AMT8 cruise report

Dr. Guy Westbrook, CCMS Plymouth Marine Laboratory

Deployment of Fast Rate Repetition Fluorometer on board UOR.

1.1 Introduction

The undulating oceanographic recorder (UOR) was develop at Plymouth Marine Laboratory and is produced commercially, under license, by Chelsea Instruments Limited. The version deployed on AMT-8 was designed and built at PML specially to carry the Chelsea Instruments fast rate repetition flourometer (FrrF). Figure 1.1 illustrates the general layout of the payload deployed onboard the UOR.

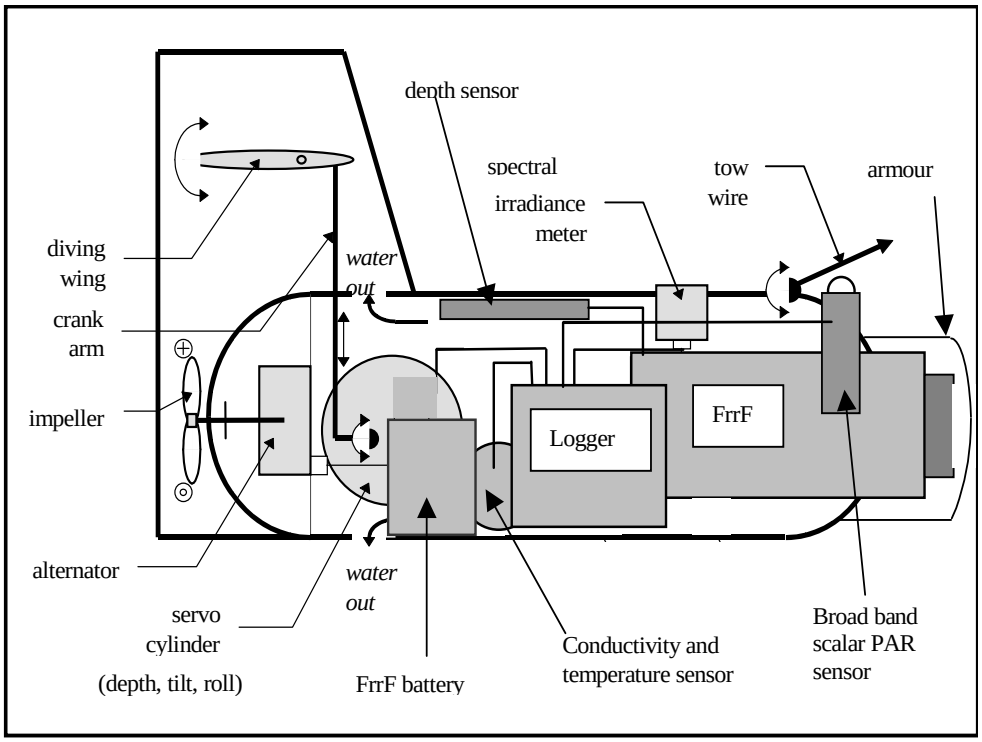


Figure 1.1. Schematic of the UOR and payload deployed during AMT-8.

More sophistocated than the more familiar broad band exitation and emission fluorometer, the FrrF measures rapid real time *in-situ* measurements of photosynthetic parameters of marine and freshwater phytoplankton by exposing the algae to a series of microsecond flashes of blue light at a repetition rate of 200KHz, a profile of the algal fluorescence is observed and recorded describing the level of maximum fluorescence and at various stages of signal decay. The complete instrumentation suite deployed is detailed in table 1.1. The FrrF was also regularly deployed attatched to the NASA CTD-F integrated bottle sampling rosette (see table 1.2). During selected casts, vicarious calibration of the UOR conductivity and temperature probes was also undertaken (see table 1.3).

Table 1.1 Payload instrumentation

Module	**Instrumentation**	**Purpose**
Servo	Incorporates programmable actuating mechanism for fin, a depth sensor and inclinometer. Propeller driven alternator. PML designed and built.	Self powering (from integrated power supply). Drive UOR in pre-set undulating pattern (profile is logged). Provides tilt and roll data for data quality control and hydrodynamic modelling of platform performance. Provides depth information.
Temper-ature and conduct-ivity	Conductivity and temperature probes incorporated into stand alone module. PML designed and built	Powered from the logger battery, C & T information is merged with depth from servo to provide temperature, salinity and hence density.
Logger (JA-6)	Programmable logger, 12v Power supply. Irradiance connected on red. PML designed and built.	Takes depth and tilt / roll data from servo, CT module and irradiance head. Additional channels available.
Scalar PAR	Integrated spectral irradiance over 300-700nm.	Characterises lightfield in terms of downwelling PAR
Vector spectral irradiance	Samples the downwelling irradiant light field at discrete 10nm intervals centred at 412nm,443nm, 490nm,510nm,555nm,670nm, 700nm.	Characterises light field in terms of downwelling spectral irradiance to better represent the dimunition of irradiance than may be derived from scalar PAR. Optical data QA is provided by periodic NASA SeaWiFS quaity monitor(SQM) field calibration and tilt and roll up to a maximum limit of 10°.
FrrF	Fluorometer built under license by Chelsea Instruments Limited.	In-situ measurement of various phtotosynthetic parameters of marine and freshwater algae.

1.2 Scientific objectives

The FrrF is a new instrument and is becoming increasingly used in studies of primary productivity. This programme of research served to

(i) Continue the assessment of the instrument in low biomas waters of the northern and southern Atlantic gyres, as well as allow comparison with the higher biomass boundary regions of the equatorial upwelling, the tendrills of nutrient rich waters eminating from the west African coast and the Western approaches to the English channel.

(ii) Collect a data set in these regions at the CTD stations where C14 P-I analyses were also being carried out, as well as HPLC pigment determinations, measurements of secondary productivity, and phytoplankton particle absorption analysis (in the mixed layer and at the deep chlorophyll maximum).

(iii) To compare the value of observations of scalar broadband PAR and spectral irradiance when assessing phytoplankton pigment absorption and how this relates to absorption by the pigment assemblage at the

precise point in space and time of measurement and what implications this has for enhancing themodels applied to FrrF data.

(iv) Continuing the assessment of the UOR for its suitability for this work and development for future studies.

The UOR derived temperature and conductivity data describe the physical structure of the study site at the time of FrrF sampling to give a general understanding of the vertical structure of the water column, particularly the depth and intensity of the thermocline, as well as to enhance the value of the profile CTD observations and the various XBT's (to 700*m*) that were also deployed at regular intervals along track.

1.3 Deployment field log

Table 1.2 FRRF coincident CTD deployment log.

SDAY	Time	Station	FrrF file name	Position	
123	1400	A809	A809CTD.BIN	35°04.6'S	51°40.3'W
124	1356	A810	A810CTD.BIN	32°57.7'S	47°01.1'W
126	1400	A813	A813CTD.BIN	28°51.0'S	38°19.1'W
127	1258	A814	A814CTD.BIN	26°53.6'S	34°15.1'W
128	1446	A815	A815CTD.BIN	24°33.2'S	29°33.6'W
129	1347	A816	A816CTD.BIN	22°13.7'S	25°49.0'W
130	1128	A817	A817CTD.BIN	19°12.7'S	23°13.2'W
130	1401	A818	A818CTD.BIN	18°59.7'S	23°03.5'W
131	1200	A819	A819CTD.BIN	16°02.8'S	20°31.9'W
132	1030	A821	A821CTD.BIN	13°10.2'S	18°07.5'W
132	1330	A822	A822CTD.BIN	12°53.4'S	17°54.7'W
138	1332	A825	A825CTD.BIN	07°38.5'S	14°31.0'W
140	1030	A828	A828CTD.BIN	00°04.6'S	16°42.6'W
141	1030	A830	A830CTD.BIN	03°53.9'N	17°53.0'W
142	1028	A832	A832CTD.BIN	07°37.2'N	18°59.3'W
143	1028	A834	A834CTD.BIN	11°33.8'N	20°09.1'W
143	1332	A835	A835CTD.BIN	11°55.0'N	20°15.6'W
145	1028	A837	A837CTD.BIN	18°48.1'N	21°00.2'W
146	1028	A839	A839CTD.BIN	22°55.0'N	21°00.9'W
148	1022	A843	A843CTD.BIN	30°28.0'N	21°33.8'W
149	1026	A845	A845CTD.BIN	34°22.0'N	20°47.3'W
150	1028	A847	A847CTD.BIN	38°10.7'N	20°00.7'W
151	1030	A849	A849CTD.BIN	41°51.0'N	20°00.7'W
152	1008	A851	A851CTD.BIN	45°56.6'N	19°58.7'W
153	1750	A853	A853CTD.BIN	47°00.0'N	20°00.0'W
153	1032	A854	A854CTD.BIN	47°27.2'N	15°39.8'W
154	1036	A856	A856CTD.BIN	48°08.9'N	09°39.9'W
154	1500	A858	A858CTD.BIN	48°15.2'N	09°14.1'W
155	1030	A859	A859CTD.BIN	48°58.9'N	09°15.0'W
155	1244	A860	A860CTD.BIN	48°59.0'N	09°10.7'W
156	1008	A862	A862CTD.BIN	49°42.1'N	4°27.5'W

Table 1.3. Vicarious CTD calibration log.

1.4 Preliminary Results

Figures 1.2 to 1.5 show data arising from sample deployments.

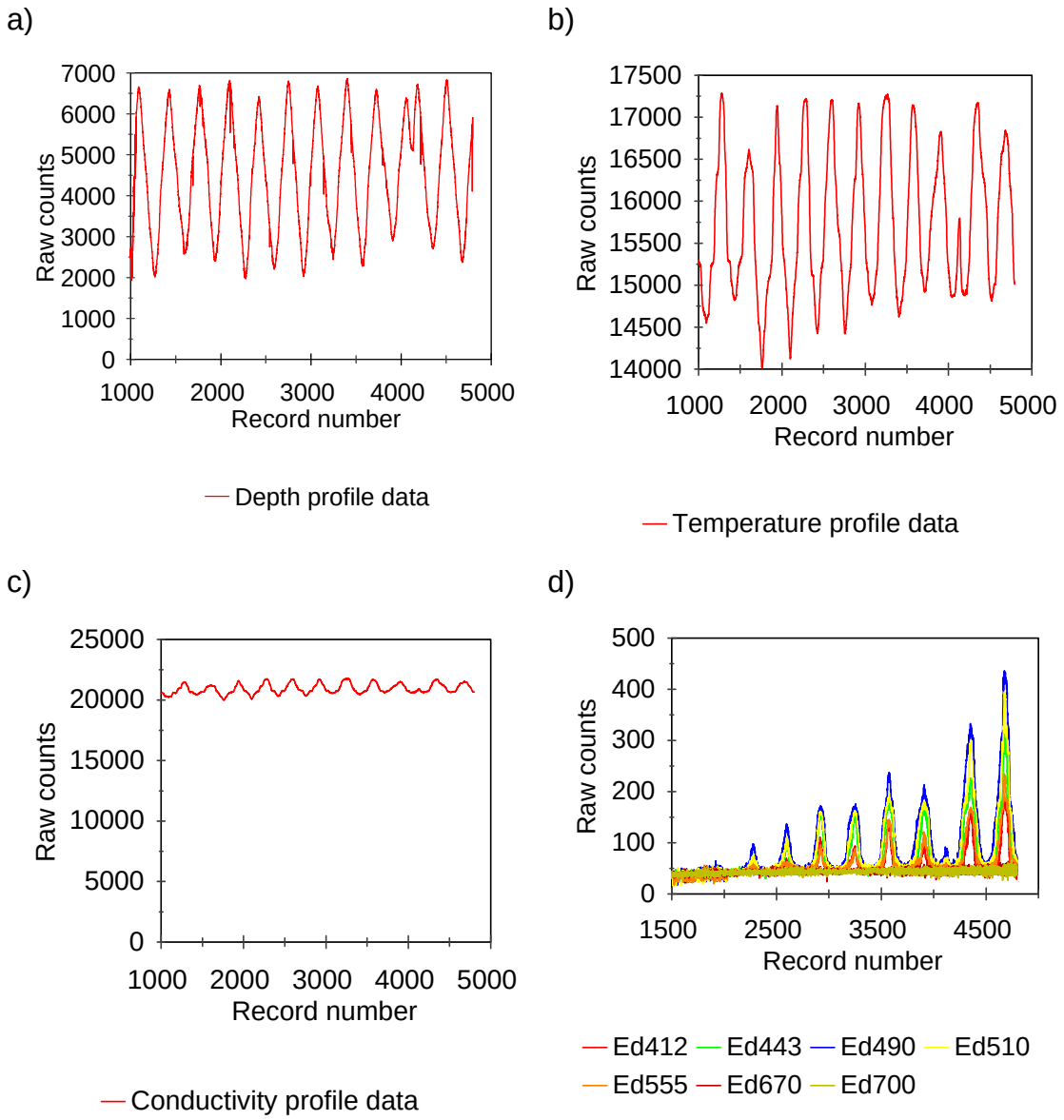
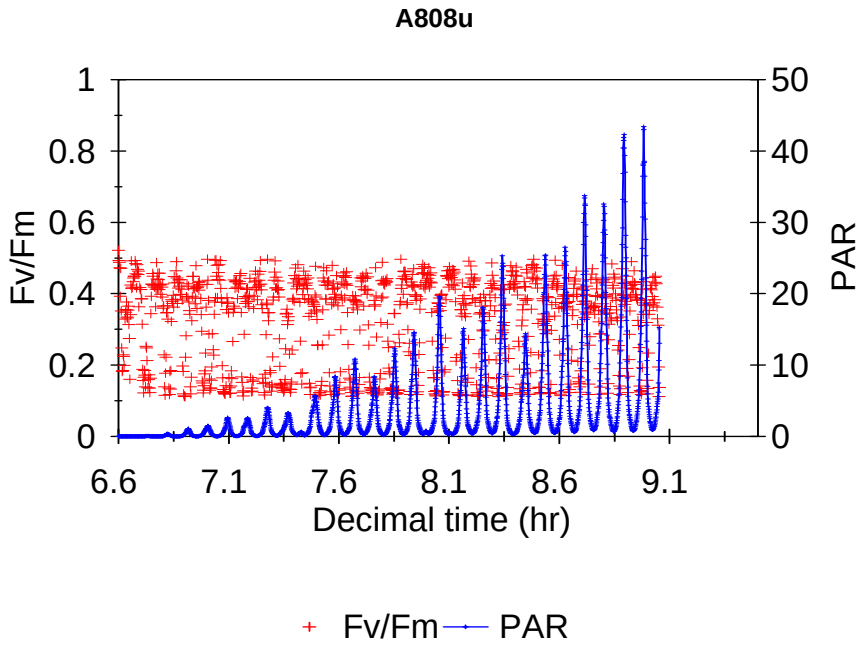


Figure 1.2. Preliminary results from the UOR. Shown are data collected during tow A808 on SDY 144 (24 May 1999). Data shown are uncalibrated where (a) depth, (b) temperature, (c) conductivity and (d) downwelling spectral irradiance.

(a)



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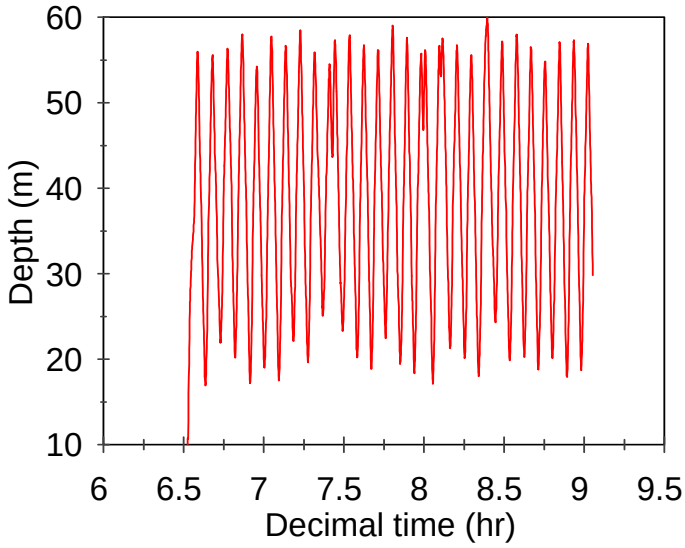

Figure 1.3 Preliminary results from the FrrF deployment on board UOR where (a) shows a time plot of Fv/Fm with PAR, and (b) a time plot of the depth profile. deployed coincident with CTD 36. Data were collected on SDY 144 (24 May 1999). PAR is in units of **********.

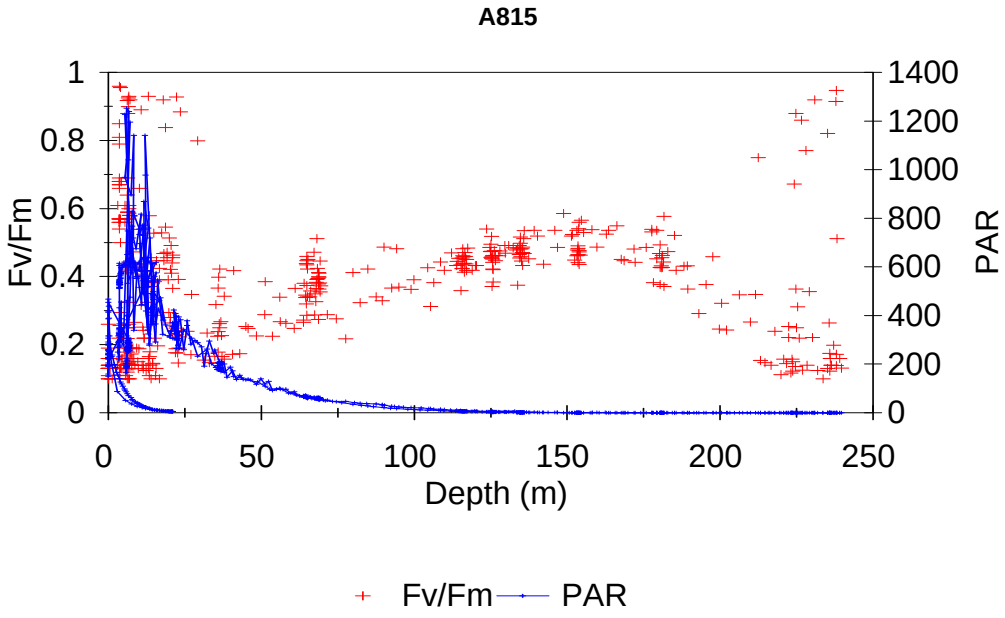

Figure 1.4 shows a data set obtained from the FrrF when deployed contemporaneously with the CTD (CTD no 15, SDY 128).

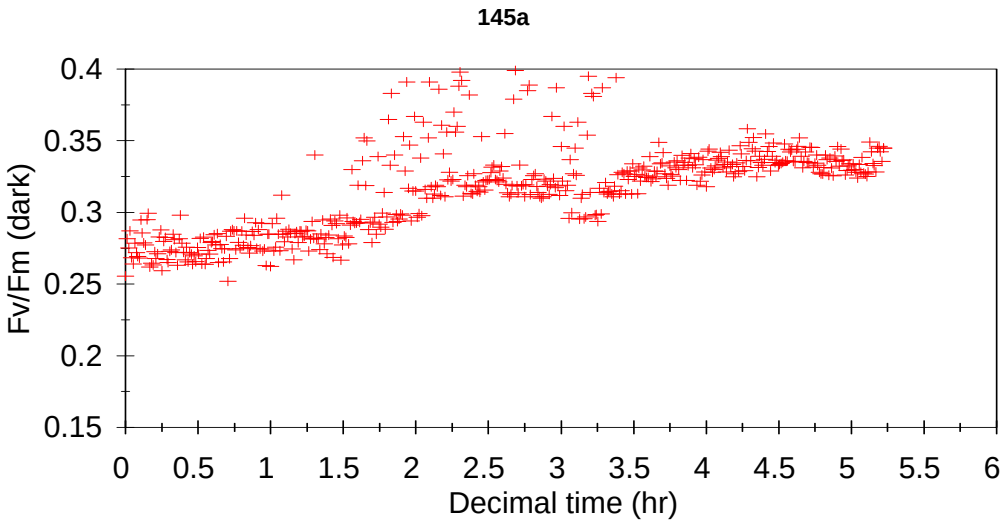

Figure 1.5 Data collected during the early morning of SDY 144 from the non-toxic supply.

1.5 Discussion