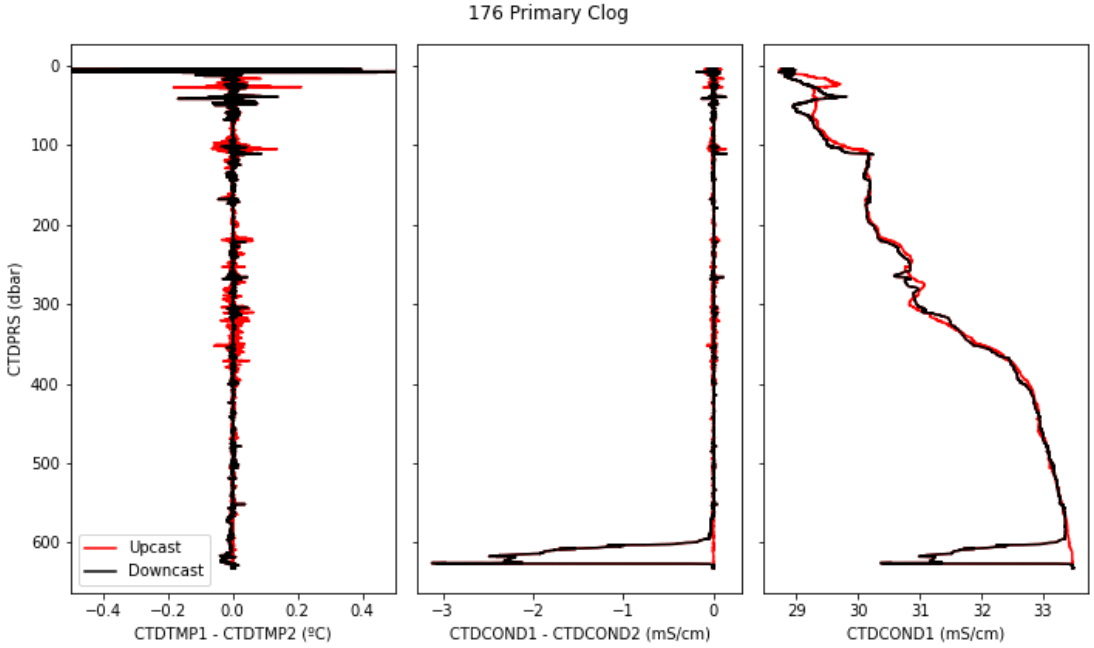
123: Due to time constraints between mooring operations, cast 123 was taken to 2000 meters rather than the full 2980 meters.

144: Similar to 018, the CTD was deployed and allowed to soak at the surface and the conductivity values were abnormal. C1-C2 residuals were in excess of over 1 mS/cm, suggesting a difference in flow between the two sensors. The cast was aborted and lines were flushed at the surface. There were no issues during the second deployment of cast 144.



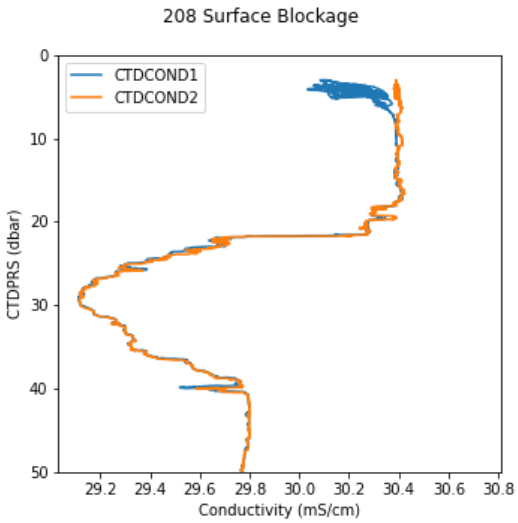

146, 168, 169: Mooring releases were soaked at these stations, no data was intended to be collected. For that reason, no bottles were fired on 146 and no samples were collected on any of these casts. For that reason, processing was skipped.

176: The primary line was plugged at around 560 m as something was sucked up, though the artifact cleared the plumbing by the time we reached the bottom. The upcast had no irregularities. Additional flushing of the lines was taken as a precautionary measure between casts 176 and 177.




200: The rosette was deployed between LSsec4 and LSsec5 to test closures on all bottles and was deployed to a depth of 150 m, rather than near 2355 m. No samples were taken.

208: During cast 208, there was a blockage in the primary line at the surface with the same behavior as in 018 and 144. This time, however, we decided to deploy and observe if the material would clear the plumbing. We did not need to redeploy as the blockage cleared the plumbing in the upper 10 meters and the cast continued as normal.



## SeaBird Processing

For immediate access to the science party, data were processed using the WHOI batch routine *goscience* which ran a number of SBE routines on the raw data (SBEDataProcessing ver. 7.26.7). These data were not fit for conductivity or oxygen and are therefore omitted from final data submission (extensions .asc, .btl, .cnv, .hdr, .ros).

SeaBird processing routines are summarized in the following table.

| SeaBird Module | Description (SeaBird, Version 7.26.7) |
|---|---|
| DATCNV | Convert raw data to pressure, temperature, conductivity, and dissolved oxygen (.cnv). |
| BOTTLESUM | Write bottle summary file (.btl). |
| ALIGNCTD | Advance oxygen by 3.5 seconds relative to pressure. |
| WILDEDIT | Despike 'wild' data points using 2 and 20 stdev passes. |
| CELLTM | Conductivity cell thermal mass correction where $\alpha = 0.03$ and $\beta = 1 / 7$. |
| FILTER | Low pass filter with constant time = 0.15 for pressure and depth. Increases pressure resolution for LOOPEDIT. |
| LOOPEDIT | Mark scans where CTD descent is 0.25 m/s or less, accounting for ship roll. |
| DERIVE sal | Compute salinity on each line. |
| DERIVE oxy | Compute oxygen from filtered oxygen current and primary sensor line. |
| BINAVG | Average data into 2 dbar pressure bins. |
| SPLIT | Break cast into upcast and downcast (.cnv). |

## SIO/ODF Processing

Shipboard CTD data processing was performed after deployment using a modified version of SIO/ODF CTD processing software "ctdcal" v. 0.1.3b. CTD acquisition data (.HEX, .XMLCON) were copied onto a OS X system, and then processed.

The V1 SBE11 deck unit applies a 1.75 scan offset (0.073 seconds at 24 Hz) for the primary conductivity sensor in order to account for the distance between the SBE 3 and SBE 4C sensors, though it does not apply this offset to the seconary conductivity sensor. To account for this, the secondary conductivity sensor was aligned to the rest of the data by 1 scan. This realignment adjusted the secondary conductivity sensor to be more closely aligned with the primary sensor, which improved the absolute C2-C1 sensor residuals on the order of $10^{-3}$ mS/m for stations where it was assessed (001, 031, 060). Similarly, the SBE43 oxygen sensor was aligned by 3.5 seconds to account for plumbing distance between the SBE3 and SBE43 sensors. Scans containing pressure spikes (>6500 dbar) were removed, data during the initial soak were removed, and a 24-scan triangle filter were applied to CTD pressure, T1, T2, C1, C2, salinity, and SBE43 voltage.

CTD data at bottle trips were extracted from the upcast, and a downcast pressure series was created. 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 conductivity and oxygen sensor calibrations. Extracted bottle data, with check niskin bottle as a

reference, were used to identify residuals between the downcast and the reference to acquire fitting coefficients. These coefficients were applied to the continuous downcast and extracted bottle summary data to minimize the residual and are summarized in the conductivity and oxygen sections below.

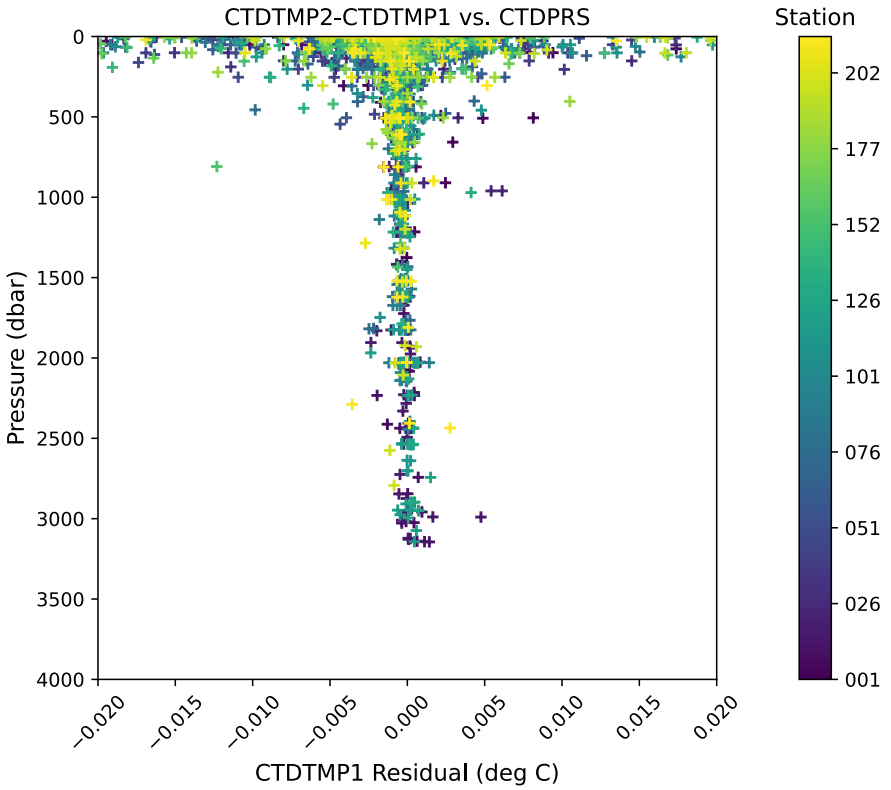
A list of calibration stations was maintained to produce hihg resolution 24 Hz downcast and upcast data, as opposed to only the with the downcast and upcast fit individually to check standards when available.

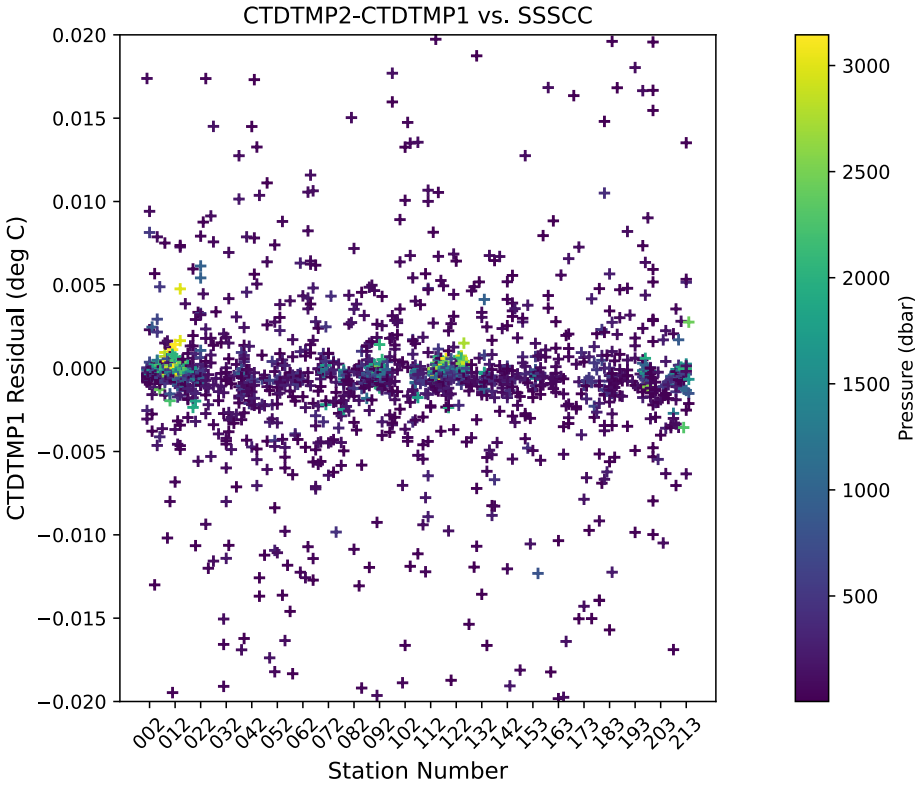
**Temperature**

Pre-cruise laboratory coefficients were used to convert SBE3plus frequencies to ITS-90 temperature. SBE3plus temperature readings were flagged by assessing residuals between the primary (CT1) and secondary (CT2) sensors. However, no bottle check values were available so no fitting was performed. For this reason, all temperature flags were assigned to WOCE flag 1.

Thresholds for flagging were determined as a function of CTD depth as follows:

| Depth (m) | > 2,000 | 2000 - 1000 | 1000 - 500 | < 500 |
|---|---|---|---|---|
| Residual bound (ºC) | 0.002 | 0.005 | 0.01 | 0.02 |






## Conductivity

The pre-cruise laboratory calibration coefficients were used to convert SBE4C frequencies to mS/cm conductivity values. Additional shipboard calibrations were performed to correct sensor bias. At each bottle closure, the primary and secondary conductivity were compared with each other. Each sensor was also compared to conductivity calculated from check sample salinities using CTD pressure and temperature.

A functioning SBE4C sensor typically exhibit a predictable modeled response. Offsets for each C sensor were determined using $C_{Bottle}$ - $C_{CTD}$ differences in a deeper pressure range (500 dbar or more). After conductivity offsets were applied to all casts, response to pressure, temperature and conductivity were examined for each conductivity sensor. The response model is second-order with respect to pressure, second-order with respect to temperature, and second-order with respect to conductivity:

$$Ccor = C + cp_2P^2 + cp_1P + ct_2T^2 + ct_1T + cc_2C^2 + cc_1C + \text{Offset}$$

Fit coefficients were distinguished by geographic location and hydrographic section as follows:

Primary SBE4C

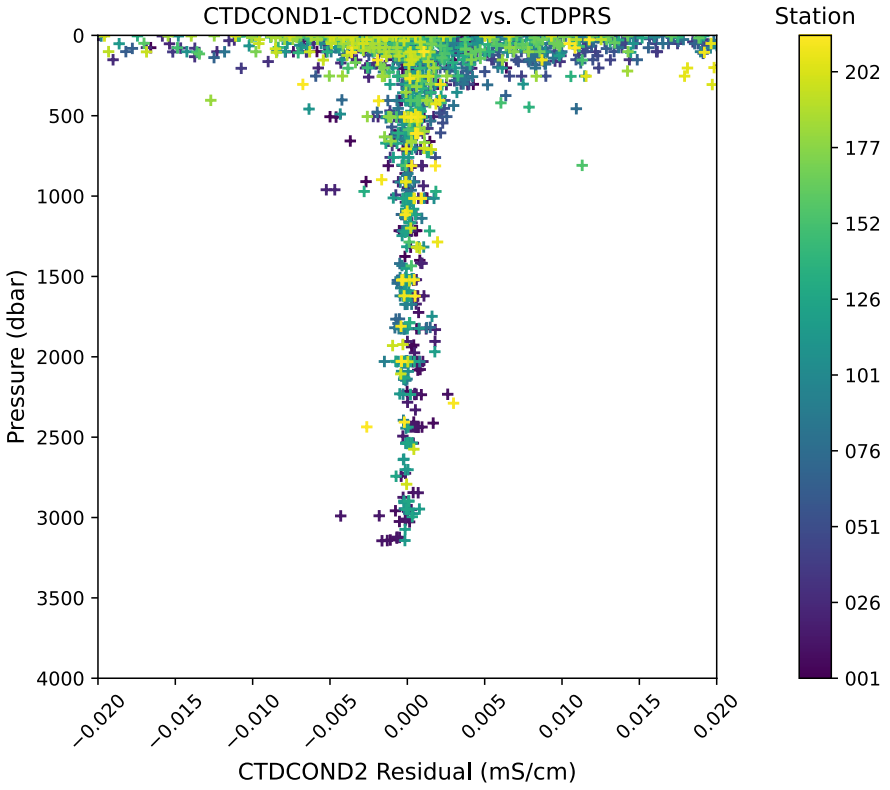
| **Stations** | **Note** | **$cp_2$** | **$cp_1$** | **$ct_2$** | **$ct_1$** | **$cc_2$** | **$cc_1$** | **$c_0$** |
|---|---|---|---|---|---|---|---|---|
| 001 | Test | 0 | -4.84E-07 | 0 | 0.00E+00 | 0 | 0.00E+00 | 8.87E-03 |
| 002 - 031 | Sec 1 | 0 | -7.58E-06 | 0 | -1.58E-02 | 0 | 1.72E-02 | -4.92E-01 |
| 032 - 084 | East GL | 0 | 1.62E-06 | 0 | 2.22E-03 | 0 | -1.73E-03 | 5.08E-02 |

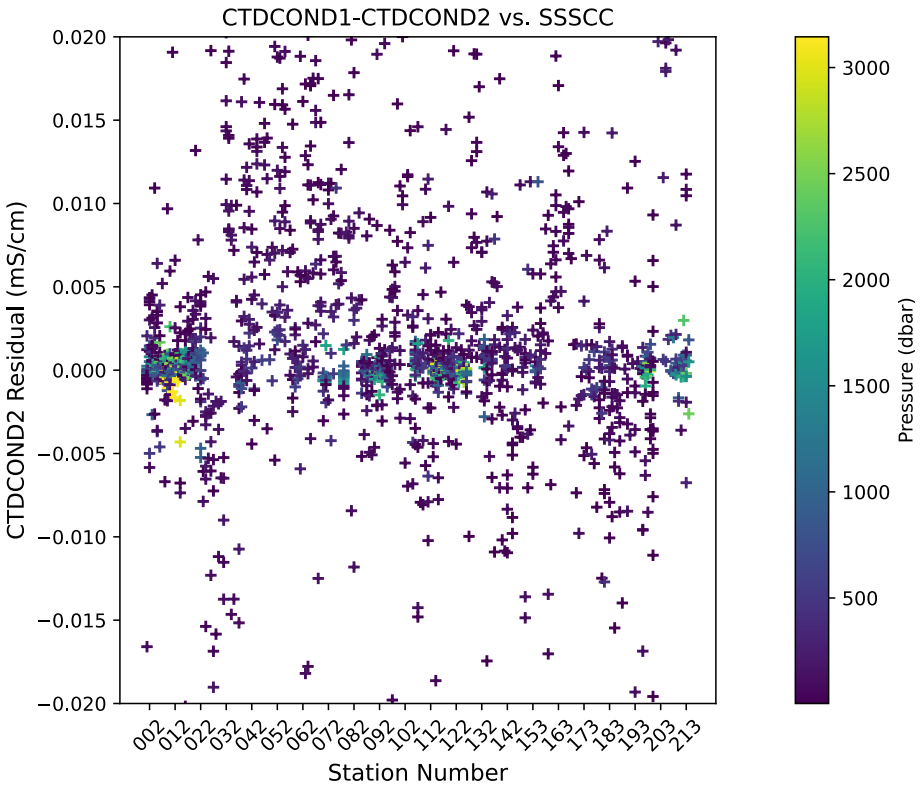
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 085 - 105, 113 - 132, 154 - 169 | Deep LS | 0 | -4.50E-06 | 0 | -8.92E-03 | 0 | 9.66E-03 | -2.75E-01 |
| 106 - 112, 133 - 153, 170 - 200 | Narsaq and LSsec4 | 0 | 4.47E-07 | 0 | 4.93E-04 | 0 | -3.30E-04 | 1.14E-02 |
| 201 - 214 | LSsec5 | 0 | 4.47E-07 | 0 | 4.93E-04 | 0 | -3.30E-04 | 1.14E-02 |

Secondary SBE4C

| **Stations** | **Note** | **$cp_2$** | **$cp_1$** | **$ct_2$** | **$ct_1$** | **$cc_2$** | **$cc_1$** | **$c_0$** |
|---|---|---|---|---|---|---|---|---|
| 001 | Test | 0 | -2.17E-07 | 0 | 0.00E+00 | 0 | 0.00E+00 | 6.62E-03 |
| 002 - 031 | Sec 1 | 0 | -1.04E-06 | 0 | -2.60E-03 | 0 | 2.11E-03 | -5.58E-02 |
| 032 - 084 | East GL | 0 | 6.34E-07 | 0 | -2.69E-03 | 0 | 4.37E-03 | -1.30E-01 |
| 085 - 105, 113 - 132, 154 - 169 | Deep LS | 0 | -5.83E-06 | 0 | -1.24E-02 | 0 | 1.34E-02 | -3.85E-01 |
| 106 - 112, 133 - 153, 170 - 200 | Narsaq and LSsec4 | 0 | 3.85E-06 | 0 | 4.20E-03 | 0 | -3.16E-03 | 8.45E-02 |
| 201 - 214 | LSsec5 | 0 | 4.78E-06 | 0 | 8.83E-03 | 0 | -8.96E-03 | 2.55E-01 |

For all stations on both the primary and secondary conductivity sensors, a first-order fit was used to prevent overcorrection at the surface. Due to a lack of stations of sufficient depth (pressure ≥ 500 dbar), some sections were combined or regrouped from those reported in the CTDO section of the AR69-03 report. This helped maintain sufficient data as not to underconstrain the fit, residuals given below.






Additional figures are available in Appendix B.

**Oxgyen**

Pre-cruise laboratory calibration coefficients were used to convert SBE43 frequencies to µmol/kg oxygen values for acquisition only. All oxygen corrections reported in this data package are distinguished as "CTDOXY_SIO", with "CTDOXY1" and "CTDOXYVOLTS" otherwise unaltered SBE43 oxygen in mL/L and voltage, respectively.

Additional shipboard fitting were performed to correct for the sensors non-linear response. Corrections for pressure, temperature, and conductivity sensors were finalized before analyzing dissolved oxygen data. Corrections for hysteresis are applied following Sea-Bird Application Note 64-3. The SBE43 sensor data were compared to dissolved $O_2$ check samples taken at bottle stops by matching the downcast CTD data to the upcast trip locations along isopycnal surfaces. CTD dissolved $O_2$ was then calculated using a *Clark Cell MPOD $O_2$* sensor response model for Beckman/SensorMedics and SBE43 dissolved $O_2$ sensors. The residual differences of bottle check value versus CTD dissolved $O_2$ values are minimized by optimizing the PMEL (NOAA Pacific Marine Environmental Laboratory) DO sensor response model coefficients using the BFGS non-linear least-squares fitting procedure.

The general form of the PMEL DO sensor response model equation for Clark cells follows Brown and Morrison (1982) and Owens (1985). Dissolved $O_2$ concentration is then calculated using the equation:

$$O_2 = S_{oc} \cdot (V + V_{\text{off}} + \tau_{20} \cdot e^{(D_1 \cdot p + D_2 \cdot (T-20))} \cdot dV/dt) \cdot O_{sat} \cdot e^{Tcor \cdot T} \cdot e^{[(E \cdot p)/(273.15+T)]}$$

Where:

- V is oxygen voltage (volts)
- $D_1$ and $D_2$ are (fixed) SBE calibration coefficients
- T is corrected CTD temperature (°C)
- p is corrected CTD pressure (dbar)
- dV/dt is the time-derivative of voltage (V/s)
- $O_{sat}$ is oxygen saturation
- Soc, Voff, $\tau$20, Tcor, and E are fit coefficients

All station downcasts were fit together to get an initial coefficient estimate. For upcasts, fitting coefficients were reused from the downcast. Overall fit SBE43 coefficients are provided below.

| **Station** | **$S_{oc}$** | **$V_{off}$** | **$Tau_{20}$** | **$T_{cor}$** | **E** |
|---|---|---|---|---|---|
| 001 - 214 | 4.75E-01 | -5.72E-01 | 1.22E+00 | -1.08E-03 | 4.11E-02 |

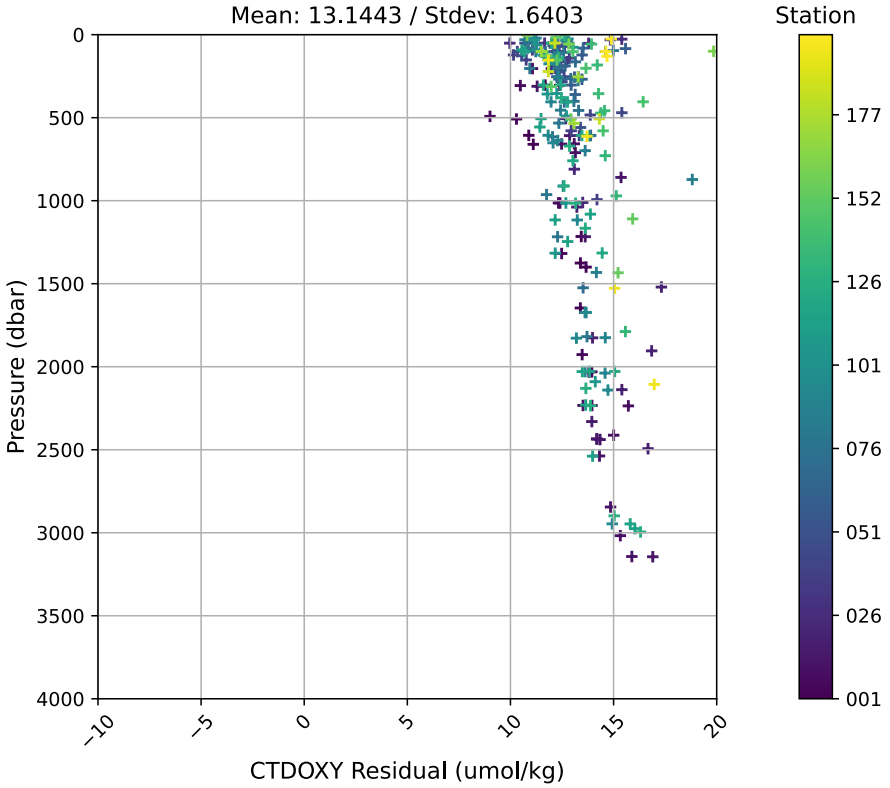



*Figure 1: Oxygen prefit residuals for bottle data.*

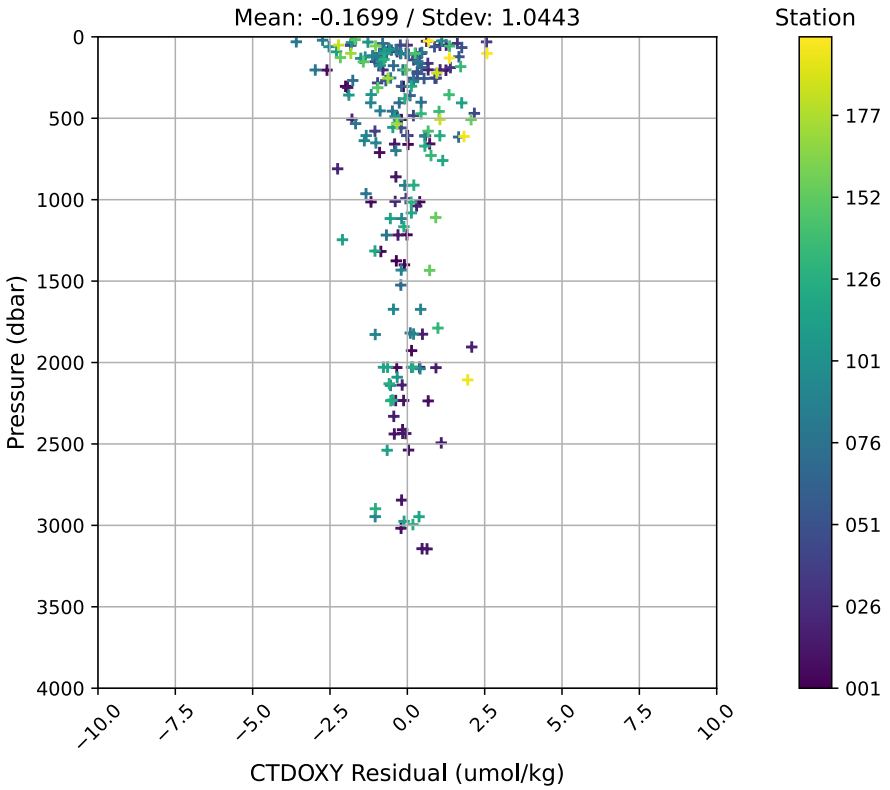



*Figure 2: Oxygen post-fit residuals (WOCE flag = 2) for bottle data.*

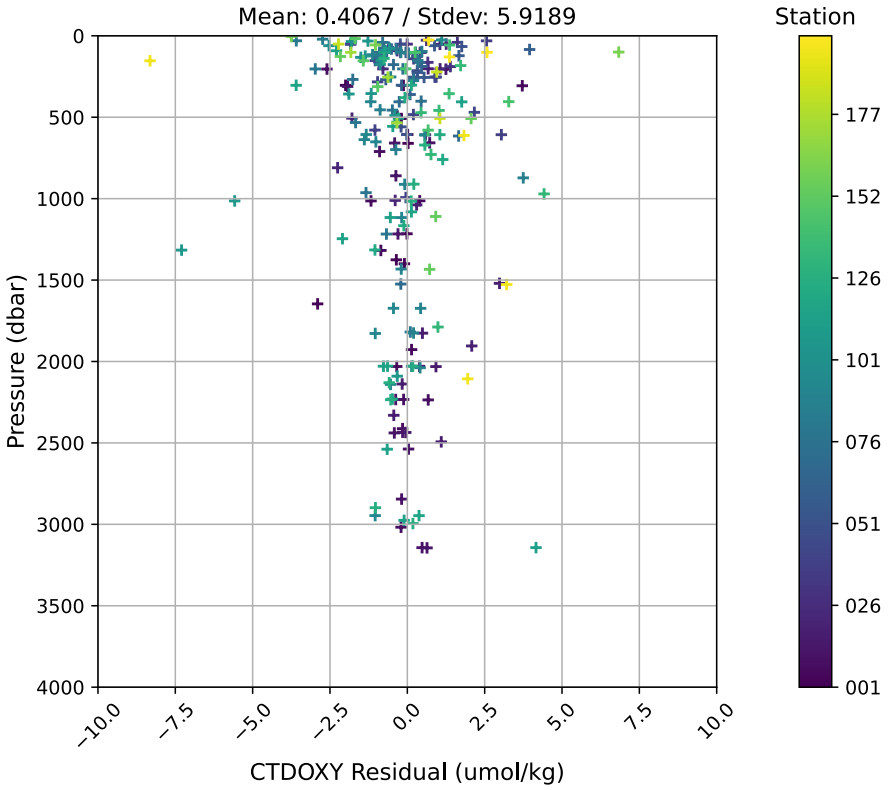



*Figure 3: All oxygen post-fit residuals.*

## Appendix A

Instrument configuration file and instrument coefficients

SBE Instrument Configuration, Version 7.26.4.0
Configuration Report for SBE911/917plus CTD
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| | |
|---|---|
| Frequency channels suppressed | : 0 |
| Voltage words suppresssed | : 0 |
| Computer interface | : 0 |
| Deck unit | : SBE11plus Firmware Version >= 5.0 |
| Deck unit version | : 1 |
| Scans to average | : 1 |
| NMEA position data added | : Yes |
| NMEA depth data added | : No |
| NMEA device connected to PC | : Yes |
| Surface PAR voltage added | : Yes |
| Scan time added | : Yes |

1) Frequency 0, Temperature

| | |
|---|---|
| Serial number | : 4491 |
| Calibrated on | : 30-Jul-21 |
| G | : 4.42677677e-003 |
| H | : 6.46955067e-004 |
| I | : 2.29179017e-005 |
| J | : 2.00641968e-006 |
| F0 | : 1000.000 |
| Slope | : 1.00000000 |
| Offset | : 0.0000 |

2) Frequency 1, Conductivity

| | |
|---|---|
| Serial number | : 3009 |
| Calibrated on | : 30-Jul-21 |
| G | : -9.84150643e+000 |
| H | : 1.39632746e+000 |
| I | : 3.15813731e-004 |
| J | : 5.56430060e-005 |
| CTcor | : -9.57000000e-008 |
| CPcor | : 3.2500e-006 |
| Slope | : 1.00000000 |
| Offset | : 0.00000 |

3) Frequency 2, Pressure, Digiquartz with TC

| | |
|---|---|
| Serial number | : |
| Calibrated on | : |

C1 : -4.323739e+004
C2 : 9.035410e-001
C3 : 1.314670e-002
D1 : 3.632400e-002
D2 : 0.000000e+000
T1 : 2.990226e+001
T2 : -2.674390e-006
T3 : 4.042440e-006
T4 : 3.671670e-009
T5 : 0.000000e+000
Slope : 1.00016283
Offset : -0.11107
AD590M : 1.135000e-002
AD590B : -8.132450e+000

4) Frequency 3, Temperature, 2

Serial number : 4492
Calibrated on : 30-Jul-21
G : 4.33903335e-003
H : 6.33203832e-004
I : 2.01150806e-005
J : 1.66153150e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 3521
Calibrated on : 29-Jul-21
G : -1.01905137e+001
H : 1.59803708e+000
I : -2.41181493e-003
J : 2.88661768e-004
CTcor : -9.57000000e-008
CPcor : 3.2500e-006
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Altimeter

Serial number : VA500-46506
Calibrated on : 2018
Scale factor : 5.000
Offset : 0.000

7) A/D voltage 1, Oxygen, SBE43

Serial number : 1960
Calibrated on : 31-Jul-21
Equation : Sea-Bird
Soc : 4.4678e-001
Offset : -0.5086
A : -5.0019e-003
B : 2.5132e-004
C : -3.5938e-006
E : 3.6000e-002
Tau20 : 1.2200
D0 : 2.5826e+000
D1 : 1.92634e-004
D2 : -4.64803e-002
H1 : -3.3000e-002
H2 : 5.0000e+003
H3 : 1.4500e+003

8) A/D voltage 2, Fluorometer, WET Labs ECO-AFL/FL

Serial number : FLNTURT-969
Calibrated on : 2019-05-09
Scale factor : 1.10000000e+001
Dark output : 0.0790

9) A/D voltage 3, Turbidity Meter, WET Labs ECO-NTU

Serial number : FLNTURT-969
Calibrated on : 2019-05-09
Scale factor : 5.000000
Dark output : 0.050000

10) A/D voltage 4, PAR/Irradiance, Biospherical/Licor

Serial number : QSP200L4S-4550
Calibrated on : 20140514
M : 1.00000000
B : 0.00000000
Calibration constant : 2500000000.00000000
Multiplier : 1.00000000
Offset : -0.60264286

11) A/D voltage 5, Transmissometer, WET Labs C-Star

Serial number : CST-1116
Calibrated on : 2021-July-15
M : 21.3750
B : -0.0860

Path length : 0.250

12) A/D voltage 6, Fluorometer, WET Labs ECO CDOM

Serial number : FLCDRTD-1964
Calibrated on : 20161118
Scale factor : 30.000
Dark output : 0.047

13) A/D voltage 7, Free

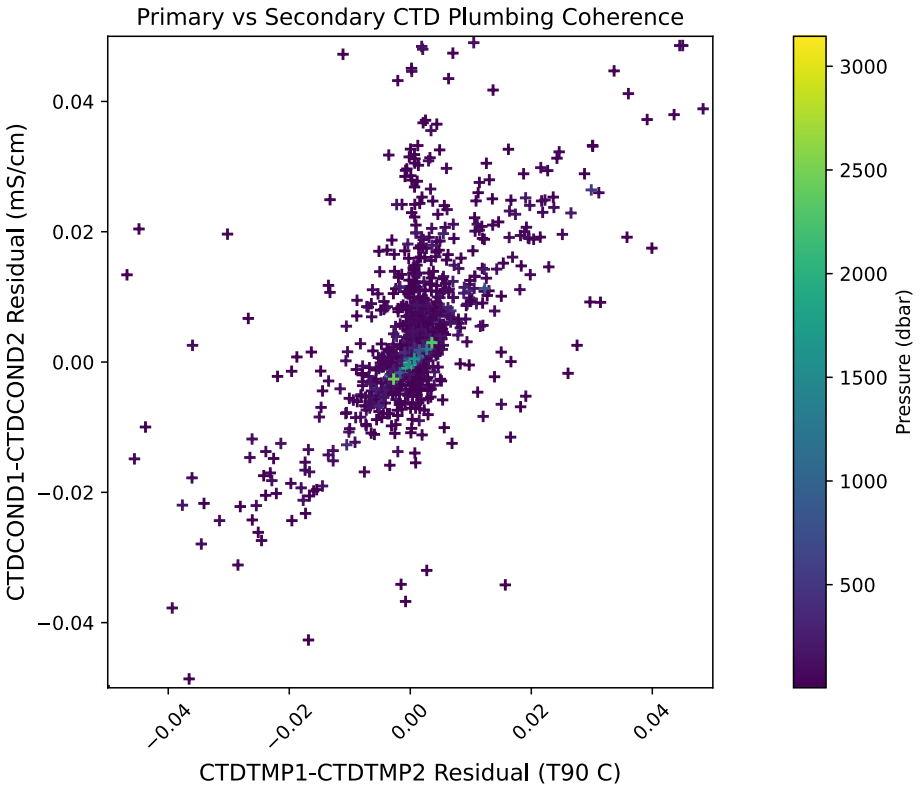
14) SPAR voltage, Unavailable

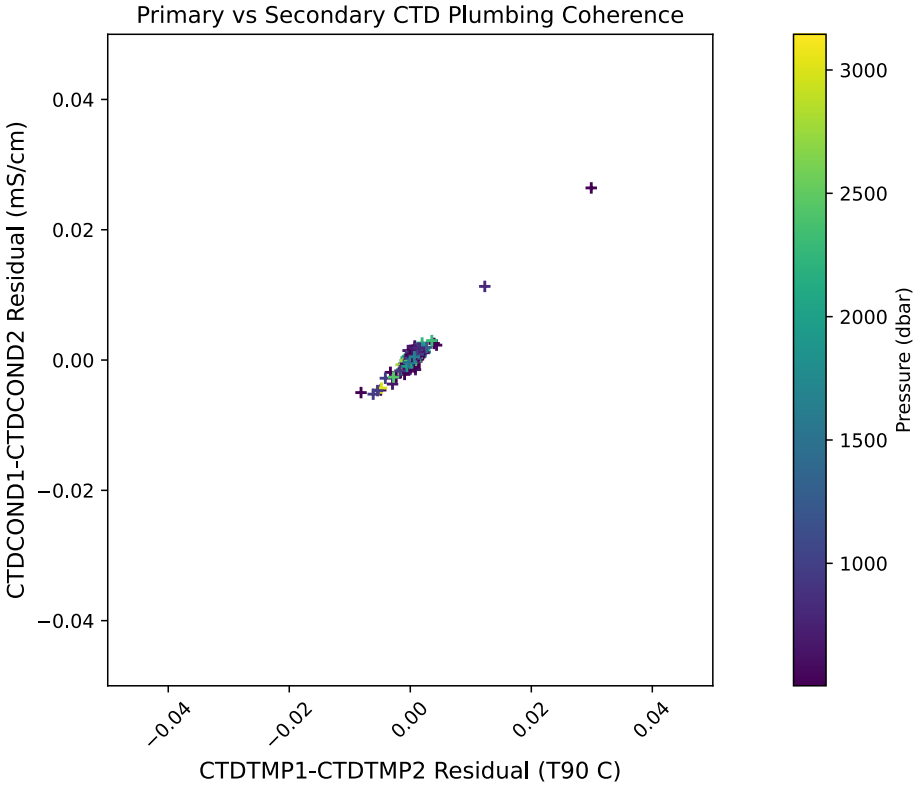
15) SPAR voltage, SPAR/Surface Irradiance

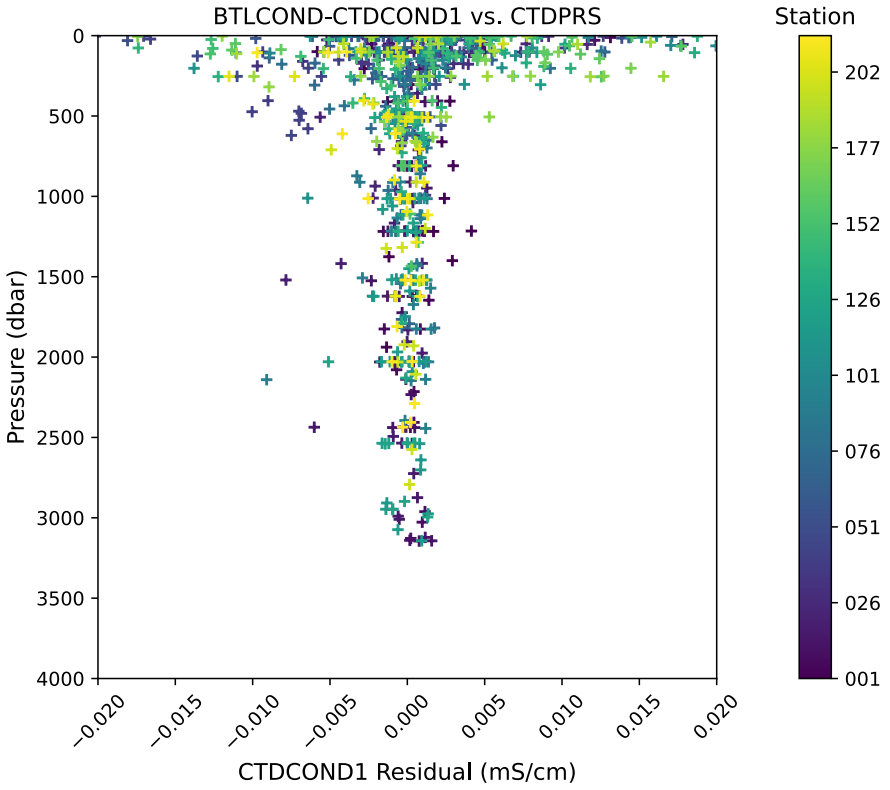
Serial number : N/A
Calibrated on : N/A
Conversion factor : 1.0000e+000
Ratio multiplier : 0.00000000

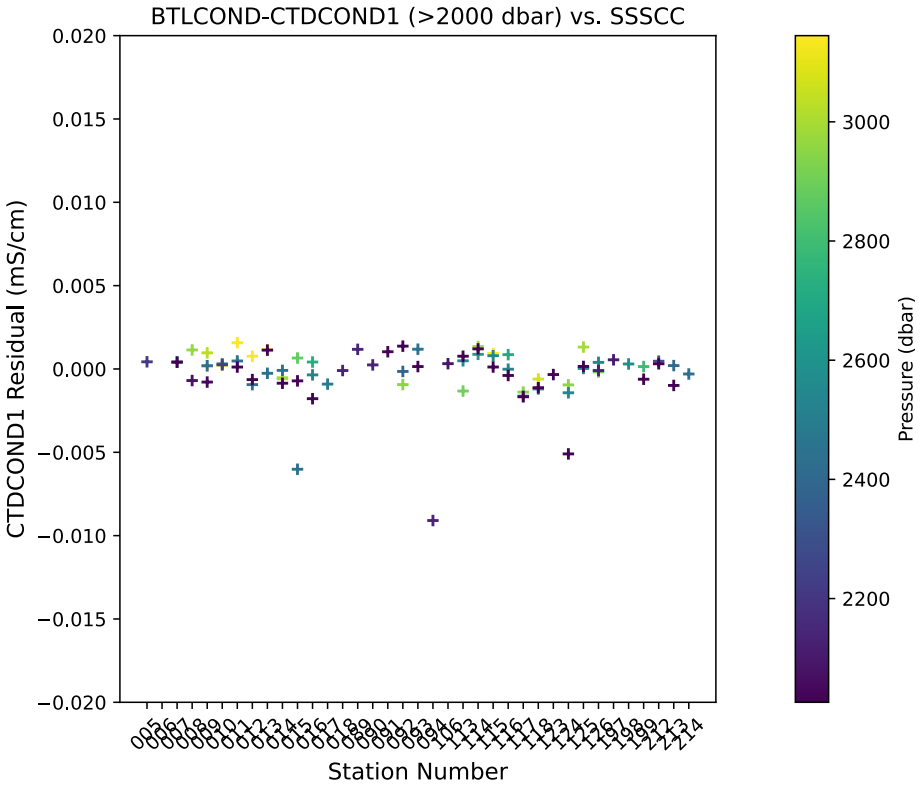
## Appendix B

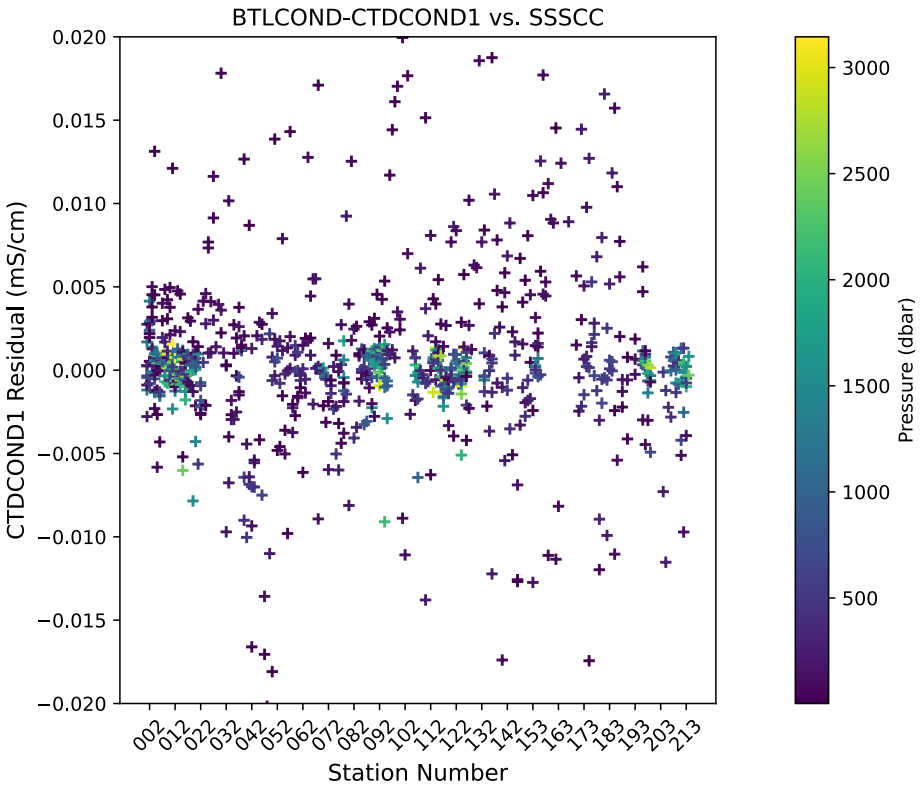
Fit residuals and supplementary figures.

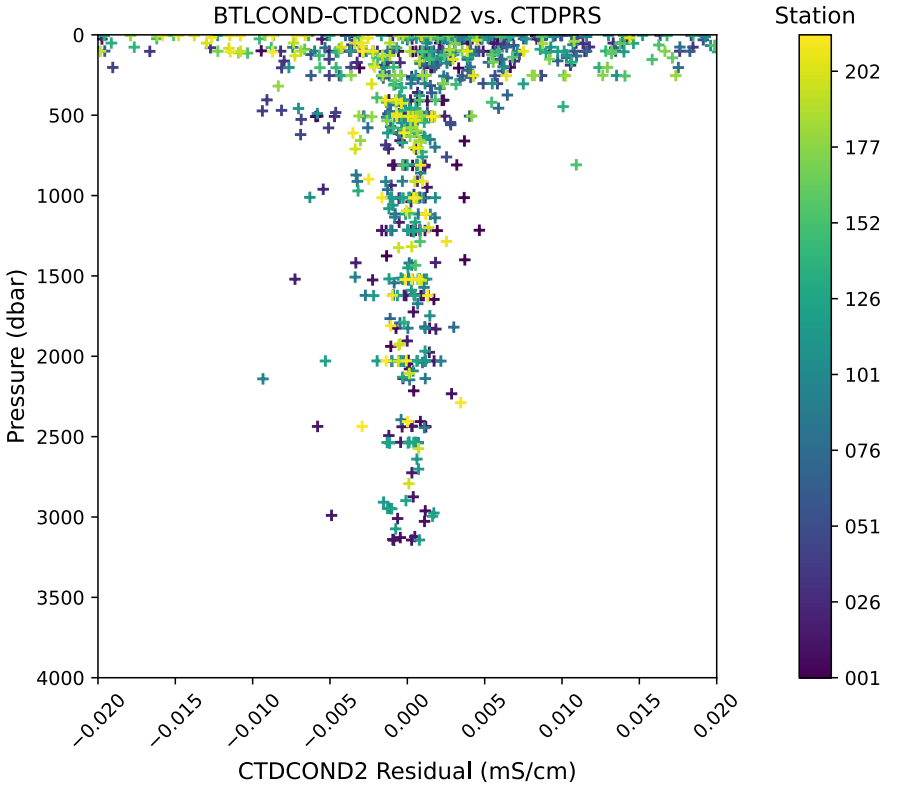


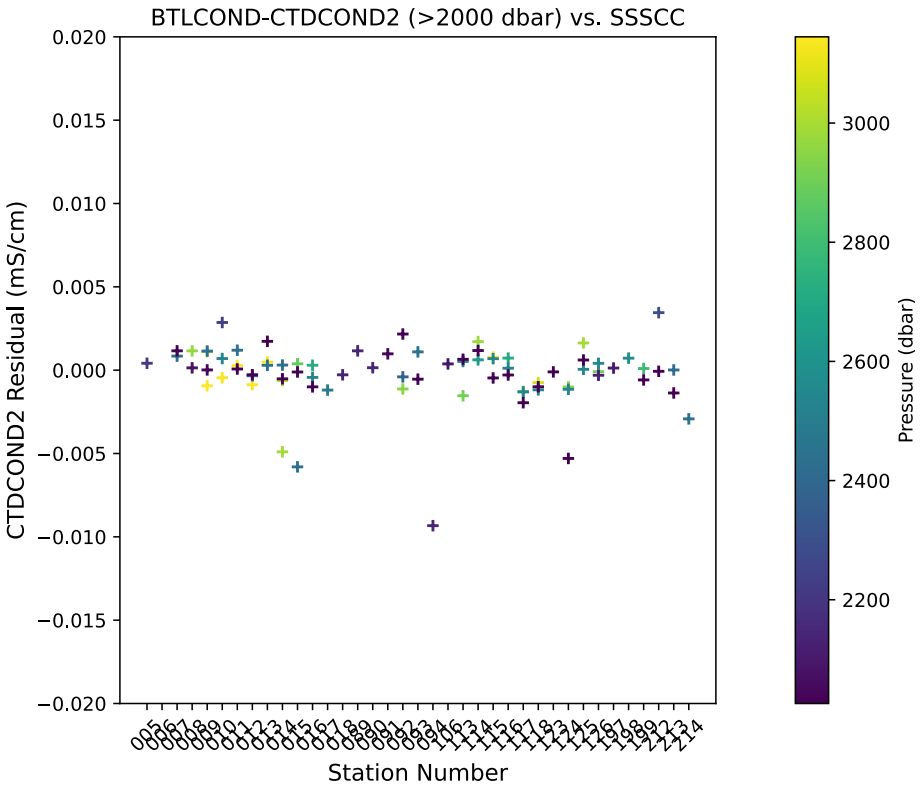



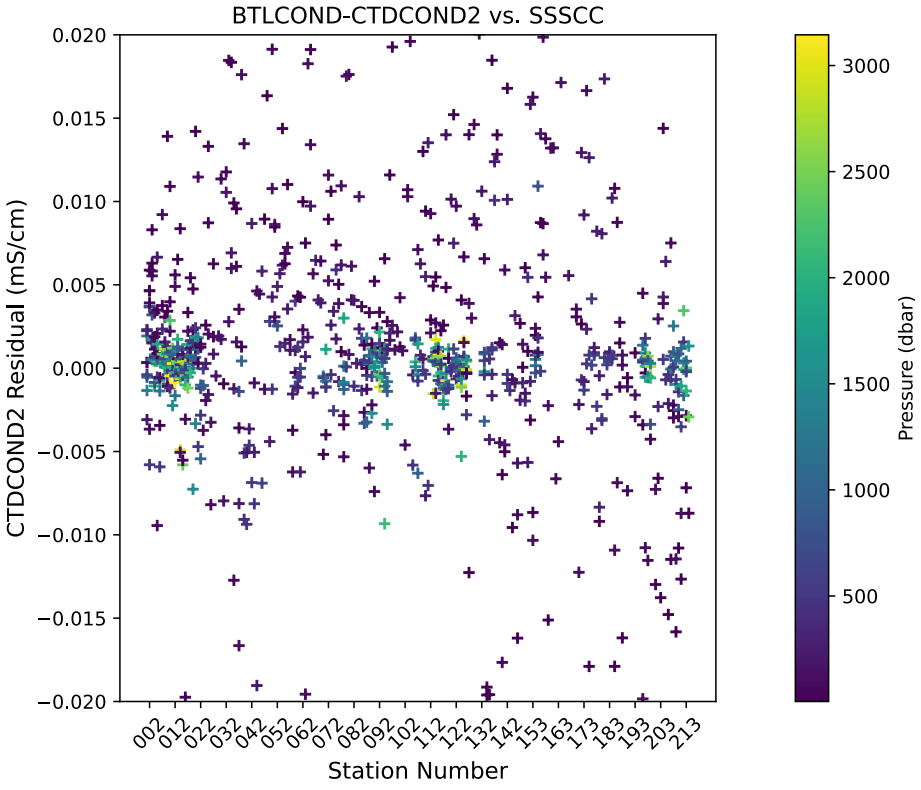

BTLCOND-CTDCOND1 vs. CTDPRS
Station
Pressure (dbar)
CTDCOND1 Residual (mS/cm)
0
500
1000
1500
2000
2500
3000
3500
4000
−0.020
−0.015
−0.010
−0.005
0.000
0.005
0.010
0.015
0.020
202
177
152
126
101
076
051
026
001

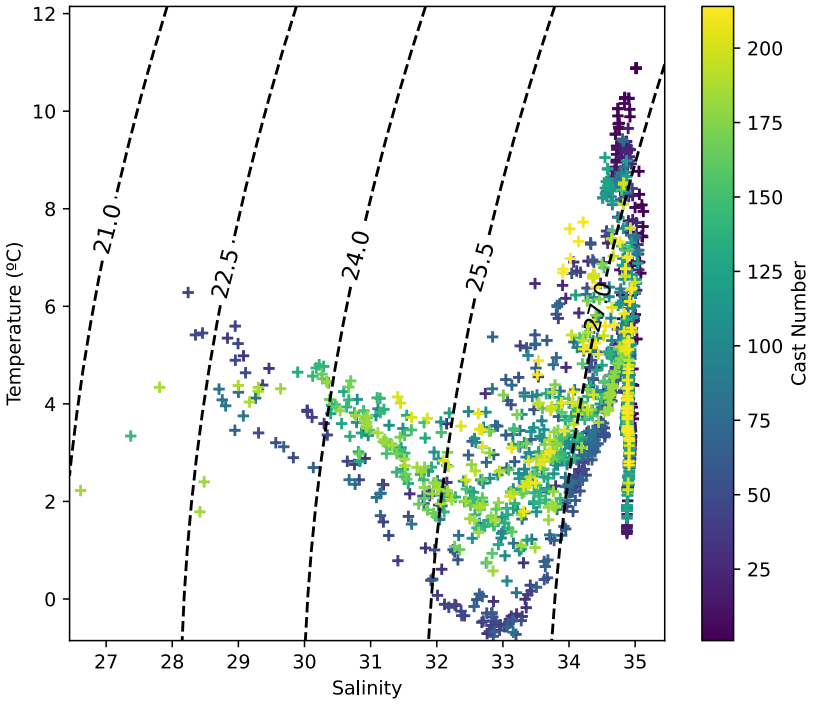

BTLCOND-CTDCOND1 (>2000 dbar) vs. SSSCC
CTDCOND1 Residual (mS/cm)
Station Number
Pressure (dbar)
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
−0.020
3000
2800
2600
2400
2200

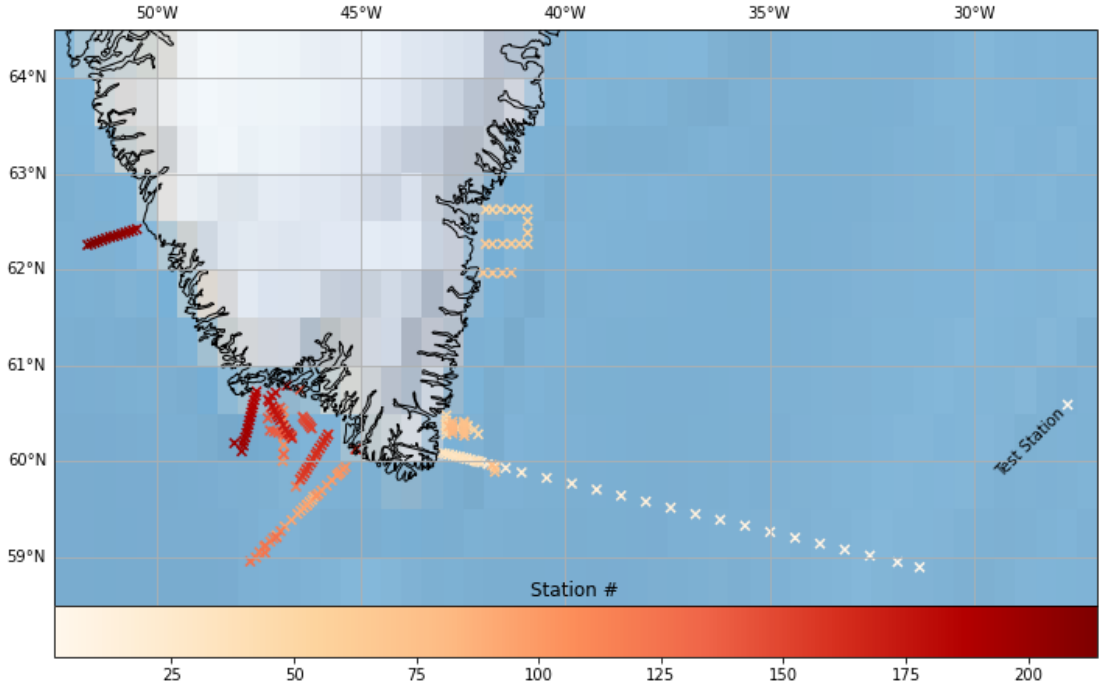

BTLCOND-CTDCOND1 vs. SSSCC
CTDCOND1 Residual (mS/cm)
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
−0.020
002
012
022
032
042
052
062
072
082
092
102
112
122
132
142
153
163
173
183
193
203
213
Station Number
Pressure (dbar)
3000
2500
2000
1500
1000
500


BTLCOND-CTDCOND2 vs. CTDPRS
Pressure (dbar)
0
500
1000
1500
2000
2500
3000
3500
4000
−0.020
−0.015
−0.010
−0.005
0.000
0.005
0.010
0.015
0.020
CTDCOND2 Residual (mS/cm)
Station
202
177
152
126
101
076
051
026
001


BTLCOND-CTDCOND2 (>2000 dbar) vs. SSSCC
CTDCOND2 Residual (mS/cm)
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
−0.020
Station Number
Pressure (dbar)
3000
2800
2600
2400
2200


BTLCOND-CTDCOND2 vs. SSSCC
CTDCOND2 Residual (mS/cm)
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
−0.020
002
012
022
032
042
052
062
072
082
092
102
112
122
132
142
153
163
173
183
193
203
213
Station Number
Pressure (dbar)
3000
2500
2000
1500
1000
500


Temperature (ºC)
Salinity
Cast Number
21.0
22.5
24.0
25.5
27.0


50°W
45°W
40°W
35°W
30°W
64°N
63°N
62°N
61°N
60°N
59°N
Test Station
Station #