CTD profiles with auxiliary sensors from Kongsfjorden and Rijpfjorden cruises in 2011-2020

Authors:

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Summary of the data

Conductivity-Temperature-Depth (CTD) profiles with auxiliary sensor data from cruises to Kongsfjorden (KF) in summers of 2011-2020 and Rijpfjorden (RF) in 2011-2014 and 2016-2017. The cruises were funded by MOSJ (Environmental monitoring of Svalbard and Jan Mayen) and others.

This dataset contains processed profiles of sensor temperature and salinity collected using an SBE911+ unit from R/V Lance (2011-2018), R/V Helmer Hanssen (2019) and R/V Kronprins Haakon (2020) as well as calibrated fluorescence profiles and other auxiliary sensor data. The parameters included are (not all parameters available for every year) temperature, conductivity, calculated practical salinity (EOS-80), chlorophyll fluorescence, uncalibrated dissolved oxygen (both as dissolved oxygen and raw sensor voltage, colored dissolved organic matter (CDOM) fluorescence (voltage only), beam attenuation, PAR and SPAR and uncalibrated turbidity (Table 1). Profile data are from down casts only and available in a 1 decibar vertical resolution (i.e. averaged into 1-decibar bins).

The processing for 2014-2020 involved following steps using SeaBird Electronics software:

1. Data conversion
2. Filtering the data: Temperature, conductivity, and descent rate no filter. Other variables A 0.03 s (Voltages and oxygen) or B 0.15 s (all other variables).
3. Cell thermal mass computations
4. Loop edit, remove surface soak and velocities lower than 0.15 m/s (2015-2017, 2019), 0.2 m/s (2018, 2020)
5. Wild edit with pass 1 2, pass 2 20, npoint 100
6. Derive salinities
7. Bin average to 1 dbar bins from a minimum of 3 data points
8. Bottle summary
9. Extra filtering for CDOM

For 2013 and 2014 only data conversion and derive were run due to raw data having been averaged by presumably number of measurements. The ‘binned’ data contains the value from the nearest averaged raw data bin within 2 dbar.

For 2011 and 2012 no raw data were available. In 2012 data conversion and bin averaging have been run earlier. For 2011 no information of the processing details were found.

Temperature and salinity have been quality-controlled and salinity spikes have been removed. No salinity samples were taken and the salinity data could however not be verified against bottle samples. The primary conductivity sensors were of better quality than the secondary sensors and data from the primary sensors were selected to be included. The fluorescence data have been calibrated against Chl-a samples from bottles (Table 2, Figure 1). Bottle sample data will be published separately by Anette Wold et al. Please note that the rest of the data have not been calibrated nor quality-controlled and are provided as-is. The quality of fluorescence data from the CTD in 2013 seems worse than in other years. The sensors are listed in Table 3.

CTD Chlorophyll data were calibrated based on a linear fit of CTD fluoroscence against bottle sample chlorophyll (Chla) measurements:

1. The median value was determined at depths from 250 to 500 m depth where the fluorescence value was expected to equal or be close to zero.
2. A visual inspection confirmed that there was no drift between profiles.
3. The offset was removed from the fluorescence values
4. The calibration of fluorescence values against Chl-a values: When .btl files were available from the CTD, we only included the values when the standard deviation of the bottle value divided by the fluorescence measurement was < 0.15, to avoid highly noisy parts of the fluorescence profile. As the standard deviation was not available for all the years and the data are quite sparse, CTD fluorescence values larger than 2.5 mg/m3 were also excluded. We then fit a linear regression through the origin between the bottle Chl-a measurement and the offset-corrected CTD fluorescence. The coefficients were used to calibrate the offset-corrected CTD (and SAIV) fluorescence profiles.

The data are first be published as two .csv files containing all the years. File 'CTD_KF_2011_2020_version1.csv' contains 2011-2020 Kongsfjorden and nearby areas and file 'CTD_RF_2011_2017.csv' contains Rijpfjorden and other areas.

The data will be published in annual, self-documenting netCDF files. Profile data are organized in arrays with one column per cast and one row per pressure bin (BIN_*). 1-dimensional metadata such as time and position are organized in a row-vector with one value per cast. All variables within an annual file have the same number of columns, equal to the total number of CTD casts. Not all years contain the same auxiliary sensor data. For more information on the sampling routines, please refer to some of the cruise reports at https://brage.npolar.no/npolar-xmlui/handle/11250/172693

Temperature and salinity from the earlier years have been included in datasets published in data.npolar.no before (https://doi.org/10.21334/unis-hydrography (UNIS HD) and other parameters are included in the KF 2016-2017 dataset https://doi.org/10.21334/npolar.2023.62247dad.

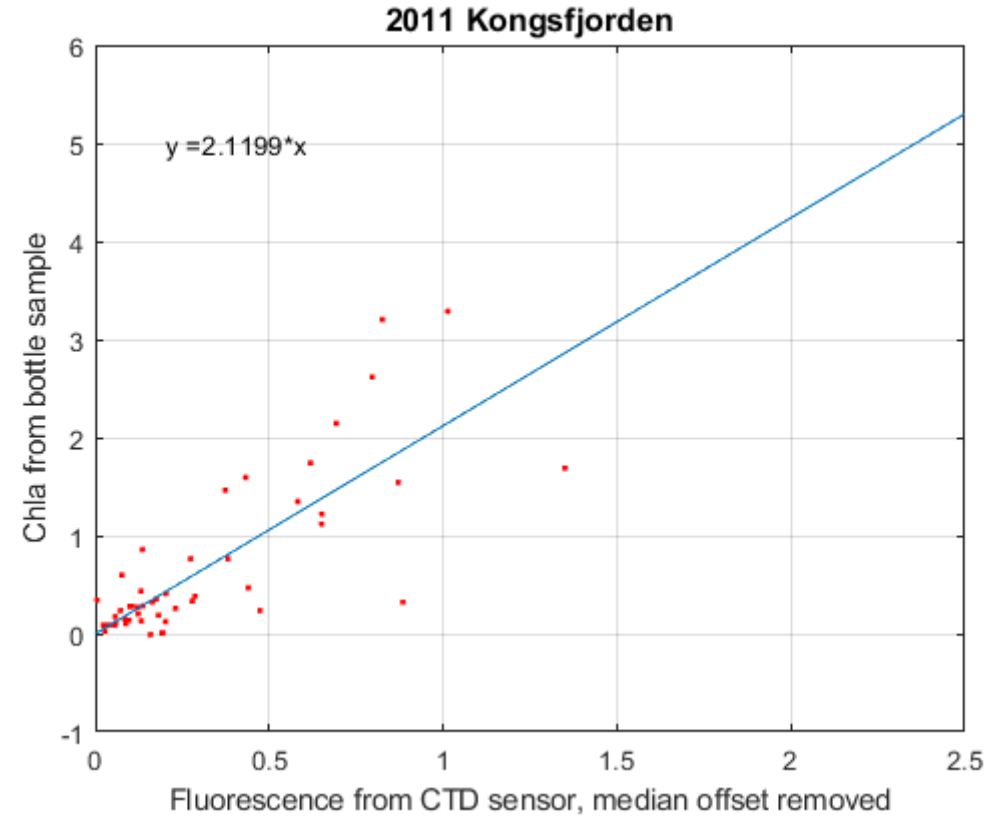
Table 1. Variables

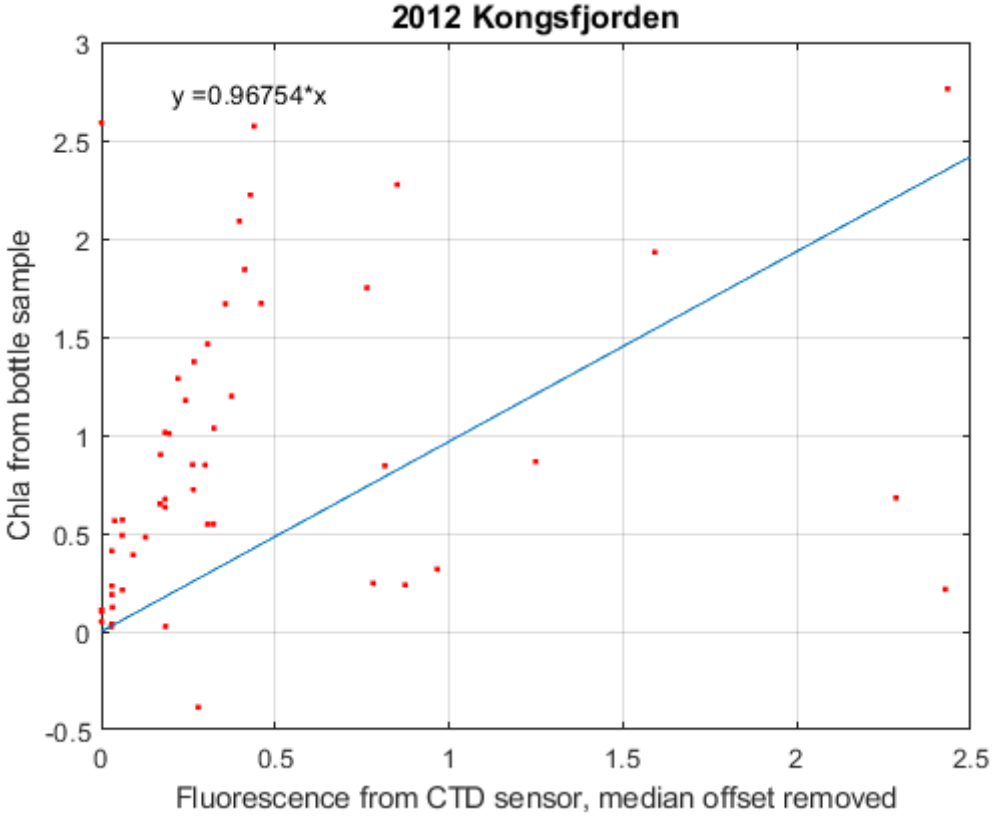
Variable name in csv file	Variable and [unit]
Cruise	Research cruise
Ship	Research vessel
Station	Station name. Note that the coordinates are not the exact same between casts and years.
Cast	Cast number at the station
Cast_btl	1 or 0: 1 if bottle samples for Chla were taken (so called main cast), 0 if no Chla bottle samples
Stn_name	Station name as in raw CTD data
Latitude	Latitude [decimal degrees North]
Longitude	Longitude [decimal degrees East]
Date_time	Yyyy-mm-ddThh:mm:ss in UTC
Date	Dd/mm/yyyy
Time	Hh:mm:ss in UTC
Pressure	Sea water pressure [dbar]
Temp	Sea water temperature [degrees Celsius]
Sal	Sea water practical salinity [1]
Cond	Sea water electrical conductivity [S/m]
Chla_calibr	Chlorophyll-a in sea water [mg m-3]
Oxy	Dissolved oxygen, uncalibrated [umol/kg]
Oxy_Volt	Dissolved oxygen [Volt]
Spar	Surface PAR [umol photons/m^2/sec]
Par	PAR/Irradiance [umol photons/m^2/sec]
Par_Volt	PAR [Volt]
Attn	Beam attenuation [1/m]
Trans	Beam transmission [%]
Trans_Volt	Transmission [Volt]
CDOM_Volt	Coloured dissolved organic matter (CDOM) fluorometer output [Volt]
Turb	Turbidity [FTU]
Turb_Volt	Turbidity [Volt]

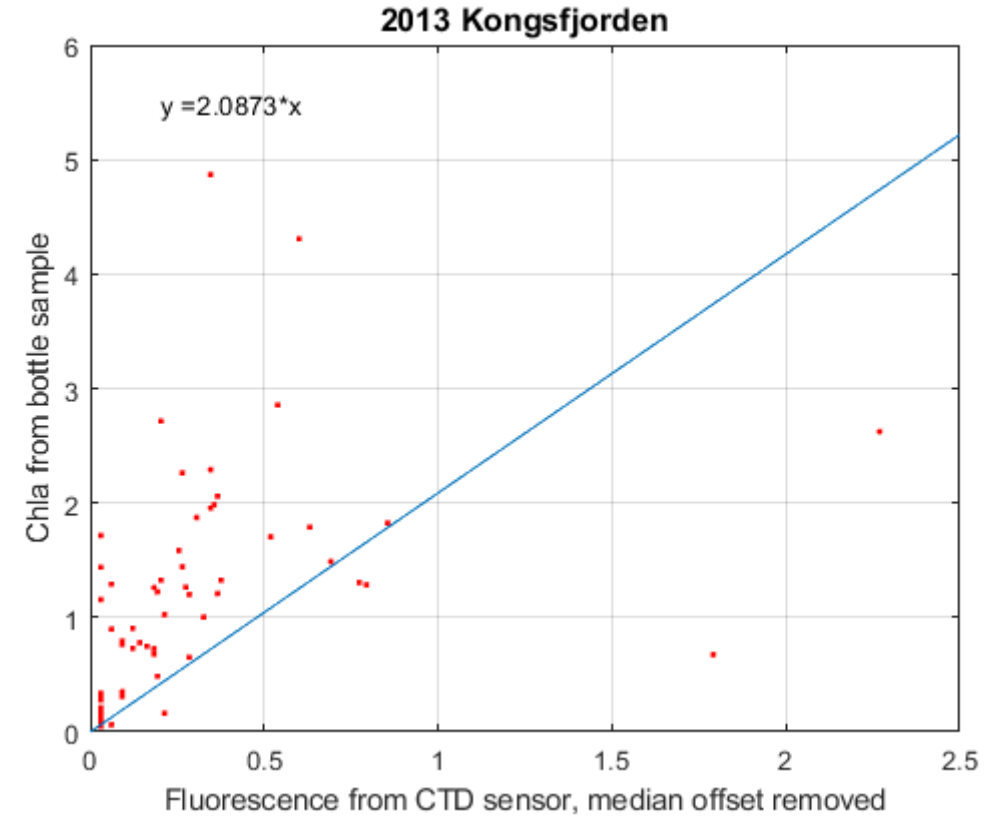
Table 2. Chlorophyll / fluorescence linear regression coefficients through origin and the offset of sensor data at depth 250-500 dbar

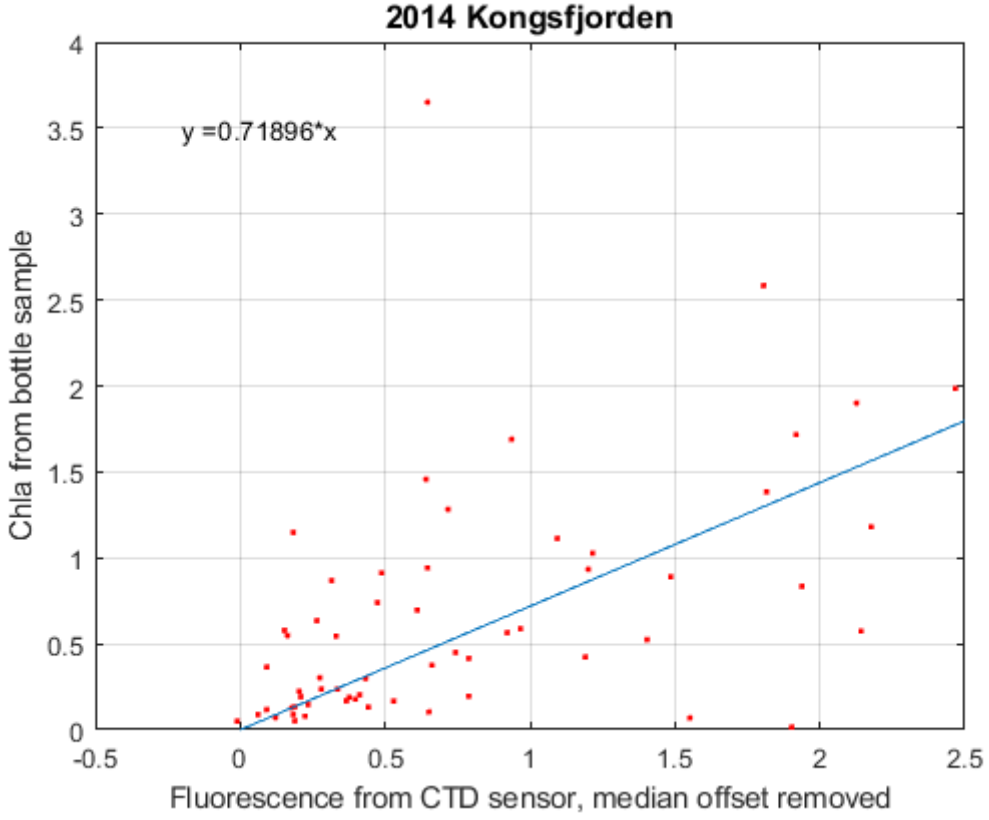
Year	Correlation coefficient	Offset	Number of stations with Chla bottle samples/Nr stations
2020	0.7615	0.0250	25/26
2019	0.4188	0.0366	13/40
2018	0.3437	-0.1016	10/23
2017	1.0005	-0.1267	20/47
2016	0.6856	-0.0973	21/49
2015	0.3698	-0.0313	9/15
2014	0.7190	-0.1253	22/25
2013	2.0873	-0.1558	21/49
2012	0.9675	-0.1558	12/48
2011	2.1199	-0.1673	13/36

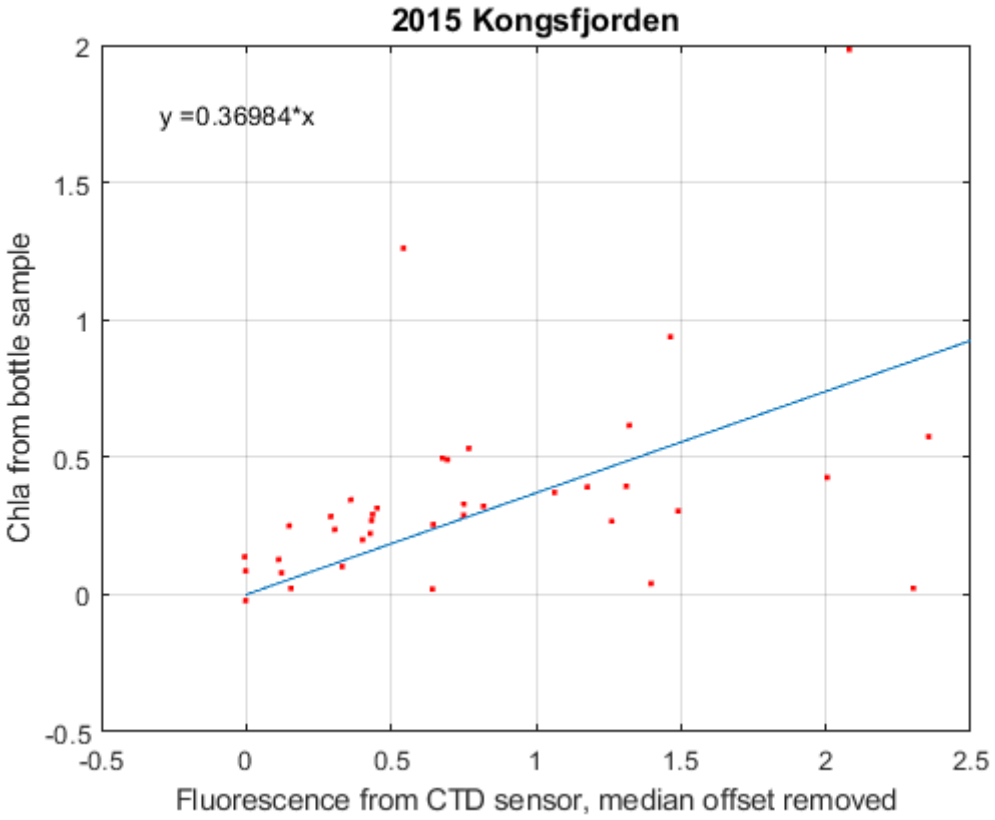
Figures: Linear regression fit used for calibrating the offset-corrected CTD fluorescence against chlorophyll from bottle samples. Offsets and regression coefficients are listed in Table 1 above.

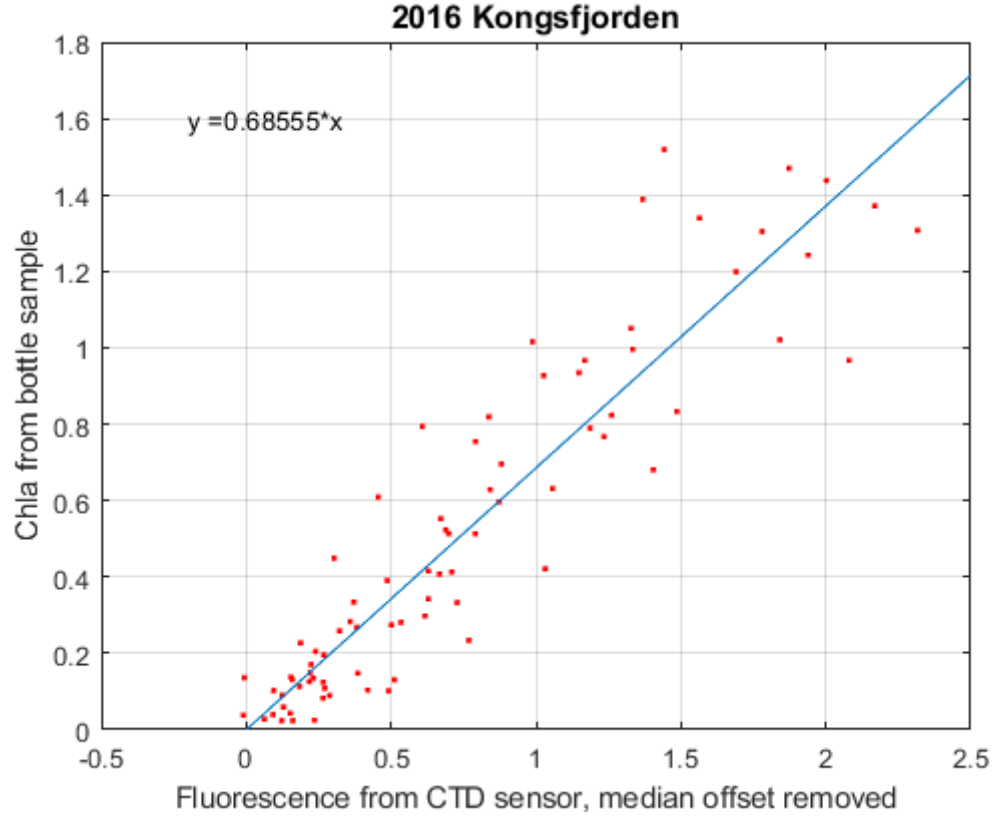

2011 Kongsfjorden
y =2.1199*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
6
5
4
3
2
1
0
-1
0
0.5
1
1.5
2
2.5

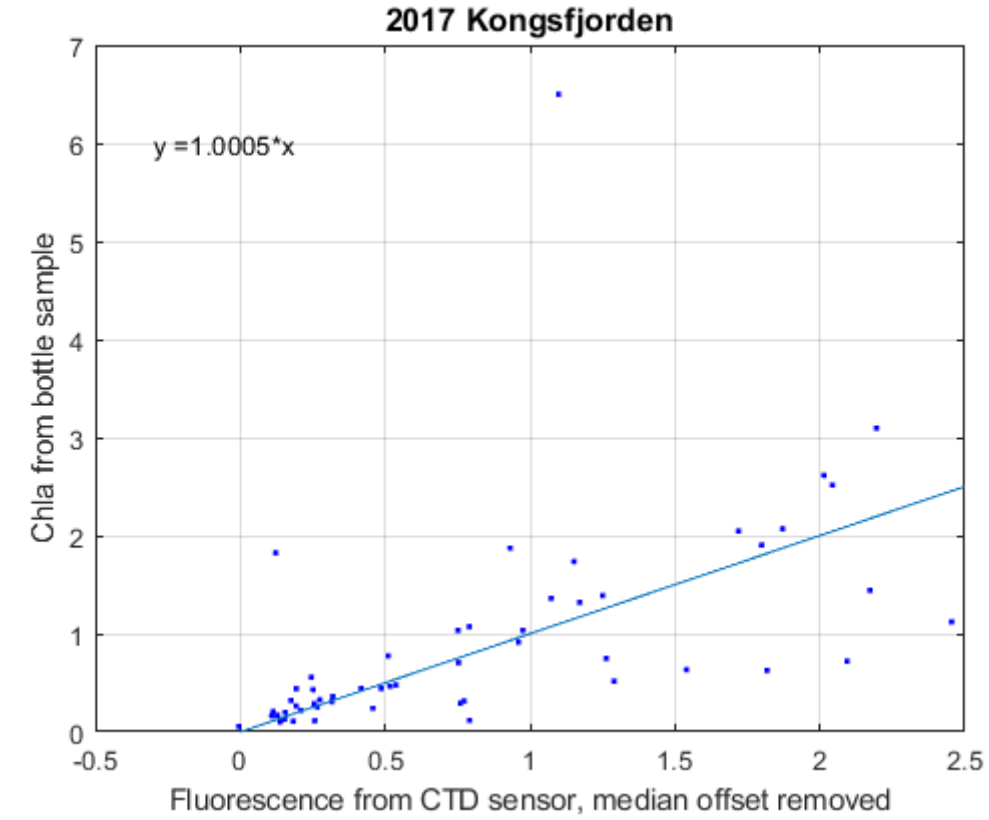

2012 Kongsfjorden
y =0.96754*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
3
2.5
2
1.5
1
0.5
0
-0.5
0
0.5
1
1.5
2
2.5

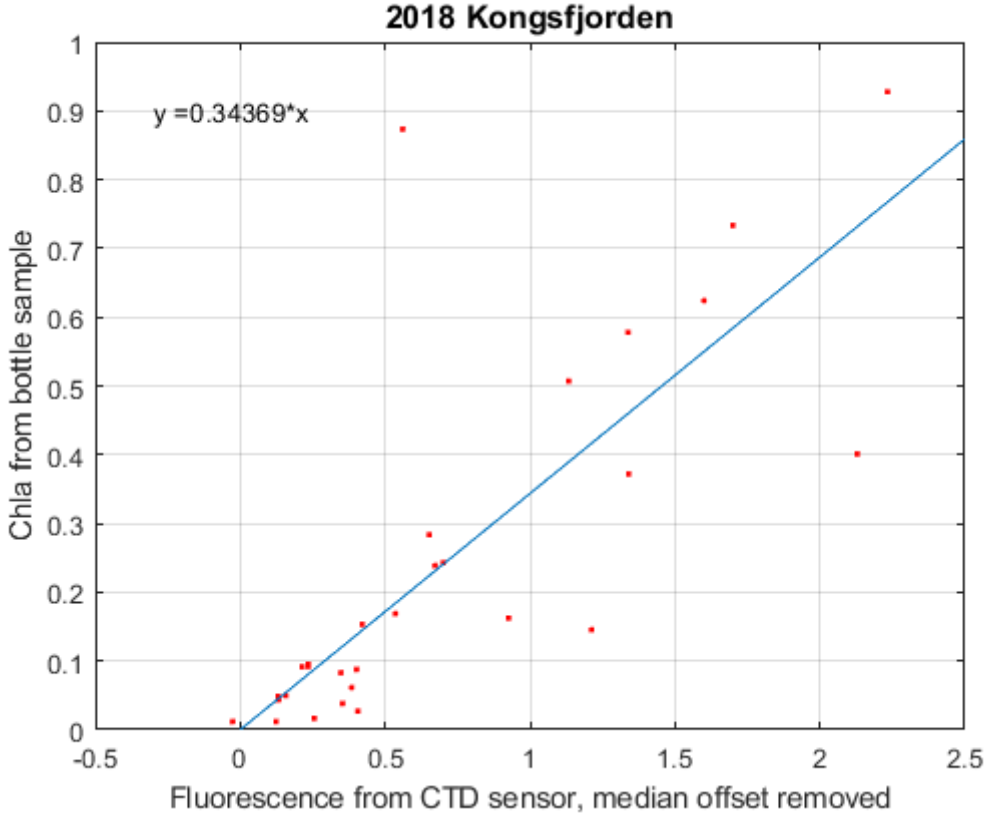

2013 Kongsfjorden
y =2.0873*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
0
1
2
3
4
5
6
0
0.5
1
1.5
2
2.5

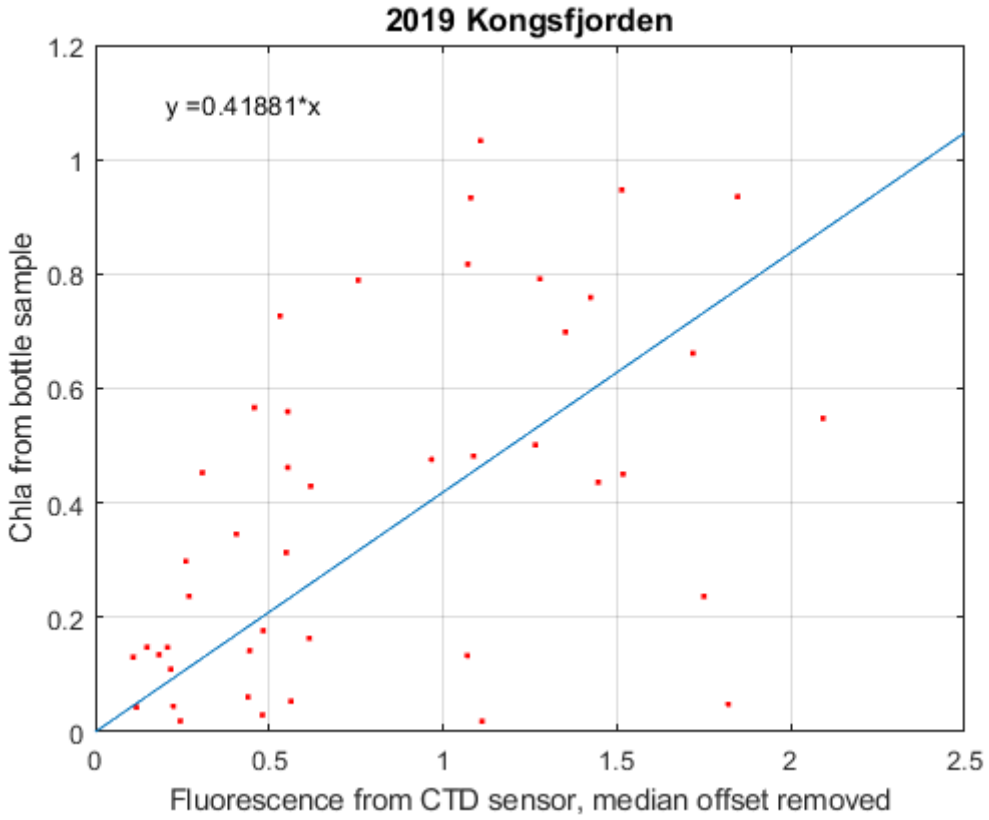

2014 Kongsfjorden
y =0.71896*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
0
0.5
1
1.5
2
2.5
3
3.5
4
-0.5
0
0.5
1
1.5
2
2.5


2015 Kongsfjorden
y =0.36984*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
2
1.5
1
0.5
0
-0.5
-0.5
0
0.5
1
1.5
2
2.5


2016 Kongsfjorden
y =0.68555*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.5
0
0.5
1
1.5
2
2.5


2017 Kongsfjorden
y =1.0005*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
0
1
2
3
4
5
6
7
-0.5
0
0.5
1
1.5
2
2.5


2018 Kongsfjorden
y =0.34369*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
-0.5
0
0.5
1
1.5
2
2.5


2019 Kongsfjorden
y =0.41881*x
Chla from bottle sample
Fluorescence from CTD sensor, median offset removed
0
0.2
0.4
0.6
0.8
1
1.2
0.5
1.5
2
2.5

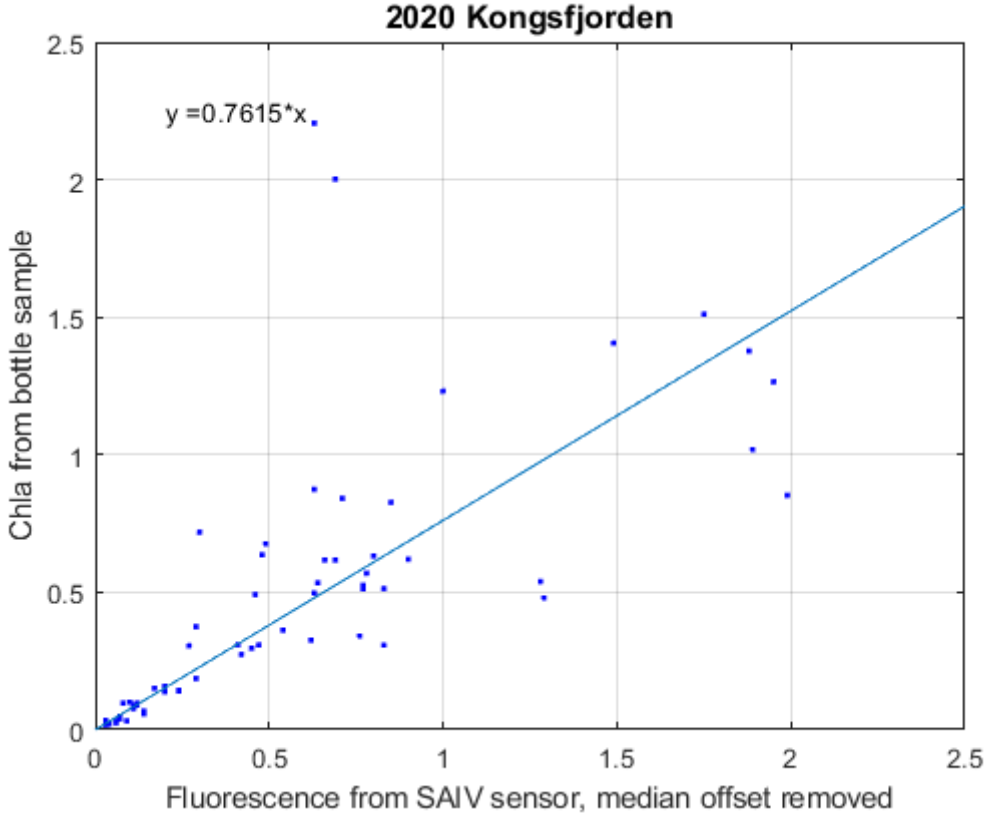

2020 Kongsfjorden
y =0.7615*x
Chla from bottle sample
Fluorescence from SAIV sensor, median offset removed
0
0.5
1
1.5
2
2.5

Table 3. Sensors and their calibration dates. 2020 fluorescence data was measured using a separate SAIV instrument over the side.

2020

Sensor	Serial number	Calibration date
Temperature	4535	20-Feb-20
Conductivity	4386	28-Jan-20
Pressure, Digiquartz with TC	141612	19-Dec-17
Oxygen, SBE 43	3087	12-nov-19
Transmissiometer, WET Labs C-Star	CST-2003DR	2019-10-01
Fluorometer, WET Labs ECO CDOM	FLCDRTD-4885 analog range 1	15/08/2019
PAR/Irradiance, Biospheric/Licor	70736	10/29-2018
SPAR, Biospherical/Licor	20568	27/11-2017
SAIV Fluorometer		

2019

Sensor	Serial number	Calibration date
Temperature	2512	12-Aug-16 (skiftet02.01.19)
Conductivity	3022	26-jul-16 (skiftet02.01.19)
Pressure, Digiquartz with TC	77984 (578)	28.11.07
Fluorometer, Seapoint	3049	13.03.2008
Turbidity Meter, Seapoint	10894	01.04.08
Oxygen, SBE 43	2557	12-May-18 (inst 21.01.19)
PAR/Logarithmic, S atlantic	1141	09/12/2017
SPAR/Logarithmic, S atlantic	1162	25.07.18(inst jan2019)

2018

Sensor	Serial number	Calibration date
Temperature	2400	11-Apr-17
Conductivity	3234	12-Apr-17
Pressure, Digiquartz with TC	0972	20-Feb-14
Oxygen, SBE 43	1740	27-Apr-17
Transmissiometer, Chelsea/Seatech	CST-1306DR	18-Dec-15
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	4-Jan-16
SPAR, Biospherical/Licor	20349	12/9/2015

2017

Sensor	Serial number	Calibration date
Temperature	2400	11-Apr-17
Conductivity	3234	12-Apr-17
Pressure, Digiquartz with TC	0972	20-Feb-14
Oxygen, SBE 43	1740	27-Apr-17
PAR/Irradiance, Biospherical/Licor	70257	09-Dec-15
Transmissiometer, Chelsea/Seatech	CST-1306DR	18-Dec-15
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	4-Jan-16
Fluorometer, WET Labs ECO-AFL/FL, 2 (CDOM)	FLCDRTD-1930	3 Dec 2015
SPAR, Biospherical/Licor	20349	12/9/2015

2016

Sensor	Serial number	Calibration date
Temperature	2400	19-Dec-15
Conductivity	2056	03-Dec-15
Pressure, Digiquartz with TC	0972	20-Feb-14
Oxygen, SBE 43	1740	01-Dec-15
PAR/Irradiance, Biospherical/Licor	70257	09-Dec-15
Transmissiometer, Chelsea/Seatech	CST-1306DR	18-Dec-15
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	4-Jan-16
Fluorometer, WET Labs ECO-AFL/FL, 2 (CDOM)	FLCDRTD-1930	3 Dec 2015
SPAR, Biospherical/Licor	20460	5/17/2013

2015

Sensor	Serial number	Calibration date
Temperature	5258	13-Nov-13
Conductivity	2063	12-Nov-13
Pressure, Digiquartz with TC	0972	20-Feb-14
Oxygen, SBE 43	1740	22-Nov-13
PAR/Irradiance, Biospherical/Licor	70257	17-Jan-14

Transmissiometer, Chelsea/Seatech	CST-1306DR	08-Jan-10
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	18-Dec-13
Fluorometer, WET Labs ECO-AFL/FL, 2 (CDOM)	FLCDRTD-1930	unknown
SPAR, Biospherical/Licor	20460	5/17/2013

2014

Sensor	Serial number	Calibration date
Temperature	2400?	13-Nov-13
Conductivity	2056	12-Nov-13
Pressure, Digiquartz with TC	0972	20-Feb-14
Oxygen, SBE 43	1740	22-Nov-13
PAR/Irradiance, Biospherical/Licor	70257	17-Jan-14
Transmissiometer, Chelsea/Seatech	CST-1306DR	08-Jan-10
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	18-Dec-13
Fluorometer, WET Labs ECO-AFL/FL, 2 (CDOM)	FLCDRTD-1930	18-Dec-13
SPAR, Biospherical/Licor	20460	17-May-13

2013

Sensor	Serial number	Calibration date
Temperature	2400	20-Nov-12
Conductivity	2063	21-Nov-12
Pressure, Digiquartz with TC	0972	05-Jan-10
Oxygen, SBE 43	1740	05-Jan-10
PAR/Irradiance, Biospherical/Licor	70257	08-Jan-10
Transmissiometer, Chelsea/Seatech	CST-1306DR	08-Jan-10
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	08-Jan-10
Fluorometer, WET Labs ECO-AFL/FL, 2 (CDOM)	FLCDRTD-1930	13-Oct-10
SPAR, Biospherical/Licor	2046	5/17/2013

2012

Sensor	Serial number	Calibration date
Temperature	4052	08-Dec-10
Conductivity	2056	03-Dec-10
Pressure, Digiquartz with TC	0972	05-Jan-10
Oxygen, SBE 43	1740	05-Jan-10
PAR/Irradiance, Biospherical/Licor	70257	08-Jan-10
Fluorometer, WET Labs ECO-AFL/FL	FLRTD-1547	08-Jan-10

2011

Sensor	Serial number	Calibration date
Temperature	unknown	unknown
Conductivity	unknown	unknown
Pressure	unknown	unknown
Oxygen, SBE 43	unknown	unknown
PAR/Irradiance	unknown	unknown
Transmissiometer	unknown	unknown
Fluorometer	unknown	unknown
SPAR, Biospherical/Licor	unknown	unknown