BOUSSOLE Monthly Cruise Report

Cruise 254
May 07 & 09, 2023

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

Science Personnel: Hugo Berrenger, Olivier Bun, Bastien Gaucher, Melek Golbol, Juliette Maury and Paco Stil

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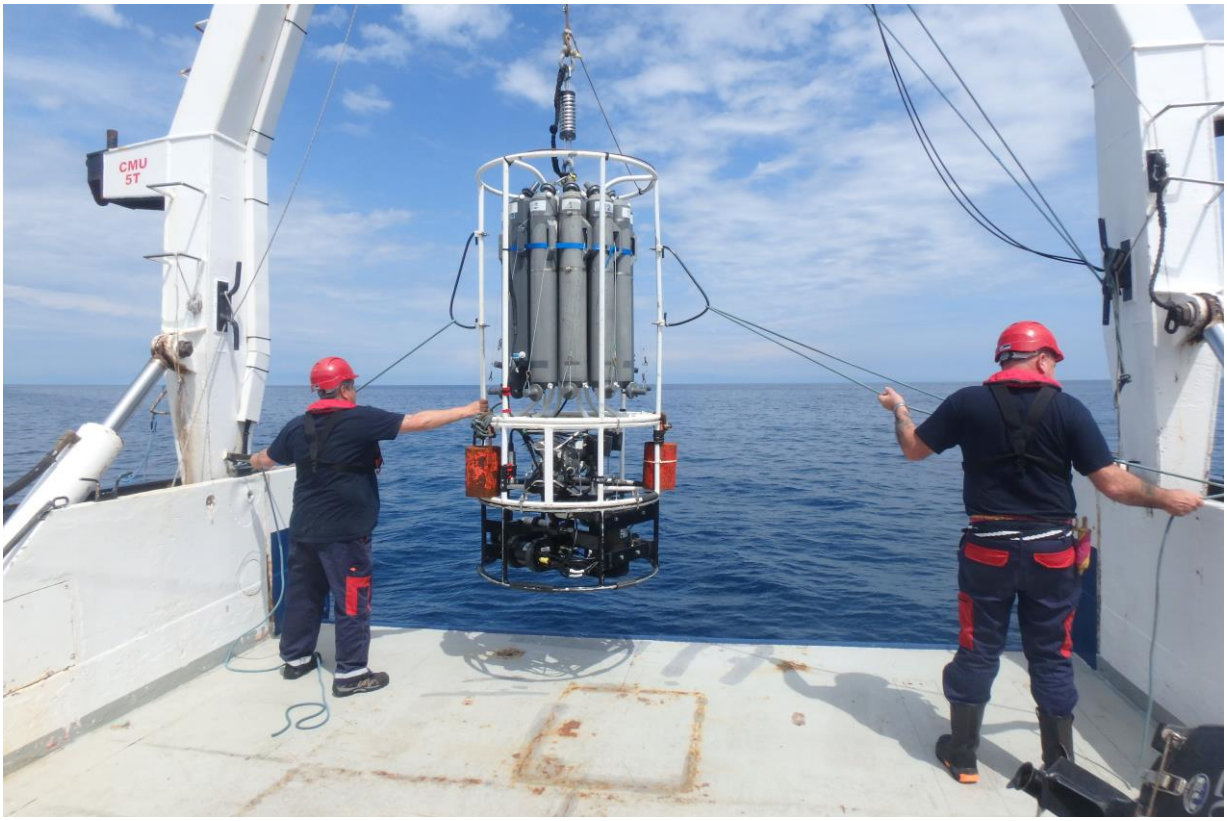

Deployment of the CTD Rosette + IOP package at the BOUSSOLE site from the deck of the R/V *Téthys II*.

BOUSSOLE project

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

May 26, 2023

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

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Contents

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 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, the DO and pH sensors 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

Data were downloaded from the SeapHOx sensor installed on the buoy at 3 m depth for the MOOSE program.

Cruise Summary

The BOUSSOLE cruise was initially planned on May 8th-9th but the first day was swapped with the DYFAMED cruise which was initially planned on May 7th, because the weather forecasts were better for diving operations. So, the first day was used for CTD casts with water sampling, an optical profile, a Secchi disk and diving operations at the BOUSSOLE site. The last day was used for optical profiles, CTD casts with water sampling at the BOUSSOLE site and for downloading data from the SeapHOx sensor on the BOUSSOLE buoy.

Sunday 7 May 2023

The sea state was smooth with a light to gentle breeze. The sky was cloudy to overcast and the visibility was good. Firstly, a CTD cast was performed at the BOUSSOLE site at 50 m depth with water sampling and a cap put on the backscattering meter for dark measurements. Then a CTD cast with water sampling and 1 C-OPS profile were performed at the BOUSSOLE site. It was not possible to perform other C-OPS casts because the sky became hazy

after the first one with unstable surface irradiance. Finally, divers went at sea to clean the buoy instruments, to take pictures and to put a cap on the backscattering meter for dark measurements. 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 divers switched the battery off and on, to restart the system in order to create new acquisitions files but it failed. However, the DL3 at 4 m and 9 m depths were restarted and the underwater instruments were seen working. In the meantime, the surface DL3 on the top of the buoy was restarted and switched off and on three times in order to have three series of dark measurements. The files recorded on the surface DL3 and the battery voltage were checked with a WIFI connection. The solar panels and the surface sensor were cleaned.

Tuesday 9 May 2023

The sea state was slight with a calm breeze in the morning and a light air to light breeze in the afternoon. The sky was blue and the visibility was good. Firstly, three C-OPS profiles and a CTD cast with water sampling were performed at the BOUSSOLE site. Then, data were downloaded from the SeapHOx sensor installed on the buoy at 3 m depth for the MOOSE program. Then, a CTD cast with water sampling was performed at the BOUSSOLE site with a cap 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. Finally, a Secchi disk was performed before returning to the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/jE21mvaorJnhHuqp9

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

Cruise Report

Sunday 7 May 2023 (UTC)

People on board: Hugo Berrenger (technician), Olivier Bun (technician), Bastien Gaucher (diver), Melek Golbol, Juliette Maury (diver) and Paco Stil.

0640 Departure from Nice harbour.
1000 Arrival at the BOUSSOLE site.
1025 CTD 01, 50 m with water sampling at 5 m for TSM (with cap on the HS6).
1050 CTD 02, 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.
1155 C-OPS 01.
1235 Diving operations: cleaning, functional checking, dark measurements, pictures.
Maintenance on the top of the buoy: functional checking, sensor and solar panels cleaning.
1340 End of diving operations.
1355 Secchi 01, 16 m.
1400 Departure to the Nice harbour.
1700 Arrival at the Nice harbour.

Tuesday 9 May 2023

People on board: Hugo Berrenger, Olivier Bun, Melek Golbol and Paco Stil.

0630 Departure from Nice harbour.
0935 Arrival at the BOUSSOLE site.
1000 C-OPS 02, 03, 04.
1110 CTD 03, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p, DO, TA/TC and pH.
1200 Data downloading from the SeapHOx sensor (MOOSE program).
1250 CTD 04, 400 m with water sampling at 5 m for HPLC and a_p (5 m) and 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).

1350 Secchi 01, 15 m.
1420 Departure to the Nice harbour.
1745 Arrival at the Nice harbour.

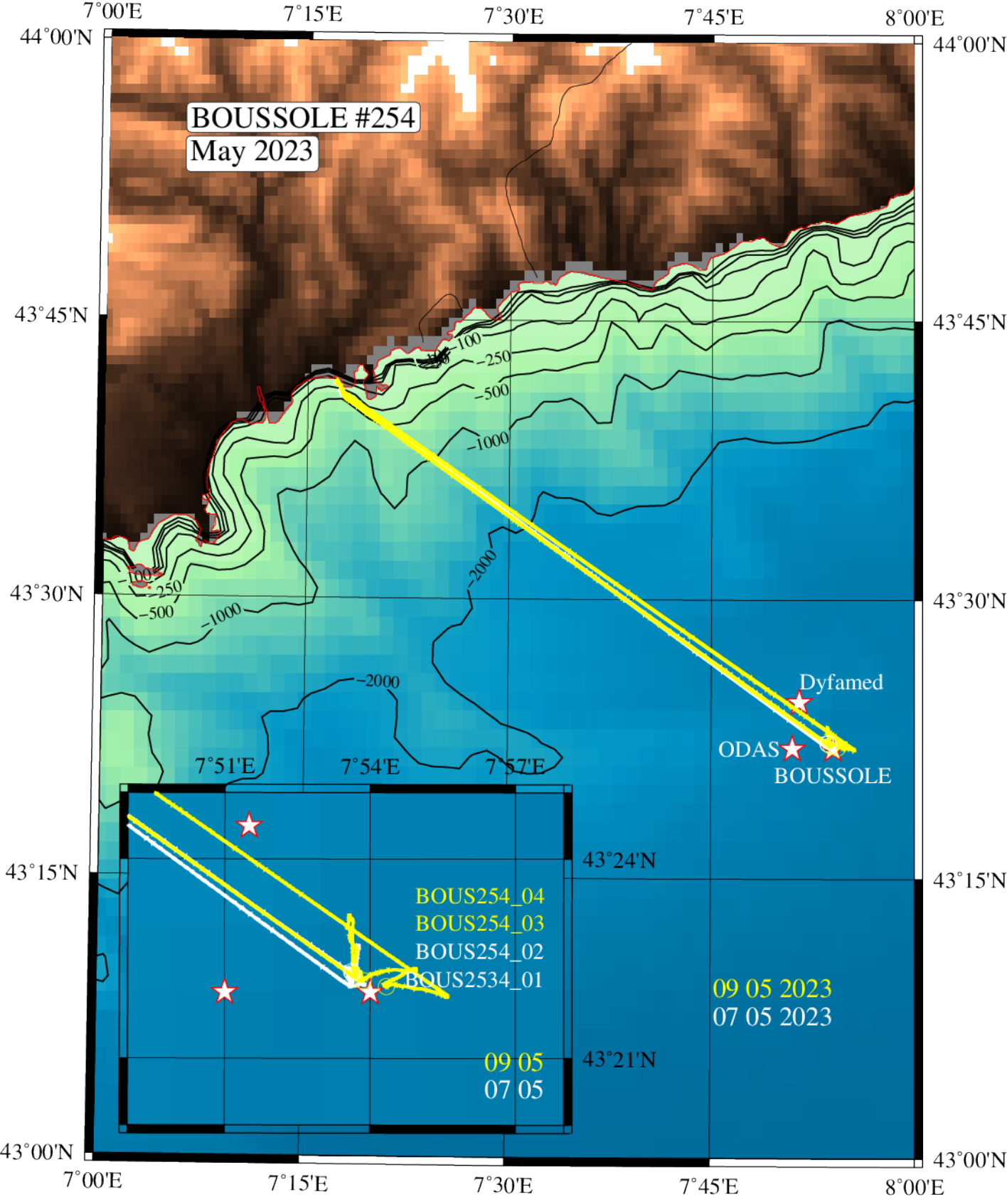
Problems identified during the cruise

- CTD 03: there was not enough water to sample for HPLC and a_p parameters at 5 m depth. So, these parameters were sampled at 5 m depth from the CTD 04.

Appendices

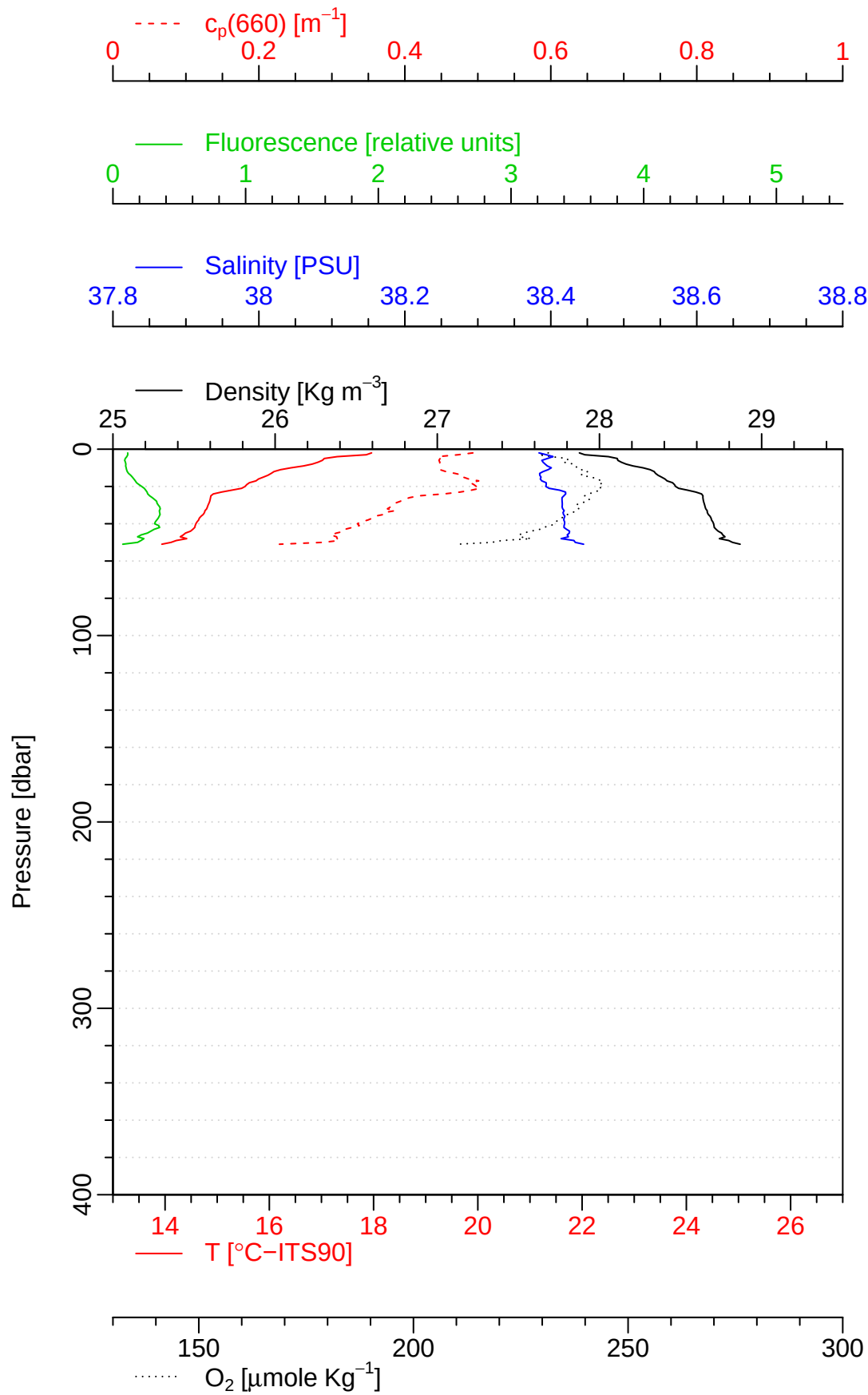
Cruise Summary Table for Boussole 254

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
07/05/23			BOUS254_01	TSM	10:24	0:06:00	400	43	22.283	7	53.641	cloudy		4	7.8	80	1017	83		17.7	18.8	smooth			
			BOUS254_02	HPLC & ap	10:48	0:36:00	400	43	22.299	7	53.622	blue		3	5.6	90	1017	79		18	19.0	smooth			
		bou_c-ops_230507_1140_003_data.csv			11:52	0:04:22	101	43	22.376	7	53.658	overcast	Ac/As	7	5.2	120	1017	79	good	18.2		smooth	0.2		no
				Secchi 01	13:55	0:04:00	16	43	22	7	54	overcast							good			smooth			
08/05/23	DYFAMED cruise																								
09/05/23		bou_c-ops_2300509_0944_001_data.csv			10:01	0:06:21	159	43	22.395	7	53.689	blue	Ci/Cc	2	0.7	125	1016	81.8	good	19.8		smooth	0.3		no
		bou_c-ops_2300509_0944_003_data.csv			10:23	0:06:35	168	43	22.762	7	53.601	blue	Ci/Cc	2	0.7	125	1016	81.8	good	19.8		smooth	0.3		no
		bou_c-ops_2300509_0944_004_data.csv			10:37	0:07:00	179	43	22.969	7	53.441	blue	Ci/Cc	2	0.7	125	1016	81.8	good	19.8		smooth	0.3		no
			BOUS254_03	HPLC, ap, TA/TC, DO & pH	11:11	0:35:00	400	43	22.171	7	53.860	blue		2	1.9	120	1015	82		19.4	17.9	smooth			
			BOUS254_04	HPLC, ap (5m) & TSM	12:51	1:27:00	400	43	22.08	7	54.340	blue		3	6	230	1015	80		19.7	17.9	smooth			
				Secchi 02	13:50	0:04:00	15	43	22	7	54.000	blue							good			smooth			


BOUSSOLE #254
May 2023
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
BOUS254_04
BOUS254_03
BOUS254_02
BOUS2534_01
09 05 2023
07 05 2023
09 05
07 05

bous254_01

Date = 07/05/2023
Heure debut [TU] = 10:24
Longitude = 007 53.641 E
Latitude = 43 22.283 N



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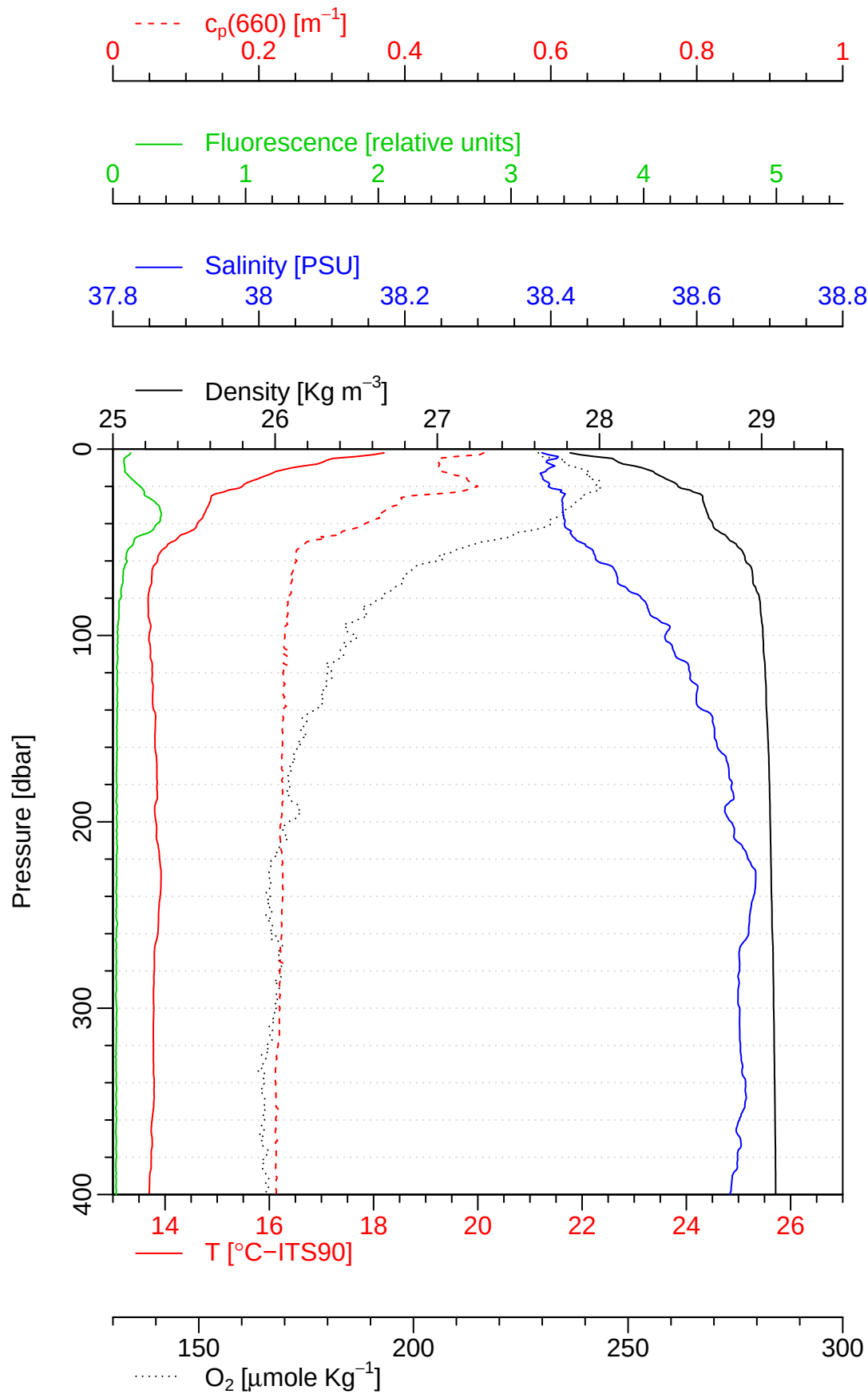
Latitude = 43 22.299 N



bous254_03

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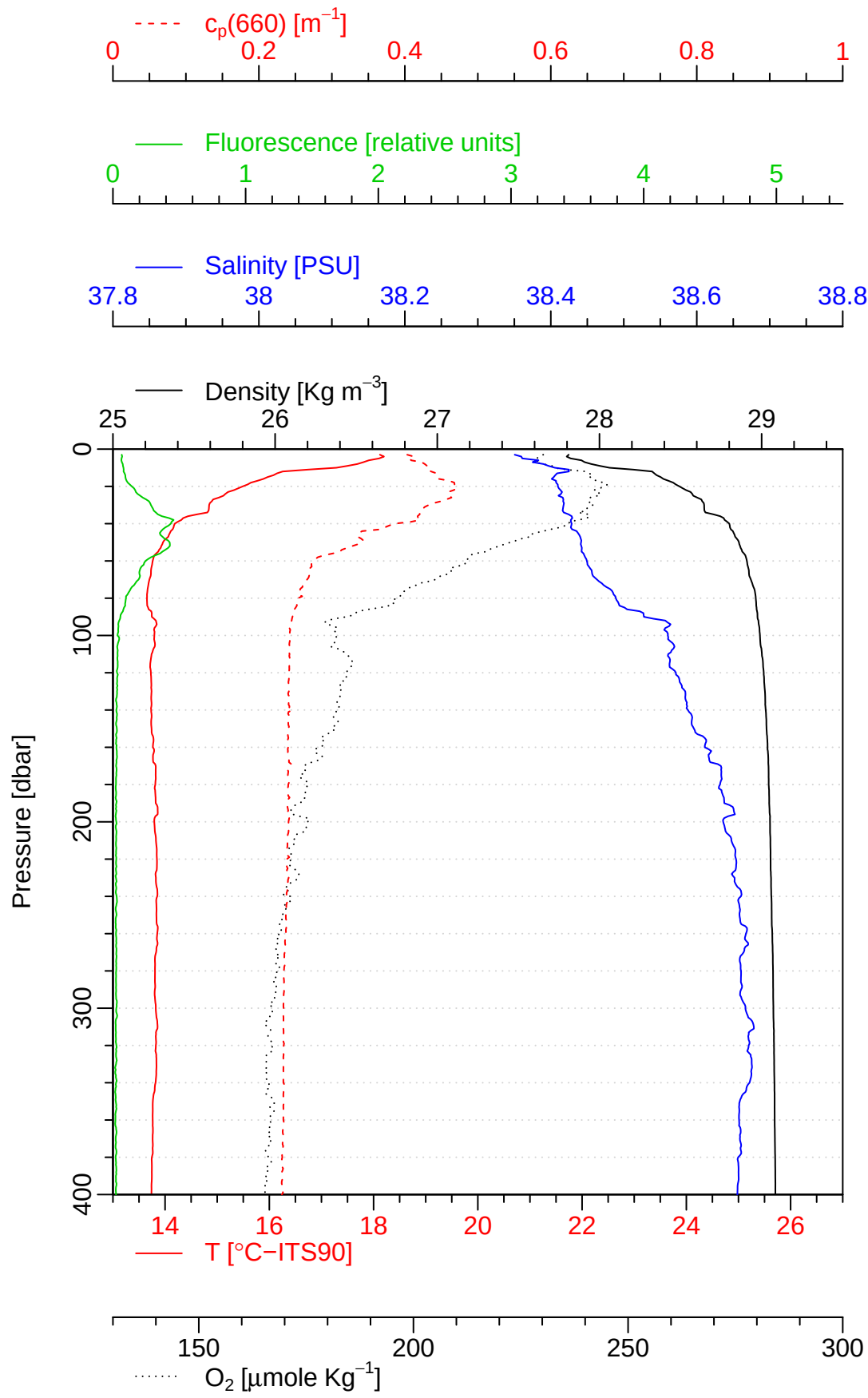
Heure debut [TU] = 11:11
Longitude = 007 53.860 E
Latitude = 43 22.171 N



bous254_04

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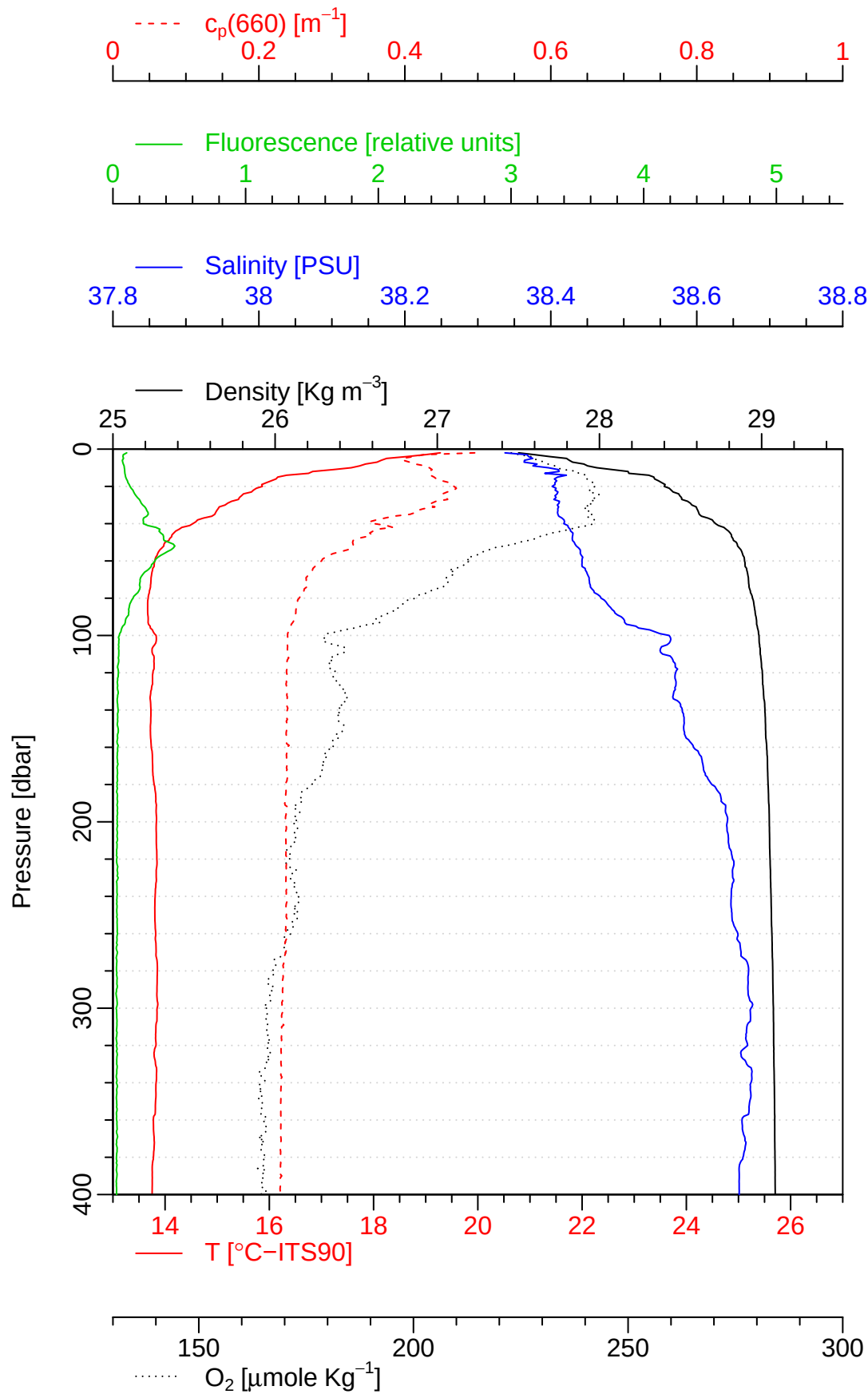
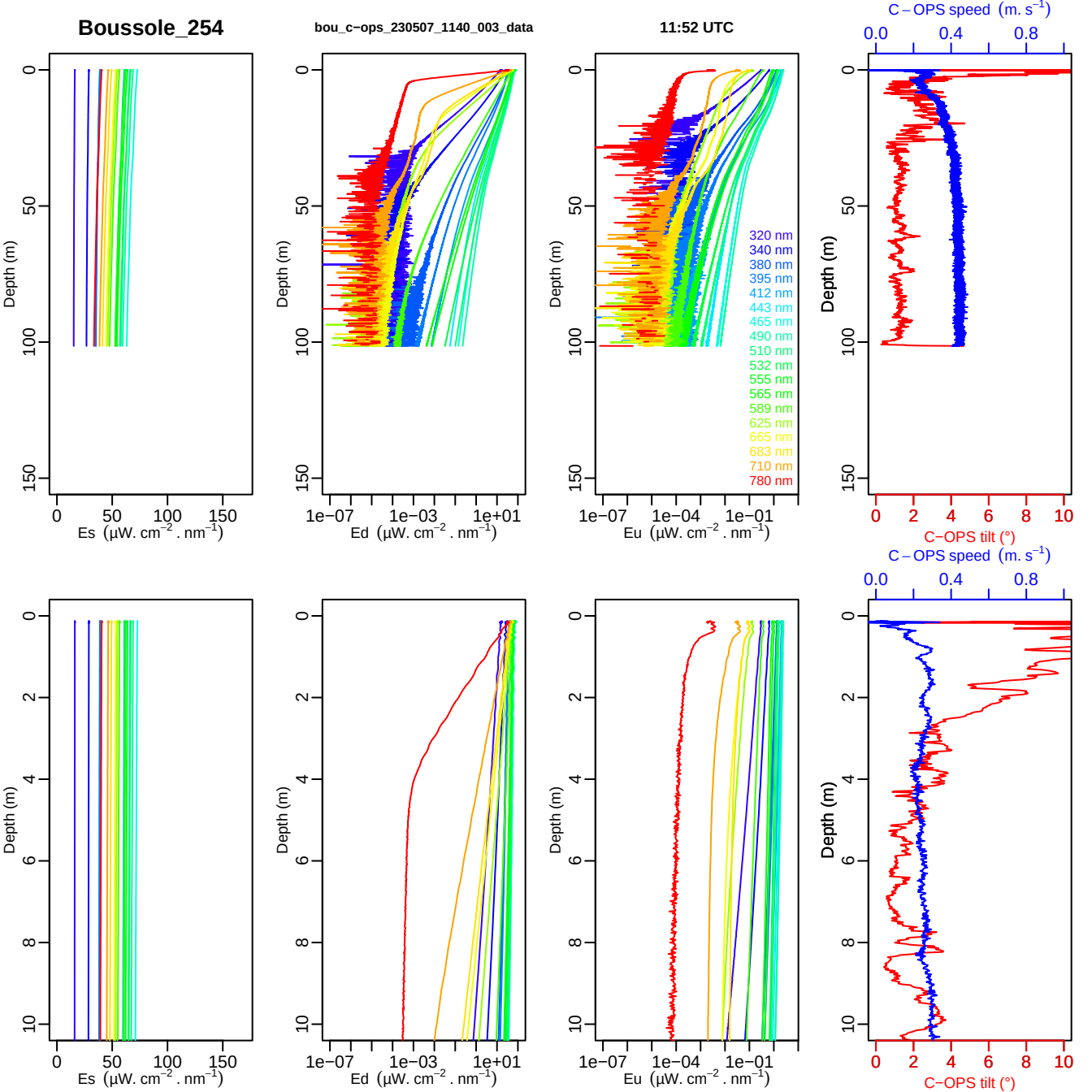
Longitude = 007 54.340 E
Latitude = 43 22.080 N




Boussole_254
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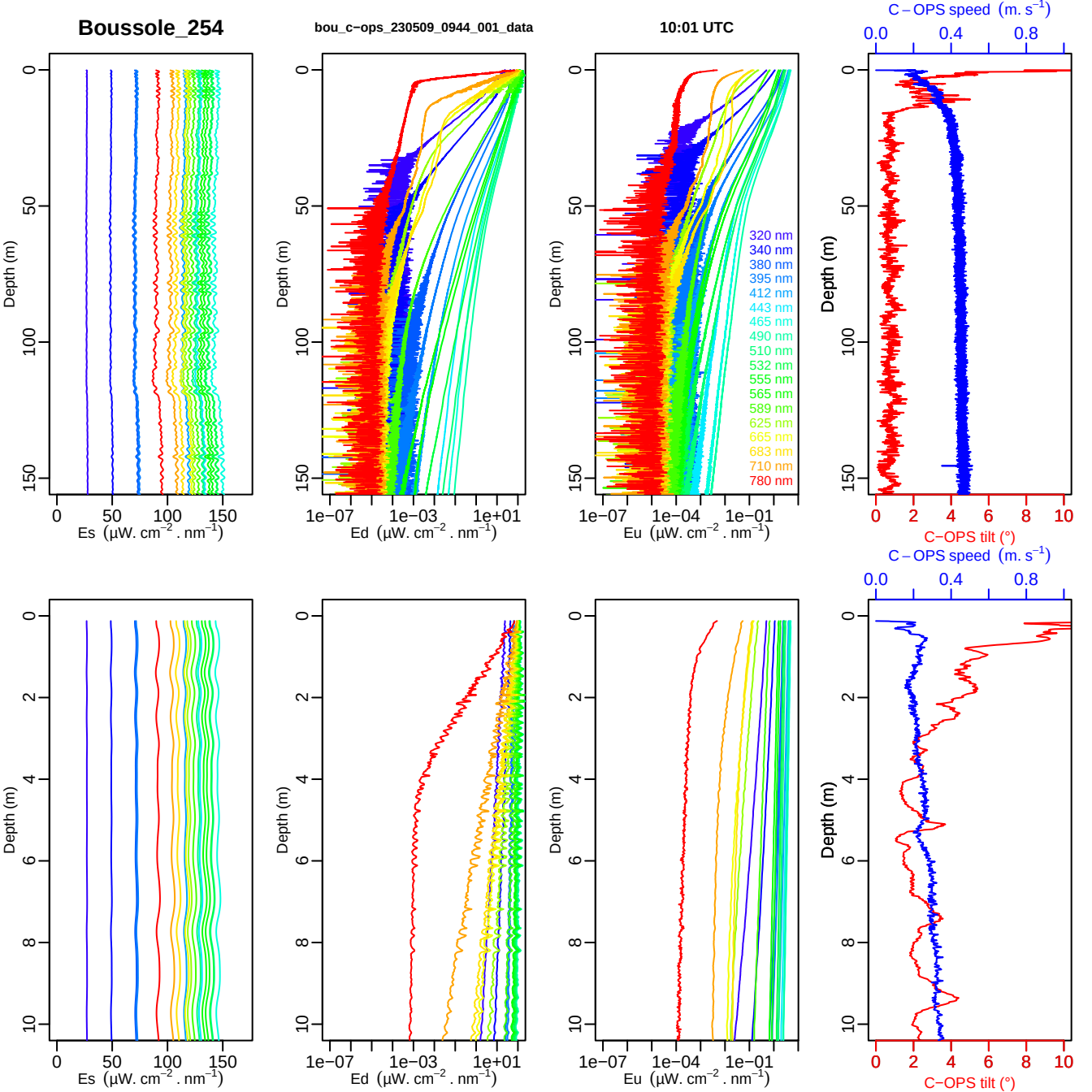
11:52 UTC
C – OPS speed (m. s^{-1})
0.0
0.4
0.8
Depth (m)
0
50
100
150
0
50
100
150
Es (µW. cm^{-2}. nm^{-1})
1e−07
1e−03
1e+01
Ed (µW. cm^{-2}. nm^{-1})
1e−07
1e−04
1e−01
Eu (µW. cm^{-2}. nm^{-1})
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm
0
2
4
6
8
10
C−OPS tilt (°)
C – OPS speed (m. s^{-1})
0.0
0.4
0.8
Depth (m)
0
2
4
6
8
10
Es (µW. cm^{-2}. nm^{-1})
1e−07
1e−03
1e+01
Ed (µW. cm^{-2}. nm^{-1})
1e−07
1e−04
1e−01
Eu (µW. cm^{-2}. nm^{-1})
0
2
4
6
8
10
C−OPS tilt (°)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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
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412 nm
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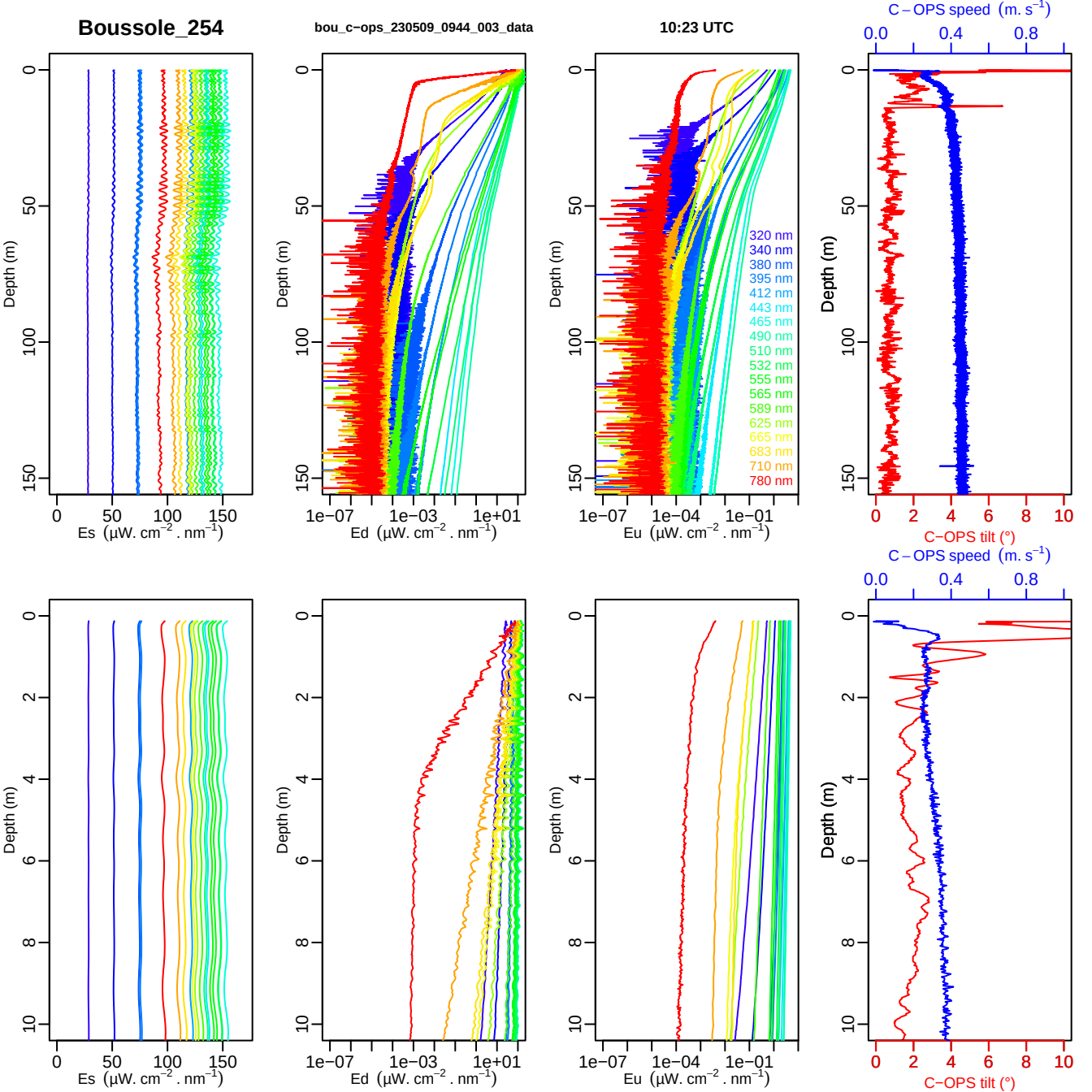
625 nm
665 nm
683 nm
710 nm
780 nm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Depth (m)
Es (µW. cm⁻². nm⁻¹)
Ed (µW. cm⁻². nm⁻¹)
Eu (µW. cm⁻². nm⁻¹)
C-OPS speed (m. s⁻¹)
C-OPS tilt (°)
320 nm
340 nm
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395 nm
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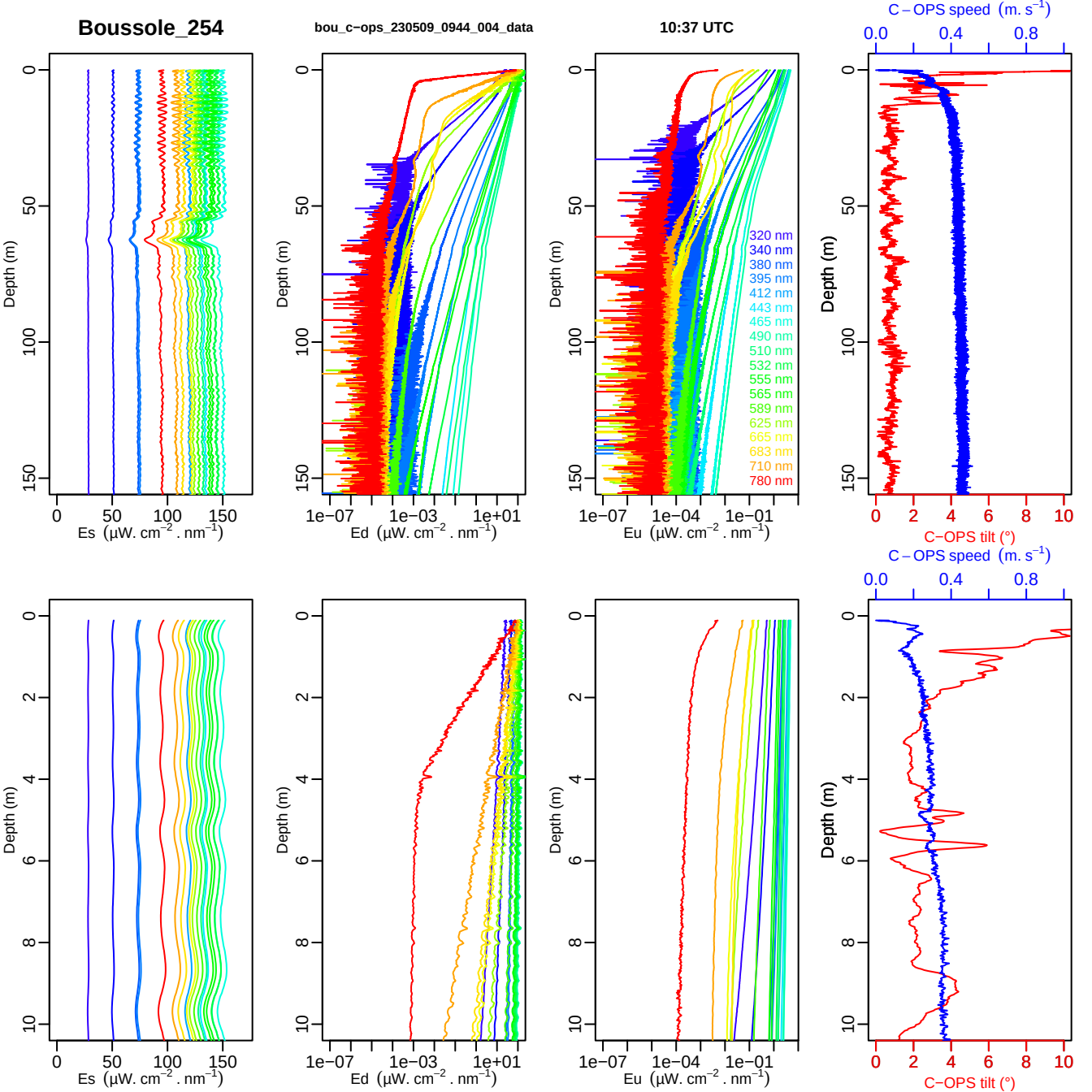
665 nm
683 nm
710 nm
780 nm


Boussole_254
bou_c-ops_230509_0944_004_data
10:37 UTC
C – OPS speed (m. s^{-1})
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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})
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1e−01
320 nm
340 nm
380 nm
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412 nm
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510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm
C−OPS tilt (°)
0
2
4
6
8
10