Continuous underway data series for cruise AMT11 (13th September – 11th October, 2000)

Chief Scientist

Chris Gallienne, Plymouth Marine Laboratory

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
Atmospheric pressure	APRES	mbar	
Dry bulb air temperature	ATDRY	Degrees C	Caution
Relative wind speed	Relative Speed	Knots	Caution
Relative wind direction	Relative Direction	Degrees	Caution
Photosynthetically available radiation	VPARD	W m^{-2}	Caution
Solar radiation	SOLR	W m^{-2}	Noisy data

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

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 ASCII output from the BAS SCS system 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 13/09/2000 18:09 to 11/10/2000 10:50, 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. There were no gaps in the record but there were several speed-check failures.

- **Meteorology**

Relative wind speed and direction were logged from the meteorological package during the cruise. The ship's speed and heading channels were not available from the data sent to BODC, so the wind data could not be corrected for the effect of the ship's movement.

- **Temperature**

The underway sea temperature channel was compared with averaged surface values extracted from CTD profiles up to 7 metres. The 46 samples gave a small offset of 0.0177˚C between CTD and surface underway data with a standard deviation of 0.0183˚C. This offset has been applied to the underway data.

Temperature(corr) ˚C = Temperature(raw) + 0.0177

- **Salinity**

The underway salinity channel was compared with averaged surface values extracted from CTD profiles up to 7 metres. The 41 samples gave an offset of -0.0659 with a standard deviation of 0.0418. This offset has been applied to the underway data in order to standardise them with the CTD data.

Salinity(corr) PSU = Salinity(raw) – 0.0659 PSU

- **Fluorometer**

The Turner Designs fluorometer operated on different range settings throughout the cruise. The points at which the range setting changed were identified during screening by looking for abrupt jumps in the signal with a magnitude of approximately 3. The data were then adjusted to a constant range for the whole cruise. For AMT11, the following corrections were applied.

Section start	Section end	Scaling factor
13/09/2000 18:09:10	15/09/2000 07:03:10	3.16
15/09/2000 07:03:10	26/09/2000 02:42:40	31.6
26/09/2000 02:42:40	26/09/2000 22:37:10	10.0
26/09/2000 22:37:10	27/09/2000 08:48:40	3.16
27/09/2000 08:48:40	27/09/2000 20:29:10	10.0
27/09/2000 20:29:10	28/09/2000 11:43:10	3.16
28/09/2000 11:43:10	28/09/2000 18:36:10	10.0
28/09/2000 18:36:10	29/09/2000 11:54:10	3.16
29/09/2000 11:54:10	29/09/2000 21:02:10	10.0
29/09/2000 21:02:10	30/09/2000 00:56:10	3.16
30/09/2000 00:56:10	02/10/2000 12:20:40	10.0
02/10/2000 12:20:40	08/10/2000 19:15:40	31.6
08/10/2000 19:15:40	10/10/2000 16:55:10	10.0
10/10/2000 16:55:10	10/10/2000 19:09:10	3.16
10/10/2000 19:09:10	11/10/2000 10:50:10	10.0

At present, there are no data available to calibrate the fluorometer signal against chlorophyll-a concentrations. When these sample data become available to BODC, the fluorometer signal will be calibrated.

Comments on data quality:

The relative wind data have not been corrected for ship's heading and speed, as no heading data were available.

The air temperature data displayed problems during periods of bad weather, possibly due to wetting of the sensor. The periods of poor quality correspond to periods of high wind speed.

The position of the solar radiation and PAR sensors on the ship were unknown. The PAR data included periods that appeared to be affected by the ship's heading, suggesting that shielding of the sensor was a problem. The solar radiation did not appear to be affected by the shielding, but, like the air temperature channel, was affected during windy periods. The PAR values appeared to be too low in comparison with the solar radiation values, being only ¼ of solar radiation.

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.