BOUSSOLE Monthly Cruise Report

Cruise 222
September 11-12, 2020

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Vessel: R/V Téthys II
(Captain: Aurélien Courbe)

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Recovery of the Rosette CTD + IOP package on the deck of the R/V *Téthys II*

BOUSSOLE project

ESA/ESRIN contract N° 4000119096/17/I-BG

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Foreword

This report is part of the technical report series that is being established by the BOUSSOLE project.

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Contents

1. Cruise Objectives
2. Cruise Summary
3. Cruise Report
4. Problems identified during the cruise

Appendices

Cruise Objectives

Routine operations

Multiple Biospherical's C-OPS (Compact Optical Profiling System) radiometric profiles are performed at the BOUSSOLE site around solar noon, under optimal conditions: clear blue skies and flat, calm sea surface. If the sky is clear and sea conditions are reasonably calm (no whitecaps or large swell), hand held CIMEL sun photometer measurements are to be performed consecutively where possible with C-OPS profiles. If sea conditions are poor but sky is good, hand held CIMEL sun photometer measurements can be made at intervals throughout the day to measure atmospheric optical thickness. CTD deployments are required at the start and the end of the C-OPS profiling day and around noon in the longer summer days or when there is a high possibility of a satellite matchup. The CTD package also includes a Chl fluorometer. Additional instrumentation for measurement of inherent optical properties has been added from December 2011. The package includes a hyperspectral absorption meter (Hobilabs a-Sphere), a multispectral backscattering meter (Hobilabs Hydroscat-6) and a multispectral beam transmissometer (Hobilabs Gamma-4). A CTD cast including a 0.2 µm filter installed on the inlet tube of the a-Sphere is to be performed once per cruise at the BOUSSOLE site for the dissolved matter absorption measurements. This cast will be stopped at ten depths during 2 or 7 min depending on the depths in order to ensure that the integrating cavity of the a-Sphere be completely filled at each of these depths during the ascent of the CTD.

Seawater samples are to be collected, filtered and stored into liquid nitrogen for subsequent HPLC pigment and particle absorption spectrophotometric filter analysis in the lab. Three replicates samples are to be collected at surface for total suspended matter weighting in the lab.

Divers check the underwater state of the buoy structure and instrumentation, take pictures for archiving, clean the sensor optical surfaces, and then take again some pictures after cleaning. Divers also put a neoprene cap on the backscattering meter and on the transmissometers for acquiring dark measurements (started in April 2009).

In addition, water samples are to be collected at two depths (5 m and 10 m) for dissolved oxygen (DO), total alkalinity (TA) and total inorganic carbon (TC) analysis (from March 2014). This operation is part of the BIOCAREX ANR project, in collaboration with the LOCEAN in Paris (J. Boutin and collaborators). The TA/TC samples will be processed by the National service for such analyses (SNAPOCO – LOCEAN in Paris). The results will allow checking the data collected by the two pCO_2 CARIOCA sensors and the two optodes installed on the buoy at 3 m and 10 m.
Water samples are to be collected at four depths for metagenomic analyses of different types of Synechococcus, cytometry and nutrients. This operation is part of the EFFICACY ANR project in collaboration with the *Roscoff Biological Station.* The aim is to study the distribution of different types of Synechococcus populations characterized by distinct pigmentation and adaptation to the colour of light. It includes two years of cytometry and metagenomic sampling at the BOUSSOLE site.

Further details about these operations and the data collection and processing protocols are to be found in:
Antoine, D. M. Chami, H. Claustre, F. D'Ortenzio, A. Morel, G. Bécu, B. Gentili, F. Louis, J. Ras, E. Roussier, A.J. Scott, D. Tailliez, S. B. Hooker, P. Guevel, J.-F. Desté, C. Dempsey and D. Adams. 2006, BOUSSOLE: a joint CNRS-INSU, ESA, CNES and NASA Ocean Color Calibration And Validation Activity. NASA Technical memorandum N° 2006 - 214147, 61 pp.
(http://www.obs-vlfr.fr/Boussole/html/publications/pubs/BOUSSOLE_TM_214147.pdf)

Additional operations

This BOUSSOLE cruise was initially planned on 10-11th September. The MOOSE GE - DYFAMED cruise scheduled on 7-9th September on R/V *Téthys II* for the rotation of the DYFAMED mooring was cancelled because of bad weather. The first day of the BOUSSOLE cruise was therefore given to the MOOSE program in order to allow the recovery of the DYFAMED mooring. An additional day (12th September) was given to BOUSSOLE and MOOSE activities because of bad weather the days before. Unfortunately, the DYFAMED mooring could not be recovered the first day, a triangulation was performed the last day at the DYFAMED site in order to localize the mooring. Zooplankton net was performed in order to complete the MOOSE program.

Seawater was sampled at 3 depths for micro-, nano- and pico-phytoplankton analysis by microscopy and cytometry. This operation is part of the OBOO (*From Optics to Biodiversity in the world Open Oceans: application*

to BGC-Argo floats) LEFE-CYBER (*Les Enveloppes Fluides et l'Environnement – CYcles Biogéochimiques, Environnement et Ressources*) project of the *Marine optics and remote sensing group* of the *Laboratoire d'Océanographie de Villefranche (LOV).* In addition, three sensors were added to the Rosette CTD in the frame of this project: an Eco FLBB2 sensor which measures fluorescence (excitation at 470 nm, emission at 695 nm) and backscattering coefficient at 700 nm, an Eco 3X1M sensor which measures multispectral fluorescence (excitation at 440, 470 et 532 nm, emission at 695 nm) and a C-rover transmissometer which measures attenuation at 650 nm.

An APEX autonomous profiling float was deployed by LOV-OMTAB in the vicinity of the BOUSSOLE site in the frame of a collaboration with Heindrik Bünger from Oldenburg University. It is equipped with a TRIOS RAMSES sensor, an Aanderaa optode sensor, a Seabird ECO V1 fluorometer and a CTD.

Cruise Summary

Only one day was dedicated to BOUSSOLE operations. This day was used for the triangulation of the DYFAMED mooring, for deployment of the APEX profiling float, for CTD casts with water sampling, for buoy surface maintenance, for zooplankton nets, for a Secchi disk and for optical profiles.

Thursday 10 September 2020

This day was entirely given to the MOOSE program because bad weather did not allow performing MOOSE DYFAMED operations the days before.

Friday 11 September 2020

Bad weather prevented departure from the Nice harbour.

Saturday 12 September 2020

The sea state was smooth with a gentle to light breeze. The sky was blue and the visibility was good. Firstly, we went to the DYFAMED site in order to perform the triangulation of the DYFAMED mooring. Then the APEX profiling float was deployed during the way up to BOUSSOLE. When arrived at BOUSSOLE, a CTD cast was performed with water sampling. Then, buoy maintenance was performed on the top of the buoy in order to check the battery voltage from the cable arriving at the surface, to check the Junction Box voltage and to download data from the surface DL3 (Data Logger) via an external battery. It appeared that the voltage of the battery was very low (1,02V), the voltage of the Junction Box was normal (19,57V). In the meantime, a WP2 triple zooplankton net was deployed. Then 2 CTD casts with water sampling and a Secchi disk were performed. For the first cast, a cap was put on the Hydroscat-6 for dark measurements. Finally, two C-OPS profiles were performed before returning to the Nice harbour. Only the second C-OPS profile was kept because the first profile was too tilted and had to be stopped early during the acquisition.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/aZ13PjPSNAHcNk6x7

Data from the BOUSSOLE cruises and buoy are available at:
http://www.obs-vlfr.fr/Boussole/html/boussole_data/login_form.php

Cruise Report

Thursday 10 September 2020

MOOSE DYFAMED operations.

Friday 11 September 2020

Bad weather prevented departure from the Nice harbour.

Saturday 12 September 2020 (UTC)

People on board: Laurent Coppola, Emilie Diamond Riquier, Céline Dimier, Melek Golbol, Flavien Petit and Eduardo Soto Garcia.

0530 Departure from the Nice harbour.
0830 Arrival at the DYFAMED site.
0835 Start of triangulation of DYFAMED mooring.
0930 End of triangulation of DYFAMED mooring.
1000 APEX profiling float deployment (43°23.922'N, 7°53.817'E)
1030 Arrival at the BOUSSOLE site.
1040 CTD 01, 100 m with water sampling at 60, 45, 20 and 5 m for metagenomic, cytometry and nutrients analyses (EFFICACY project).
1100 Buoy surface maintenance.
1135 Zooplancton net, 200 m
1215 CTD 02, 100 m with water sampling at 60, 44, 5 m for phytoplankton microscopy, cytometry, PIC, POC and HPLC (OBOO project) and 5 m for TSM (with cap on the HS6).
1250 Secchi 01, 13 m.
1320 CTD 03, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5m for HPLC and a_p.
1415 C-OPS 01.
1440 Departure to the Nice harbour.
1800 Arrival to the Nice harbour.

Problems identified during the cruise

- CTD 01: Niskin bottles #3 and #4 (60 and 45 m) did not close but there was enough water in other bottles closed at the same depth to sample for metagenomic analyses.

- It was not possible to perform the IOP cast including a 0.2 µm filter installed on the inlet tube of the a-Sphere for the dissolved matter absorption measurements because of the lack of time.

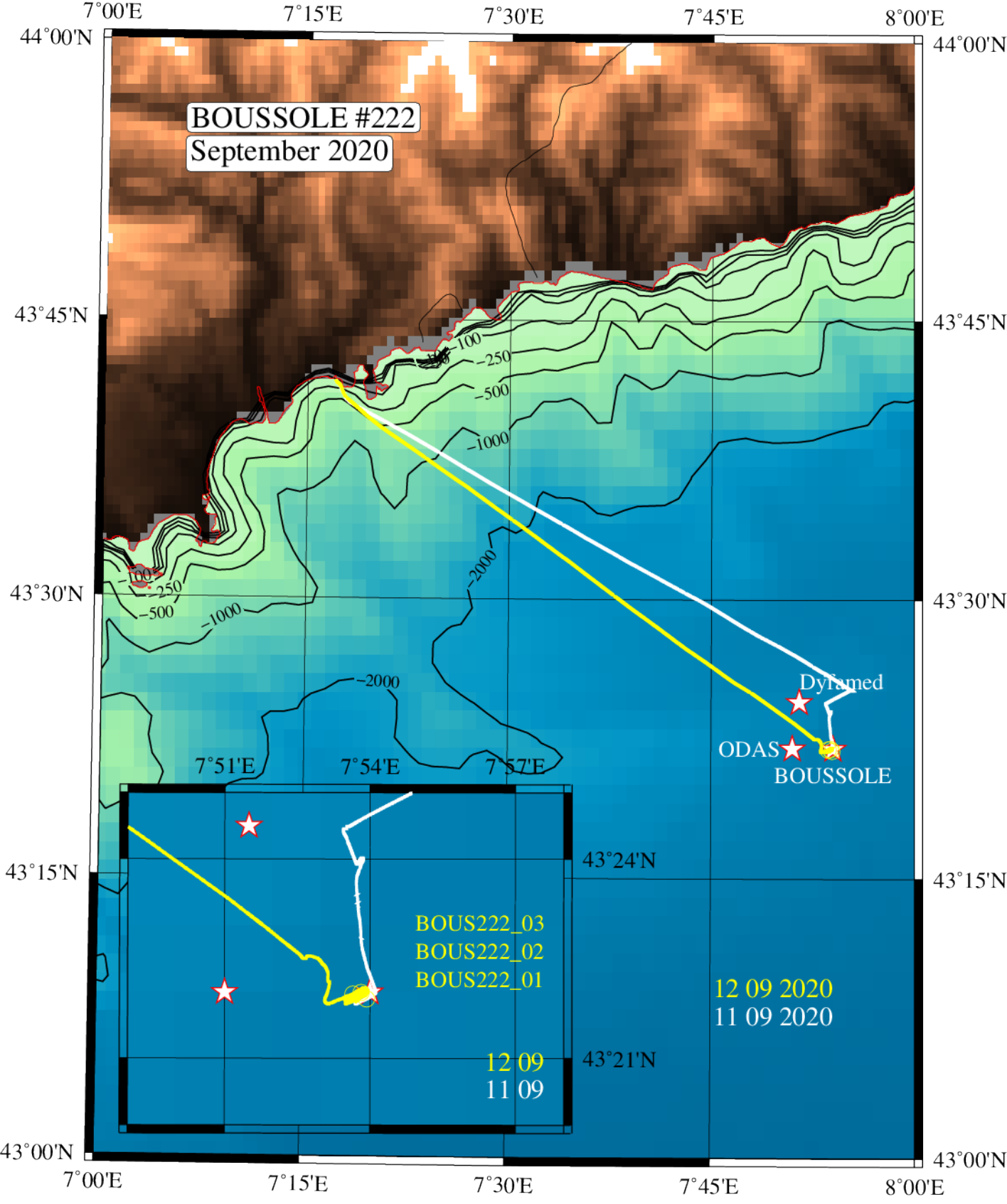
- The buoy was still not functioning. The battery and Junction Box voltage were measured. It appeared that the voltage of the battery was very low (1,02V), the voltage of the Junction Box was normal (19,57V). Data were downloaded from the surface DL3 (Data Logger) via an external battery. A few files were recorded the two first days after the launch of the buoy. The first file revealed that data were acquired the first day but the buoy worked not correctly. The next files were empty.

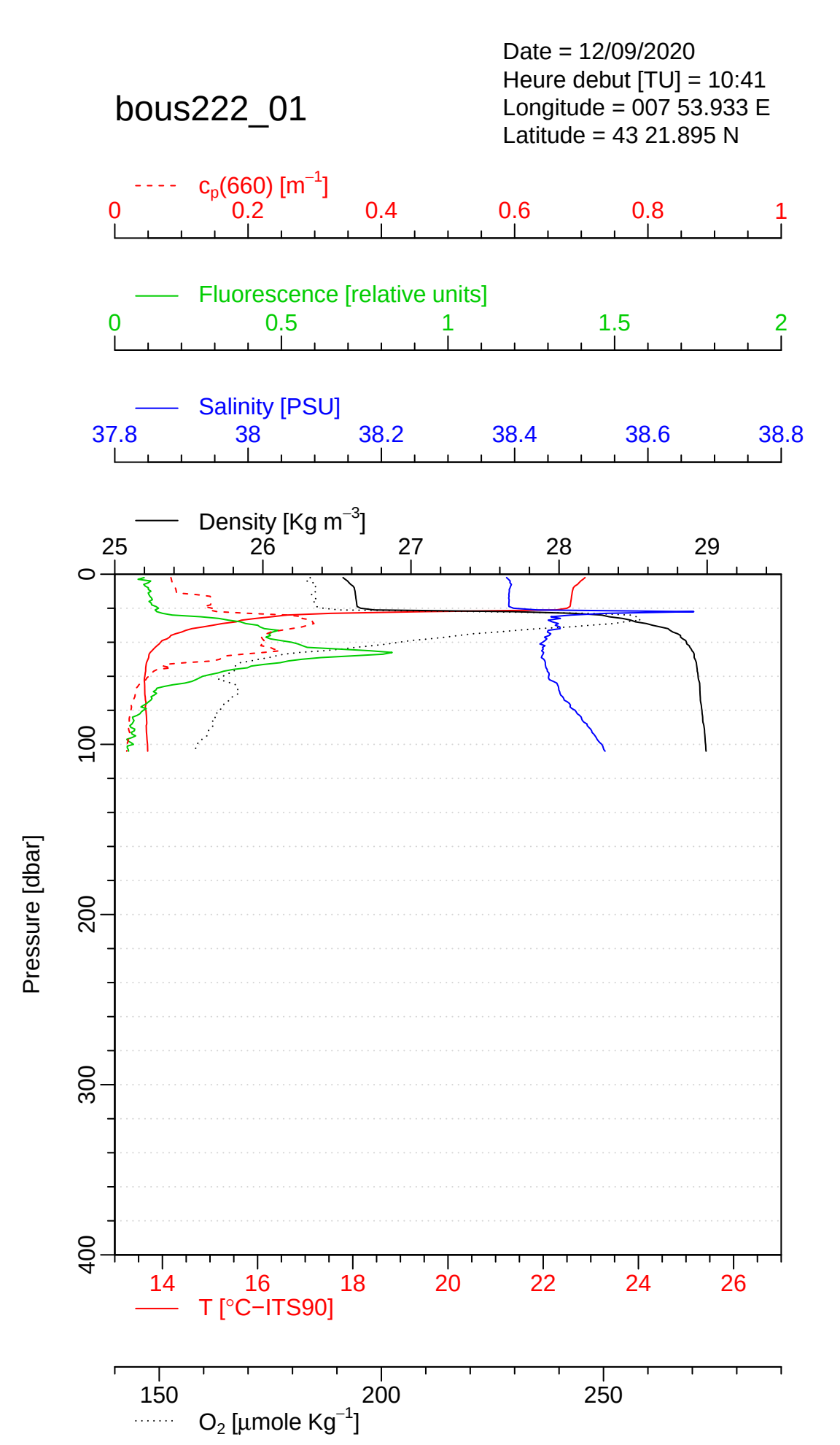
- Two C-OPS profiles were performed at the BOUSSOLE site but only one profile was kept because the first profile had to be stopped during the acquisition because the profiler was too much tilted.

Appendices

Cruise Summary Table for Boussole 222

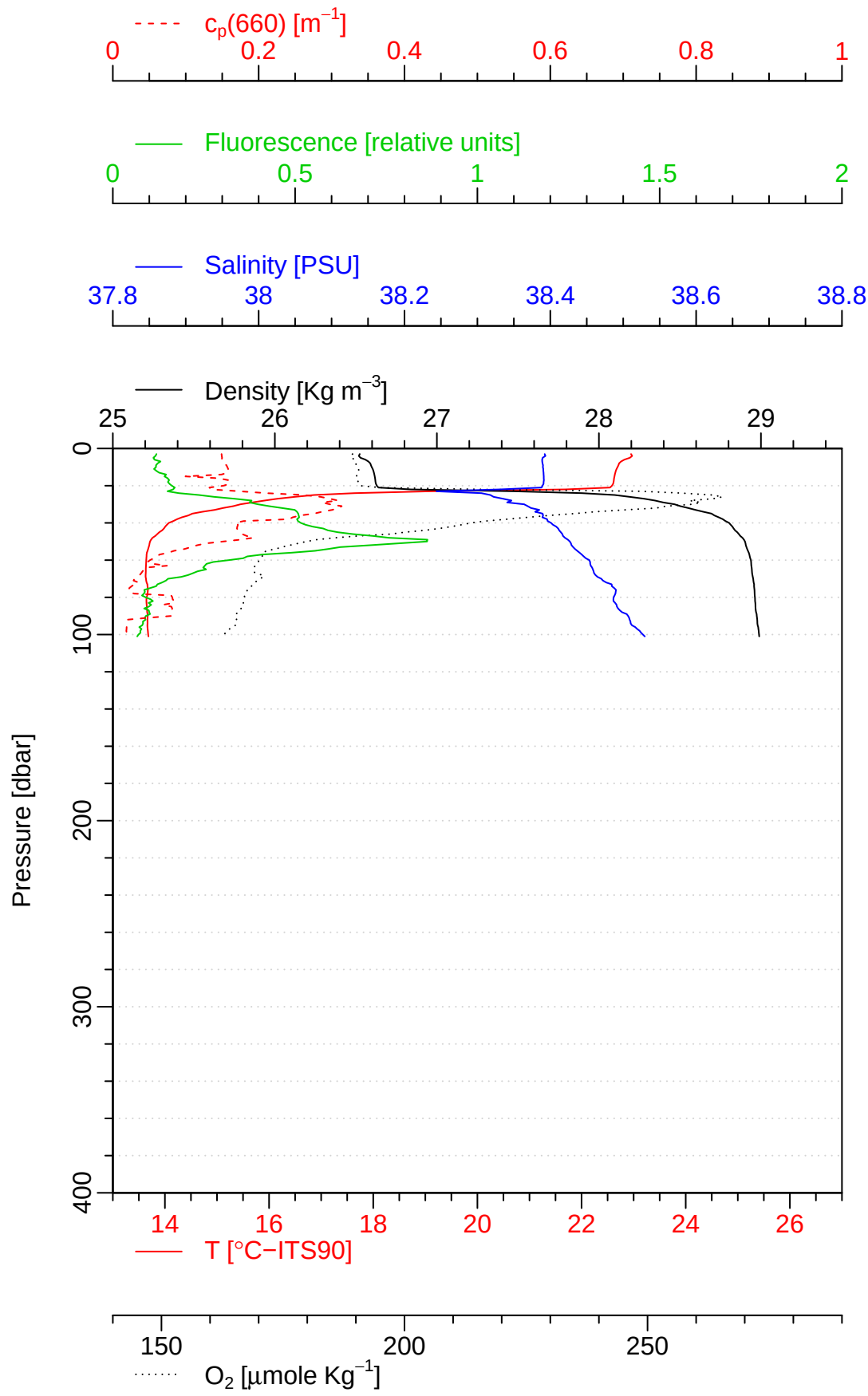
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather							Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
10/09/20	DYFAMED operations																							
11/09/20	Bad weather																							
12/09/20			BOUS222_01	Metagenomics, Cyto & Nutrients	10:41	15:00	100	43	21.895	7	53.933	blue		1	10	76	1016.8	76		24.1	23.6	smooth			
			BOUS222_02	Phytofloat (HPLC, PIC, POC, Cyto, phyto) & TSM	12:13	16:00	100	43	21.992	7	53.82	blue		2	3	75	1016.9	77		24.7	23.66	smooth			
				Secchi01	12:50	4:00	13	43	22	7	54	blue							good			smooth			
			BOUS222_03	HPLC, a_p, TA/TC & O_2	13:18	39:00	100	43	21.967	7	53.65	blue		1	3	41	1016.8	77		25	23.38	smooth			
		bou_c-ops_200912_1300_002_data.csv			14:10	4:52	122	43	22.397	7	53.055	blue	Ci	1	0	350	1016.5	75	good	25		smooth	0.5		No


BOUSSOLE #222
September 2020
7°00'E
7°15'E
7°30'E
7°45'E
8°00'E
44°00'N
43°45'N
43°30'N
43°15'N
43°00'N
100
250
500
1000
2000
Dyfamed
ODAS
BOUSSOLE
7°51'E
7°54'E
7°57'E
43°24'N
43°21'N
BOUS222_03
BOUS222_02
BOUS222_01
12 09 2020
11 09 2020
12 09
11 09


bous222_01
Date = 12/09/2020
Heure debut [TU] = 10:41
Longitude = 007 53.933 E
Latitude = 43 21.895 N
cp(660) [m−1]
0
0.2
0.4
0.6
0.8
1
Fluorescence [relative units]
0
0.5
1
1.5
2
Salinity [PSU]
37.8
38
38.2
38.4
38.6
38.8
Density [Kg m−3]
25
26
27
28
29
Pressure [dbar]
0
100
200
300
400
14
16
18
20
22
24
26
T [°C−ITS90]
150
200
250
O2 [µmole Kg−1]

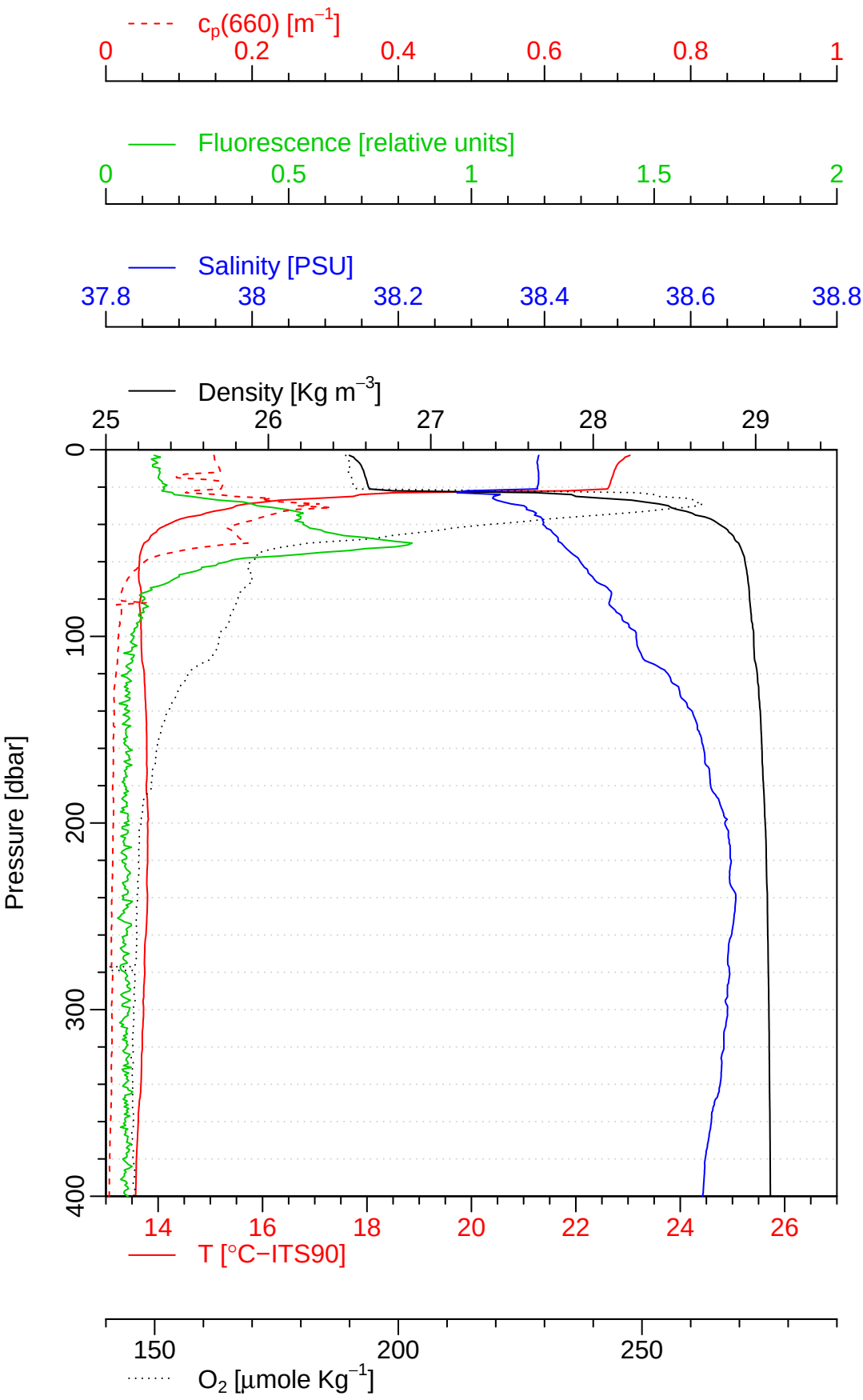
bous222_02

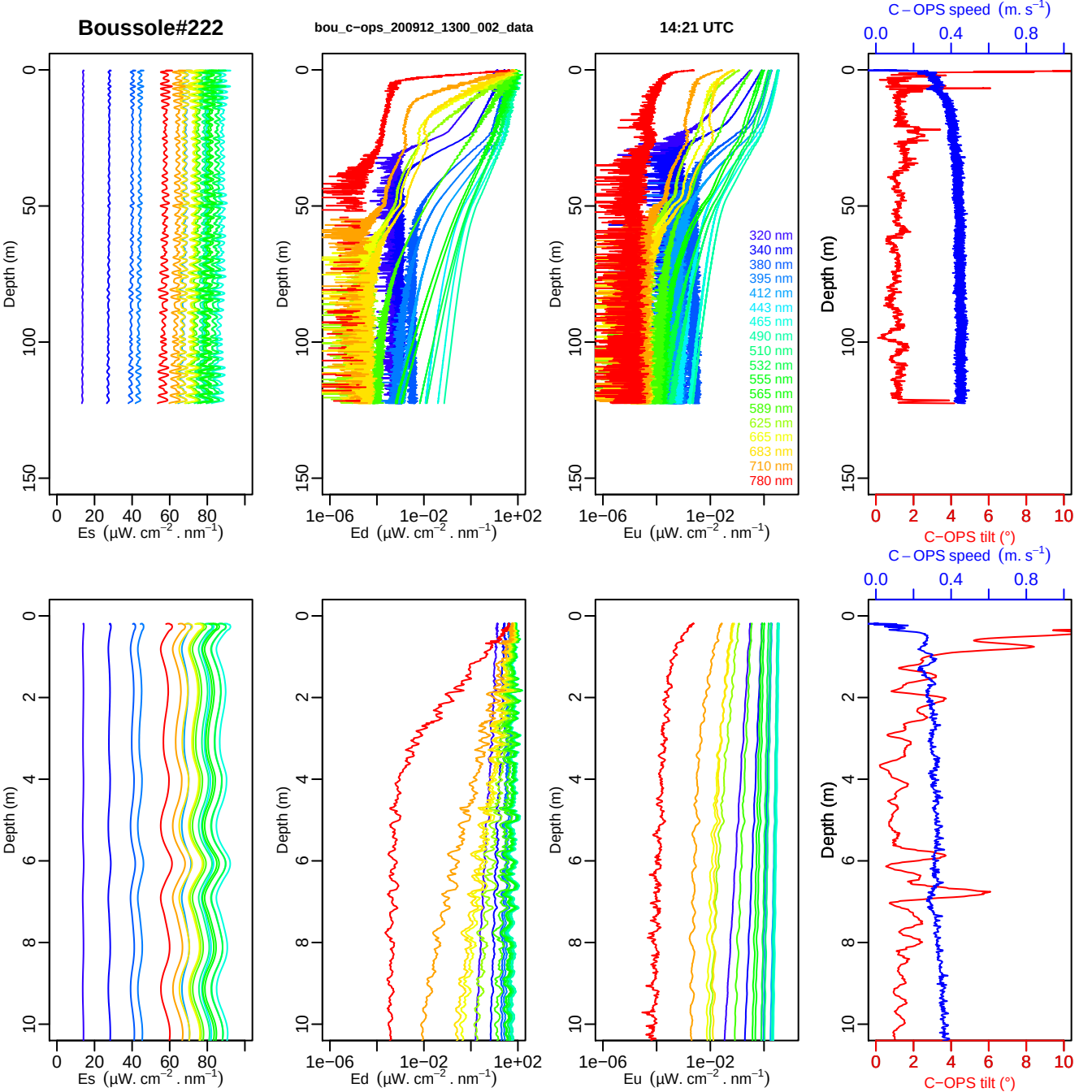
Date = 12/09/2020
Heure debut [TU] = 12:13
Longitude = 007 53.820 E
Latitude = 43 21.992 N



bous222_03

Date = 12/09/2020
Heure debut [TU] = 13:18
Longitude = 007 53.650 E
Latitude = 43 21.967 N




Boussole#222
bou_c-ops_200912_1300_002_data
14:21 UTC
Depth (m)
Es (µW. cm⁻². nm⁻¹)
Ed (µW. cm⁻². nm⁻¹)
Eu (µW. cm⁻². nm⁻¹)
C-OPS speed (m. s⁻¹)
C-OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm