

Continuous underway data series for cruise AMT5 (14th September – 17th October, 1997)

Chief Scientist

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Content of data series

Parameter	Column heading	Units	Comments
Latitude	LAT+VEN	Degrees +ve N	
Longitude	LON+VEE	Degrees +ve E	
Salinity	RPSAL	PSU	
Sea temperature	RTEMP	Degrees C	
Bathymetric depth	DEPTH	m	
Raw Turner Designs fluorometer output	TFLUOR	Nominal units	Range changes
Calibrated fluorometer output	CPHYL	mg chl-a m ⁻³	Calibrated against fluorometric chl-a
Atmospheric pressure	APRES	mbar	
Dry bulb air temperature (Masthead starboard)	SMDBT	Degrees C	
Wind speed	Speed	knots	
Wind direction	Direction	Degrees	
Photosynthetically available radiation	IRRAD	W m ⁻²	
Solar radiation	SOLR	W m ⁻²	Noisy data
Ship's velocity North-South	VN	Knots +ve N	
Ship's velocity East-West	VE	Knots +ve E	

Instrumentation and data processing by originator

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 EA-500 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 ship also had a scientific meteorological package including the following:

- Wind vane and anemometer
- A photosynthetically available radiation (350 – 700 nm) sensor
- A total irradiance sensor,
- A dry bulb thermometer

According to the cruise report, the Kipp & Zonen CM-10 pyranometer was installed on the first stage island of the JCR foremast. The instrument was not mounted on gimbals and suffered from shading by the foremast. The data may also be affected by reflection that may occur from the white paint of the mast structure. This effect is difficult to correct for (cruise report p17).

Data acquisition and on-board data processing

Raw data were logged as ADC counts on the ship's computers. They were converted into engineering units using initial manufacturers' calibrations. Conductivity and two temperature channels were produced from the thermosalinograph counts.

The data from the fluorometer was logged into the JCR Ocean Logger system using the internal A/D converter and range output.

The data were submitted to BODC in RVS internal format for post-cruise processing and data banking.

BODC post-cruise processing and screening

Reformatting

Underway data files were merged into a single binary merge file using time as the primary linking key. The time span of the file was from 14/09/1997 04:00:00 to 17/10/1997 13:13:00, with a sampling interval of 30 seconds.

Salinity was computed from housing temperature and conductivity using the UNESCO 1978 Practical Salinity Scale (Fofonoff and Millard, 1982).

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**

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. The program identified 3 gaps which were filled using linear interpolation.

- **Meteorology**

Relative wind speed and direction were logged from the meteorological package during the cruise. The ship's speed and heading channels were used with the relative wind data to produce absolute wind speed and direction.

- **Temperature**

The underway sea temperature channel was compared with averaged surface values extracted from CTD profiles up to 7 metres. The 31 samples gave a very small offset of -0.00240°C between CTD and surface underway data with a standard deviation of 0.0308. As the offset was smaller than the standard deviation, no correction has been applied to the underway data.

- **Salinity**

Surface CTD data were also extracted to calibrate the underway salinity. The average offset from 30 comparisons was 0.01166 PSU, with a standard deviation of 0.00445. The underway data were corrected as follows:

$$\text{Salinity}_{\text{corr}} \text{ PSU} = \text{Salinity}_{\text{raw}} + 0.01166$$

- **Fluorometer**

In contrast to other AMT cruises, it appeared that there were no obvious range changes on the fluorometer during AMT5. However, the data were variable towards the end of the cruise, and it would have been difficult to identify range changes, so it cannot be stated with certainty that the range remained constant throughout the cruise.

There were a limited number of chlorophyll-a measurements made on samples taken from the non-toxic supply, from the first few days of the cruise only. Samples taken from the CTD rosette were available for the duration of the cruise. The data from fluorometric chlorophyll-a measurements were compared with the underway fluorometer readings, but the relationship was fairly poor. The relationship with chlorophyll-a measured by HPLC was much better. Although it was intended to use fluorometric data for all cruises to maintain consistency, an exception had to be made in this case.

The data were split into two sections for the purposes of the calibrations; this was necessary because of the very different concentrations evident during the beginning and end parts of the cruise.

From 14/09/1997 04:00 (beginning of underway file to 10/10/1997 19:20:

Chlorophyll-a = 0.168 * Fluor voltage – 0.2
($r^2 = 0.803$, N = 34)

From 10/10/1997 19:20 to 17/10/1997 13:13 (end of underway file):

Chlorophyll-a = 0.0536 * Fluor voltage + 0.135
($r^2 = 0.862$, N = 8)

For the second section, there was a lot of variability in the calibration samples. In particular, the samples taken on 13/10/1997 had a lower voltage but higher HPLC chlorophyll-a concentration than samples taken on 14/10/1997. The chlorophyll-a concentrations on 13/10/1997 may, therefore, have been underestimated by the underway fluorometer measurements.

Comments on data quality:

Users should be cautious when using ship-borne wind measurements. Although the relative wind data have been corrected for ship's heading and speed, they are still sensitive to shielding effects. Users can consult the ship's E-W and N-S speed alongside the wind speed and direction.

Reference

Fofonoff N.P. and Millard Jr., R.C. 1982. Algorithms for Computation of Fundamental Properties of Seawater. *UNESCO Technical Papers in Marine Science* 44.