## REVISION NOTICE TABLE

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| DATE | DESCRIPTION OF REVISION |

## PROCESSING NOTES

Cruise: 2022-075

Agency: OSD

Location: Kitimat / WCVI

Project: Kitimat Fjords & WCVI Oceanographic Survey

Chief Scientist: Johannessen S.

Platform: Sir John Franklin

Date: 12 October 2022 – 23 October 2022

Processed by: Germaine Gatien

Final Processing: 22 March 2023 – 17 April 2023

Number of HEX files: 71 Number of CTD files processed: 69 (1 split cast; 1 aborted cast)

Number of rosette files: 35 Number of bottle casts processed: 32 (2 joined, 2 no sampling)

# INSTRUMENT SUMMARY

CTD #0585 was mounted in a rosette and attached were 2 Wetlabs CSTAR transmissometers (1201DR and 1883DG), a SBE 43 DO sensor on the primary pump (#1176), SeaPoint Fluorometer (10X gain) on the secondary pump (#2228) and an altimeter (#75321).

Seasave version 7.26.7.121was used for acquisition.

The data logging Computer was Nitro 5.

The deck unit was a Seabird model 11+ #1043.

A Guildline model 8400B Autosal serial # 73274 was used to analyze salinity samples.

An IOS rosette with 24 10L bottles was used.

A thermosalinograph (SeaBird 21 S/N 2488) was mounted with a Wetlabs WETStar fluorometer (#1656) and flow meter; sampling interval was 30s.

# SUMMARY OF QUALITY AND CONCERNS

The Daily Science Log Book and rosette log sheets were generally in good order with many comments about problems encountered, but there were some problems. The equipment list had the wrong serial number entered for one of the transmissometers. Station names were missing from the first 26 files. There were some changes to planned order of stations that were recorded correctly in the Daily Science Log, but event numbers in the sampling logs and master sample list were not changed. This leads to extra work for analysts and data processors.

When a cast is aborted and rerun, a new event number should be assigned rather than using the number from the previous attempt with letter “B” after it. Our software systems cannot deal with letters in cast #s. Just mark the original cast as aborted in the log and make a new entry for the next attempt. The processed data files named 2022-075-0067 correspond to those originally named 2022-075-0067B in the raw data. It is ok to use the “B” approach when a cast has to be split into multiple files, though using new event numbers are also fine as long as the split is noted in the log.

Both temperature and conductivity channels were close during downcasts, but were unusually noisy during upcasts. Fortunately, during stops for bottles, the noise disappeared. The noise was present even when ascent rates of the CTD were very smooth. This seems normal from the Franklin.

There was no 10m soak before running the full casts. This was a deliberate choice in order to sample undisturbed surface water. However, a 30 second soak at a 10-metre depth is needed to flush the CTD tubing, pump and sensors free of air. The near-surface variability may make the associated error seem insignificant, but the effects can be seen down to 10m where variability is often much lower.

During casts #41 and #98 the pumps turned off briefly during the downcast. Data from pumped channels were replaced with pad values.

The dissolved oxygen sensor calibration appears to be drifting and the correction is quite large. There appeared to be a sudden shift during cruise 2022-015 in May 2022, but since then no notable drift has been found.

The SBE DO sensor has a fairly long response time so data accuracy is not as high when it is in motion as it is during stops for bottles. This will be especially true when vertical DO gradients are large. A rough comparison was made between downcast SBE DO after recalibration and upcast titrated samples. There was insufficient sampling to make an estimate of accuracy of the downcast (CTD files) Oxygen:Dissolved:SBE data for this cruise, but errors found were well within those found for cruise 2202-025 (September). Some of the difference will be due to problems with flushing of Niskin bottles and/or analysis errors and small mismatches in depth in the presence of large DO gradients, so the following statement likely underestimates SBE DO accuracy. Errors are considered very roughly, to be:

 ±0.25 mL/L from 0-100db except in areas of very large DO gradients

 ±0.07 mL/L from 100db-150db

 ±0.02 mL/L below 150db

Channel Fluorescence:URU:SeaPoint was removed because the values found were extremely low and compared very badly with extracted chlorophyll samples during this cruise and previous cruises.

Files that include fluorescence may be obtained by sending a request to:

 PAC SCI IOS Data / Données ISO SCI PAC (DFO/MPO)

 <DFO.PACSCIIOSData-DonneesISOSCIPAC.MPO@dfo-mpo.gc.ca>

# PROCESSING SUMMARY

##### Seasave

This step was completed at sea; the raw data files have extension HEX.

##### Preliminary Steps

* The configuration files used at sea was checked. There were a few problems:
	+ The configuration file for the first cast had 1 transmissometer listed and the rest showed 2. A test conversion suggests that both were mounted for the first cast.
	+ The log states that the 2 transmissometers were #1201DR and 1883DG. The configuration files list 1185DR and 1883DG. Since the 1185DR has a special mount with the 1883DG the log must be wrong.
	+ There was some concern about the fluorometer based on a problem during previous Franklin cruises that used CTD#0585. Fluorescence values were extremely low. While this could be due to an error in the gain, photos available from 2022-025 show that a 10X gain cable was used and tests were done that it was working properly. Initial tests show very low fluorescence values for this cruise as well.
	+ Corrections were made to one configuration file which was saved as 2022-075-ctd.xmlcon.
* The Log Book and rosette log sheets were obtained. They were in good order (except for the error in transmissometer serial number) with many useful comments.
* Dissolved oxygen and salinity data were obtained in QF spreadsheet format from the analysts.
* The cruise summary sheet was completed.
* The history of the T, C and P sensors was checked and all were used during 2022-002, 2022-015, 2022-067 and 2022-025.

##### BOTTLE FILE PREPARATION

The ROS files were created using files 2022-075-ctd.xmlcon.

Casts #2, 15 and 58 had bottle files created but no sampling, so the ROS files for those casts were deleted.

There were also surface samples collected with no accompanying CTD data: 34, 50, 59, 75, 87.

Cast 67b was a repeat of 67. The file 222-075-0067b.ROS was renamed as 2022-075-0067.ROS

Cast #56 and 56-b will need to be joined which is best done after conversion to \*.IOS.

The ROS files were converted to IOS Header format with extension \*.BOT.

The IOS files were put through CLEAN to create BOT files.

JOIN was run to join the 2 parts of cast #56. The file was edited to renumber the order of firing of bottles and fix the header limit.

Temperature and salinity were plotted for all BOT files to check for outliers. No editing was found necessary.

The BOT files were bin-averaged on bottle number.

The output was used to create file ADDSAMP.csv. First, the file was sorted on event number and Bottle Position order. Then sample numbers were added based on the rosette logs.

The ADDSAMP file was sorted on sample numbers.

The ADDSAMP file was used to add sample numbers to the BOT files – output \*.SAM.

The station names are missing from the early files, so MERGE CSV file to Headers was used to add that information using file 2022-075-header-mrg.csv which was prepared with file names and station names.

The SAM files were bin-averaged on bottle # and called SAMAVG.

The addsamp.csv file was converted to CST files, which will form the framework for the bottle files.

Next, each of the analysis spreadsheets were examined to see what comments the analysts wanted included in the header file. These were used to create file 2022-075-bot-hdr.txt which will be updated as needed during processing.

DISSOLVED OXGYEN

Dissolved oxygen data were provided in spreadsheet QF2022-075\_OXY\*.xlsx which includes flags, comments and a precision study. Draw temperatures are available. The spreadsheet page with the final data was simplified and saved as 2022-075oxy.csv. That file was converted into individual \*.OXY files.

There were 2 samples in the DO file that had comments starting with “ALL:” but only DO was taken from those bottles.

EXTRACTED CHLOROPHYLL

Extracted chlorophyll and phaeo-pigment data were obtained in file QF2022-075\_CHL QF\*.xlsx. The file included comments and flags and a precision study. A simplified version of the spreadsheet was prepared and saved as 2022-075chl.csv. The csv file was then converted to individual CHL files.

NUTRIENTS

The nutrient data were obtained in spreadsheet QF2022-075\_NUTS\*.xlsx. This includes a precision study. The file was simplified, saved as 2022-075nuts.csv. The file was converted to individual NUT files.

SALINITY

Salinity analysis was obtained in file QF2022-075\_SAL.xlsx which included a precision study. The analyses were carried out in a temperature-controlled lab within 21-42 days of collection. The files were simplified and saved as 2022-075sal.csv. That file was then converted to individual SAL files.

ALL: Event 13 was changed to 15 in all the converted analysis files.

The SAL, CHL, OXY and NUTS data files were merged with CST files in 4 steps.

The files were then put through CLEAN to reduce the headers to File and Comment sections only.

These files are ordered on sample number, but the SAMAVG files are ordered on bottle number, so the MRGCLN1 files were reordered on Bottle\_Number and saved as \*. MRGCLN1s.

The MRGCLN1s files were then merged with SAMAVG files using merge channel Bottle\_Number.

The output of the MRG files were exported to a spreadsheet and compared to the Bottle Summary document to look for omissions.

A number of problems were found:

* Samples were missed for events #8 and #15 as they were mislabelled on the rosette sheets and sample master list.
* Nutrient sample with event # called #67B was missed. File was renamed and the analyst notified
* Several samples were missing that were on the sample master list. They were flagged 9 and analysts notified.

CHL- Event 56 sample 247 missing – Flag 9 “Sampled planned but not taken”

SAL – Event 22 – samples 73 and 81 indicated on sampling log but not found – Flag 9 “Sample planned but not taken”

A header check and cross-reference listing were produced and no problems were found.

##### Compare

Salinity

Compare was run with pressure as reference channel.

There were 16 bottles from 9 casts between 0m and 763m. For 8 casts 1 of the bottles was fired very close to the bottom.

When outliers were excluded based on standard deviation in the CTD Salinity >0.001 plus all bottles above 140db, the primary salinity was found to be low by an average of 0.0099psu (std dev 0.0024) and the secondary was low by an average of 0.00265psu (std dev 0.0025). The fits included only 18 bottles, 7 of which came from close to the bottom. Excluding those bottom bottles the differences were -0.0102psu and -0.0053psu. There was clear evidence of poor flushing of Niskin bottles above 140db. The overall fit is still likely somewhat influenced by poor flushing; that would make the CTD look lower than bottles on the upcast and higher at the bottom. The bottom bottles are lower than the CTD by an average of ‑00.0088psu and -0.0033psu, so there might be some effect of Niskin contents having not fully reached ambient values. There are too few bottles to analyze the results with any confidence, except to say that the secondary salinity is much closer to bottles, as it has been in other uses of this equipment.

All outliers are associated with noisy CTD salinity or are at depths likely to be influenced by poor flushing at levels with high vertical salinity gradients. No quality flags are recommended for salinity samples.

For 2022-025 recalibration was applied by adding 0.008psu and 00.002 to the primary and secondary salinity. That cruise had more deep offshore sampling where incomplete flushing was less likely to be a major source of error, but sample analysis was run about 10 weeks after collection, so evaporation and/or desorption would have led to an error of the same sign. So the same corrections will be selected.

There is no evidence of drift during this cruise, though there are too few data for this to be significant.

For full details for the COMPARE run see file 2022-075-sal-comp1.xls.

Dissolved Oxygen

COMPARE was run with pressure as the reference channel.

There are 75 bottles, among which 24 bottles are from the top 10db where fits are often poor due to high vertical DO gradients and/or local reversals in DO. There are no DO samples <1mL/L, so getting a good fit requires setting an offset. Two were tried – 0 and -0.0255 (based on results from cruise 2022-067).

When outliers were identified based on residuals there were 54 bottles in the fit and the results were:

CTD DO Corrected = CTD DO \* 1.0941 (Fit 1)

Or if the offset is forced to 0.0255:

CTD DO Corrected = CTD DO \* 1.0861 + 0.0255 (Fit 2)

The first fit has a slope very close to that found for 2022-067, though the earlier cruise had an offset of 0.0255.

CTD DO Corrected = CTD DO \* 1.0939 + 0.0255 (2022-067)

Both fits are reasonably close to that used for 2022-067.

When only the 2 casts that were in more open waters are included and the 2022-067 offset was used, the fit was:

CTD DO Corrected = CTD DO \* 1.0915 + 0.0255

This fit is based on few samples but flushing is likely better.

Overall, the choice of the 2022-067 correction looks like the best choice.

For full details for the COMPARE run see file 2022-075-dox-comp1.xls.

Plots of Titrated DO and CTD DO against CTD salinity were examined. No further outliers were found.

Fluorescence

COMPARE was run with pressure as the reference channel.

An initial comparison showed fluorescence to be ~10x lower than extracted chlorophyll even in the range of chlorophyll where they usually agree quite well. On previous uses of this sensor a similar result was found but it was thought that the wrong gain cable must have been used. However, during 2022-025 a photo of the gain cable is clearly labelled as 10X.

These data will be removed before the final processing step and saved in case anyone wishes to see the profiles. The actual values are clearly bad.

##### Conversion of Full Files from Raw Data

All files were converted using 2022-075-ctd.xmlcon.

The Tau function was selected but not the hysteresis function since there was no sampling below 800m. Depth was included in the conversion.

A few casts were examined.

The T and C pairs were close during downcasts but not upcasts. There is always more noise in upcast temperature and conductivity channels than in downcasts, but this is typical of recent Franklin cruises. Fortunately, the noise stops during bottle stops.

The descent rate is generally high with very steady rates in inlets and moderate noise level in more open waters.

The transmissivity, DO, altimetry and fluorescence profiles look normal except fluorescence values are low.

##### WILDEDIT

Program WILDEDIT was run to remove spikes from the pressure, depth, conductivity & temperature only in the full cast files (\*.CNV).

Parameters used were: Pass 1 Std Dev = 2 Pass 2 Std Dev = 5 Points per block = 50

The parameter “Keep data within this distance of the mean” was set to 0 so all spikes would be removed.

A few spikes noted in conductivity were successfully removed by this step.

##### ALIGN DO

A few casts were examined; both temperature channels were noisy during upcasts so the tests were not easy to interpret, but using +2.5s certainly improves the alignment and overall looks like a good choice for both sensors. That setting has worked well for many SBE DO sensors in recent years. ALIGNCTD was run on all casts using +2.5s.

##### CELLTM

The noise in the upcast data makes tests for the best parameters for this routine very difficult to interpret. In the past when upcast data were not so noisy, the default setting of (α = 0.0245, β=9.5) was generally found to be the best choice. A few casts were checked for this cruise and the default setting does improve the data. CELLTM was run using (α = 0.0245, β=9.5) for both the primary and secondary conductivity.

##### DERIVE and Channel Comparisons

Program DERIVE was run on all casts to calculate primary and secondary salinity and dissolved oxygen concentration.

File 2022-075-0067.cnv was remove and file 2022-075-0067B was renamed as 2022-075-0067.

DERIVE was run a second time on 4 casts deeper than 500m to find the differences between the pairs of temperature, conductivity and salinity channels.

Data are included from the 4 previous cruises since the last factory calibration.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Cast # | Press | T1-T0  | C1-C0 | S1-S0 | Descent Rate |
| 2022-002-0058 | 1000 | +0.0002 | +0.00031 | +0.0035 | High, XNoisy |
|  | 1900 | +0.0001 | +0.00025 | +0.0030 | “ |
| 2022-002-0142 | 1000 | +0.0001 | +0.00033 | +0.0040 | High, XNoisy |
|  | 1900 | +0.0002 | +0.00029 | +0.0033 | “ |
| 2022-015-0046 | 1000 | +0.0002 | +0.00040 | +0.0047 | High, Very Noisy |
|  | 1900 | +0.0002 | +0.00035 | +0.0041 | “ |
| 2022-015-0048 | 1000 | +0.0001 | +0.00040 | +0.0048 | High XNoisy |
|  | 1900 | +0.0000 | +0.00036 | +0.0043 | “ |
| 2022-015-0077 | 1000 | +0.0002 | +0.00045 | +0.0052 | High, Moderate |
| 2022-067-0008 | 600 | +0.0002 | +0.00067 | +0.0072 | High, Steady |
| 2022-067-0066 | 400 | +0.0001XN | +0.00063 | +0.0064 | High, Steady |
| “ | 600 | +0.0002 | +0.00061 | +0.0072 | “ |
| 2022-067-0075 | 400 | +0.0003 | +0.00055 | +0.0054 | High, Steady |
| 2022-067-0106 | 400 | +0.0003 | +0.00048 | +0.0050 | High, Steady |
| 2022-067-0119 | 500 | +0.0002 | +0.00067 | +0.0073 | High, Moderate |
| 2022-067-0143 | 400 | +0.0002 | +0.00047 | +0.0045 | High, Moderate |
| 2022-067-0206 | 300 | +0.0002 | +0.00037 | +0.0038 | High, Steady |
| 2022-025-0059 | 500 | +0.0003 | +0.00052 | +0.0056 | High, Noisy |
|  “ | 1000 | +0.0003 | +0.00047 | +0.0051 | “ |
|  “ | 1800 | +0.0003 | +0.00042 | +0.0047 | “ |
| 2022-025-0062 | 500 | XN | +0.00051 | XN | High XNoisy |
|  “ | 1000 | +0.0001 | +0.00050 | +0.0058 | “ |
|  “ | 1800 | 0 | +0.00043 | +0.0054 | “ |
| 2022-025-0064 | 500 | +0.0001 | +0.00052 | +0.0058 | High, VNoisy |
|  “ | 1000 | +0.0001 | +0.00049 | +0.0058 | “ |
|  “ | 1800 | +0.0001 | +0.00044 | +0.0052 | “ |
| 2022-075-0009 | 550 | +0.0003 | +0.00048 | +0.0051 | High, Steady |
| 2022-075-0033 | 600 | +0.0004 | +0.00052 | +0.0045 | High, VSteady |
| 2022-075-0065 | 550 | +0.0004 | +0.00051 | +0.0053 | High, VSteady |
| 2022-075-0084 | 500 | +0.0003 | +0.00056 | +0.0054 | High, VSteady |

Temperature differences are slightly higher than during previous uses, but still very small. Conductivity and salinity differences are similar to those in other cruises with similar maximum pressures.

These differences are close to those found between CTD salinity channels in COMPARE when the average difference was 0.0052psu.

##### Conversion to IOS Header Format

The IOSSHELL routine was used to convert Sea-Bird 911+ CNV files to IOS Headers.

The station names are missing from the early files, so MERGE CSV file to Headers was used to add that information using file 2022-075-header-mrg.csv which contains file names and station names.

CLEAN was run to add event numbers and to replace pad values in the pressure channel with interpolated values based on record number.

Plots were examined to see how many records needed to be removed. Estimates were entered in file CLIP.csv, based on being near the end of the soak period.

CLIP was run and plots made afterwards to ensure that too many records had not been removed. A few adjustments were made to the CLIP file and it was run on affected casts.

##### Checking Headers

* The cross-reference check was run. No problems were found.
* The header check was run and showed pressures got as low as -1.2db at the end of a deep cast. It is known that there is some hysteresis in the pressure sensor with final pressures low by as much as 1db with the difference increasing with depth of cast. For the downcasts, the error is likely <0.5db.
* A check of hysteresis was made by putting the CLN files through Reverse and running a surface check on those files. A plot was then made of the final upcast pressure versus the maximum pressure of the cast. It showed the same pattern seen in previous cruises – with just a few outliers there is a clear picture of surface pressures becoming more negative as maximum pressures increase. For shallow casts the error ranges from -0.25 to -0.6db and for the deepest casts close to -1db. Downcast errors would likely be no more than half that size, so well within the specifications for the sensor. (See 2022-075-pressure-hysteresis.xlsx)
* The CTD was run as the CTD went through the surface, at least for most casts. Starting pressures varied from about -0.6 to +0.8db. The higher values are likely cases of acquisition starting late, while the lowest values are associated with transmissivity values indicative of being in air. As soon as the transmissivity drops to “in water” values the pressure is usually quite close to 0db. So no recalibration is needed. These sensors are considered good to 1m, so these results are well within expectations.
* Surface check was run and found an average of 0.0db. The minimum value was -0.64db, but once the transmissivity dropped from to “in-water” values the pressure was ~-0.2db.
* Cruise tracks were plotted and were added to the end of this report.
* Water depth header entries were checked. Header values for altimetry and water depth were exported to file 2022-075-altimeter-ctd.xlsx. A “check value” was calculated as follows:

Check Value = Absolute Values {(Altimetry header + Max. depth sampled - Water depth in Header}

This value is expected to be close to 0, but in an area with narrow channels and steep slopes larger check values are common. All cases with that value >6m were checked. In 2 cases there was a large check value. One was clearly a typo in the header and the other differed significantly from the log. Using the sounder entries from the log produced good results, so those were entered in those headers (Casts #38 and #46). 5 others were checked but the altimetry looks good and the check values are between 6m and 9m, so quite reasonable for this area.

Changes were made to 2 CLIP1 files; neither cast was a bottle cast.

##### Shift

Fluorescence

SHIFT was run on the SeaPoint fluorescence channel in all casts using the usual advance of +24 records. Plots show that the fluorescence offset is closer to the temperature offset after this step.

Dissolved Oxygen

The Dissolved Oxygen voltage channel was aligned earlier and the results look good. No further alignment will be applied.

Conductivity

Tests were run on 3 casts to assess what settings are best to align conductivity with temperature (as judged by the effect on salinity as seen in T-S space). The best settings were -0.7 records for the primary and -0.1 records for the secondary conductivity. Those settings were also used for the previous cruise.

SHIFT was run twice on all SBE911 casts using those settings. Salinity was recalculated for both channels.

##### DELETE

The following DELETE parameters were used:

Surface Record Removal: Last Press Min

Maximum Surface Pressure (relative): 10.00

Surface Pressure Tolerance: 1.0 Pressure filtered over 15 points

Swells deleted. Warning message if pressure difference of 2.00

Drop rates < 0.30m/s (calculated over 11 points) will be deleted.

Drop rate applies in the range: 10db to 10db less than the maximum pressure

Sample interval = 0.042 seconds. (taken from header)

COMMENTS ON WARNINGS: There were no warnings.

##### Other Comparisons

Experience with these sensors since last factory service –

* During 2022-002 pressure was thought to be reading low by 0.6db.The primary salinity was lower than bottles by 0.0052psu & secondary salinity lower by 0.0019psu; primary was recalibrated by adding 0.0033psu and was selected for archiving. Dissolved oxygen was recalibrated using slope/offset=1.0076/0.0507.
* During 2022-015 the DO calibration appeared to shift so 2 recalibrations were applied with slope/offset= 1.0158/0.0449 and 1.0726/0.0449 for the early and late casts, respectively. The primary salinity was low by 0.0072psu and the secondary was low by 0.0024psu. Fluorescence values were low by a factor of 10 due to an error in the configuration. Pressure looked good.
* During 2022-067 the pressure was found to be within 0.5db. Primary salinity was low by 0.0081psu and secondary low by 0.0024psu. Secondary salinity was selected for archiving. Dissolved oxygen was recalibrated using slope/offset=1.0939/0.0255.
* During 2022-025 the pressure was found to be within 0.5db. In COMPARE the primary salinity was low by 0.0098psu and secondary low by 0.0044psu, but there was a long wait for analysis. Corrections of 0.008psu and +0.002psu were applied to primary and secondary salinity respectively. The secondary salinity was very noisy so the primary channels were selected for archiving. There were many problems with dissolved oxygen samples, so dissolved oxygen was recalibrated using slope/offset=1.0939/0.0255 based on 2022-067.

Historic ranges –Profile plots were made with 3-standard deviation climatology ranges of T and S superimposed, but local climatology was only available for 2 casts. For those casts, all temperature and salinity data fell within the climatology.

Post-Cruise Calibration – There were no post-cruise calibrations available.

##### DETAILED EDITING

The decision on which channel pair to use was clear since the secondary salinity is closer to bottles and the primary salinity was noisier than the secondary.

It was noted in the log that the pumps turned off occasionally. Particular mention was made of interruptions affects casts 41 and 98.

Plots were made to see if any other casts had such problems but no others were affected.

CTDEDIT was used to remove records that appear to be corrupted by shed wakes and to clean salinity where small spikes appear to be due to small misalignment or instrumental noise.

Many inlet casts needed only light editing at the top and/or bottom of casts.

The following casts required no editing: 9, 10, 19-25, 29, 35, 39-40, 42-44, 49-54, 62-65, 68-69, 71-73, 84, 89.

Heavy editing was applied to casts #41 and 98 due to pumps turning off mid-downcast.

Notes about editing applied were added to the files.

The edited files were copied to \*.EDT.

After editing T-S plots were examined for all casts. Small unstable features remain in many casts which is expected with most casts being close to shore and in areas of tidal mixing and mixing near sills.

##### Corrections to Pressure, Salinity and Dissolved Oxygen Concentration

Silicate requires recalibration since there was silicate sampling and salinity was <25psu for some samples.

File 2022-075-recal-sil.ccf was prepared and applied to the MRGCLN2 files.

No correction is needed to pressure.

File 2022-075-recal1.ccf was prepared to add 0.008psu to Salinity:T0:C0 and 0.002psu to Salinity:T1:C1 (though it is not expected that primary salinity will be archived) and to apply the following correction to channel Oxygen:Dissolved:

CTD DO Corrected = CTD DO \* 1.0939 + 0.0255

This correction was first applied to the SAM and MRGCLN2 files.

COMPARE was rerun on dissolved oxygen and shows that the corrections were applied properly When the same bottles were included as in the original comparison, the SBE DO was found to be high by an average of 0.012mL/L with a standard deviation of 0.050mL/L. When only the 2 casts in open water were included the SBE DO was high by an average of 0.003mL/L with a standard deviation of 0.053mL/L. The calibration applied looks to be appropriate. See 2022-075-dox-comp2.xls.

COMPARE was rerun on salinity and shows that the corrections were applied properly. When the same bottles were included as in the original comparison, the SBE primary salinity was found to be low by an average of 0.0019psu with a standard deviation of 0.0024psu and the secondary salinity was low by an average of 0.0025psu with a standard deviation of 0.0025psu. Those differences are about what is expected due to flushing errors and/or evaporation or desorption of samples.

Calibrate was then run the EDT files.

##### Final Calibration of DO

The initial recalibration of dissolved oxygen corrects for sensor calibration drift. Alignctd corrects for transit time errors. Those 2 steps may partly correct for response time errors, but to see if a further correction is needed, a comparison is made of downcast CTD data to bottle data from the same pressure. Small differences are expected due to ship drift, temporal changes, incomplete flushing of Niskin bottles and delayed response and noise in CTD data and imperfect matching of levels.

Downcast files were bin-averaged to 0.5m bins for the casts with DO bottle samples. Those files were then thinned and compared to the bottle values in the MRG files. COMPARE was run to study the differences between the recalibrated downcast CTD DO data and the titrated samples from upcast bottles.

When a few outliers were removed based on standard deviations in the CTD DO data, the CTD DO was higher than the titrated samples by an average of ~0.093mL/L but the standard deviation was 0.16mL/L using all hydro casts. When only the 2 casts in open water were used the CTD DO was higher than the titrated samples by an average of ~0.018mL/L with a standard deviation of 0.052mL/L. When plotted against pressure, it is clear that the largest differences are all in the top 100db. Below that, differences are <0.1mL/L. Looking at only the data from casts #2 and #8, all except 1 bottle is within 0.07mL/L of bottles and within 0.03mL/L below 50db.

Thee are too few bottles to make error estimates for the SBE DO but the results appear to be well within estimates made during 2022-025

For more detail see file 2022-075-dox-comp3.xls.

##### Fluorescence Processing

A median filter, size 11, was applied to the fluorescence channel in the COR1 files. Plots of a few casts showed that the filter was effective. (Output:\*.FIL)

##### BIN AVERAGE of CTD files

The following Bin Average values were applied to the FIL files (output AVG):

Bin channel = pressure Averaging interval = 1.000 Minimum bin value = .000

Average value will be used. Interpolated values are NOT used for empty bins.

On-screen T-S plots were examined. There are some small unstable features but from this complex region of intersecting narrow channels and active mixing they may well be real.

Profile plots were examined to see if there any problems. None were found.

##### Final CTD File Steps (REMOVE and HEADEDIT)

A second SBE DO channel (with umol/kg units) was added.

REORDER was run to get the two DO channels together.

REMOVE was run to remove the following channels:

Scan\_Number, Temperature:Primary, Conductivity:Primary, Oxygen:Voltage:SBE, Descent\_Rate, Status:Pump, Altimeter, Salinity:T0:C0 and Flag and Fluorescence:URU:Seapoint.

HEADER EDIT was used to fix formats and channel names and to add the comments about processing.

*REMOVE was run to create files Rem-FL by removing all the above EXCEPT Fluorescence:URU:Seapoint.*

*HEAD EDIT was also run on the files WITH fluorescence with extensions ctd-FL.*

*Those files were placed in folder “Files-with-FLUOR” in case requests are received for fluorescence data.*

The Standards Check routine was run and no problems were found.

The Header Check was run; no problems were found.

Profile and T-S plots were examined. No problems were found.

The sensor history was updated.

##### Dissolved Oxygen Study

As a final check of dissolved oxygen data, % saturation was calculated and plotted. Given the wide variety of environments sampled it is not surprising that values at 2m ranged between 60% and 160%.

##### Final Bottle Files

MRGSORT was run to get files in pressure order.

A second SBE DO channel with mass units was added for both the CTD DO and titrated DO and REORDER was run to get the pairs of DO channels together.

REMOVE was run to remove the following channels:

Scan\_Number, Temperature:Primary, Conductivity:Primary, Oxygen:Voltage:SBE, Descent\_Rate, Status:Pump, Altimeter, Salinity:T0:C0, Fluorescence:URU:Seapoint and Flag.

Cast #15 has extra records with no sampling as bottles were fired as test. They were removed with a text editor and CLEAN was run to fix the channel limits.

HEAD EDIT was run to add comments to the headers.

*A second set of files were produced that include fluorescence.*

*REMOVE was run to remove Scan\_Number, Temperature:Primary, Conductivity:Primary, Oxygen:Voltage:SBE, Descent\_Rate, Status:Pump, Altimeter, Salinity:T0:C0 and Flag.*

*HEAD EDIT was also run on the files WITH fluorescence with extensions che-FL.*

*Those files were placed in folder “Files-with-FLUOR” in case requests are received for fluorescence data.*

Data were exported from the CHE files to file 2022-075-bottles-final.xlsx. The entries were compared with the rosette log sheets and no data were missing.

A Header Check and Standard Check were prepared and no problems were found.

The track plot looks ok.

A cross-reference listing and header check were produced for the CHE files.

**Particulars - Mainly notes from log of concern in processing + some notes on processing**

* + - 1. All bottles tripped – no sampling.

9. Shallow soak at beginning of cast.

12. May have hit bottom. Pump turned off and sensors went wild. Bottles 1-9 tripped (no sampling).

15. CTD “crapped out again”. Fired bottles manually at surface. Plot looked good. Sampling Log had event #13, wrong in analysis QF files.

17. Anoxic at bottom.

28. Cast restarted after at 10m – interference on trace and pump turned off. At least 4th time this happened.

38. Rosette started accidentally. No sampling.

40. Very noisy upcast signals. Cleaned trans connectors and sea-cable connector.

41. Spike at ~130m, pump turned off. Turned on again and continued down.

44. Anticipated depths wrong – prepared samples for 280m.

56. Split cast – 56 and 56B.

58. Bottle fired – no samples taken.

65. Samples 261-265 omitted.

67. Returned to surface, all sensor data wild for first 20m.Restarted cast as 67B. Named 67 in processing.

98. Spike and pump went off at 138m.

**2022-075**

**CRUISE SUMMARY – CTD**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CTD#** | **Make** | **Model** | **Serial#** | **Used with Rosette?** | **CTD Calibration Sheet Competed?** |
| **1** | **SEABIRD** | **911+** | **0585** | **Yes** | **Yes** |
| **Calibration Information - 0506** |
| **Sensor** | **Pre-Cruise** | **Post Cruise** |
| **Name** | **S/N** | **Date** | **Location** | **Date** | **Location** |
| **Temperature** | **2449** | **28Jan2021** | **Factory** |  |  |
| **Conductivity** | **1764** | **01Feb2021** | **Factory** |  |  |
| **Secondary Temp.** | **4484** | **02Feb2021** | **Factory** |  |  |
| **Secondary Cond.** | **2128** | **02Feb2021** | **Factory** |  |  |
| **Transmissometer** | **1201DR** | **28Apr2021** | **IOS** |  |  |
| **Transmissometer** | **1883DG** | **28Apr2021** | **IOS** |  |  |
| **SBE 43 DO sensor** | **1176** | **04Feb2021** | **Factory** |  |  |
| **SeaPoint Fluor.** | **2225** |  | **Factory** |  |  |
| **Pressure Sensor** | **0585** | **17Feb2021** | **Factory** |  |  |
| **Valeport Altimeter** | **75321** | **23Sept2020** | **Factory** |  |  |

The following plot excluded Event #1 in Saanich Inlet to better display the inlet sites



The following plot excluded Event #1 in Saanich Inlet to better display the inlet sites

