CTD.csv: Bottle-corrected CTD+Bottle FinalQC Index

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C Last Updated: 14 September 2018

CalCOFI's Seabird 911+ CTD includes dual Temperature, Conductivity, and Oxygen sensor arrays (dual O2s since Jul 2009) that are separately plumbed & pumped. Data from these sensors are labeled Temp1, Salt1, Ox1, & Temp2, Salt2, Ox2 respectively (refer to the index below for units). The "FinalQC" version of the CTD csvs also include oxygens in umol/kg (Ox1uM, Ox2uM) and data-quality code columns. Data codes (flags) are used to identify bad (datacode "9") or questionable (datacode "8") data.

CalCOFI collects seawater samples using 24-10L metal-free bottles mounted on an epoxy-coated rosette. The seawater samples are analyzed & processed at-sea then undergo a series of additional post-cruise calibration, data-processing & data-quality steps on shore. Initial merging & comparison of CTD & bottle data generates the "prelim" CTD csvs used for point-checking. Once bottle data have been gone through CalCOFI's data quality control protocols, the final bottle data are merged with 1m-binavg CTD sensor data from the same cast and depths. CTD salinities deeper than 350m are subtracted from matching bottle (depth) salinities. These differences are averaged into offsets for both primary and secondary CTD salinities and applied to all CTD salinities. Bottle-corrected CTD salinities are reported as Salt1_Corr (primary), Salt2_Corr (secondary), and SaltAve_Corr (ave of both).

Oxygen bottle samples are plotted versus the corresponding CTD primary (Ox1) and secondary (Ox2) oxygen sensor data. Regression coefficients to correct CTD oxygens are derived for both sensors in ml/L and µM/kg - 4 plots total. The bottle-corrected CTD sensor data are reported in the Ox1_CruiseCorr (ml/L) and Ox1µM_CruiseCorr (µM/Kg) and Ox2_CruiseCorr and Ox2_µM_CruiseCorr data columns.

One-meter binavg CTD fluorometer voltages are plotted versus the corresponding depth chlorophyll bottle samples to derive regression coefficients. These are applied to the 1m binavg fluorometer voltages from 0-200 meters, estimating chlorophyll-a & reported as EstChl_CruiseCorr.

A plot of 1m binavg ISUS voltages versus nitrate (NO3) using all the nitrate bottle samples generates regression coefficients. These are applied to the 1m binavg ISUS voltage to derive estimated nitrate data, reported as EstNO3_CruiseCorr
Note: when bottle data are plotted versus CTD sensor data, **bottle data "fliers" are excluded** so they do not influence the bottle data sensor correction coefficients.

In addition to cruise-corrected CTD data, there are **station-corrected data**. These data are bottle-corrected CTD data that use the bottle data from only the matching station. These data are generated using CalCOFI-developed software that dynamically calculates the correction coefficients and applies them automatically to CTD sensor data. These data are usually the best data since this method adjusts for station-to-station variablilty in the sensor behavior such as sensor drift. These data are reported as "StaCorr": Ox1_StaCorr, Ox2_StaCorr, EstChl_StaCorr, EstNO2_StaCorr. The coefficients applied dynamically for each station may be different and are tabulated in each cruises CTD metadata file "DBcoeff.csv".

Please note that the FinalQC format with additional data quality code columns was adopted in 2015. **CTD data files with the 82-column format are labeled "FinalQC"**. **Cruise files labeled "Final" ~~are being~~ reprocessed to add the data-quality columns, data codes, & O2s in uM/Kg.** When updated, they will be relabled "FinalQC". Note that most data values, particularly T & S, should remain unchanged - only the format is changing and data-flags added.
QCodes: blank or "0" code = good data; "8" = questionable data; "9" = bad data

82-Column CTD + Bottle CSV Format (color key & data code index at bottom)

Count (Excel Column)	Field	Description	Format
1 (A)	Project	Cruise; usually CalCOFI	Text, variable

2 (B)	Study	YYMMSS (year month ship) Cruise designation	Text, 6 char
3 (C)	Ord_Occ	Order Occupied	Integer
4 (D)	Event_Num	CTD-at-Depth event number	Integer
5 (E)	Cast_ID	Study+Order Occupied+up or downcast	Text, YYMM_###D or U
6 (F)	Date_Time_UTC	Date Time UTC; downcast = start time; upcast=time @ 1st bottle tripped	DD-MMM-YYYY HH:M:SS
7 (G)	Date_Time_PST	Date Time PST: downcast = start time; upcast=time @ 1st bottle tripped	DD-MMM-YYYY HH:MM:SS
8 (H)	Lat_Dec	GPS Decimal Latitude: downcast = start lat; upcast=lat @ 1st bottle tripped	R7.5; ##.#####
9 (I)	Lon_Dec	GPS Decimal Longitude: downcast = start lon; upcast=lon @ 1st bottle tripped	R8.5; -###.#####
10 (J)	Sta_ID	CalCOFI Line and Station	Text; LLL.L SSS.S
11 (K)	Line	CalCOFI Line	R4.1; LLL.L
12 (L)	Sta	CalCOFI Station	R4.1; SSS.S
13 (M)	Depth	1 Meter Binavg Depth (meters)	R7.3; #.###
14 (N)	Pressure	1 Meter Binavg Pressure (db)	R7.3; #.###
15 (O)	PrQ	Pressure Sensor Data Quality	I1
16 (P)	Temp1	1° Temperature (deg C)	R6.4; ##.####
17 (Q)	Temp1Q	1° Temperature Data Quality Code	I1; see key below
18 (R)	Temp2	2° Temperature (deg C)	R6.4; ##.####
19 (S)	Temp2Q	2° Temperature Data Quality Code	I1
20 (T)	TempAve	Average Temperature, deg C; (1° +2°)/2	R6.4;# #.####
21 (U)	Salt1	1° Salinity (PSU)	R6.4; ##.####
22 (V)	Salt1Q	1° Salinity Data Quality Code	I1
23 (W)	Salt1_Corr	1° Salinity, Bottle-corrected (PSU)	R6.4
24 (X)	Salt2	2° Salinity (PSU)	R6.4
25 (Y)	Salt2Q	2° Salinity Data Quality Code	I1
26 (Z)	Salt2_Corr	2° Salinity, Bottle-corrected (PSU)	R6.4
27 (AA)	SaltAve_Corr	Average Corrected Salinity; (1°+2°)/2	R6.4
28 (AB)	Ox1	1° Oxygen; ml/L	R6.5
29 (AC)	Ox1Q	1° Oxygen Data Quality Code	I1
30 (AD)	Ox1_CruiseCorr	1° Oxygen, cruise-corrected; ml/L	R6.5; see key
31 (AE)	Ox1_StaCorr	1° Oxygen, sta-corrected; ml/L	R6.5; see key
32 (AF)	Ox2	2° Oxygen; ml/L	R6.5
33 (AG)	Ox2Q	2° Oxygen Data Quality Code	I1
34 (AH)	Ox2_CruiseCorr	2° Oxygen, cruise-corrected; ml/L	R6.5
35 (AI)	Ox2_StaCorr	2° Oxygen, sta-corrected; ml/L	R6.5
36 (AJ)	OxAve_StaCorr	Average Oxygen (ml/L); (1°+2°)/2	R6.5

37 (AK)	Ox1uM	1° Oxygen; uM/Kg	
38 (AL)	Ox1uM_CruiseCorr	1° Oxygen;cruise-corrected;uM/Kg	
39 (AM)	Ox1uM_StaCorr	1° Oxygen;sta-corrected; uM/Kg	
40 (AN)	Ox2uM	2° Oxygen; uM/Kg	
41 (AO)	Ox2uM_CruiseCorr	2° Oxygen;cruise-corrected;uM/Kg	
42 (AP)	Ox2uM_StaCorr	2° Oxygen;sta-corrected; uM/Kg	
43 (AQ)	OxAveuM_StaCorr	Average Oxygen (ml/L); (1°+2°)/2	
44 (AR)	FluorV	Fluorometer Voltage (V)	R5.4
45 (AS)	FluorQ	Fluorometer Data Quality Code	I1
46 (AT)	EstChl_CruiseCorr	Estimated Chlorophyll, cruise-corrected	R6.4
47 (AU)	EstChl_StaCorr	Estimated Chlorophyll, sta-corrected	R6.4
48 (AV)	ISUSV	ISUS Voltage	R5.4
49 (AW)	ISUSQ	ISUS Data Quality Code	I1
50 (AX)	EstNO3_CruiseCorr	Estimated Nitrate, cruise-corrected	R5.4
51 (AY)	EstNO3_StaCorr	Estimated Nitrate, sta-corrected	R5.4
52 (AZ)	SigThetaTS1	Sigma-theta T1S1	R6.4
53 (BA)	SigThetaTS1Q	Sigma-theta T1S1 Quality Code	I1
54 (BB)	SigThetaTS2	Sigma-theta T2S2	R6.4
55 (BC)	SigThetaTS2Q	Sigma-theta T2S2 Quality Code	I1
56 (BD)	BAT	Beam Attenuation Coefficient	R5.4
57 (BE)	XMiss	% Light Transmission	R6.4
58 (BF)	TransQ	Transmissometer Quality Code	I1
59 (BG)	pH	pH Sensor	R6.4
60 (BH)	pHQ	pH Sensor Quality Code	I1
61 (BI)	SPAR	Surface PAR	#.##E+##
62 (BJ)	SPARQ	Surface PAR Quality Code	I1
63 (BK)	PAR	Remote PAR	#.##E+##
64 (BL)	PARQ	Remote PAR Quality Code	I1
65 (BM)	PoT1	Potential Temperature	R6.4
66 (BN)	PoT2	Potential Temperature	R6.4
67 (BO)	DynHt	Dynamic Height	R5.4
68 (BP)	SVA	Specific Volume Anomaly	R6.3
69 (BQ)	OxSat1	Oxygen Saturation	R5.4
70 (BR)	OxSat2	Oxygen Saturation	R5.4
71 (BS)	BTL_Depth	Bottle Depth (meters)	I4
72 (BT)	BTL_Temp	Bottle Temperature (deg C); usually 1°T	R5.3
73 (BU)	SaltB	Bottle Salinity (PSU)	R6.4
74 (BV)	OxB	Bottle Oxygen (ml/L)	R4.3
75 (BW)	OxBuM	Bottle Oxygen (umol/KG)	R6.2
76 (BX)	Chl-a	Bottle Chlorophyll	R4.3
77 (BY)	Phaeo	Bottle Phaeopigments	R4.3
78 (BZ)	NO3	Bottle Nitrate	R3.1

79 (CA)	NO2	Bottle Nitrite	R3.2
80 (CB)	NH4	Bottle Ammonium	R3.2
81 (CC)	PO4	Bottle Phosphate	R4.2
82 (CD)	SIL	Bottle Silicate	R5.2

Color Codes for this table (background color indicates data source)		
Color	Data Type	Source
White	CTD Cast Information	CTD "At Depth" Metadata
Green	CTD Data	1m binavg CTD Data, Seasave processed
Yellow	Bottle-corrected CTD Data	1m CTD Data, Seasave processed, bottle corrected
Blue	Bottle Data	Final, processed bottle data
Purple	Data Quality	Data Quality Codes and Comments:
		• 0 or blank = Good Data • 1 = use Primary sensor data (dual sensors) • 2 = use Secondary sensor data (dual sensors) • 8 = data questionable • 9 = bad or missing data