

## CTD data series for cruise Dana D1198 (14 to 27 October 1998)

### Cruise Principal Scientist and Data Originator

Dr. Andy Visser, Danish Institute for Fisheries Research (DIFRES), Charlottenlund, Denmark.

### Content of data series:

Parameter	Unit	Parameter code	Number of casts	Comments
Pressure	db	PRESR01	51	none
Temperature (ITS-90)	deg. C	TEMPST01	51	none
Potential Temperature	deg. C	POTMCV01	51	none
Salinity	PSU-78	PSALST01	51	see text
Sigma-theta	kg m <sup>-3</sup>	SIGTEQ01	51	see text
Dissolved oxygen	µmol l <sup>-1</sup>	DOXYPR01	51	good but uncalibrated
Oxygen saturation	percent	OXYBB01	51	good but uncalibrated
Chlorophyll a	µg l <sup>-1</sup>	CPHLPR01	51	calibrated from fluorescence
Optical attenuation	m <sup>-1</sup>	ATTNMR01	51	none
Total suspended sediment	mg l <sup>-1</sup>	TSEDTR01	51	calibrated from attenuation
Downwelling irradiance	µE m <sup>-2</sup> s <sup>-1</sup>	IRRDUV01	51	none

### Instrumentation and data processing by originator

#### **CTD unit and auxiliary sensors:**

Sea-Bird Electronics 911 Plus system fitted with the following standard Sea-Bird instruments: oxygen sensor, fluorometer (WetStar), PAR sensor for downwelling irradiance and a surface PAR sensor. In addition a 20 cm pathlength Seatech transmissometer (SN T1021) from the University of Wales, Bangor, was fitted on the CTD frame and logged with the Seabird software.

Change of sensors during the cruise: none reported.

Data were logged onto a PC running Seabird data acquisition software version Seasave 4.213 and manufacturer's calibration coefficients were applied to the raw data. In addition the conductivity and the fluorescence channels had the following calibration equations applied to the data:

$$\begin{array}{ll} \text{Cond(samples)} = 0.999739 * \text{Cond(CTD)}, & R^2=0.9997, \quad n=39 \\ \text{Chl } a = 1.468 * \text{Fluor} + 0.1776, & R^2= 0.512, \quad n=45 \end{array}$$

where Cond(samples) is the conductivity measured on water samples, Cond(CTD) is the conductivity value from the CTD sensor, Chl a (µg l<sup>-1</sup>) is the chlorophyll concentration extracted from water samples and Fluor (µg Chl a l<sup>-1</sup>) is the chlorophyll concentration calculated from the CTD fluorometer output and the manufacturer's calibration coefficients. These calibration equations were determined from linear regression of values measured on sea water samples against CTD values.

Data were supplied to BODC as Seabird ASCII files including both downcast and upcast with a binning interval of 0.5 m.

#### **Sampling device:**

- Rosette sampling system equipped with 11 x 5-L Niskin bottles.
- No reversible thermometer was used.

### BODC post-cruise processing and screening

#### **Reformatting:**

**BODC Data Documentation**  
**PROVESS Project MAS3-CT97-015**

The data were converted into BODC internal format (PXF) to allow use of in-house software tools notably the workstation graphics editor SERPLO. In addition to reformatting, the transfer program applied the following modifications to the data:

- temperature was converted from ITS-68 to ITS-90 by dividing the CTD values by 1.00024.
- transmissometer readings were converted from volts to attenuation using the following algorithms:

$$\begin{aligned} \% \text{ transmission} &= \text{Volts} * 20 * Va/Vb \\ \text{attenuance (m}^{-1}\text{)} &= -1 / PL * \log_e (\% \text{ transmission} / 100) \end{aligned}$$

where PL is the transmissometer pathlength in m (0.20 m), Va is the manufacturer's air reading for this instrument (Va=4.661 Volts) and Vb is the average of the air readings carried out during the cruise (Vb=4.580 Volts).

- oxygen was converted from ml l<sup>-1</sup> to µmol l<sup>-1</sup> by multiplying the CTD values by 44.66.
- surface PAR channel was not transferred.

**Screening:**

Reformatted CTD data were transferred onto a high-speed graphics workstation. Using custom in-house graphics editors, downcasts and upcasts were differentiated and the limits of the downcasts and upcasts were manually flagged. If present, spikes and suspicious values were manually flagged. No data values were edited or deleted; flagging was achieved by modification of the associated quality control flag to 'M' for suspicious data, 'N' for null.

**Banking:**

Once screened on the workstation, the CTD downcasts were loaded into a database under the ORACLE Relational Database Management System.

**Calibration:**

- Fluorometer: during screening, it was noticed that the chlorophyll concentrations predicted from the fluorescence profiles obtained during Dana D1198 were consistently lower than those observed during the two other concomitant Proveess cruises PE125 and CH140. It was then found that the difference between ctd chlorophyll value and extracted chlorophyll concentration for the cruise D1198 (data originator: J. Heilmann, DIFRES, DK) was still highly correlated with extracted chlorophyll a concentration (R<sup>2</sup>=0.843) suggesting that the first calibration applied could be improved by a second calibration. The following calibration equation was subsequently determined:

$$\text{Chl} = 1.74 \times \text{Fluor\_chl} - 0.05, \quad R^2=0.777, \quad n=50$$

where Chl (µg l<sup>-1</sup>) is the extracted chlorophyll concentration and Fluor\_chl (µg Chl a l<sup>-1</sup>) is the chlorophyll concentration obtained after the first calibration of the CTD fluorometer.

The chlorophyll concentrations predicted from the CTD fluorometer output are now within ±0.12 µg l<sup>-1</sup> of the extracted value (95% confidence interval) and residuals range between -0.28 and +0.20 µg l<sup>-1</sup>.

- Total suspended particulate matter concentration (TSED) was estimated at the University of Wales, Bangor, by linear regression of the concentration of total suspended particulate matter as measured on water samples by gravimetry and attenuation (ATTN) as measured by the CTD transmissometer at the time of sample collection. The resulting calibration equation is:

$$\text{TSED (mg l}^{-1}\text{)} = (\text{ATTN} - 0.39557) / 0.46891, \quad R^2=0.373, \quad n=62$$

- No further calibration/correction was applied to the other channels.

**Comments on data quality**

- Some of the salinity and oxygen profiles showed a gradient in the upper 10 to 20 m during the downcast. Such gradient was not observed on the upcast suggesting that it was the result of an insufficient period of equilibration of the CTD pump unit. These data were therefore flagged as suspect.
- No oxygen measurement on water samples was available to calibrate the oxygen probe channel. The

**BODC Data Documentation**  
**PROVESS Project MAS3-CT97-015**

absolute values from the oxygen concentration and oxygen saturation channels should therefore be used with caution.