

## CTD data series for cruise Mitra MT0499 (19 to 30 April 1999)

### Data Originator

Dr. Jo Suijlen, Rijkswaterstaat/Rijksinstituut voor Kurst en Zee (RWS/RIKZ), Den Haag, Netherlands.

### Cruise Principal Scientist

Martyn Harvey, Dunstaffnage Marine Laboratory (DML), Oban, UK.

### Content of data series

Parameter	Unit	Parameter code	Number of stations	Comments
Pressure	db	PRESR01	167	none
Salinity	PSU-78	PSALST01	167	none
Temperature	deg. C	TEMPST01	167	none
Potential temperature (UNESCO)	deg. C	POTMCV01	167	none
Sigma-theta (UNESCO SVAN)	kg m <sup>-3</sup>	SIGTPR01	167	none
Chlorophyll a	µg l <sup>-1</sup>	CPHLPR01	167	calibrated from fluorometer
Optical attenuance (10 cm transmissometer)	m <sup>-1</sup>	ATTNSR01	167	see text
Optical attenuance (25 cm transmissometer)	m <sup>-1</sup>	ATTNMR01	167	see text
Total suspended sediment	mg l <sup>-1</sup>	TSEDTR01	167	calibrated from attenuance
Dissolved oxygen	µmol l <sup>-1</sup>	DOXYPR01	167	none
Oxygen saturation	percent	OXYBB01	167	none
pH	pH units	PHXXPR01	166	none
Downwelling PAR	µE m <sup>-2</sup> s <sup>-1</sup>	IRRDUV01	79	none
Surface PAR	µE m <sup>-2</sup> s <sup>-1</sup>	IRRDSV01	157	none

### Instrumentation and data processing by originator

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

Sea-Bird Electronics (SBE) 911 Plus system fitted with the following sensors:

SBE13 oxygen sensor with YSI 5739 oxygen probe

SBE18 pH sensor

Chelsea Instruments transmissometers with pathlength of 10 cm and 25 cm

Aquatracka fluorometer

underwater PAR sensor (Biospherical QSP-200L)

on-deck reference PAR sensor (Biospherical QSR-240)

The manufacturer's specifications are listed in the table below. All sensors were calibrated and checked once a year by the manufacturer.

Parameter	Range	Precision
pressure	0 to 1369 db	± 0.02 %
temperature	-5°C to +35°C	± 0.01 °C
conductivity	0.0 to 7.0 S/m	± 0.001 S/m
pH	0 to 14	± 0.1
oxygen	0 to 20 mg/l	± 0.03 mg/l
ox. temperature	-5°C to +45°C	± 0.1 °C
light attenuation	400 to 700 nm	0.02% fs
turbidity	660 nm	0.01% fs
fluorescence	0.01 to 100 µg/l	± 0.01 µg/l

The precisions guaranteed by the North Sea Directorate were as follows:

- better than 0.05 m for the pressure sensor
- ± 0.01 °C for temperature
- ± 0.005 S/m for conductivity
- ± 0.1 for pH

For the oxygen probe, dissolved oxygen concentrations measured by the probe were checked against oxygen concentration measured on surface water samples by the Winkler titration during the cruise. Calibration checks were performed on 19/04, 21/04, 26/04 and 29/04. The precision of the oxygen probe was acceptable within ± 6 % of the concentration measured by Winkler titration. On 21/04 a decrease in precision was noted and the oxygen sensor was replaced after cast 037.

Data were logged on a PC running Seabird data acquisition software version Seasave Win32 v.1.10 and manufacturer's calibration coefficients were applied to the raw data.

CTD data were supplied to BODC as downcasts only, binned to 0.1 m.

**Sampling device:**

- Rosette sampling system.
- No reversible thermometer was used.

**BODC post-cruise processing and screening**

**Reformatting:**

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:

- dissolved oxygen was converted from mg l<sup>-1</sup> to µmol l<sup>-1</sup> by multiplying the values by 31.25 (=1000/31.998).
- transmissometer readings for the two transmissometers were converted from % transmission to attenuation using the algorithm:

$$\text{attenuance (m}^{-1}\text{)} = -1/PL * \log_e (\% \text{ transmission}/100)$$

where PL is the transmissometer pathlength in metres (0.10 and 0.25 m).

**Screening of data and metadata:**

- reformatted CTD data were transferred onto a high-speed graphics workstation. Downcast channels were screened graphically using custom in-house graphics editors. If present, spikes and suspicious data 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 values and 'N' for null.
- metadata information (station time, position) available from the cruise report was checked against the information present in the header of the CTD files. Because no navigation underway file was available for this cruise particular attention was paid to checking that both station date/time and station position were logged correctly both in the cruise report and in the originator's files header. No suspicious discrepancy was found in the date and times recorded. For station location a few discrepancies were found (see table below). Based on the comparison between successive CTD stations, the discrepancies were attributed to typing errors in the cruise report and station position coordinates were banked according to the entries logged in the CTD file header. For the other stations discrepancies were small with differences not greater than 0.5 minutes for the latitude and 0.9 minutes for the longitude.

Originator ID	Parameter	Cruise report	CTD file header	Value used in Provess Database
CTD018	Longitude	4 deg 47.75'	4 deg 17.75'	4 deg 17.75'
CTD042	Longitude	4 deg 6.68'	4 deg 9.68'	4 deg 9.68'
CTD055	Latitude	52 deg 17.19'	52 deg 27.19'	52 deg 27.19'
CTD067	Longitude	4 deg 28.28'	4 deg 18.28'	4 deg 18.28'
CTD079	Latitude	52 deg 15.56'	52 deg 18.56'	52 deg 18.56'

**Banking:**

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

**Calibration:**

- Fluorescence: CTD chlorophyll fluorescence output ( $\mu\text{g Chl l}^{-1}$ ) was calibrated against extracted chlorophyll concentrations measured on samples collected during the cruise (data originator: K. Jones, DML, UK). The calibration equation was determined by linear regression between extracted chlorophyll concentration (range: 1.95 to 20.60  $\mu\text{g l}^{-1}$ ) and CTD chlorophyll fluorescence values measured on the upcast. The equation is (including standard errors on slope and intercept):

$$\text{Chl} = 1.21 (\pm 0.11) \times \text{CTD\_FL} + 1.72 (0.95), \quad R^2=0.730, \quad n=49$$

- 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 medium pathlength transmissometer at the time of sample collection. The resulting calibration equation is:

$$\text{TSED} (\text{mg l}^{-1}) = (\text{ATTN} - 0.2805) / 0.758, \quad R^2= 0.609, \quad n=47$$

- Data from the other channels had already been calibrated by the data originator and no further calibration/correction was applied.

**Comments on data quality**

- Attenuance: the two transmissometers used on the CTD unit give attenuation values significantly different from each other. The two outputs are highly correlated ( $R^2=0.988$ ) and the relationship shows no deviation from linearity in the lower or higher range of attenuation values. It is found that over the full range of attenuation values (ca. 1-2 to 11-12 per metre) attenuation derived from the short pathlength transmissometer output is consistently higher than that derived from the medium pathlength transmissometer output (average offset: 1.01  $\pm 0.12$  per metre). Comparisons, carried out by the SPM Group, University of North Wales, Bangor, with calibrated attenuation data from the transmissometer moored close to the surface layer on POLRIG#A, suggested that the medium pathlength transmissometer was closer to the correct value.

- Oxygen: a decrease in the precision of the oxygen probe was noted during the cruise on 21/04/1999 and resulted in the replacement of the probe before cast 037. Although no obvious anomaly was noticed during the visual screening of the data series, users are advised to consider with caution data collected just before this cast.

The absolute oxygen concentrations were very high giving rise to oxygen saturation levels of up to 180%. Although these may appear exceptionally high, the data originators confirmed that they were plausible for the area studied at times of high phytoplanktonic production (pers. comm. and Zindler et al. 2001).

**Reference**

Zindler JS, Baretta JW, Heins C, Hoogervorst RDN, Suijlen JM (2001) Non-turbulent dynamics and water column biology and physics. Report RIKZ/OS/2001.112X