BOUSSOLE Monthly Cruise Report

Cruise 247
October 18-20, 2022

Duty Chief: Melek Golbol (melek.golbol@imev-mer.fr)
Vessel: R/V Téthys II
(Captain: Dany Deneuve)

Science Personnel: Cyril Debost, Melek Golbol, Judicaël Rivier and Paco Stil

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Diving operations on the BOUSSOLE buoy

BOUSSOLE project

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

October 28, 2022

Foreword

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

BOUSSOLE is funded and supported by the following Agencies and Institutions

European Space Agency

Centre National d'Etudes Spatiales, France

Centre National de la Recherche Scientifique, France

Sorbonne Université, France

Institut de la Mer de Villefranche, France

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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. 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 replicate 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).

Projects-specific operations

In addition, water samples are to be collected at 5 m depth for dissolved oxygen (DO), total alkalinity (TA) and total inorganic carbon (TC) analysis (from March 2014) and pH analysis (from October 2021). The TA/TC samples will be processed by the National service for such analyses (SNAPOCO – LOCEAN in Paris). The DO and pH samples will be analysed in the *Institut de la Mer de Villefranche* by the MOOSE team. The results will allow checking the data collected by the pCO_2 CARIOCA sensors, the optode and the pH sensor installed on the buoy at 3 m.

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

The PCO_2 CARIOCA sensor located at 3 m depth was replaced with a newly calibrated one.

A Manta net was deployed after BOUSSOLE operations for the MOOSE program on the way back to the Nice harbour.

Data downloading from the SeapHOx sensor installed on the buoy at 3 m depth for the MOOSE program was attempted via the communication cable on the top of the buoy but failed.

A SBE25 CTD was tested at 80 m depth for the Institut de la Mer de Villefranche. This CTD, which is usually used for the national coastal observation service SOMLIT, was not working correctly and was tested during this cruise.

Cruise Summary

The first day was used for CTD casts with water sampling and for a Secchi disk at the BOUSSOLE site. Optical profiles could not be performed because of the unstable irradiance (broken clouds). C-OPS balance tests were nevertheless performed in order to check and adjust it during the descent phase of the profiles. The second day was used for diving and maintenance operations on the buoy, for C-OPS balance tests and optical profiles, for a CTD cast with water sampling and for a Secchi disk. The last day was used for C-OPS balance tests, for optical profiles, for a CTD cast with water sampling, for maintenance operations on the top of the buoy, for a Secchi disk, for the CTD test and for a Manta Net.

Tuesday 18 October 2022

The sea state was smooth with a moderate to gentle breeze. The sky was overcast/cloudy and the visibility was good. Firstly, two CTD casts with water sampling were performed at the BOUSSOLE site. For the second cast (CTD 02), a cap was put on the backscattering meter for dark measurements and a 0.2µm filter put on the a-Sphere absorption meter for the dissolved matter absorption measurements. This cast was stopped at 10 depths during the ascent of the CTD. Then, a Secchi disk measurement was performed. It was decided not to perform C-OPS profiles because of the unstable irradiance (sky too cloudy). We took advantage of that situation to perform C-OPS balance tests in order to check and adjust it during the descent phase of the profiles before returning to the Nice harbour. One of the radiometers, EdZ was just received from the manufacturer after its repair. It appeared that it was difficult to balance the C-OPS during the descent probably because the change of configuration or material inside the EdZ. It appeared it was lighter than usual.

Wednesday 19 October 2022

The sea state was smooth with a light breeze. The sky was overcast and the visibility was good. Firstly, divers went at sea to replace the PCO_2 CARIOCA sensor at 3 m depth on the buoy. They cleaned the instruments, took pictures and put caps on the transmissometers and the backscattering meter for dark measurements. Then, they switched the battery off and on. And the surface DL3 on the top of the buoy was switched off and on two times to restart the system in order to have three series of dark measurements. Solar panels and the surface sensor were also cleaned. The functioning of the buoy was checked on the top of the buoy, the surface sensor was heard working and the underwater instruments were seen working (opening of the fluorometers shutters during the measurements).
The files recorded on the surface DL3 and the battery voltage were checked with a WIFI connection. It was not possible to check the functioning of the DL3s at 4 m and 9 m depths because it was not possible to connect via the communication cable on the top of the buoy: nothing appeared on the software window when the connection was attempted. Furthermore, the seapHOx data could not be downloaded via the communication cable on the top of the buoy. A dummy plug was put on the connector of the communication cable of the seapHOx because it was missing.
Then, C-OPS balance tests were performed, only the last profile which was correct was kept on the database. Then, a CTD cast with water sampling and a Secchi disk were performed.
It appeared that the neoprene caps were forgotten on one of the transmissometers and the surface DL3 was not switched again after the WIFI connection. So, divers returned to the buoy to remove the caps and the surface DL3 was switched on before returning to the Nice harbour.

Thursday 20 October 2022

The sea state was smooth with a light breeze. The sky was overcast and the visibility was medium. Firstly, the C-OPS was readjusted and balanced again, then four C-OPS profiles and a CTD cast with water sampling were performed at the BOUSSOLE site. Then, the downloading of data from the seapHOx sensor was attempted at the top of the buoy and failed again. Then, a Secchi disk and a 80-m deeep CTD test were performed. Finally, a Manta horizontal net was deployed on the way back to the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/4ZokKg962ZyyFmWN9

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

Cruise Report

Tuesday 18 October 2022 (UTC)

People on board: Melek Golbol and Paco Stil

0630 Departure from the Nice harbour.
1000 Arrival at the BOUSSOLE site.
1010 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, and a_p.
1045 no C-OPS: unstable irradiance and cloudy sky.
1205 CTD 02, 400 m with water sampling at 5 m for TSM (with a 0.2 µm filter on a-Sphere and with 2 minutes stop at 400, 150 m and 7 minutes stop at 80, 60, 50, 40 m) (with cap on the HS6).
1225 Secchi 01, 27 m.
1255 C-OPS balance tests.
1400 Departure to the Nice harbour.
1715 Arrival to the Nice harbour.

Wednesday 19 October 2022 (UTC)

People on board: Cyril Debost, Melek Golbol, Judicaël Rivier and Paco Stil

0530 Departure from the Nice harbour.
0845 Arrival at the BOUSSOLE site.
0900 Diving operations: replacing of pCO_2 sensor, cleaning, dark measurements, pictures.
Maintenance on the top of the buoy: functional checking, solar panels cleaning.
Attempt of seapHOx data downloading.
1030 Lunch.
1140 Installation of the cap on the communication cable of the seapHOx sensor.
1215 C-OPS balance tests.
1310 C-OPS 01.
1340 CTD 01, 400 m with water sampling at 400, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p, TSM, TA/TC, DO and pH.
1425 Secchi 02, 27 m.
1400 Departure to the Nice harbour.
1415 Diving operation: removing of cap on transmissometer.
Switching on the surface DL3 on the top of the buoy.
1430 Departure to the Nice harbour.
1800 Arrival to the Nice harbour.

Thursday 20 October 2022 (UTC)

People on board: Melek Golbol and Paco Stil

0630 Departure from the Nice harbour.
1000 Arrival at the BOUSSOLE site.
1005 C-OPS balance tests.
1015 C-OPS 02, 03, 04, 05.
1120 CTD 04, 400 m with water sampling at 400, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p and TSM.
1200 Attempt of seapHOx data downloading: failed.
1245 Secchi 03, 25 m.
1225 CTD SBE25 test, 80 m.
1250 Manta horizontal net (MOOSE program).
1330 Departure to the Nice harbour.
1700 Arrival to the Nice harbour.

Problems identified during the cruise

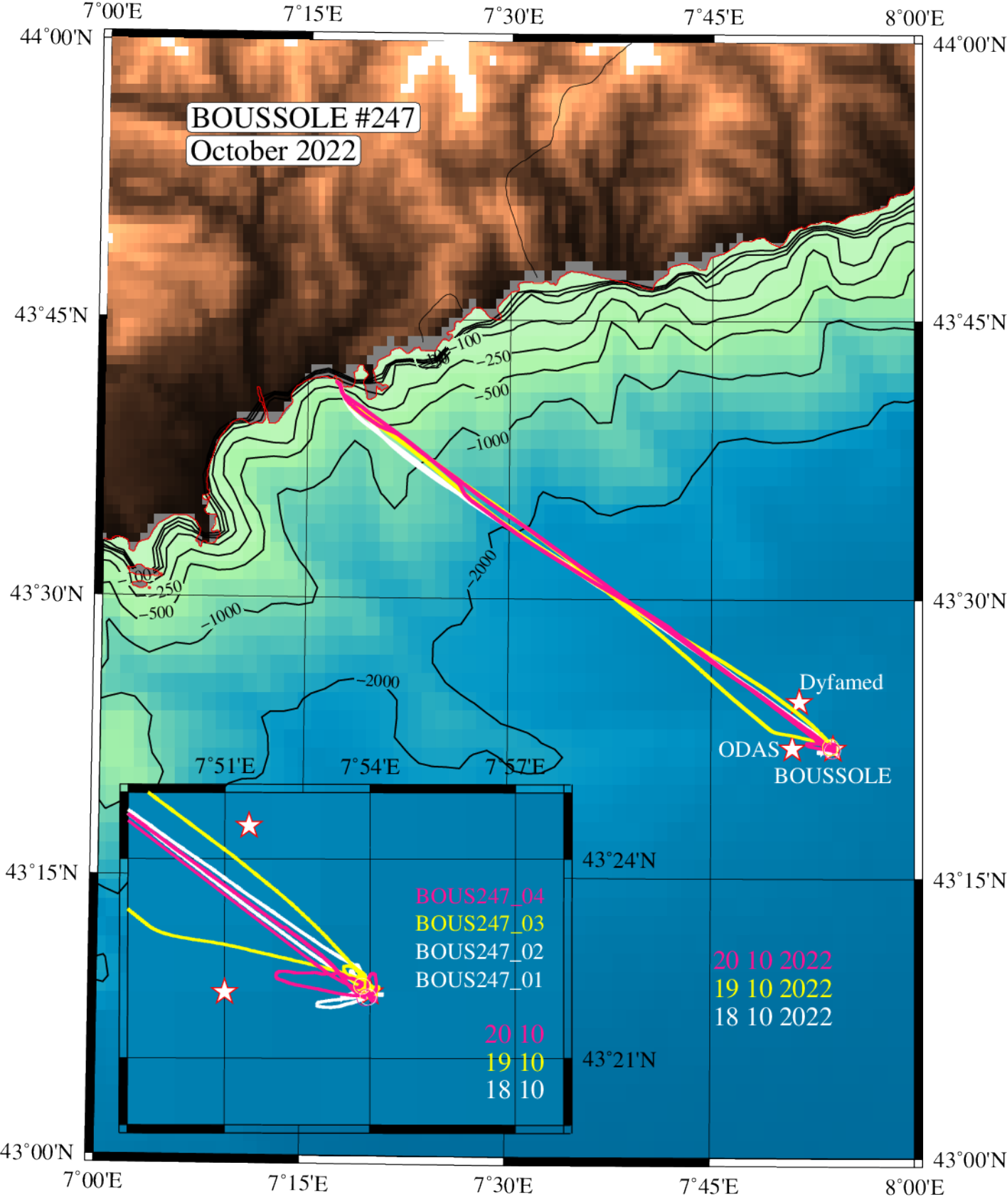
- The BOUSSOLE C-OPS EdZ radiometer (S/N #152) was returned from the manufacturer after repair. It was difficult to balance and adjust the C-OPS for the descent phase of the profiles because its configuration was probably modified. The EdZ radiometer appeared to be much lighter than before its repair. This issue was solved by adding 140 g of weight in the frame on the EdZ side.

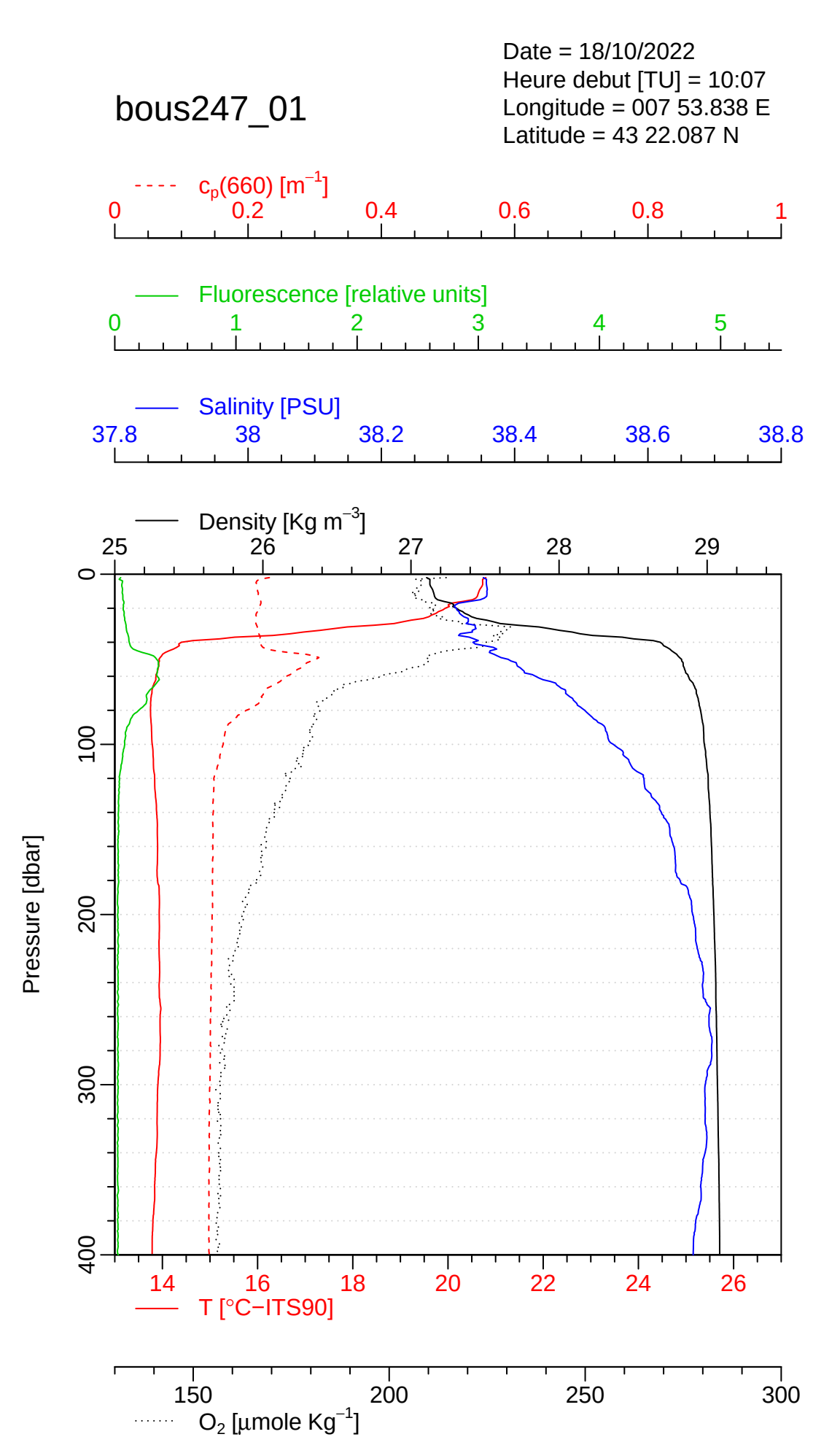
- It was not possible to check the functioning of the DL3s at 4 m and 9 m depths because it was not possible to connect via the communication cable on the top of the buoy: nothing appeared on the software window when the connection was attempted. The communication cable was suspected to be faulty. However, the underwater instruments were seen working by the divers.

Appendices

Cruise Summary Table for Boussole 247

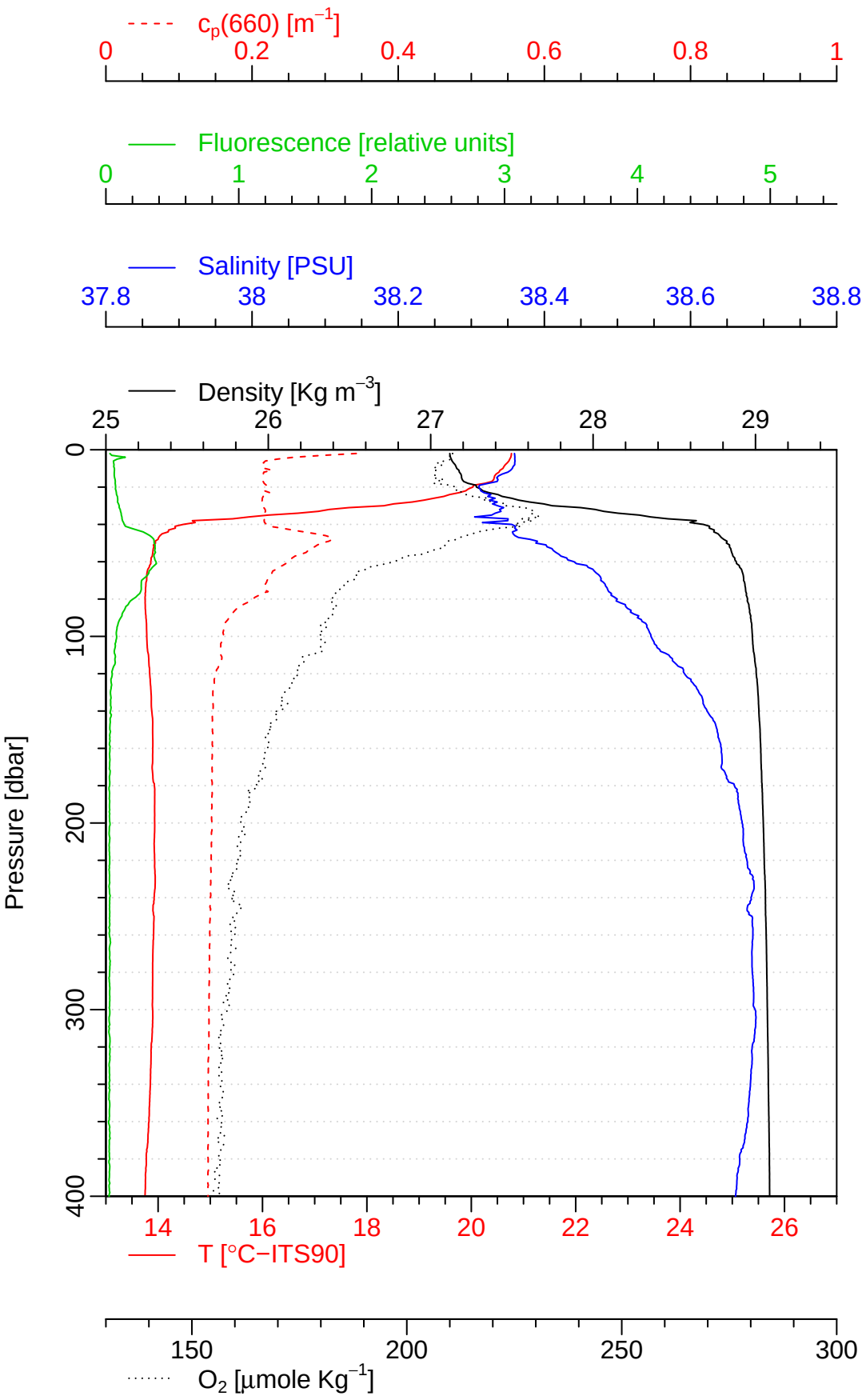
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather							Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(hour.min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
18/10/22			BOUS247_01	HPLC & ap	10:07	0:29:00	400	43	22.087	7	53.838	overcast		6	13.6	21	1027	87.5		20.6	19.80	smooth			
			BOUS247_02	TSM	11:16	1:22:00	400	43	21.926	7	53.965	cloudy		4	7.3	30	1026	86.9		20.9	19.80	smooth			
				Secchi 01	12:25	0:04:00	27	43	22	7	54	cloudy		4					good			smooth			
19/10/22		bou_c-ops_221019_1208_007_data.csv			13:12	0:04:25	116	43	22.368	7	53.665	overcast	St	6	1.1	258	1020	76	good	20.6		smooth	0.2		no
			BOUS247_03	HPLC, ap, TSM, TA/TC, O_2 & pH	13:41	0:26:00	400	43	22.098	7	53.830	overcast		7	3.5	323	1020	77.6		20.3	20.80	calm			
				Secchi 02	14:25	0:04:00	27	43	22	7	54	overcast		7					good			calm			
20/10/22		bou_c-ops_221020_1000_002_data.csv			10:13	0:03:44	89	43	22.199	7	53.543	overcast	Cs	4	3.3	196	1021	78.9	medium	20.1		smooth	0.2		no
		bou_c-ops_221020_1000_003_data.csv			10:23	0:03:21	81	43	22.28	7	53.294	overcast	Cs	4	3.3	196	1021	78.9	medium	20.1		smooth	0.2		no
		bou_c-ops_221020_1000_004_data.csv			10:37	0:04:29	110	43	22.281	7	52.942	overcast	Cs	4	3.3	196	1021	78.9	medium	20.1		smooth	0.2		no
		bou_c-ops_221020_1000_005_data.csv			10:48	0:03:43	91	43	22.286	7	52.547	overcast	Cs	4	3.3	196	1021	78.9	medium	20.1		smooth	0.2		no
			BOUS247_04	HPLC, ap & TSM	11:20	0:30:00	400	43	21.914	7	53.898	overcast		8	0.3	202	1020	79.4		20.1	20.80	calm			
				Secchi 03	12:45	0:04:00	25	43	22	7	54	overcast		0					medium			calm			


BOUSSOLE #247
October 2022
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
BOUS247_04
BOUS247_03
BOUS247_02
BOUS247_01
20 10 2022
19 10 2022
18 10 2022
20 10
19 10
18 10


bous247_01
Date = 18/10/2022
Heure debut [TU] = 10:07
Longitude = 007 53.838 E
Latitude = 43 22.087 N
cp(660) [m−1]
0
0.2
0.4
0.6
0.8
1
Fluorescence [relative units]
0
1
2
3
4
5
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
300
O2 [µmole Kg−1]

bous247_02

Date = 18/10/2022
Heure debut [TU] = 11:16
Longitude = 007 53.965 E
Latitude = 43 21.926 N



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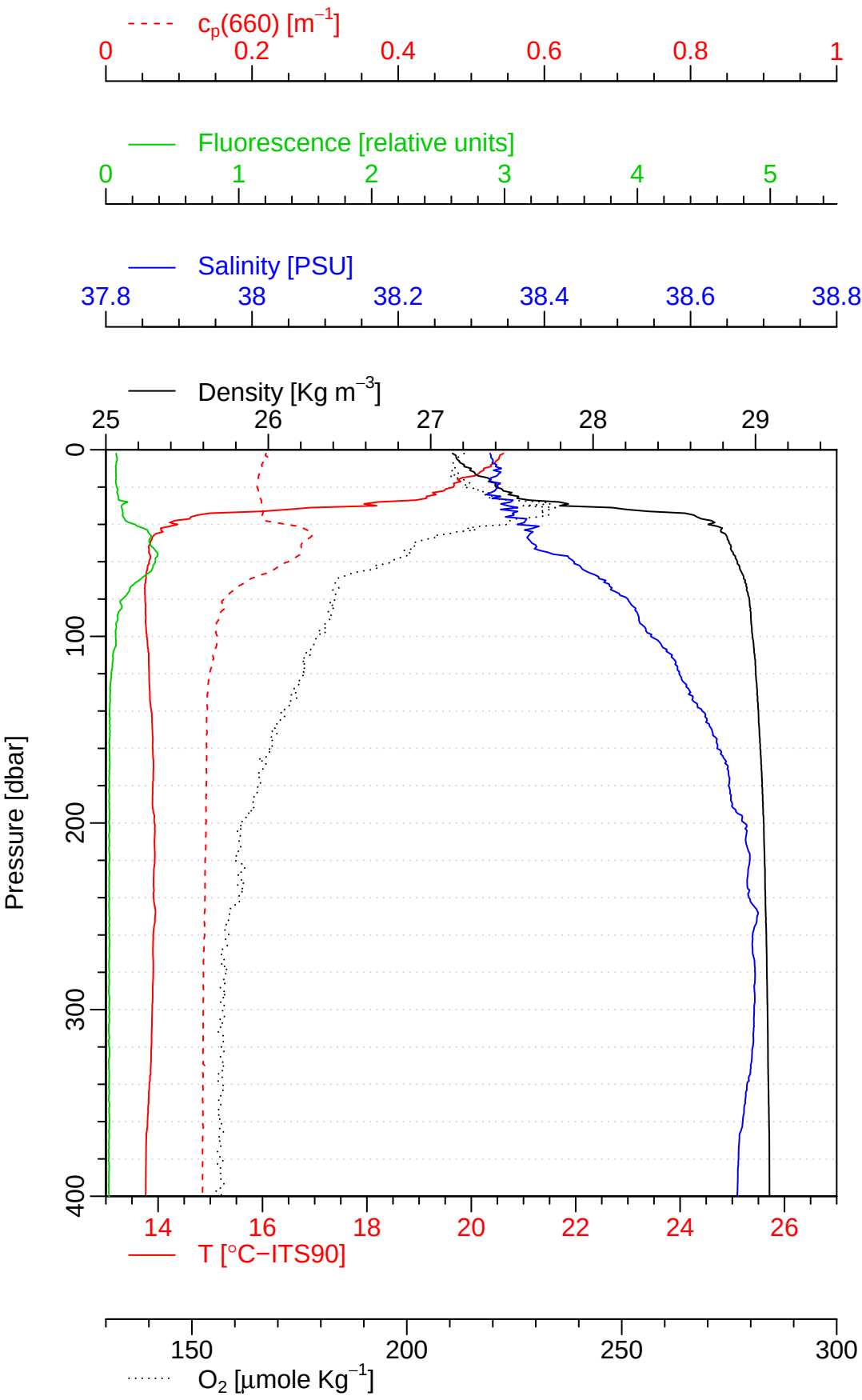
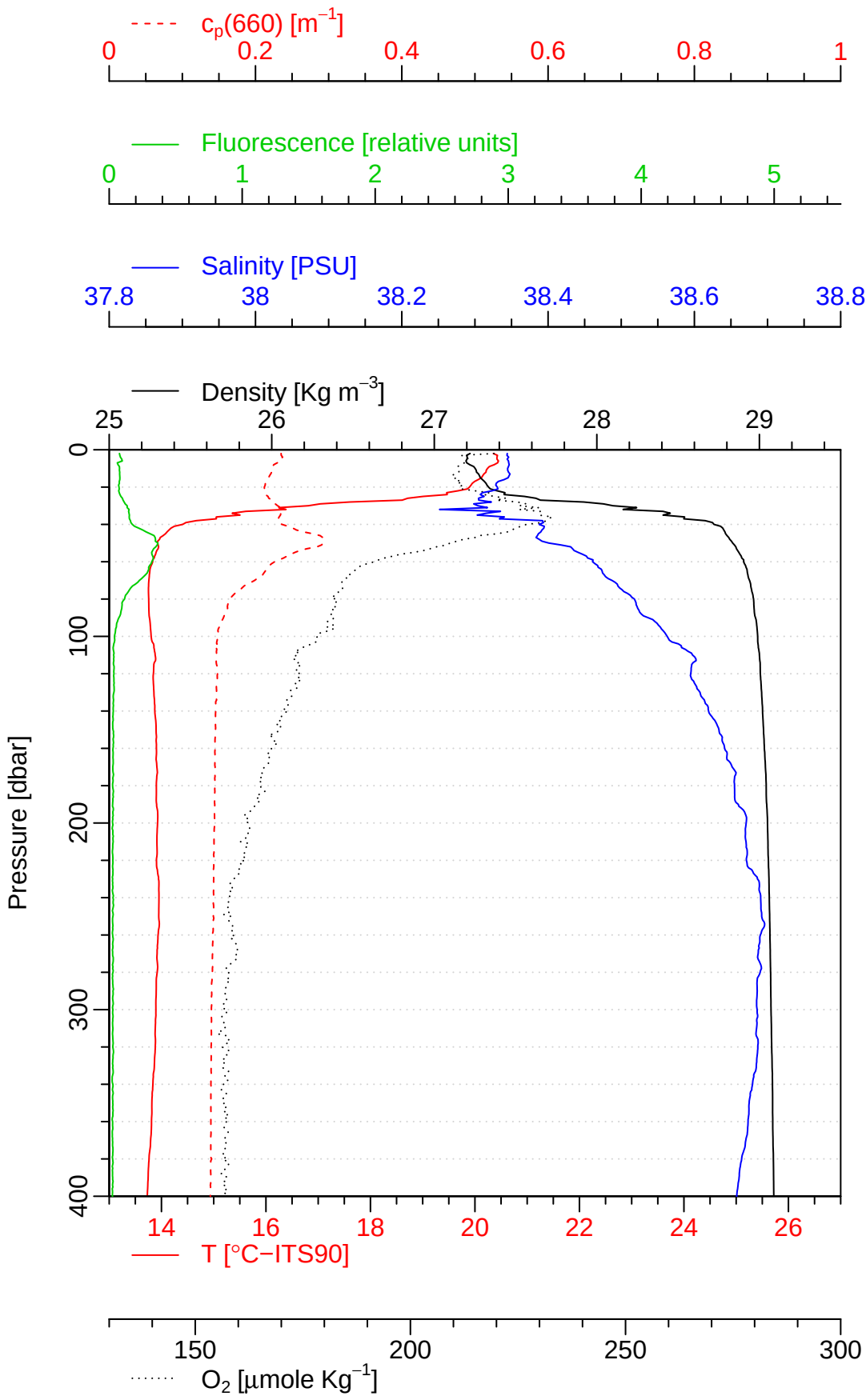
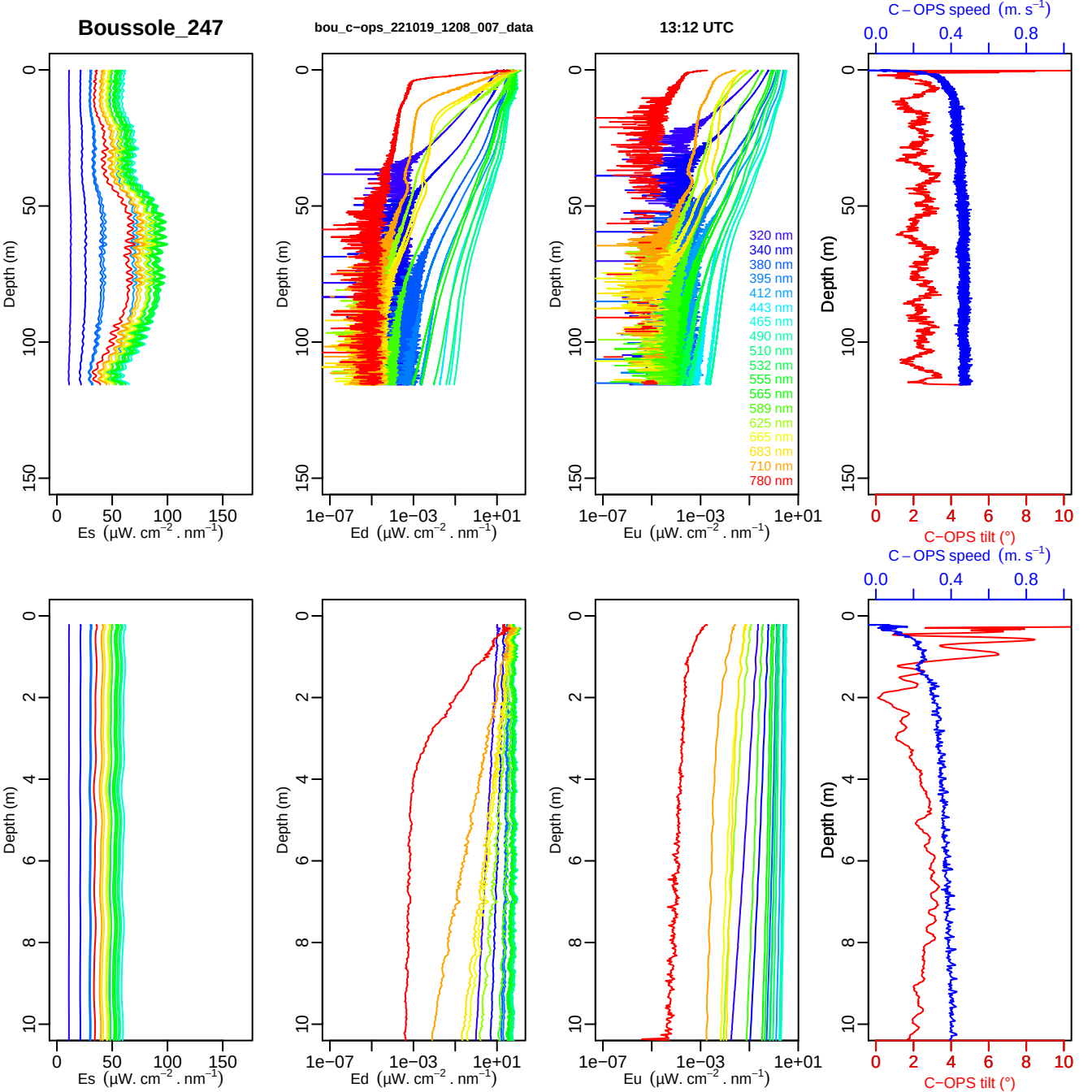
Latitude = 43 22.098 N

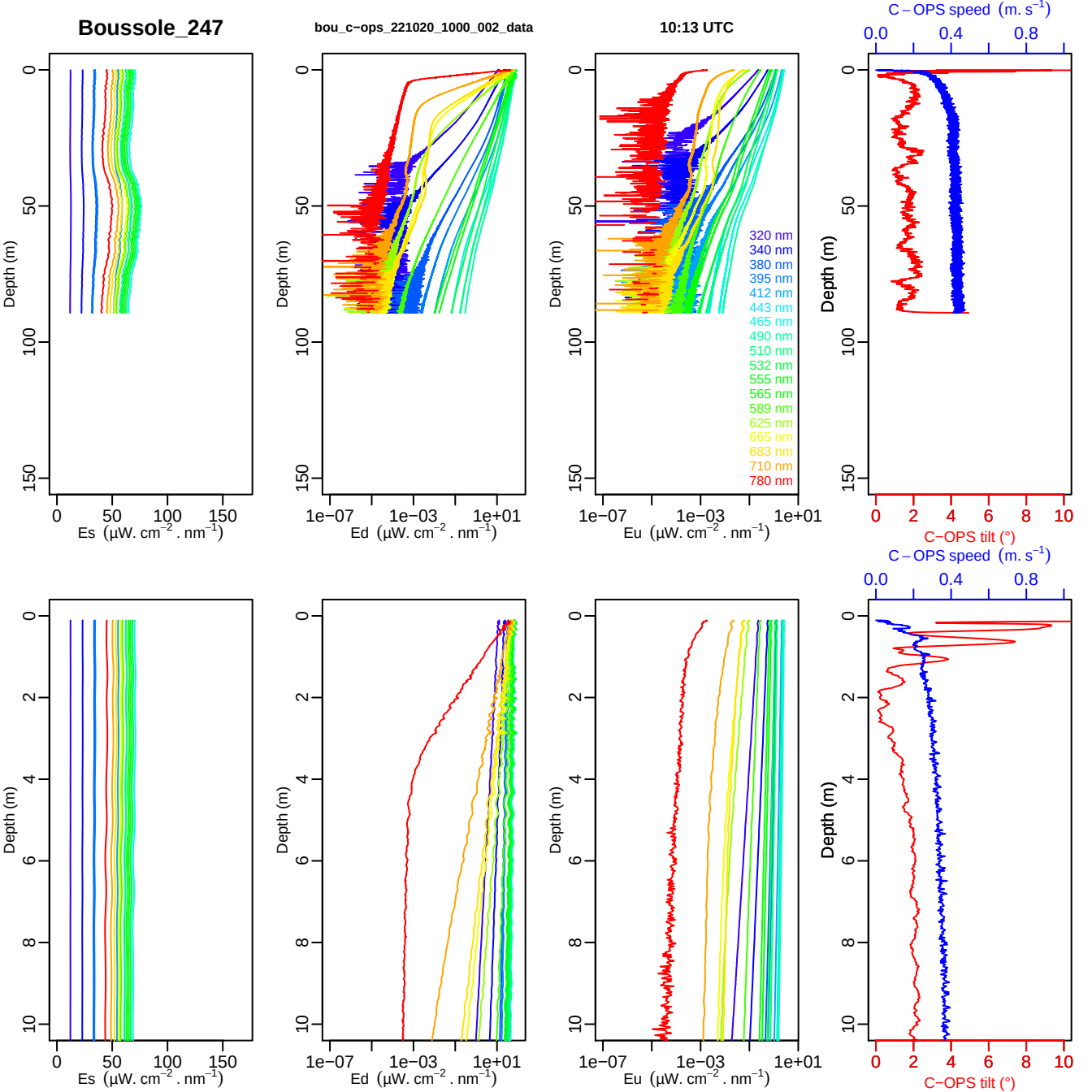


bous247_04

Date = 20/10/2022
Heure debut [TU] = 11:20
Longitude = 007 53.898 E
Latitude = 43 21.914 N




Boussole_247
bou_c-ops_221019_1208_007_data
13:12 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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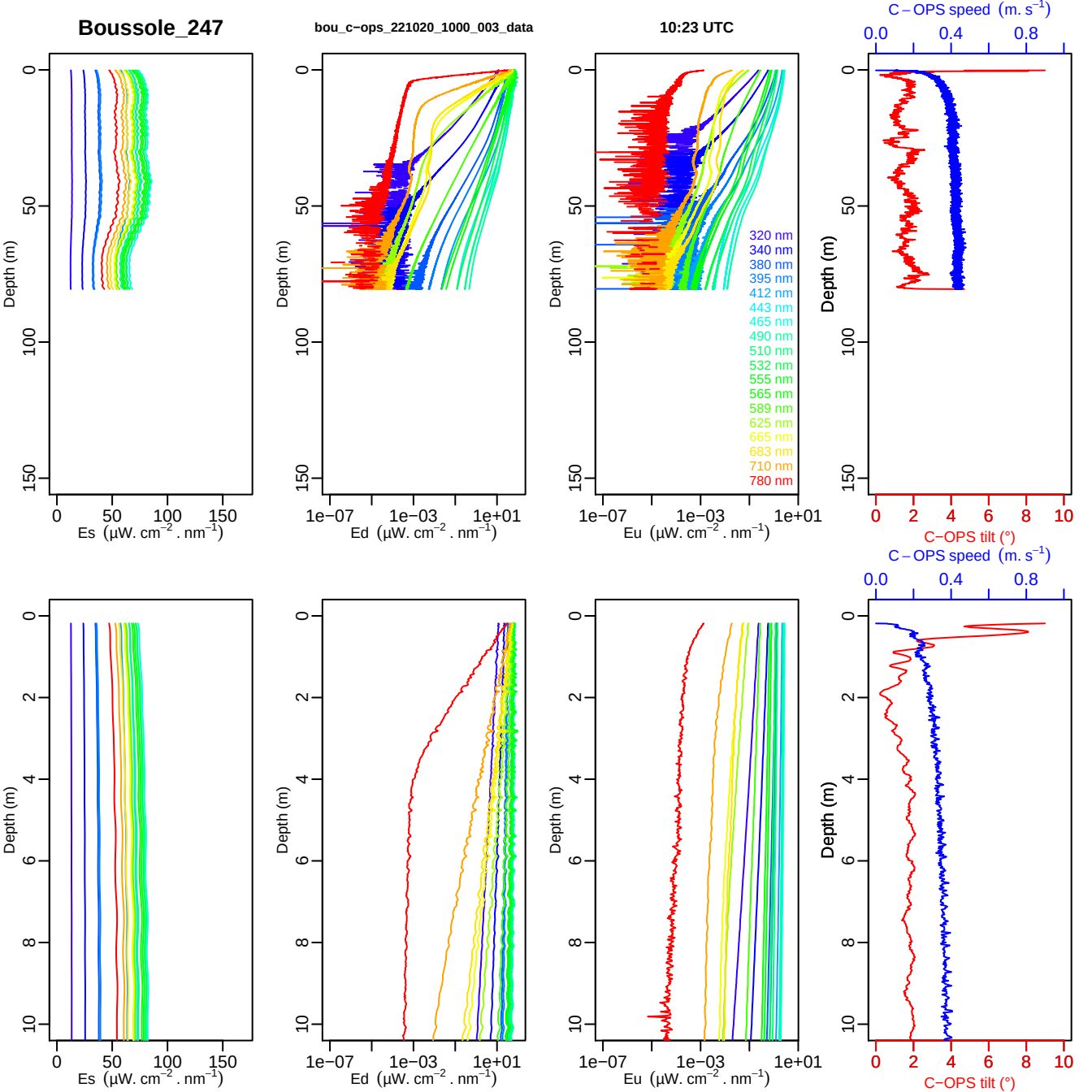
10:13 UTC
Depth (m)
Es (µW. cm⁻². nm⁻¹)
Ed (µW. cm⁻². nm⁻¹)
Eu (µW. cm⁻². nm⁻¹)
C – OPS speed (m. s⁻¹)
C–OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm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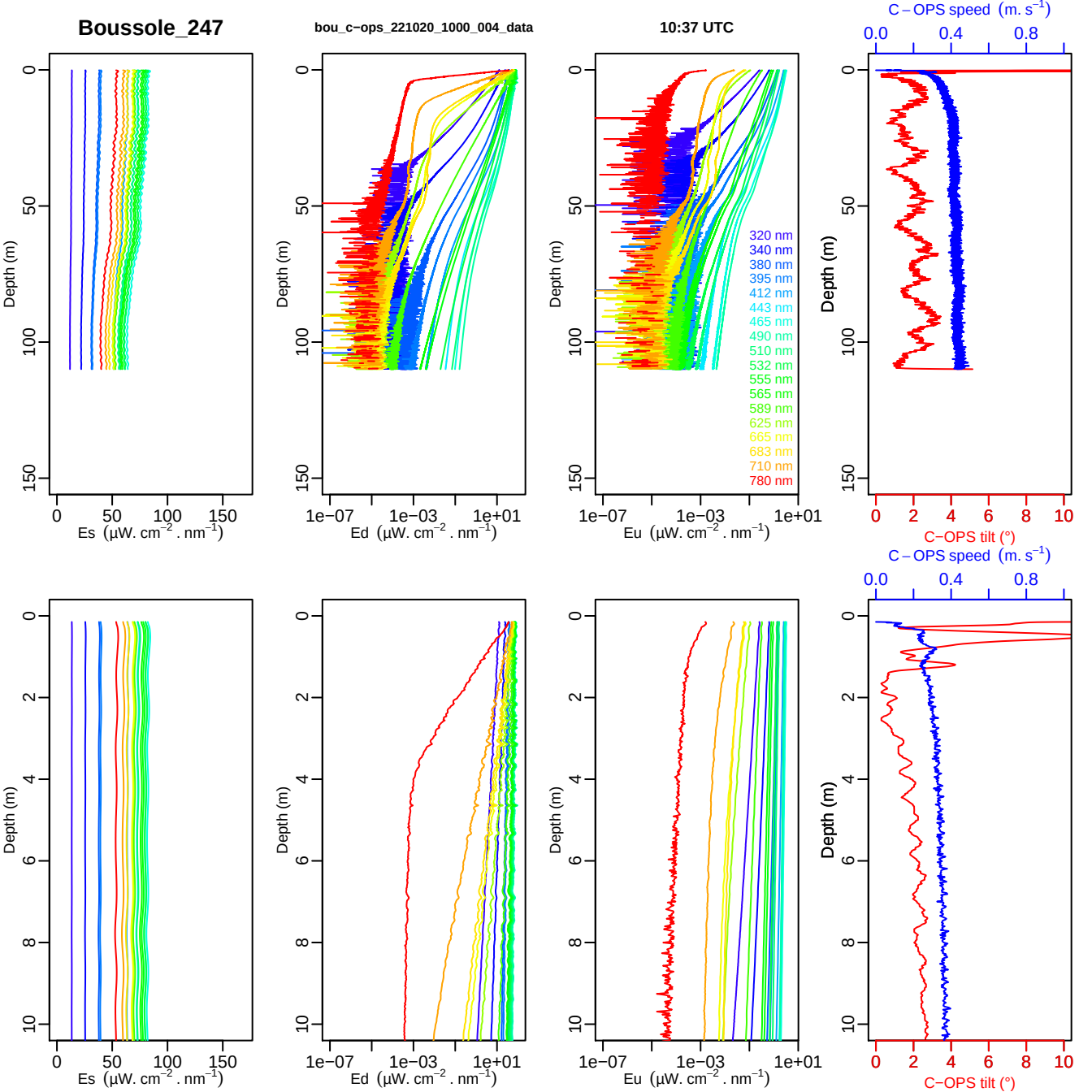
Depth (m)
Es (µW. cm^{-2}. nm^{-1})
Ed (µW. cm^{-2}. nm^{-1})
Eu (µW. cm^{-2}. nm^{-1})
C-OPS speed (m. s^{-1})
C-OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm


Boussole_247
bou_c-ops_221020_1000_004_data
10:37 UTC
C – OPS speed (m. s^{-1})
0.0
0.4
0.8
Depth (m)
0
50
100
150
Es (µW. cm^{-2}. nm^{-1})
Ed (µW. cm^{-2}. nm^{-1})
Eu (µW. cm^{-2}. nm^{-1})
1e−07
1e−03
1e+01
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
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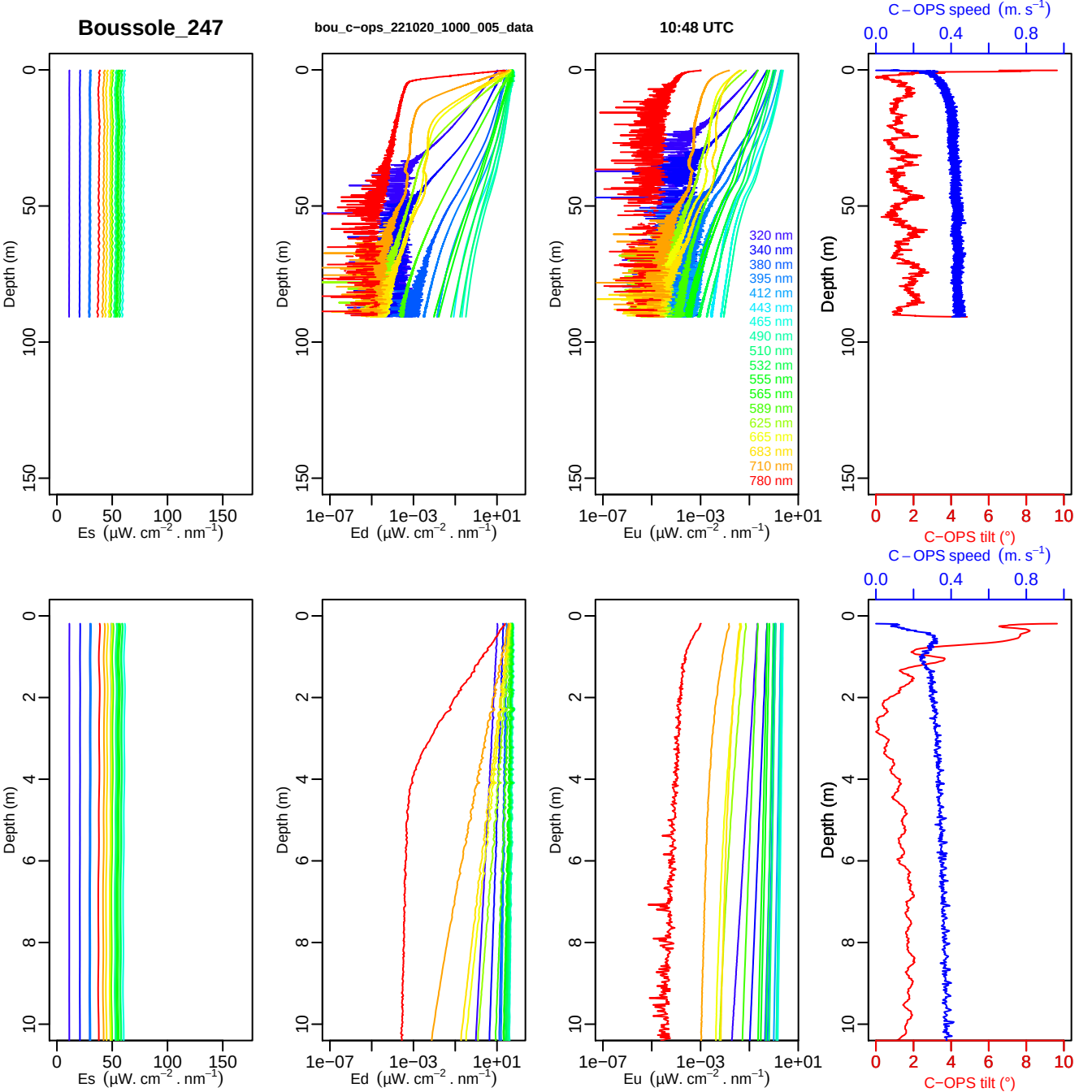
683 nm
710 nm
780 nm
C−OPS tilt (°)
0
2
4
6
8
10


Boussole_247
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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