Continuous underway data series for cruise AMT14 (28th April – 1st June, 2004)

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Chief Scientist

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Content of data series

Parameter	Column heading	Units	Comments
Latitude (Trimble navigation)	ALATTR01	Degrees +ve N	Selected as best quality navigation channel
Longitude (Trimble navigation)	ALONTR01	Degrees +ve E	Selected as best quality navigation channel
Ship's heading (Glonass compass)	HEADCM01	Degrees true	
Ship's N-S velocity over the ground	APNSTR01	cm s^{-1}	Computed from ship's heading and Trimble navigation
Ship's E-W velocity over the ground	APEWTR01	cm s^{-1}	Computed from ship's heading and Trimble navigation
Bathymetric depth (uncorrected for density effects)	MBANUA01	m	
Salinity	PSALSG01	PSU	Calibrated against CTD data
Sea temperature	TEMPSG01	Degrees C	Checked against CTD data
Chlorophyll fluorescence from through-flow fluorometer output – manufacturer's calibrations only	CPHLUMTF	Nominal mg m^{-3}	Uncalibrated
Chlorophyll fluorescence calibrated against extracted chlorophyll measurements	CPHLUT01	mg m^{-3}	Calibrated against sample data
Atmospheric pressure	CAPHSL01	mbar	Sensor 1
Atmospheric pressure	CAPHSL02	mbar	Sensor 2
Dry bulb air temperature	CDTASS01	Degrees C	Sensor 1
Dry bulb air temperature	CDTASS02	Degrees C	Sensor 2 – about 0.05 deg. C lower than Sensor 1
Relative humidity	CRELSS01	%	Sensor 1
Relative humidity	CRELSS02	%	Sensor 2 – about 3-4% values lower than Sensor 1
Relative wind speed	ERWSSS01	m s^{-1}	
Relative wind direction (blowing from)	ERWDSS01	Degrees	
Absolute wind speed	EWSBSS01	m s^{-1}	Re-calculated 03/05/2005

Absolute wind direction (blowing from)	EWDASS01	Degrees true	Re-calculated 03/05/2005
Downwelling surface scalar PAR irradiance	IRRDSS01	μEinstein m^{-2} s^{-1}	Sensor 1
Downwelling surface scalar PAR irradiance	IRRDSS02	μEinstein m^{-2} s^{-1}	Sensor 2 – lower reading than Sensor 1 by ca. 50-70 μEistein m-2 s-1 at maximum irradiance
Solar radiation (300 – 3000 nm)	CSLRR101	W m^{-2}	Sensor 1
Solar radiation (300 – 3000 nm)	CSLRR102	W m^{-2}	Sensor 2 – lower reading than Sensor 2 by ca. 100 W m-2
Solar radiation (300 – 3000 nm)	CSLRR1XS	W m^{-2}	Merge of two sensors

Note: each data channel has a flag column 'f': rows containing an N indicate that no data were available for that time interval. An M flag indicates suspect data from BODC's quality control procedures.

Additional channels available on request

The channels listed above are a subset of the channels that have been processed from AMT14. The following additional channels can also be listed if required – please contact the AMT data manager at BODC if you would like data from the list.

Latitude and Longitude from the Glonass satellite navigation system (now removed)
Conductivity (Siemens m^{-1})
Temperature of thermosalinograph conductivity measurement (°C)
Temperature from fluorometer sensor (°C)
Flow rate through thermosalinograph and fluorometer (l m^{-1})
Uncalibrated salinity and temperature channels

Instrumentation and data processing by originator

Detailed information about the instrumentation used on the James Clark Ross during AMT14 was not provided and we have assumed that there had not been any changes since AMT13 (TBC).

Underway instruments and methodology

Navigation was recorded using a 3D-GPS Trimble Surveyor system using Marine Star differential corrections. Bathymetry was measured using a Simrad EM-120 multi-beam swath bathymetry echo sounder.

The ship was equipped with a pumped "non-toxic" seawater supply system. Water was pumped through a Sea-Bird Electronics (SBE) thermosalinograph system, and a fluorometer.

The fluorometer was a linear response Turner Designs model 10 instrument in flow-through mode. This was placed in line with the SBE thermosalinograph and a flow meter.

The following information about the instruments was obtained from BAS:

Sensor	Quantity	Make	Model	Range
Temperature/ Humidity	2	Rotronic AG	MP103A-CG030-W4W	Temp-40 +60 Humidity:0 to 100%RH

PAR	2	Kipp & Zonen	ParLite 0348900	(400-700nm)
TIR/ Pyranometer	2	Kipp & Zonen	SP Lite 0339-900	1500 W/m^2 (0.4 - 1.1mm)
Barometer	2	Vaisala	Pressure Transmitter PTB210B1A2B	500 - 1100 hPa abs.
Flow	1	Litremetre	PMDQRCIL Transmitter 45SNVCE	0.04 – 6.3 litres/ Minute
Thermo-salinograph	1	Sea-Bird	SBE45	Temperature –5 – 35 deg C Conductivity 0 - 7 s/m Salinity psu Sound velocity m/s
Sea temperature	1	Rosemount		-200 – 800 deg C
Fluorometer	1	Turners Instruments	10AU-005-CE	Chlorophyll ug/l

Where two sensors are used, they are physically mounted in close proximity to each other.

The meteorological instruments were all located high up on the ship's foremast (at approximately 22m above sea level).

Data acquisition and on-board data processing

Raw data were logged every second and written to the ship's main data logging system (SCS)

The data were submitted to BODC in ASCII output from the BAS SCS system for post-cruise processing and data banking.

BODC post-cruise processing and screening

Reformatting

Data from the full-resolution SCS files were transferred to BODC's NetCDF format (QXF) under the BODC Underway Data System (BUDS). This transfer involved reducing the data to 60 second intervals using averaging. Directional data were reduced by averaging using a unit circle.

Screening

Each data channel was inspected on a graphics workstation and any spikes or periods of dubious data were flagged. The power of the workstation software was used to carry out comparative screening checks between channels by overlaying data channels. A map of the cruise track was simultaneously displayed in order to take account of the oceanographic context.

Data processing, correction and calibration

- **Navigation**

Navigational data were available from three different systems on the JCR. These were screened in order to select the best quality data for the primary navigation channels. The data from the Trimble GPS system were consistently good and showed no spikes.

A program was run which located any null values in the latitude and longitude channels and checked to ensure that the ship's speed did not exceed 15 knots. There was 1 speed check failures in the Trimble navigation data and 2 small gaps. These points were screened again to look for improbable spikes which were flagged as null. The gaps were then filled using linear interpolation.

- **Meteorology**

Relative wind speed and direction were logged from the meteorological package during the cruise. The anemometer was positioned with 0 degrees at the ship's bow. The ship's speed relative to the ground was calculated at BODC using the ship's navigational information and the ship's heading. The speed and heading were then used to correct the wind data for the effect of the ship's movement. Absolute wind speed and direction channels were created.

- **Salinity**

Salinity data from the thermosalinograph have been compared with calibrated surface CTD data to a depth of 20m. This is usually done to a depth of 6m, however, the CTD data down to 6m depth are suspect (see CTD notes). Different averaging depths (6m, 10m, 15m and 20m) were investigated and it was found that it was needed to average 20m of CTD salinity data. Comparison of all depth averages to the underway data shows that there is no adverse effect in increasing the depth averaging window to 20m. It was therefore decided to calibrate the underway salinity data to the calibrated CTD data averaged over 20m depth. The underway data were averaged over the period of CTD deployments and standard deviations were used to check the quality of the data. The 84 samples showed the following relationship, which has been used to produce a calibrated temperature channel (PSALSG01).

PSALSG01 = 0.994056 * PSALSU01 + 0.225660 (BODC calibration 3796)

- **Temperature**

TSG temperature was checked against the CTD temperature measurements averaged over the upper 6 m of the water column. Only CTD data points with a standard deviation (SD)< 0.01 deg.C in the upper 6 m and underway records with SD< 0.01 deg.C over the duration of the cast were considered. Based on a total of 23 paired samples, the diffference between the TSG and the CTD values averaged 0.00 degree C ±0.03 and ranged between -0.08 and 0.05 degree C with no obvious trend. No correction was applied to the TSG channel.

- **Chlorophyll**

The fluorometer channel was calibrated by comparing the uncalibrated fluorometer output with chlorophyll concentration values extracted from samples collected from the ship's non-toxic water supply (N=263). The relationship between extracted and fluorometer values was reasonable (R^2=0.76) and apparently unskewed.

The following equation was derived by linear regression:

CPHLUT01 = 1.861 (±0.065) * CPHLUMTF – 0.098 (±0.012), R^2=0.76

Residuals (extracted chlorophyll from the non-toxic minus calibrated fluorometer) follow a normal distribution and range between -0.73 and 0.53 mg chl m^{-3} for chlorophyll concentrations ranging from 0.09 to 1.48 mg Chla m^{-3}. The largest variations are due to a peak in the chlorophyll concentration values around 16/05/2004 which is not present in the fluorometer readings.

Updates

03/05/2005: An error in the calculation of the absolute wind speed and direction was corrected. A new version of the underway file was made available on 03/05/2005.

16/05/2005: CSLRR1XS was produced by merging data from the two solar radiation channels (CSLRR101 and CSLRR102).