**REVISION NOTICE TABLE**

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| **DATE** | **DESCRIPTION OF REVISION** |
| 3 Dec 2024 | Added Data Description to CTD files. G.G. |
| 6 July 2023 | DO Saturation converted to DO Concentration. Archived CTD files had Average values instead of Bin Values – corrected to be Bin Values. S.H. |

**PROCESSING NOTES**

Cruise: 2019-100

Agency: OSD

Location: Clayoquot Sound

Project: Meteorology Network

Party Chief: Cooper G.

Platform: CME Anderson

Date: March 25, 2019 – March 29, 2019

Processed by: Germaine Gatien

Date of Processing: 5 December 2019 – 18 December 2019

Number of Raw files: 51 Number of Processed Files: 51

# INSTRUMENT SUMMARY

Equipment: RBR Concerto CTD (s/n 066024) with a Fluorometer (Chlorophyll a Turner Cyclops s/n 848) and oxygen sensor (JFE Advantech Rinko III BT s/n 300)

Sampling was at 6Hz. Deployment was by winch.

# SUMMARY OF QUALITY AND CONCERNS

A Data Tap Log was provided with times and positions of all casts. A field report was available.

There was a problem with one cast that led to problems separating subsequent data into appropriate files. This apparently happened when the RBR CTD was left running on deck after 1 cast. After considerable manipulation, a solution was found for that problem and some problems with time and date formats.

Many of the casts during the first half of the cruise had sections of low conductivity at the bottom that are likely due to the CTD hitting bottom. There were problems with the sounder. The bad data were removed.

The data looked good overall with good correspondence between nearby casts.

# PROCESSING SUMMARY

##### Conversion to IOS Headers

The original files are in separate spreadsheets with header information. These files contained downcast and upcast data. Prior to cast #14 the CTD was left running on board. That led to problems attributing data to the correct events for subsequent casts since some motion on board was interpreted as a downcast or upcast leading to much confusion. After considerable manipulation, a solution was found for that problem and some problems with time and date formats. (Thanks to Lu Guan!)

A single file with all the data including event numbers and just a single line of headers was prepared.

The data were delivered in 2 csv files.

A 6-line header was inserted.

CONVERT Spreadsheet was run to produce files with IOS Header format. Many header entries were included in this step but there was not room for everything required. The time increment is critical – other items can be added in the final Head Edit step. For event numbers <10, the files names needed adjusting to standard format.

Plots of salinity were examined and many have had bad data at the bottom. They were casts: 1, 9,10,11,12,15,17,20,21,22,40. In some of these casts the dissolved oxygen and fluorescence channels also look bad at the bottom. Temperature looks ok. These look like cases of the CTD hitting bottom and sometimes the upcast looks bad as well, which is likely due to be caused by mud. Most of the problems are early in the first half of the cruise.

File “2019-100CTD\_DataTapLog.xlsx” was saved as file 2019-100\_header-merge.csv. A few changes had to be made to make this file usable for routine “Merge csv files to Headers”.

* Many columns were not needed so were removed including the bottom depth column since those data were not available.
* A station name column was added and set equal to the event numbers.
* A column for file names was added and entries were derived from the event numbers.
* The position data had to be reformatted. For latitude that was done by subtracting the integral part from the latitude, multiplying that by 60 and truncating that result to 5 decimal places. Then using something like G2&” “&H2&” N ! (deg min)”. The same thing is done for longitude except that you need to remove the negative sign and use W instead of N.

The routine “Merge CSV Files to headers” was run to add those headers to the IOS files.

Next CLN was run to add a start time and event numbers to the headers.

A track plot showed one bad position; cast #15 had a bad start position – the Data Tap Log shows a reasonable position for the bottom and end of the cast so those were used in the file header. The error is believed to be due to the Tap Log sometimes obtaining positions from cell towers.

Plots were made of data from the same regions and data profiles fall in tight groups.

A header check was run and produced reasonable results but confirms there are some bad values.

##### Data processing

A number of corrections are suggested for RBR CTD data. These were investigated.

* Corrections for zero-order holds: There is no evidence that pressure has such regular repeats, but a typical cast takes only a few minutes. Descent rate was derived for some of the deeper casts and plotted. They do not show any regular dips to lower values. Most values vary from 0.1m/record to 0.15m/record, equivalent to 0.6 to 0.9m/s.
* Correction to Pressure: The CTD records total pressure and a corrected pressure with atmospheric pressure removed. In a previous use of this sensor the corrected pressure was found to be low by ~0.1db. Looking at plots it appears that the conductivity becomes non-zero when the pressure is roughly -0.1db. So file 2019-100-recal1.ccf was prepared to add 0.1 to the pressure and depth channels. While this is not a significant error, it removes most negative pressures. A few points remain with very low conductivity and slightly negative pressures for which the CTD was likely out of water or just entering water.
* Data despiking: The are no significant spikes in temperature, conductivity and salinity, although there is often a very large change between the 1st and 2nd data points. Fluorescence needs at least 15 scans to equilibrate. Pressure is steady for the first 30 scans or more. CLIP was used to remove the 1st 30 data records from all casts.
* Filter: A Gull-winged filter, size 9, was applied to temperature, conductivity and pressure. Salinity was NOT recalibrated.
* SHIFT: Based on suggested values in document “Guidelines for processing RBR CTD profiles” the following adjustments were made to conductivity and dissolved oxygen channels:
  + The alignment of temperature and conductivity was improved by applying a shift of -0.3 records. Salinity was recalculated and the results looks good.
  + Better alignment with temperature profiles was found by applying an advance by 11records (1.9s). The advice given in document “Guidelines for processing RBR CTD profiles” was that an advance between 2 and 3 seconds is appropriate. The last time this equipment was used a 10-record (1.7s) was found best.
* DELETE was run to remove records with descent rate lower than 0.5m/s over 3 points; this was not applied in the top 5m to avoid loss of surface records as the CTD began its descent.
* Plots were examined after DELETE and confirm that bad data remain for the cases with bad conductivity at the bottom. 2 other casts were found to have significantly unstable features at the surface. CTDEDIT was used to remove clearly bad records from the bottom of 11 casts and bad data at the surface of 2 of those plus 2 other casts.

##### Final checks and header editing

* Profile plots show reasonable values for fluorescence, temperature and salinity.
* DO saturation values at the surface ranged from about 50% to 120%, with similar values in casts from the same areas. There was no calibration sampling and no climatology to enable a judgement about the data reliability.
* REMOVE was run to remove the following channels from all casts: Date, Time and Pressure:Air.
* BIN AVERAGE was used to metre-average data.
* CALIBRATE was run to change conductivity units to S/m (using file 2019-100-recal2.ccf).
* Header Edit was used to fix channel names, to add a few header entries, remove END TIME and to add header comments.
* Header Check was run and no problems were found.
* A cross-reference file list was produced and looks fine.
* DO concentration was not derived since there are various equations used for this purpose, so it is left to the users to choose one consistent with other data in their studies. If you wish to derive DO concentration using IOS SHELL the following method is available:
* DERIVED QUANTITIES to derive Oxygen Solubility
* CALIBRATE using formula 182 to multiply Saturation X Solubility to get concentration in mass units.
* CHANGE UNITS to get DO concentration in volume units.

