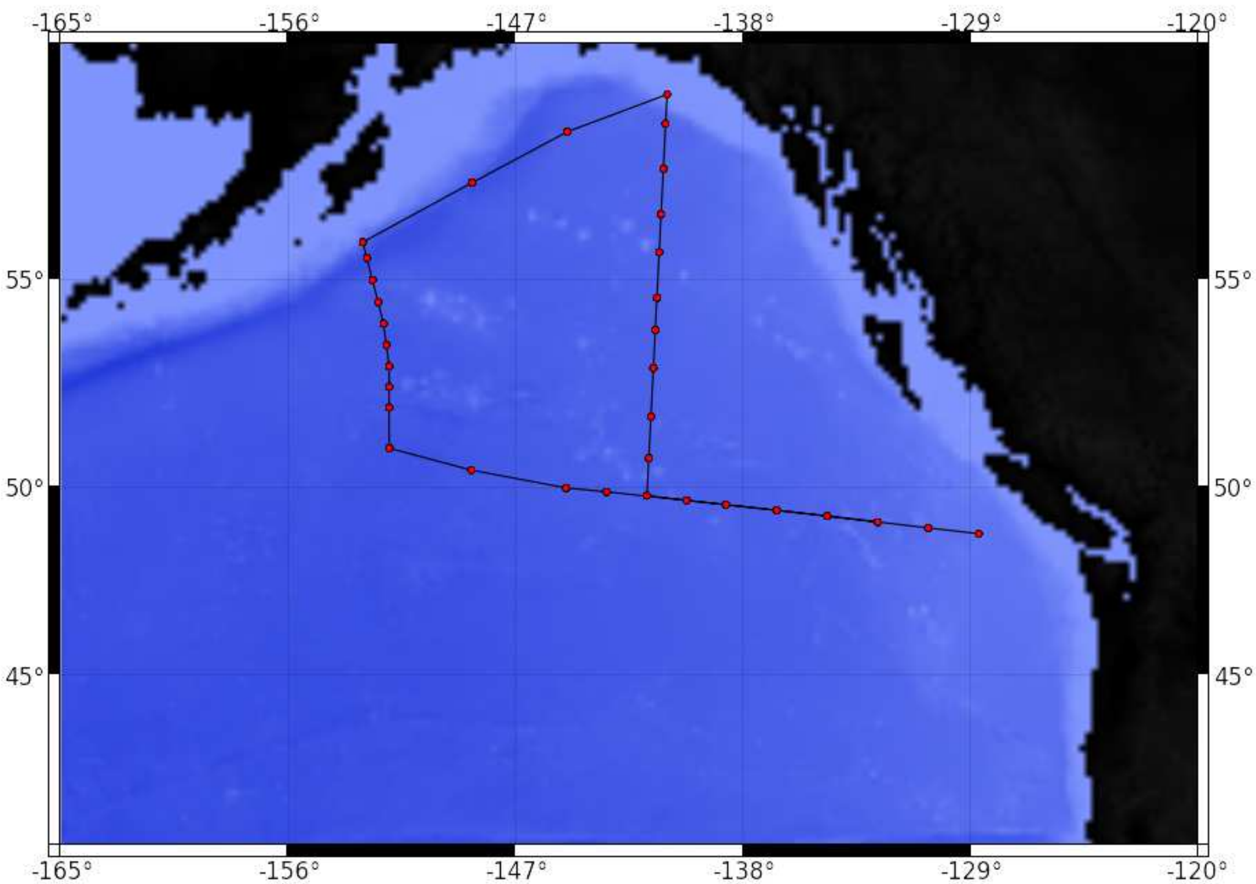
R/V Melville
04 August 2013 - 23 August 2013
Seattle, Washington– Seattle, Washington

Chief Scientist:
Dr. Dennis A. Hansell
Rosenstiel School of Marine & Atmospheric Science at the University of Miami

Preliminary Cruise Report

Data processed by:

Alejandro D. Quintero & Courtney M. Schatzman
Oceanographic Data Facility
Scripps Institution of Oceanography (SIO)
La Jolla, CA



Summary

The MV1310 Hansell 2013 cruise took place in the Gulf of Alaska on the SIO ship R/V Melville and was completed successfully during the period of 04 August 2013 – 23 August 2013. The MV1310 expedition began and terminated in Seattle, Washington. A total of 58 CTD/rosette casts were completed along multiple sections with in the Gulf of Alaska. Approximately 78 salinity and dissolved oxygen samples were collected on these casts for analysis. Sections of the MV1310 cruise ran in four intersecting transects. The rectangular region was framed with in coordinates 48°N to 59°N and 129°W to 153°W.

This report describes efforts to complete the MV1310 Hansell 2013 hydrographic data set. Comparisons of MV1310 hydrographic data set were made with global repeat hydrographic lines P16N and P17N. Lines P16N and P17N were last completed in 2009 and 2001 respectively. Those data sets can be found at the following website addresses: http://cchdo.ucsd.edu/cruise/49NZ200107_1 and http://cchdo.ucsd.edu/cruise/325020060213

Due to the poor quality of many of the salinity and especially dissolved oxygen check samples final data uncertainties are much larger than those in the reference data sets.

1. CTD Data

1.1. CTD Data Acquisition and Rosette Operation

The CTD data acquisition system consisted of a generic PC workstation running Windows operating system. SBE SeaSave v.7.18c software was used for data acquisition and to close bottles on the rosette. The science party maintained a CTD cast log containing a description of each deployment, a record of every attempt to close a bottle and any pertinent comments.

The science party was requested to adhere to the following procedures for quality assurance.

- Allow two minutes start-up after power up of deck unit.
- Deploy rosette to 10m for a two-minute wait.
- After start-up soak, CTD is returned to the surface for the start of the cast.
- Monitor the quality of CTD data through out entire cast.
- Maintain cast logs (location, date, time and pressure).
- Log the start, bottom, end and each bottle trip for each cast.
- Wait thirty seconds between winch stop and bottle trip.

Bottles were closed on the up cast by operating an on-screen control. The science team was asked to allow at least 30 seconds after stopping at the trip location for the rosette wake to dissipate and the bottles to flush before tripping bottles.

1.2. CTD Data Processing

ODF performs systematic standard processes on all hydrographic data sets. The 0.5-second time series data were checked for consistency, clean sensor response and calibration shifts. A 1-decibar pressure series was generated from the down cast data. On-deck pressure values were observed at the start and end of each cast for potential drift. Alignment of temperature and conductivity sensor data (in addition to the default 0.073-second conductivity "advance" applied by the SBE11*plus* deck unit) was optimized for each pump/sensor combination to minimize salinity spiking by using data from multiple casts of various depths after acquisition. If the pressure offset or conductivity "advance" values were altered after data acquisition, the CTD data were re-averaged from the 24Hz stored data.

The primary and secondary temperature sensors (SBE3*plus*) were compared to each other. CTD conductivity sensors (SBE4C) were compared to each other, then calibrated by examining differences between CTD and check-sample conductivity values. CTD dissolved oxygen sensor data were fit to check-sample data.

Bottle salinity and oxygen were used to refine shipboard conductivity and oxygen sensor calibrations. Theta-salinity and theta-oxygen comparisons were made between down and up-casts, between groups of adjacent deployments and finally with the most recent global repeat hydrographic program data collected in the Gulf of Alaska.

1.3. CTD Processing Details

In this data set, only 12 of the 58 casts had bottle data. Many of the casts appear to have been aborted due to incorrect lab calibration coefficients where sensor changes took place between casts. There were a total of 78 bottles from which salinity and dissolved oxygen samples were drawn for this expedition.

The primary conductivity and temperature sensors failed on the up-casts of stations 19, 21-27 and on the down-cast of stations 28 and 29. The secondary sensors were chosen for consistent reporting.

In addition to the 0.0073 second temperature and conductivity standard alignment factor an offset of 0.08 seconds was applied for each station and sensor configuration.

On casts 1/1, 2/1, 3/1, 3/2, 10/1, 12/2, 13/1, 14/1, 15/1, 17/2, 17/3, 17/4, 21/1, 33/1 the temperature, conductivity or oxygen sensors had not stabilized before casts had started. A delayed start was applied to the cast pressure sequence to reduce spiking and smooth fits from surface. No more than 10 m of surface data was interpolated from any of the aforementioned casts.

1.4. CTD Shipboard Calibration Procedures

A single SBE9*plus* CTD (S/N 831) was used for all CTD/rosette casts during MV1310. The CTD was deployed with all sensors and pumps as recommended by SBE.

An SBE35RT Digital Reversing Thermometer was not in use for the cruise MV1310 Hansell 2013. Thus only standard laboratory calibrations were used for T1 and T2 sensors. *In situ* salinity and dissolved oxygen check samples collected during each cast were used to calibrate the conductivity and dissolved oxygen sensors.

1.4.1. CTD Pressure

The Paroscientific Digiquartz pressure transducer (S/N 831-99677) was calibrated in November 2012 at the SIO/STS Calibration Facility. The calibration coefficients provided on the report were used to convert frequencies to pressure. The SIO/STS pressure calibration coefficients already incorporate the slope and offset term usually provided by Paroscientific.

Residual pressure offsets (the difference between the first and last submerged pressures, after the offset corrections) indicated that an offset of -0.84350 dbar be applied to pressure sensor calibration.

1.4.2. CTD Temperature

The lack of a SBE35RT Digital Reversing Thermometer sensor on the package played a role in limiting the overall precision of the corrections that were performed: Other than laboratory pre-cruise calibrations, there was no reference to correct further calibrate temperature sensor values. In addition, the primary conductivity and temperature sensors failed on the up-casts of stations 19, 21-27 and on the down-casts of stations 28 and 29. The secondary sensors were chosen for consistent reporting.

Configuration files supplied by the science team indicated which sensors were used on each cast. The SBE3*plus* secondary (T2/03-2309) was swapped for (T2/03-4307) after cast 12/1. The SBE3*plus* primary (T1/03-2368) was swapped for (T1/03-4209) and SBE3*plus* secondary (T2/03-4307) was swapped for (T2/03-2309) after cast 12/3. The SBE3*plus* secondary (T2/03-2309) was swapped for (T2/03-2322) after cast 28/1. The SBE3*plus* primary (T1/03-4209) was swapped for (T1/03-2309) after cast 029/01.

Cast 12/3 appears to have had a 1.9 °C offsets applied to the temperature from the acquisition side of the data. This offset was adjusted based on data from adjacent casts at the same station. Residual temperature differences are shown in figures 1.4.2.0 through 1.4.2.3.

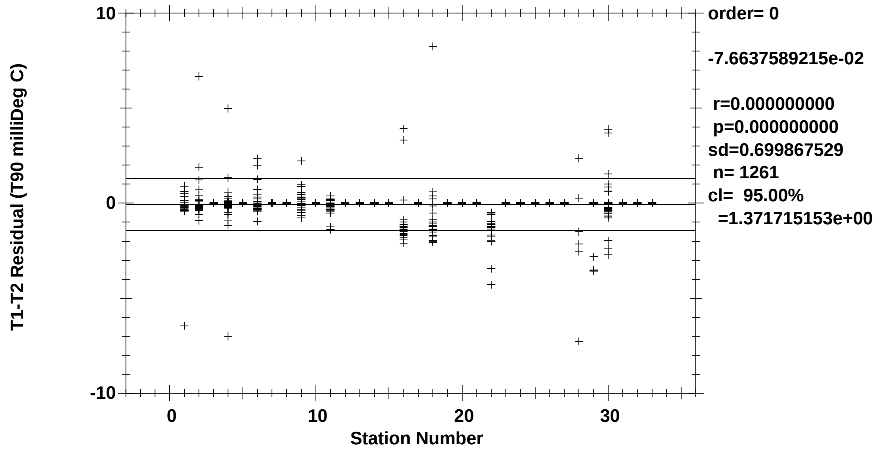


Figure 1.4.2.0 MV1310 T1-T2 by station (-0.01°C≤*T1-T2*≤0.01°C).

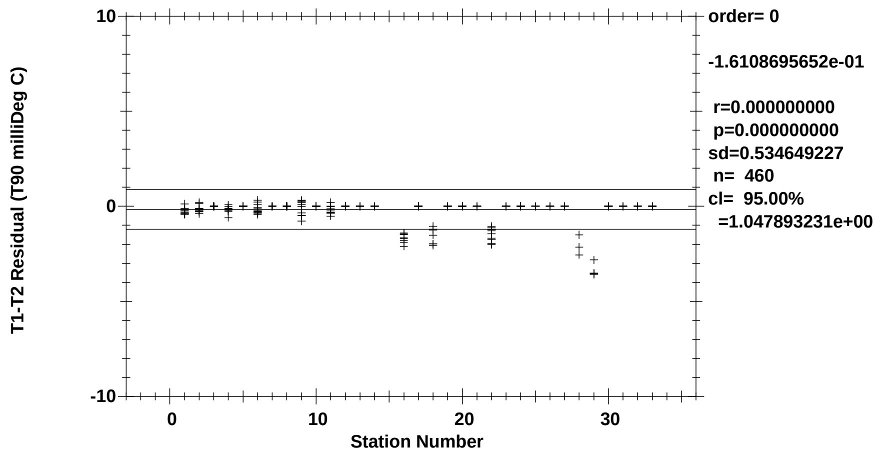


Figure 1.4.2.1 MV1310 Deep T1-T2 by station (Pressure >= 1800 dbars).

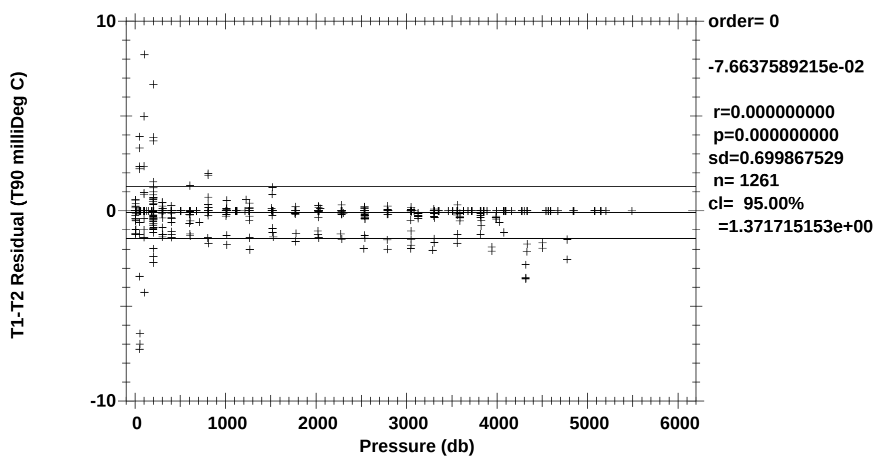


Figure 1.4.2.2 MV1310 T1-T2 by pressure (-0.01°C≤*T1-T2*≤0.01°C).

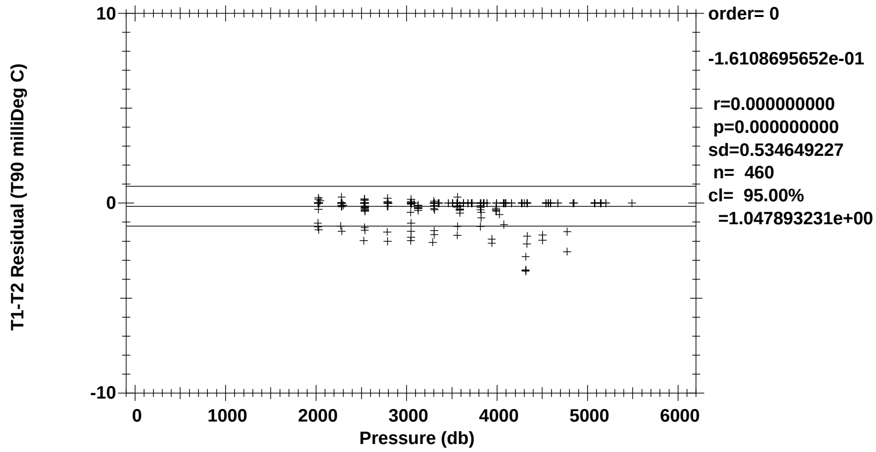


Figure 1.4.2.3 MV1310 T1-T2 by pressure (Pressure >= 1800 dbars).

The 95% confidence limits for the MV1310 data mean low-gradient differences are ±0.00137°C for *T1-T2*. The 95% confidence limit for deep temperature residuals (where pressure > 1800 dbars) is ±0.00105°C for *T1-T2*.

1.4.3. CTD Conductivity

Calibration coefficients derived from the pre-cruise calibrations were applied to convert raw frequencies to conductivity. Shipboard conductivity corrections, determined during analysis, were applied to secondary conductivity data for each cast. Secondary sensors were compared to conductivity calculated from check sample salinities using CTD pressure and temperature.

Configuration files supplied by the sciente team indicated which sensors were used on each cast. The SBE4C primary (C1/04-1880) was swapped for (C1/04-2818) after cast 2/1. The SBE4C secondary (C2/04-2819) was swapped for (C2/04-2765) after cast 28/1. The SBE4C primary (C1/04-2818) was swapped for (C1/04-2309) after cast 29/1.

Secondary TC sensor data were used to report final CTD data. Due to primary temperature dropouts primary conductivity data is not reported. Casts 1/1 and 2/1 appear to have an offset of approximately -0.010 PSU applied to conductivity from the acquisition. A counter adjustment offset was applied based on bottle data statistics.

The residual conductivity differences before corrections are shown in figures 1.4.3.0 through 1.4.3.5.

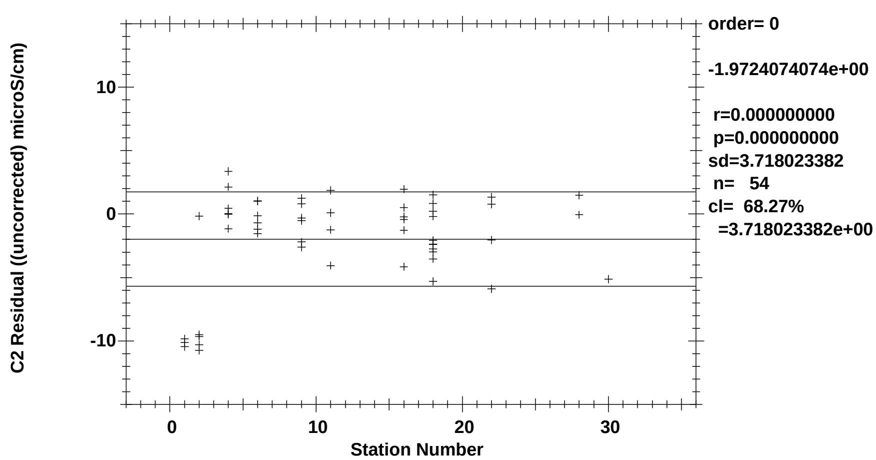


Figure 1.4.3.0 MV1310 Uncorrected C Bottle - C2 by station

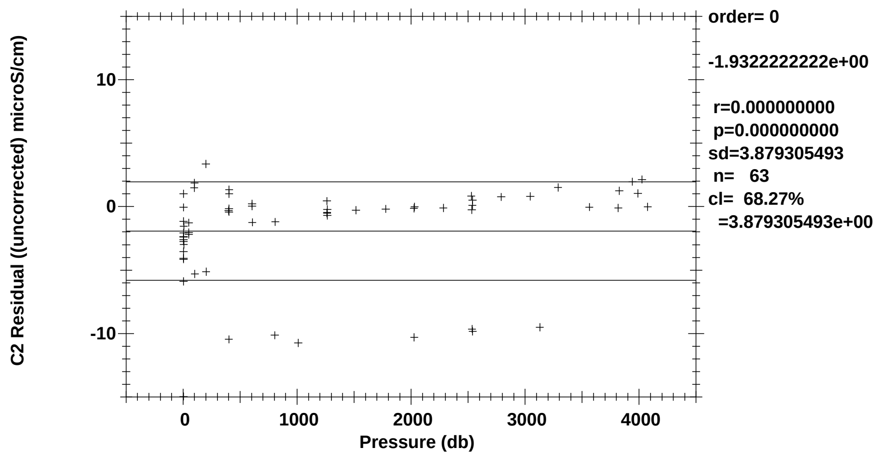


Figure 1.4.3.1 MV1310 Uncorrected C Bottle - C2 by pressure

The residual conductivity differences after correction are shown in figures 1.4.3.2 through 1.4.3.5.

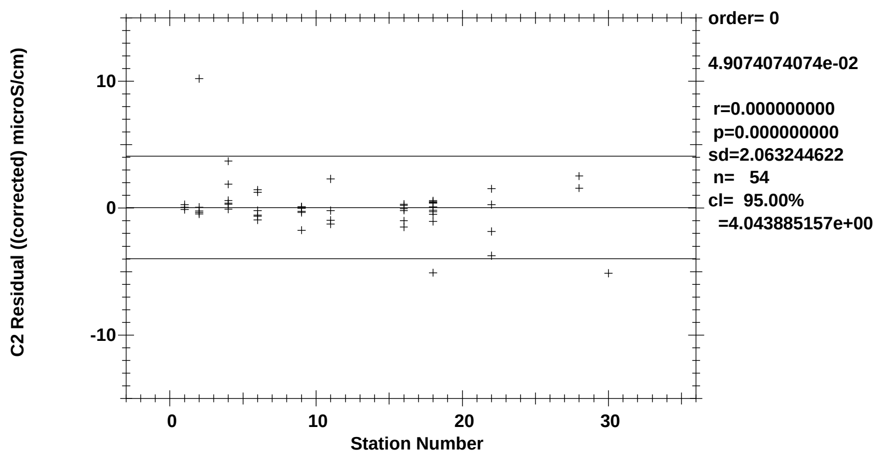


Figure 1.4.3.2 MV1310 Corrected C Bottle - C2 by station (-0.01°C≤*T1*-*T2*≤0.01°C).

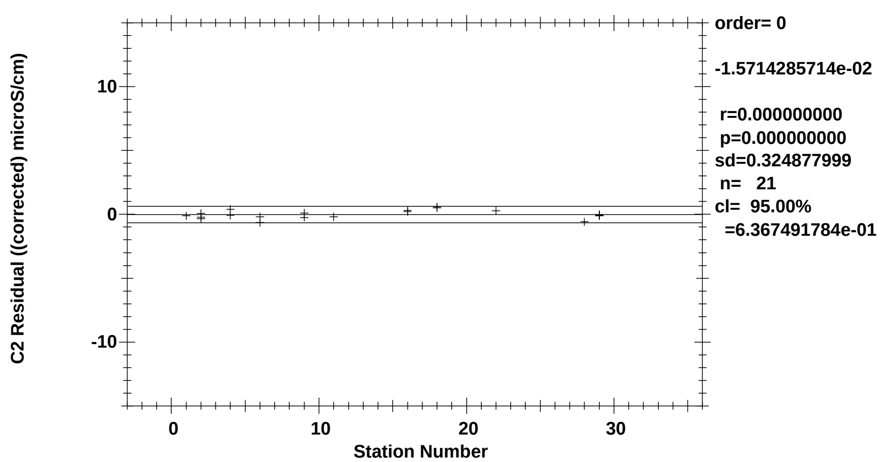


Figure 1.4.3.3 MV1310 Deep Corrected C Bottle - C2 by station (Pressure >= 1800 dbars).

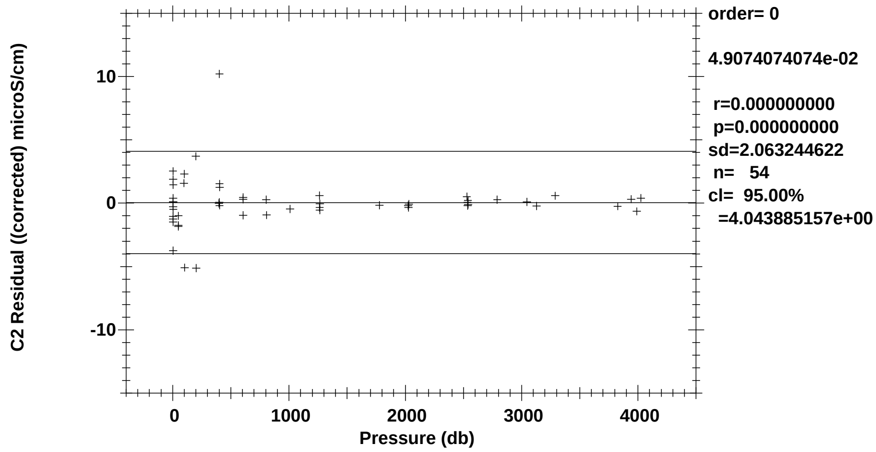


Figure 1.4.3.4 MV1310 Corrected C Bottle - C2 by pressure (-0.01°C≤*T1*-*T2*≤0.01°C).

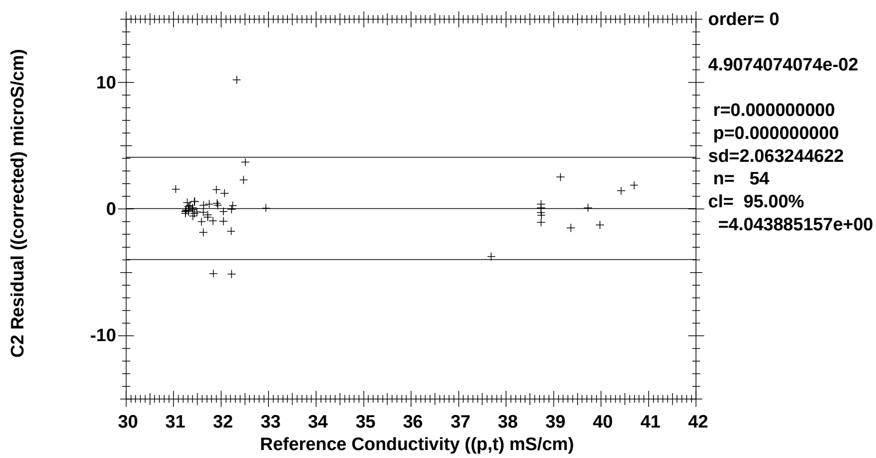


Figure 1.4.3.5 MV1310 Corrected C Bottle - C2 by conductivity (-0.01°C≤*T1*-*T2*≤0.01°C).

The final corrections for the sensors used on MV130 are summarized in Appendix A. Corrections made to the primary conductivity sensor had the form:

$$C_{cor} = C + cp1 * P + c2 * C^2 + c1 * C + c0$$

Corrections made to the secondary conductivity sensor had the form:

$$C_{cor} = C + cp2 * P^2 + cp1 * P + c2 * C^2 + c1 * C + c0$$

Salinity residuals after applying shipboard P/T/C corrections are summarized in figures 1.4.3.6 through 1.4.3.8. Only CTD and bottle salinity data with "acceptable" quality codes are included in the differences.

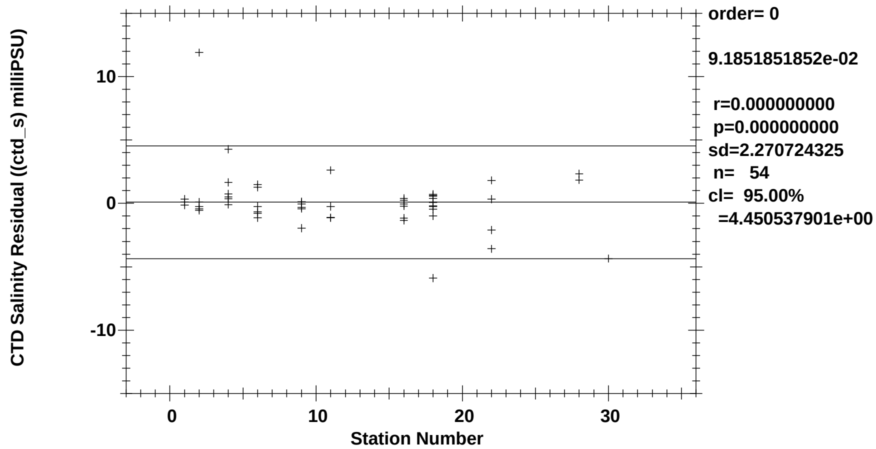


Figure 1.4.3.6 MV1310 Salinity residuals by station (-0.01°C≤*T1*-*T2*≤0.01°C).

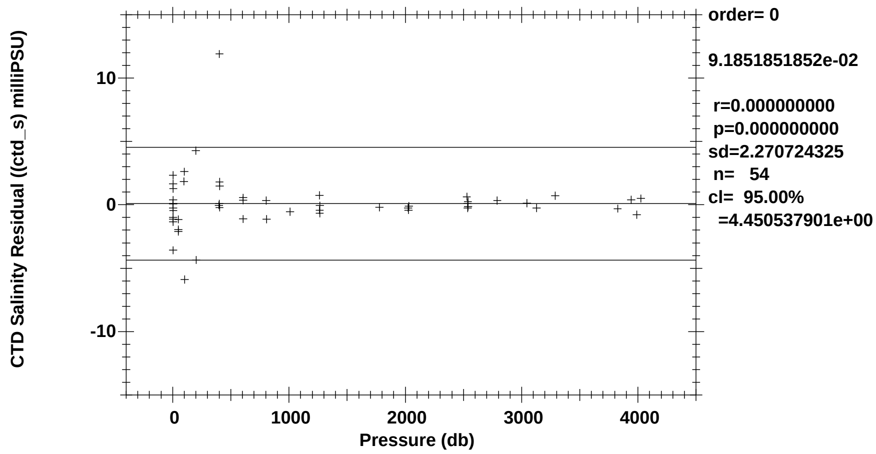


Figure 1.4.3.7 MV1310 Salinity residuals by pressure (-0.01°C≤*T1*-*T2*≤0.01°C).

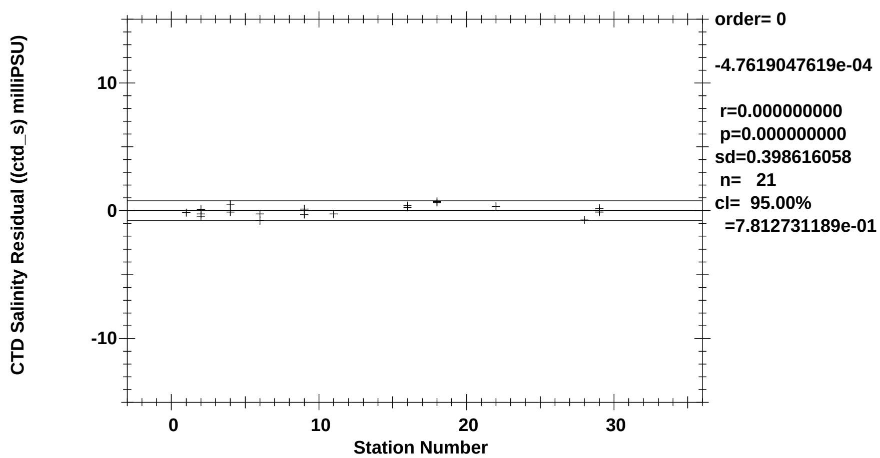


Figure 1.4.3.8 MV1310 Deep Salinity residuals by station (Pressure >= 1800 dbars).

Salinity figures represent estimates of the salinity accuracy of MV1310. The 95% confidence limits are ±0.00445 relative to bottle salinities for all salinities, where T1-T2 is within ±0.01°C; and ±0.000781 relative to bottle salinities for deep salinities, where pressure is more than 1800 decibars. Within the context of having only a small number of salinity check samples, when questionable check samples were ignored, the final CTD salinities (and temperatures) appear to meet a reasonable standard, though less reliable than the reference cruises.

1.4.4. CTD Dissolved Oxygen

A single SBE43 dissolved oxygen sensor (DO/43-0275) was used during MV1310. This dissolved oxygen sensor was plumbed into the primary T1/C1 pump circuit after C1.

The SBE43 DO sensor was calibrated to dissolved oxygen bottle samples taken at bottle stops by matching the down cast CTD data to the up cast trip locations on isopycnal surfaces, then calculating CTD dissolved oxygen using a DO sensor response model and minimizing the residual differences from the bottle samples. A non-linear least-squares fitting procedure was used to minimize the residuals and to determine sensor model coefficients, and was accomplished in three stages.

First the time constants for the lagged terms in the model were determined for the sensor. These time constants are sensor-specific but applicable to an entire cruise. Next, casts were fit individually to bottle sample data. Bottle oxygen data from nearby casts with similar deep TS structure were used to help fit CTD oxygen data for casts with one or more mis-tripped bottles. Furthermore, consecutive casts were compared on plots of Theta vs. oxygen to verify consistency over the course of MV1310.

At the end of the cruise, standard and blank values for bottle oxygen data were smoothed, and the bottle oxygen values were recalculated. The changes to bottle oxygen values were less than 0.01 ml/l for most stations. CTD oxygen data were re-calibrated to the smoothed bottle values after the leg.

Final CTD dissolved oxygen fits and residuals are shown in figures 1.4.4.0-1.4.4.2.

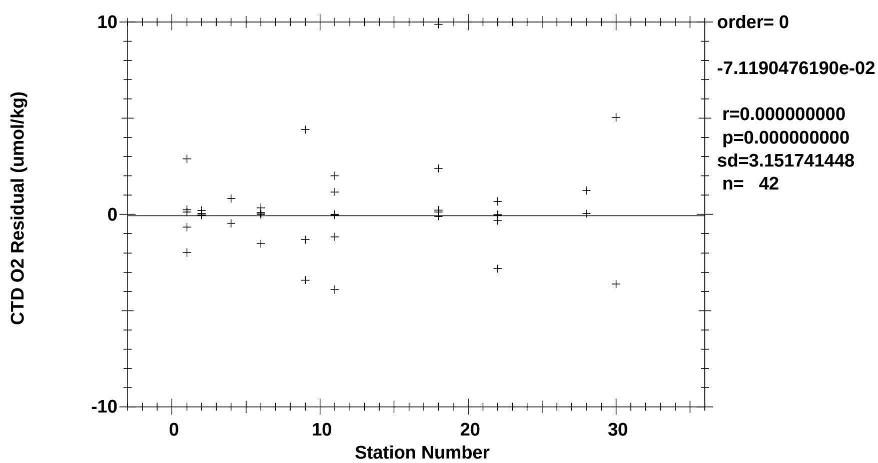


Figure 1.4.4.0 MV1310 Oxygen residuals by station (-0.01°C≤*T1*-*T2*≤0.01°C).

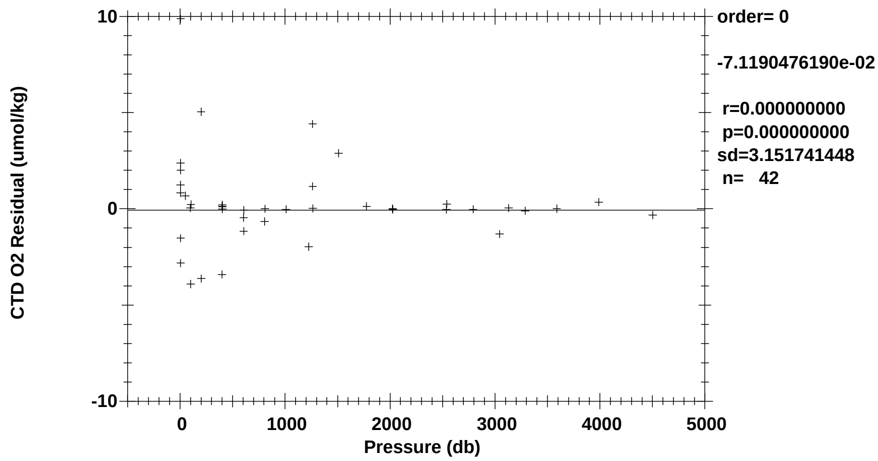


Figure 1.4.4.1 MV1310 Oxygen residuals by pressure (-0.01°C≤*T1*-*T2*≤0.01°C).

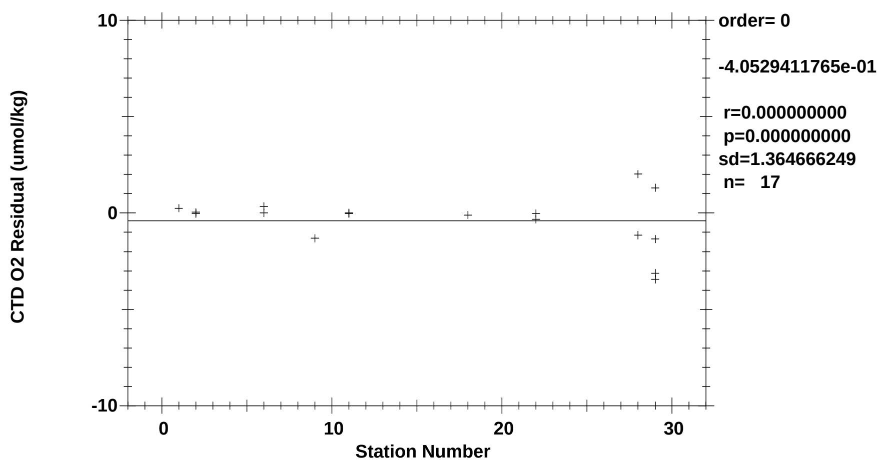


Figure 1.4.4.2 MV1310 Deep oxygen residuals by station (Pressure >= 1800 dbars).

The standard deviations of 3.152 umol/kg for all oxygens and 1.365 umol/kg for deep oxygens are only presented as general indicators of goodness of fit. SIO/STS makes no claims regarding the precision or accuracy of CTD dissolved oxygen data.

The general form of the SIO/STS DO sensor response model equation for Clark-style cells follows Brown and Morrison [*Brown*], Millard [*Millard*] and Owens & Millard [*Owen*] SIO/STS models DO sensor responses with lagged CTD data. *In situ* pressure and temperature are filtered to match the sensor responses. Time constants for the pressure response (14 tau p), a slow (14 tau Tf) and fast (14 tau T) thermal response, package velocity (14 tau dP), thermal diffusion (14 tau dT) and pressure hysteresis (14 tau h) are fitting parameters. Once determined for a given sensor, these time constants typically remain constant for a cruise. The thermal diffusion term is derived by low-pass filtering the difference between the fast response (Ts) and slow response (Tl) temperatures. This term is intended to correct non-linearities in sensor response introduced by inappropriate analog thermal compensation. Package velocity is approximated by low-pass filtering 1st-order pressure differences, and is intended to correct flow-dependent response. Dissolved oxygen concentration is then calculated:

$$O_2 ml/l = [C_1 \cdot V_{DO} e^{(C_2 \cdot \frac{P_h}{5000})} + C_3] \cdot f_{sat}(T,P) \cdot e^{(C_4 \cdot T_l + C_5 \cdot T_s + C_7 \cdot P_l + C_6 \cdot \frac{dO_c}{dt} + C_8 \cdot \frac{dP}{dt} + C_9 \cdot dT)} \quad (1.4.4.0)$$

where:

O2 ml/l	Dissolved oxygen concentration in ml/l;
V DO	Raw sensor output;
C1	Sensor slope
C2	Hysteresis response coefficient
C3	Sensor offset
fsat (T , P)	Oxygen saturation at T,P (ml/l);
T	*in situ* temperature (°C);
P	*in situ* pressure (decibars);
Ph	Low-pass filtered hysteresis pressure (decibars);
Tl	Long-response low-pass filtered temperature (°C);
Ts	Short-response low-pass filtered temperature (°C);
Pl	Low-pass filtered pressure (decibars);
dOc/dt	Sensor current gradient (muamps/sec);
dP/dt	Filtered package velocity (db/sec);
dT	low-pass filtered thermal diffusion estimate (Ts - Tl).
C4 - C9	Response coefficients.

CTD dissolved oxygen ml/l data are converted to umol/kg units on demand.

Manufacturer information on the SBE43 DO sensor, a modification of the Clark polarographic membrane technology, can be found at *http://www.seabird.com/application_notes/AN64.htm.*

2. Bottle Sampling and Data Processing

2.1. Bottle Sampling

The following salinity sampling requirements were requested for quality assurance: Salinity samples at the surface and or mixed layer of the CTD profile, at least three salinity samples evenly spaced and tripped below the high gradient region, and one of the three evenly spaced samples should be at the bottom of the cast. It is also best to have all metadata associated with salinity analysis including methods, standardization procedures and standards used.

The following dissolved oxygen sampling requirements were requested for quality assurance: At least 6 oxygen samples on full depth stations, bottle data for selected casts should be taken from similar water masses as adjacent casts without dissolved oxygen samples, and dissolved oxygen samples should be taken from the surface, bottom and major min/max inflection points with-in the profile. Small features are not as crucial. Finally all associated metadata for analytical procedures were used, including methods and standardization procedures are requested for best practice analysis.

The correspondence between individual sample containers and the rosette bottle position (1-24) from which the sample was drawn was recorded.

2.2. Bottle Data Processing

Shipboard CTDO data were processed using SIO/ODF CTD processing software v.5.6. The raw CTDO data and bottle trips acquired by SBE SeaSave on the Windows XP workstation were copied onto the Linux database and web server system. Pre-cruise calibration data were applied to CTD Pressure, Temperature and Conductivity sensor data, then the data were processed to a 0.5-second time series. A 1-decibar down-cast pressure series was created from the time series; CTDO data from down-casts were matched along isopycnals to up-cast trips and extracted, then fit to bottle oxygen data at trips.

Quality flags associated with sampled properties were set to indicate that the property had been sampled, and sample container identifications were noted where applicable (e.g., oxygen flask number). Analytical results were incorporated into the database. These results included a quality code associated with each measured value and followed the coding scheme developed for the World Ocean Circulation Experiment

(WOCE) Hydrographic Programme (WHP) [*Manual*]] [*Joyce*]

Various consistency checks, examination of bottle data, and summary of Bottle Data Quality Codes and sampling comments are included in the Appendix.

2.3. Bottle Data Processing Details

Bottle salinity samples appeared noisier than expected. This raised the question of whether they were all analyzed at a consistent temperature, in a climate controlled room, with consistent standards, or sampled correctly.

Dissolved oxygen samples shared variance in consistency. Oxygen draw temperatures were set to the temperature observed at the trip levels. This causes only a very small error in the computation of oxygen concentration from analysis results.

Some profiles, station 4/1 and 9/1 in particular, to vary from the O2 versus P behavior of the others. With the very limited number of samples and noisy bottle oxygen data it is difficult to tell if these bottle data were oceanographic. For Example in comparison with P17N data, it seems unlikely that high concentrations dissolved oxygen values in this region would be found as reported at depth for cast 4/1.

Bottle oxygen (ml/l) vs. pressure for MV1310 (purple) and WOCE P17N section (orange) in figures 2.3.0.

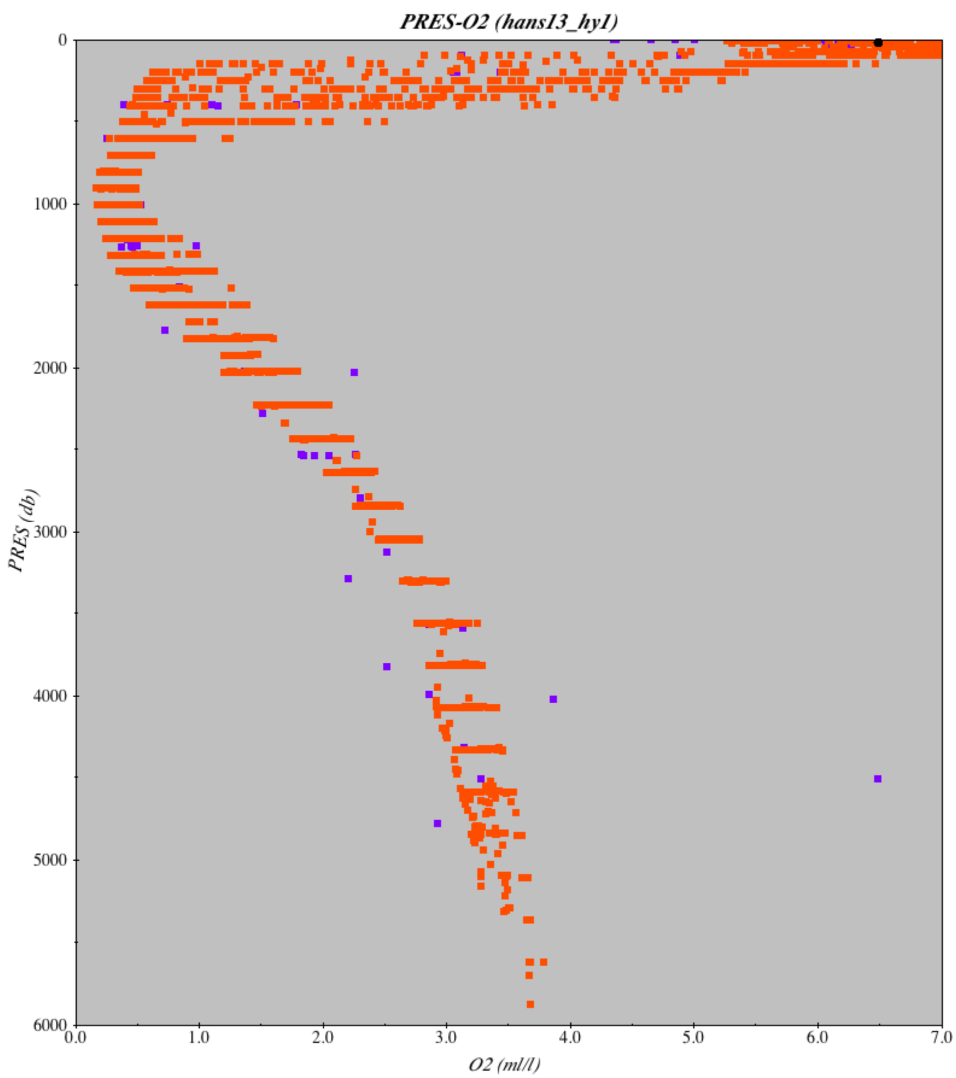


Figure 2.3.0 Discrete dissolved oxygen MV1310 vs. P17N.

From figure 2.3.0 one can judge that insufficient bottle oxygen samples of usable quality were available from this cruise to provide reasonable assurance of values of dissolved oxygen at a given level from a given profile. Because the final data do match the shape of P17N data, there is, however somewhat more confidence in the shape and gradients revealed in the final CTD oxygen probe data.

APPENDIX

Cast Bottom Data

For each station/cast the following table shows the following information for the bottom of each cast, respectively:

- Station/Cast Number
- GMT Date and Time
- Latitude and Longitude
- Calculated Depht using CTD data (meters)
- CTD Pressure (decibars)

A '-999' for any of these values indicates an instrument error in which no data was given.

Table 2.3.0 Cast bottom data

SSS/CC	Date & Time	Latitute & Longitude	CTDDepth	CTDPres
001/01	20130805 18:05:46	48.81898 N 128.67689 W	2507.8	2541.3
002/01	20130805 18:05:46	48.81898 N 128.67689 W	3084.5	3130.1
003/01	20130805 18:05:46	48.81898 N 128.67689 W	3623.5	3681.8
003/02	20130805 18:05:46	48.81898 N 128.67689 W	1002.3	1011.8
003/03	20130805 18:05:46	48.81898 N 128.67689 W	1201.1	1213.2
004/01	20130805 18:05:46	48.81898 N 128.67689 W	3959.5	4026.5
004/02	20130805 18:05:46	48.81898 N 128.67689 W	201.3	202.6
005/01	20130805 18:05:46	48.81898 N 128.67689 W	4029.4	4098.2
005/02	20130805 18:05:46	48.81898 N 128.67689 W	1747.9	1768.0
006/01	20130805 18:05:46	48.81898 N 128.67689 W	3925.0	3991.1
007/01	20130805 18:05:46	48.81898 N 128.67689 W	3789.9	3852.5
008/01	20130805 18:05:46	48.81898 N 128.67689 W	3793.0	3855.4
008/02	20130805 18:05:46	48.81898 N 128.67689 W	3006.3	3050.3
008/03	20130805 18:05:46	48.81898 N 128.67689 W	1504.5	1521.0
009/01	20130805 18:05:46	48.81898 N 128.67689 W	3766.5	3828.5
010/01	20130805 18:05:46	48.81898 N 128.67689 W	3662.3	3721.7
010/02	20130805 18:05:46	48.81898 N 128.67689 W	202.2	203.6
010/03	20130805 18:05:46	48.81898 N 128.67689 W	3012.2	3056.3
010/04	20130805 18:05:46	48.81898 N 128.67689 W	3667.0	3726.5
011/01	20130805 18:05:46	48.81898 N 128.67689 W	3534.1	3590.3
012/01	20130805 18:05:46	48.81898 N 128.67689 W	3575.2	3632.5
012/02	20130805 18:05:46	48.81898 N 128.67689 W	199.5	200.9
012/03	20130805 18:05:46	48.81898 N 128.67689 W	1251.5	1264.4
013/01	20130805 18:05:46	48.81898 N 128.67689 W	3455.1	3509.4
014/01	20130805 18:05:46	48.81898 N 128.67689 W	3409.0	3462.1
015/01	20130805 18:05:46	48.81898 N 128.67689 W	181.3	182.4
016/01	20130805 18:05:46	48.81898 N 128.67689 W	3877.5	3942.4
017/01	20130805 18:05:46	48.81898 N 128.67689 W	5048.7	5147.3
017/02	20130805 18:05:46	48.81898 N 128.67689 W	2005.8	2030.4
017/03	20130805 18:05:46	48.81898 N 128.67689 W	51.8	52.1
017/04	20130805 18:05:46	48.81898 N 128.67689 W	1755.4	1775.9
018/01	20130805 18:05:46	48.81898 N 128.67689 W	3255.5	3305.2
019/01	20130805 18:05:46	48.81898 N 128.67689 W	5382.9	5492.3
020/01	20130805 18:05:46	48.81898 N 128.67689 W	4203.0	4276.8
020/02	20130805 18:05:46	48.81898 N 128.67689 W	1752.9	1773.3
020/03	20130805 18:05:46	48.81898 N 128.67689 W	500.0	504.1

SSS/CC	Date & Time	Latitute & Longitude	CTDDepth	CTDPres
020/04	20130805 18:05:46	48.81898 N 128.67689 W	500.3	504.5
021/01	20130805 18:05:46	48.81898 N 128.67689 W	4230.0	4304.5
022/01	20130805 18:05:46	48.81898 N 128.67689 W	4424.7	4504.6
023/01	20130805 18:05:46	48.81898 N 128.67689 W	4588.4	4673.1
024/01	20130805 18:05:46	48.81898 N 128.67689 W	4462.1	4543.2
024/02	20130805 18:05:46	48.81898 N 128.67689 W	2752.0	2790.8
024/03	20130805 18:05:46	48.81898 N 128.67689 W	100.6	101.3
024/04	20130805 18:05:46	48.81898 N 128.67689 W	99.8	100.5
025/01	20130805 18:05:46	48.81898 N 128.67689 W	4487.6	4569.3
026/01	20130805 18:05:46	48.81898 N 128.67689 W	5104.8	5204.8
027/01	20130805 18:05:46	48.81898 N 128.67689 W	4984.2	5080.8
027/02	20130805 18:05:46	48.81898 N 128.67689 W	1499.8	1516.3
028/01	20130805 18:05:46	48.81898 N 128.67689 W	4689.5	4778.2
029/01	20130805 18:05:46	48.81898 N 128.67689 W	4242.7	4318.6
029/02	20130805 18:05:46	48.81898 N 128.67689 W	1252.0	1264.9
030/01	20130805 18:05:46	48.81898 N 128.67689 W	4092.5	4163.0
030/02	20130805 18:05:46	48.81898 N 128.67689 W	202.1	203.4
031/01	20130805 18:05:46	48.81898 N 128.67689 W	1104.3	1115.2
031/02	20130805 18:05:46	48.81898 N 128.67689 W	3929.1	3995.3
032/01	20130805 18:05:46	48.81898 N 128.67689 W	3826.8	3890.2
033/01	20130805 18:05:46	48.81898 N 128.67689 W	3299.7	3350.2
033/02	20130805 18:05:46	48.81898 N 128.67689 W	3309.0	3359.7

Water Property Quality Codes

Table 2.3.2 explains WOCE quality codes [*Joyce*] used in data analysis, and uses for remarks regarding bottle data.

Table 2.3.2 Water Property Quality Codes

Code	Definition
1	Sampled but not yet received.
2	No problems noted.
3	Questionable measurement.
4	Bad measurement.
5	Sample not reported.
6	Mean of replicate measurements.
7	Manual (chromatographic) peak measurement.
8	Irregular digital chromatographic peak integration.
9	Sample not drawn from this bottle.

Bottle Data Quality Code Summary and Comments

Table 2.3.1 contains WOCE quality codes [*Joyce*] used in data analysis, and remarks regarding bottle data.

Table 2.3.1 Water Sample Quality Code Summary

Property	1	2	3	4	5	6	7	8	9	Total
Bottle	0	78	0	0	0	0	0	0	1289	1367
cfc11	0	0	0	0	0	0	0	0	0	0
cfc12	0	0	0	0	0	0	0	0	0	0
ccl4	0	0	0	0	0	0	0	0	0	0
sf6	0	0	0	0	0	0	0	0	0	0
he	0	0	0	0	0	0	0	0	0	0
trit	0	0	0	0	0	0	0	0	0	0
o18o16	0	0	0	0	0	0	0	0	0	0
Oxygen	0	53	12	2	11	0	0	0	0	78
dic	0	0	0	0	0	0	0	0	0	0
talk	0	0	0	0	0	0	0	0	0	0
ph	0	0	0	0	0	0	0	0	0	0
no2	0	0	0	0	0	0	0	0	0	0
no3	0	0	0	0	0	0	0	0	0	0
po4	0	0	0	0	0	0	0	0	0	0
sio3	0	0	0	0	0	0	0	0	0	0
nh4	0	0	0	0	0	0	0	0	0	0
Salinity	0	63	5	10	0	0	0	0	0	78
doc	0	0	0	0	0	0	0	0	0	0
tdn	0	0	0	0	0	0	0	0	0	0
blackc	0	0	0	0	0	0	0	0	0	0
pigments	0	0	0	0	0	0	0	0	0	0

Quality evaluation of data included the comparison of bottle salinity and bottle oxygen data with the CTDO data using plots of differences, and the review of various property plots and vertical sections of the station profiles and adjoining stations. Comments from the Sample Logs and the results of investigations into bottle problems and anomalous sample values are included in this report. Sample number in this table is the cast number times 100, plus the bottle position number.

Table 2.3.3 Bottle Quality Codes and Comments

Station /Cast	Sample Number	Property	Quality Code	Comment
1/1	111	Salinity	4	Sample value high for density profile. Remove from fit.
1/1	113	Salinity	3	Sample value high for density profile. Remove from fit.
2/1	108	O2	3	Sample value does not appear to fit general trend in this section. Value low for profile. Code questionable.
4/1	101	O2	3	Sample data does not match adjacent profiles or historic records of data in this region. Code questionable.

Station /Cast	Sample Number	Property	Quality Code	Comment
4/1	109	O2	3	Sample data does not match adjacent profiles or historic records of data in this region. Code questionable.
4/1	112	O2	3	Sample data does not match adjacent profiles or historic records of data in this region. Code questionable.
4/1	120	O2	2	Sample data low in high gradient region. Code questionable.
9/1	102	O2	3	Value does not match water column profile or from adjacent casts. Bottle value does not match general trend with P16N or P17N. Value matches better with bottle 6. Possibly sampled incorrectly. Code questionable.
9/1	122	O2	3	Value low in high gradient region. Code questionable.
9/1	123	O2	3	Value does not match water column profile or from adjacent casts. Bottle value does not match general trend with P16N or P17N. Code questionable.
11/1	105	Salinity	4	Sample value low for density profile. Remove from fit.
11/1	114	Salinity	4	Likely bad salinity measurement.
18/1	104	O2	4	Value does not match water column profiles historically (P16N), currently, or from adjacent casts. Value matches better with bottle 1. Possibly sampled incorrectly. Code bad.
18/1	119	O2	3	High variance with CTD DO water bottle values at surface. Code questionable.
18/1	121	O2	3	Value does not match CTD DO water bottle values at surface. Code questionable.
18/1	122	O2	3	High variance with CTD DO water bottle values at surface. Code questionable.
18/1	124	O2	3	High variance with CTD DO water bottle values at surface. Code questionable.
22/1	101	Salinity	3	Sample value high for density region. Value better matches bottle 4. Possibly sampled incorrectly. Remove from fit.
22/1	102	O2	4	Sample value very high for density region. Similar problem noted in salinity. Possible bad trip. Code bad removed from fit.
22/1	102	Salinity	4	Sample value high for density region. Similar problem in o2 noted. Possible bad trip. Remove from fit.
28/1	102	O2	3	Sample value low for density region. Sample value close but doesn't match historical trend in P17N data. Similar issue noted in salinity. Possible bad trip. Removed from fit.
28/1	102	Salinity	3	Sample value low for density region after fit. Not enough salinity values at high density region to be sure of trend. Code questionable.
28/1	106	Salinity	3	Sample value low for density region, appears to better match bottle 7. Possibly sampled incorrectly.
28/1	116	Salinity	4	Sample value low for density region, appears to better match bottle 17. Possibly sampled incorrectly.
29/1	101	Salinity	3	Sample value high for density region. Remove from fit, code questionable.
30/2	202	Salinity	4	Suppression switch on auto-salinometer on the wrong setting. Sample values are about about +/-1PSU from the water column profile.
30/2	209	Salinity	4	Suppression switch on auto-salinometer on the wrong setting. Sample values are about about +/-1PSU from the water column profile.
30/2	215	Salinity	4	Suppression switch on auto-salinometer on the wrong setting. Sample values are about about +/-1PSU from the water column profile.
30/2	222	Salinity	4	Suppression switch on auto-salinometer on the wrong setting. Sample values are about about +/-1PSU from the water column profile.
30/2	223	Salinity	4	Suppression switch on auto-salinometer on the wrong setting. Sample values are about about +/-1PSU from the water column profile.