Continuous underway data series for cruise AMT15 (17th Sept – 29th Oct, 2004)

Version 1.0 – May 2005
Version 2.0 – July 2005
Version 3.0 – September 2005

Chief Scientist

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Content of data series

Parameter	Column heading	Units	Comments
Latitude (Trimble navigation)	ALATGP01	Degrees +ve N	Selected as best quality navigation channel
Longitude (Trimble navigation)	ALONGP01	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	APNSGP01	cm s^{-1}	Computed from ship's heading and Trimble navigation
Ship's E-W velocity over the ground	APEWGP01	cm s^{-1}	Computed from ship's heading and Trimble navigation
Bathymetric depth (uncorrected for density effects)	MBANCT01	m	
Salinity	PSALSG01	PSU	Calibrated against CTD data
Salinity	PSALSU01	PSU	Uncalibrated
Sea temperature	TEMPSG01	Degrees C	Calibrated against CTD data
Sea temperature	TEMPSU01	Degrees C	Uncalibrated
Fluorometer output – manufacturer's calibrations only	FVLTAQ01	Volts	Uncalibrated
Chlorophyll fluorescence calibrated against extracted chlorophyll measurements	CPHLUT01	mg m^{-3}	Calibrated against sample data
Atmospheric pressure	CAPHZZ01	mbar	Sensor 1
Dry bulb air temperature	CDTASS01	Degrees C	Sensor 1
Relative humidity	CRELSS01	%	Sensor 1
Relative wind speed	ERWSSS01	m s^{-1}	
Relative wind direction	ERWDSS01	Degrees	
Absolute wind speed	EWSBSS01	m s^{-1}	
Absolute wind direction	EWDASS01	Degrees true	(Blowing from)
Downwelling light meter – port PAR	DWIRRPSD	W m^{-2}	Sensor 1

Downwelling light meter – starboard PAR	DWIRRSSD	W m^{-2}	Sensor 2

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 AMT15. The following additional channels can also be listed if required – please contact Gwen at BODC (gmon@bodc.ac.uk) if you would like data from the list.

Port and starboard mounted 300-3000nm downwelling pyranometer (Volts)
Red light transmissometer, 25cm path (Volts)

Instrumentation and data processing by originator

Details of the instrumentation used and of any data processing undertaken by the originator are currently unavailable. They will be added to this document when the information is received by BODC.

BODC post-cruise processing and screening

Reformatting

Data from the full-resolution RVS 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 different systems on the Discovery. These were screened in order to select the best quality data for the primary navigation channels. The data from the 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 were few speed check failures in the navigation data or 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 20 m. This is usually done to a depth of 5 m, however, the CTD data down to ~15 m depth show a lot of variability. Different averaging depths (5 m, 10 m, 15 m and 20m) were investigated and compared to the underway data. There was no significant difference in the long-wavelength salinity trend when averaging over the different depths compared to the underway data. Averaging to 20m of CTD salinity data provided the best calibration and was therefore used. The underway data were averaged over the period of CTD deployments and standard deviations were used to check the quality of the data. The 79 samples showed the following relationship, which has been used to produce a calibrated salinity channel (PSALSG01).

PSALSG01 = 0.95856 * PSALSU01 + 1.39300 (BODC calibration 4175)

- **Temperature**

TSG temperature was checked against the CTD temperature measurements averaged over the upper 5 m, 10 m, 15 m and 20 m of the water column. It was found that the best calibration was obtained with CTD measurements averaged over 10 m. Only CTD data points and underway records with a standard deviation lower than 0.01 deg.C over the duration of the cast were considered. A regression analysis was run on the data and, based on a total of 93 paired samples, the following calibration was derived.

TEMPSG01 = 1.00335 * TEMPSU01 – 0.14838 (BODC calibration 4177)

- **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=88). Four different groups were identified, corresponding to the European Shelf, Northern Gyre, Equatorial Upwelling and the Southern Gyre and these were calibrated separately.

The following equations were derived by linear regression:

Group 1 (18/09/2004 to 27/09/2004, BODC calibration 4194):

CPHLUT01 = 0.996 * FVLTAQ01 – 0.065, R^2=0.69

Group 2 (27/09/2004 to 02/10/2004, BODC calibration 4195):

CPHLUT01 = 4.035 * FVLTAQ01 – 0.456, R^2=0.81

Group 3 (02/10/2004 to 23/10/2004, BODC calibration 4196):

CPHLUT01 = 0.485 * FVLTAQ01 – 0.041, R^2=0.66

Group 4 (23/10/2004 to 27/10/2004, BODC calibration 4197):

CPHLUT01 = 0.849 * FVLTAQ01 – 0.077, R^2=0.72

Residuals (extracted chlorophyll from the non-toxic minus calibrated fluorometer) follow a normal distribution and range between -0.10 and 0.20 mg chl m^{-3} for chlorophyll concentrations ranging from 0.02 to 0.51 mg Chla m^{-3}. The largest variations occur over upwelling regions on the European shelf, North West Africa and near South Africa when extracted chlorophyll highs are not mirrored to the same extent in the fluorometer readings. Using four separate regressions provides a better fit to the extracted chlorophyll than using a single regression for the whole cruise. In fact, the sum of the squares of the residuals is 6 times lower when using 4 calibrations than when using a single calibration. However, this procedure has resulted in a small jump in CPHLUT01 on the 23/10/2004 where chlorophyll concentrations change rapidly and data from that date should be used cautiously.

Data quality notes & outstanding issues

- Calibration of the TIR channels when manufacturer's calibration coefficients received.
- Calibration of the transmissometer when calibration information available.