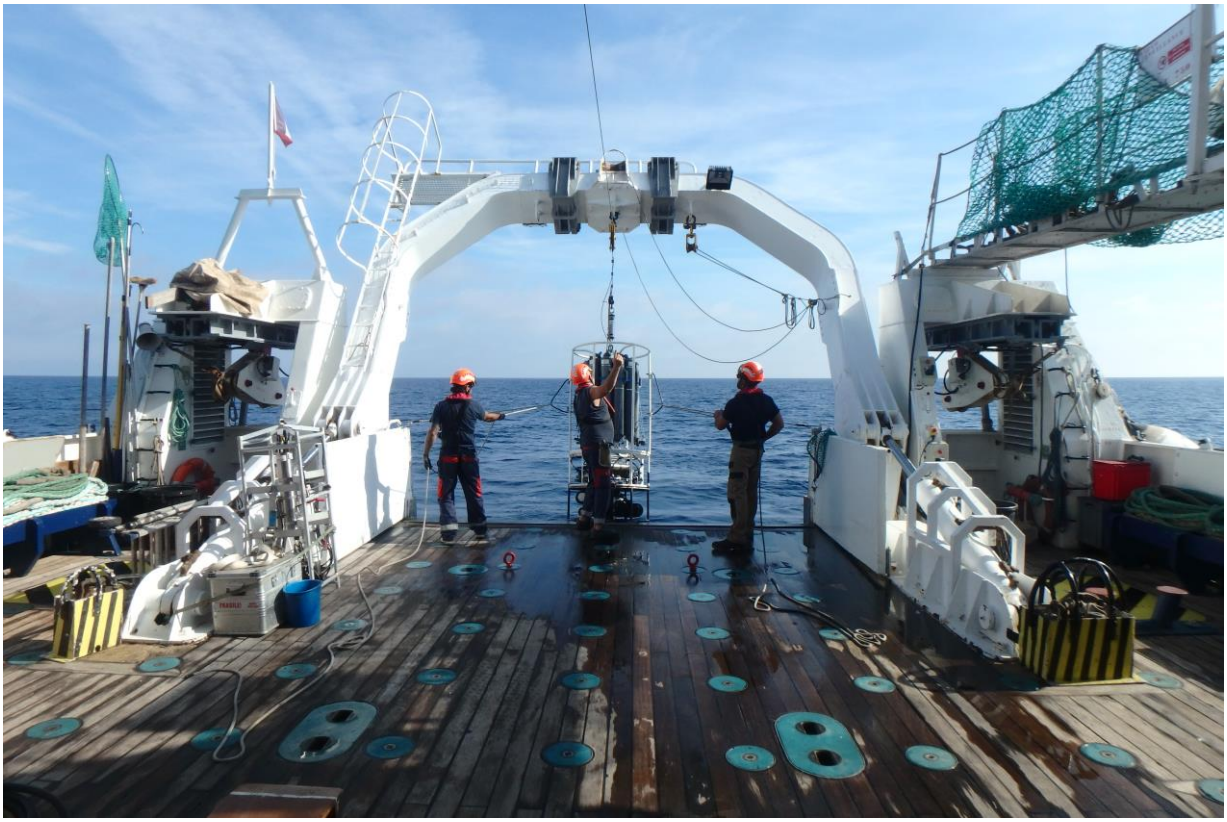
BOUSSOLE Monthly Cruise Report

Cruise 259
October 02-04, 2023

Duty Chief: Melek Golbol (melek.golbol@imev-mer.fr)
Vessel: R/V L'Europe
(Captain: Steven Guennec)

Science Personnel: Céline Dimier, Melek Golbol, Paco Stil and Vincenzo Vellucci

Institut de la Mer de Villefranche (IMEV), 06230 Villefranche-sur-Mer, France



Deployment of the CTD Rosette at the BOUSSOLE site from the deck of the R/V *L'Europe*

BOUSSOLE project

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

September 25, 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

Sorbonne Université, France

Institut de la Mer de Villefranche, France

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.

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 second day, a SBE25 CTD which was not working correctly was tested at 80 m depth for the national coastal observation service SOMLIT.

The first day, the Manta net was deployed en route between BOUSSOLE and DYFAMED and the second day, vertical zooplankton nets were deployed for the MOOSE program.

The deployment of the new DYFAMED mooring line took place in July 2023: the detection of the DYFAMED mooring with the depth sounder of the R/V *Téthys II* was performed the second day for the MOOSE program.

Cruise Summary

The first day was used to perform CTD casts with water sampling, optical profiles and a Secchi disk at the BOUSSOLE site. This day was also used to deploy the Manta net for the MOOSE program. The second day was used for CTD casts with water sampling, for Secchi disk and for C-OPS profiles. It was also used to detect the DYFAMED mooring with the depth sounder of the ship and to perform two vertical zooplankton nets for the MOOSE program. The last day was used for C-OPS profiles, for a CTD cast with water sampling and for a Secchi disk.

Monday 2 October 2023

The sea state was smooth with a light breeze. The sky was blue and the visibility was medium. Firstly, a CTD cast with water sampling and a Secchi disk were performed at the BOUSSOLE site. The cap of the backscattering meter was left on the instrument, so it was decided to use this cast for dark measurements. Then, two CTD casts were performed, the first one with water sampling. For the third cast of the day (CTD 03), a 0.2 µm filter was 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 three C-OPS profiles were performed at the BOUSSOLE site. Finally, the Manta net was deployed during the way back to Nice harbour.

Tuesday 3 October 2023

The sea state was smooth with a gentle to moderate breeze. The sky was cloudy and the visibility was medium. Firstly, a CTD cast with water sampling and a Secchi disk were performed at the BOUSSOLE site. Then three C-OPS profiles were performed at the BOUSSOLE site but only two of them were kept. The profiles had to be stopped early during the acquisition or were eliminated because of an unstable irradiance (cloudy sky). Then, we went to the DYFAMED site: the detection of the DYFAMED mooring using the depth sounder was attempted but failed. Finally, two vertical zooplankton nets were performed at the DYFAMED site for the MOOSE program and the SBE25 CTD was tested for the SOMLIT program before returning to the Nice harbour.

Wednesday 4 October 2023

The sea state was smooth with a gentle to moderate breeze. The sky was overcast in the morning and clear in the afternoon, the visibility was medium. Firstly, three C-OPS profiles and a CTD cast with water sampling were performed at the BOUSSOLE site. Then, the sky conditions became better in the afternoon (blue sky), so it was decided to perform an additional C-OPS profile. 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/A3KFTLYjZDehQaRS8

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

Cruise Report

Monday 02 October 2023 (UTC)

People on board: Céline Dimier, Vincenzo Vellucci and Paco Stil

0505 Departure from the Nice harbour.
0900 Arrival at the BOUSSOLE site.
0905 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 (with cap on the HS6).
0950 Secchi 01, 32 m.
1015 CTD 02, 400 m with water sampling at 5 m for TSM.
1115 CTD 03, 400 m (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, 30, 20, 10 et 5 m).
1255 C-OPS 01, 02, 03.
1330 Departure to the Nice harbour.
Manta horizontal net deployment (MOOSE program).
1400 Recovery of Manta horizontal net.
1730 Arrival at the Nice harbour.

Tuesday 03 October 2023 (UTC)

People on board: Céline Dimier, Vincenzo Vellucci and Paco Stil

0505 Departure from the Nice harbour.
0850 Arrival at the BOUSSOLE site.
0900 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p and TSM.
0955 Secchi 01, 29 m.
1000 Attempt of C-OPS deployment : failed (unstable irradiance).
1025 C-OPS 04, 05, 06.
1055 Departure to the DYFAMED site.
Detection of the DYFAMED mooring line: failed (MOOSE program).
1140 Zooplankton nets x 2 at 100 and 200 m (MOOSE program).

1215 SBE25 CTD test at 80 m depth (SOMLIT program).
1225 Departure to the Nice harbour.
1550 Arrival at the Nice harbour.

Wednesday 04 October 2023 (UTC)

People on board: Melek Golbol and Paco Stil

0500 Departure from the Nice harbour.
0900 Arrival at the BOUSSOLE site.
0925 C-OPS 07, 08, 09.
1020 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p and TSM.
1115 Secchi 03, 25 m.
1130 C-OPS 10.
1145 Departure to the Nice harbour.
1545 Arrival at the Nice harbour.

Problems identified during the cruise

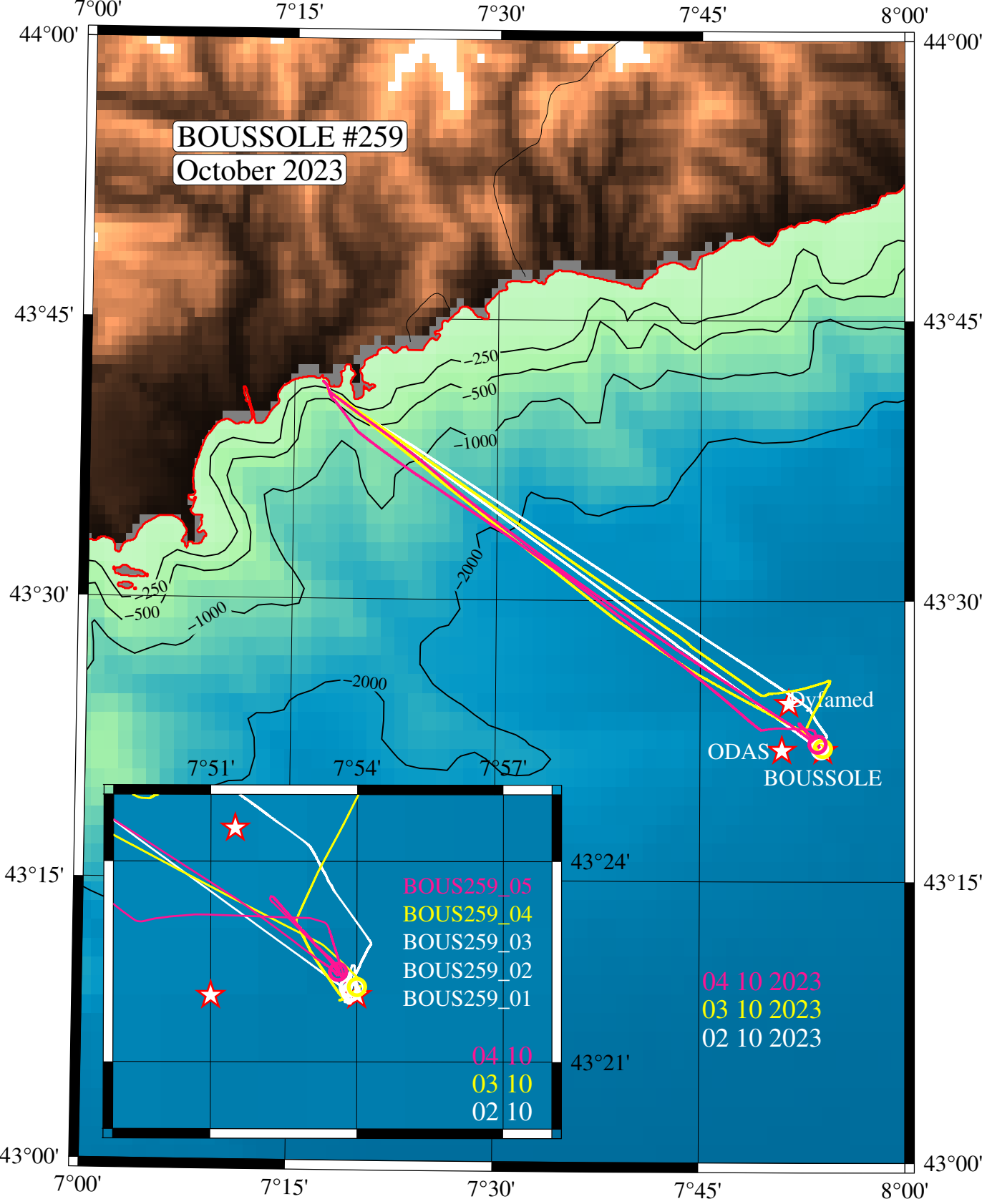
- The second day, the C-OPS measurements were not optimal because of the bad sky conditions during the acquisition: the sky was cloudy with unstable irradiance. The profiles had to be stopped early during the acquisition.

- CTD 01: the cap of the backscattering meter was not removed from the instrument by mistake. So, it was decided to use this cast for the dark measurements and to perform another cast (CTD 02) without the cap immediately after this cast. Unfortunately, it appeared next that this dark could not be used for the data processing because the cap was not properly installed on the instrument.

Appendices

Cruise Summary Table for Boussole 259

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
02/10/23			BOUS259_01	HPLC & ap	9:08	0:39:00	400	43	22.109	7	53.972	blue		0	4.2	259	1024	83		22.4	21.8	smooth			
				Secchi 01	9:50	0:04:00	32	43	22	7	54	blue		0					medium			smooth			
			BOUS259_02	TSM	10:24	0:39:00	400	43	22.115	7	53.834	blue		0	3	256	1024	78.8		22.7	21.5	smooth			
			BOUS259_03		11:14	1:37:00	400	43	22.048	7	53.875	blue		0	3	242	1024	74.3		22.9	21.9	smooth			
		bou_c-ops_231002_1237_001_data.csv			12:58	0:04:42	95	43	23.773	7	53.371	blue	none	0	3	216	1024	68.1	medium	23.5		smooth	0.2		no
		bou_c-ops_231002_1237_002_data.csv			13:08	0:04:42	110	43	23.865	7	53.301	blue	none	0	3	216	1024	68.1	medium	23.5		smooth	0.2		no
		bou_c-ops_231002_1237_003_data.csv			13:16	0:05:00	124	43	23.995	7	53.206	blue	none	0	3	216	1024	68.1	medium	23.5		smooth	0.2		no
03/10/23			BOUS259_04	HPLC, ap & TSM	9:01	0:41:00	400	43	22.122	7	54.000	cloudy		5	8.1	246	1022	86.5		22.2	22.1	smooth			
				Secchi 02	9:53	0:04:00	29	43	22	7	54	cloudy		6					medium			smooth			
		bou_c-ops_231003_0956_001_data.csv			10:29	0:02:31	58	43	22.647	7	53.033	cloudy	all	6	11	231	1023	87.5	medium	22		smooth	0.3		few
		bou_c-ops_231003_0956_002_data.csv			10:36	0:03:25	75	43	22.799	7	52.948	cloudy	all	6	11	231	1023	87.5	medium	22		smooth	0.3		few
04/10/23		bou_c-ops_231004_0900_001_data.csv			9:24	0:04:06	95	43	22.799	7	53.088	overcast	all	7	6.8	174	1021	85.2	medium	23.2		slight	0.7		few
		bou_c-ops_231004_0900_002_data.csv			9:37	0:04:15	104	43	23.037	7	52.790	overcast	all	7	6.8	174	1021	85.2	medium	23.2		slight	0.7		few
		bou_c-ops_231004_0900_004_data.csv			9:50	0:03:55	94	43	23.256	7	52.530	overcast	all	7	6.8	174	1021	85.2	medium	23.2		slight	0.7		few
			BOUS259_05	HPLC, ap & TSM	10:21	0:50:00	400	43	22.351	7	53.614	cloudy		6	9	81	1021	84		22.6	21.4	slight			
				Secchi 03	11:15	0:04:00	25	43	22	7	54	blue		0					medium			slight			
		bou_c-ops_231004_1120_001_data.csv			11:29	0:04:04	99	43	22.593	7	53.594	blue	none	0	8.7	121	1021	82.5	medium	23.5		slight	0.7		few



GMT 2024 Jan 23 09:19:07

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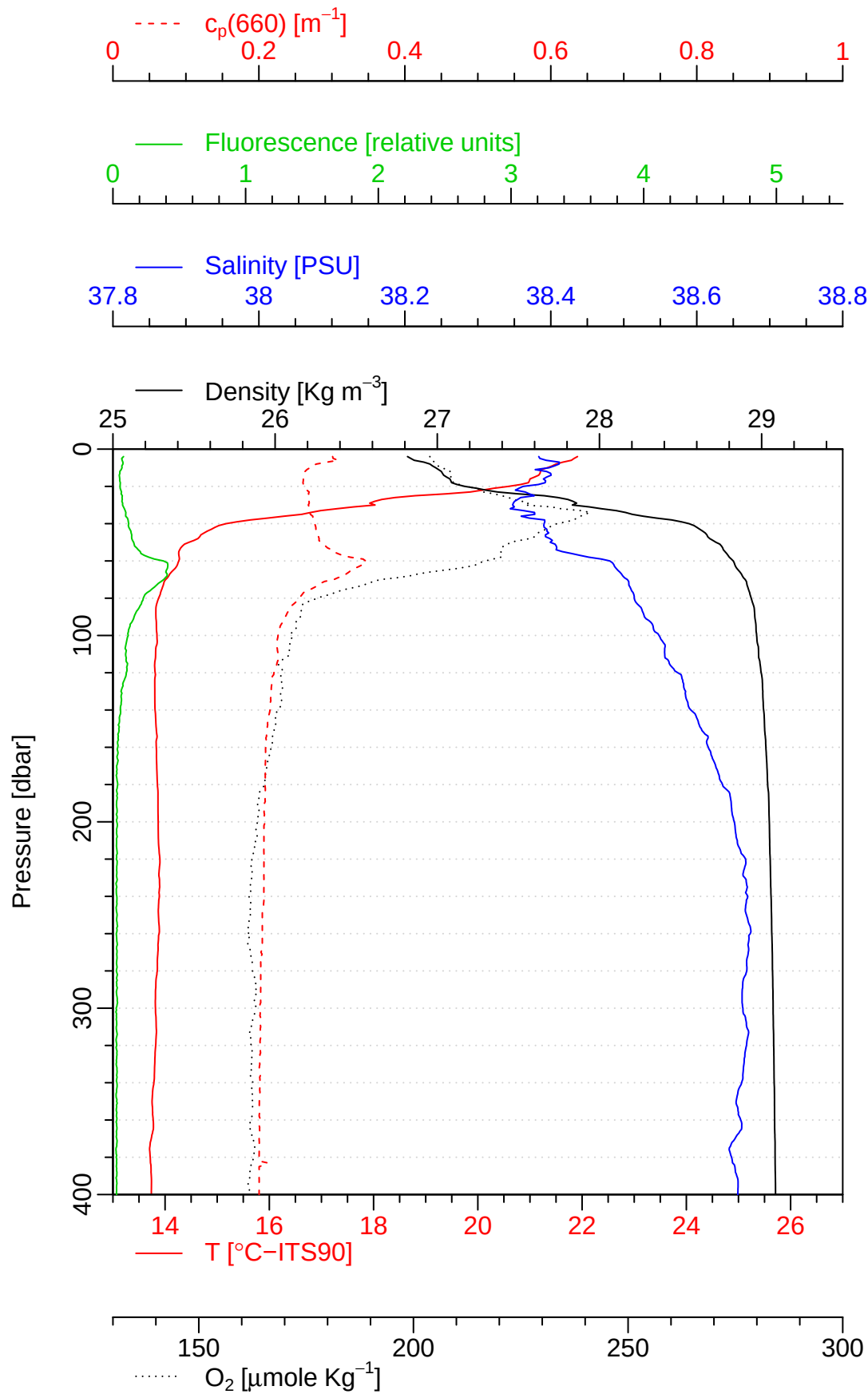
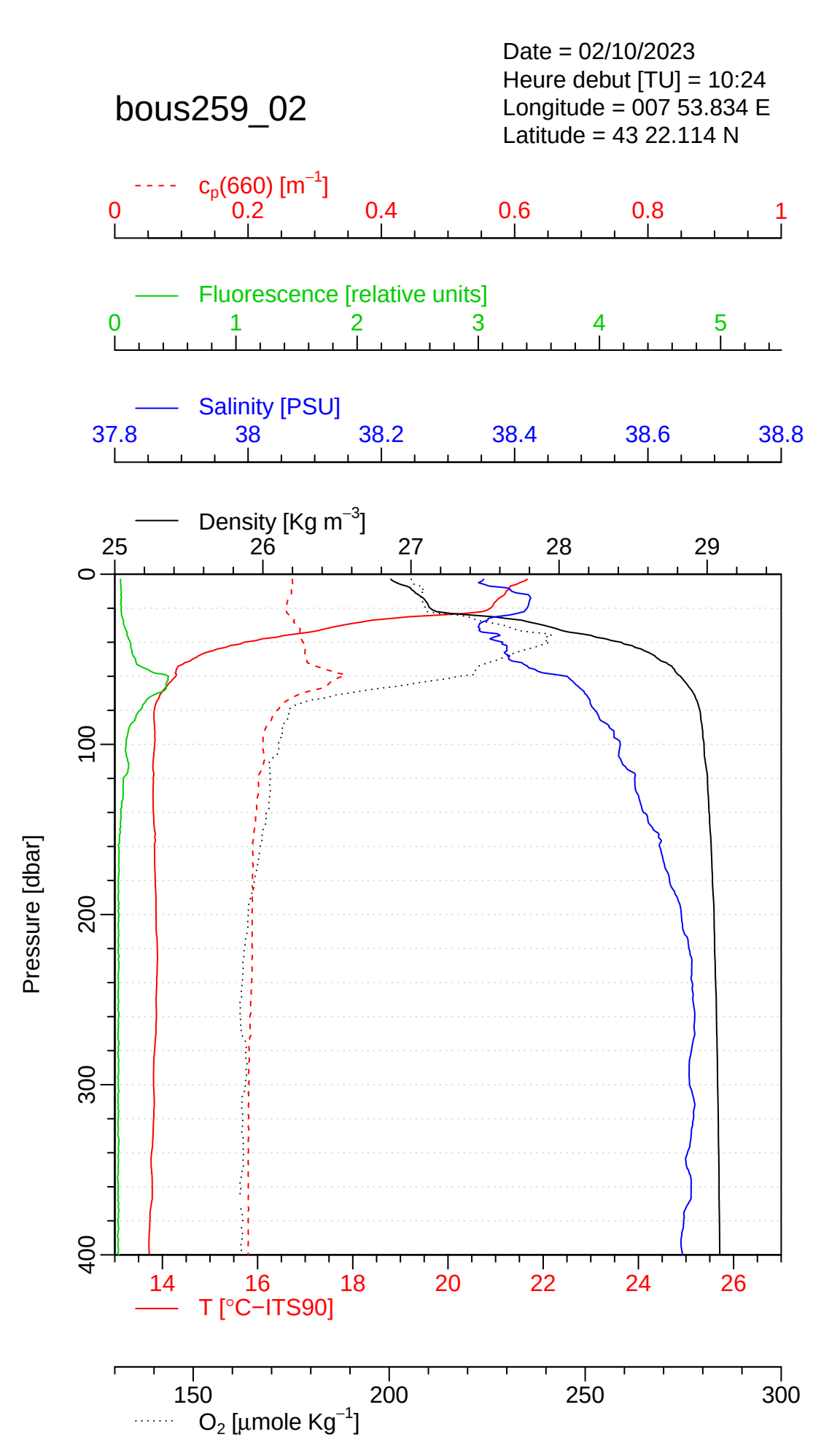
Latitude = 43 22.109 N

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Longitude = 007 53.834 E
Latitude = 43 22.114 N
cp(660) [m−1]
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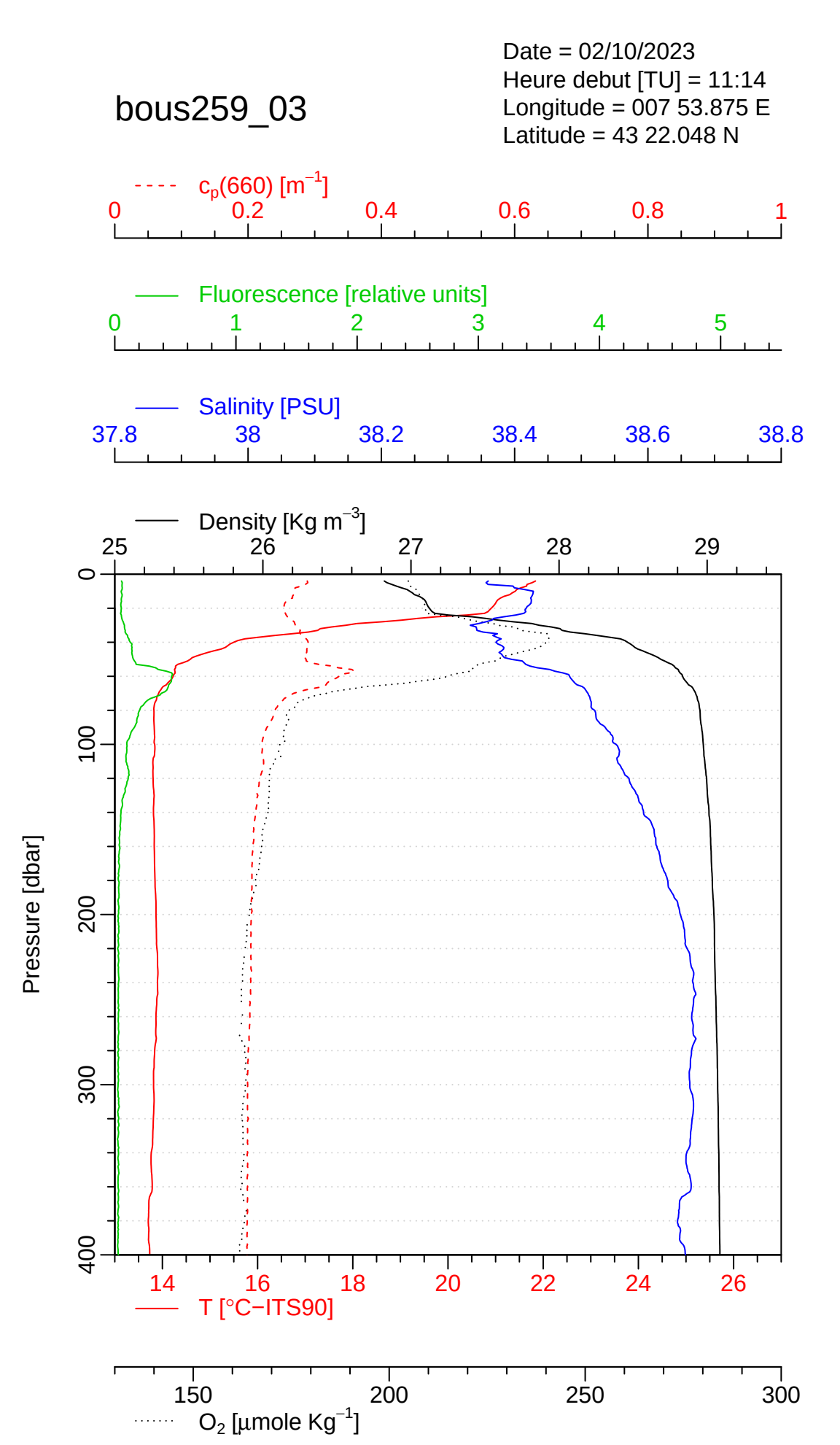
0.2
0.4
0.6
0.8
1
Fluorescence [relative units]
0
1
2
3
4
5
Salinity [PSU]
37.8
38
38.2
38.4
38.6
38.8
Density [Kg m−3]
25
26
27
28
29
Pressure [dbar]
0
100
200
300
400
14
16
18
20
22
24
26
T [°C−ITS90]
150
200
250
300
O2 [µmole Kg−1]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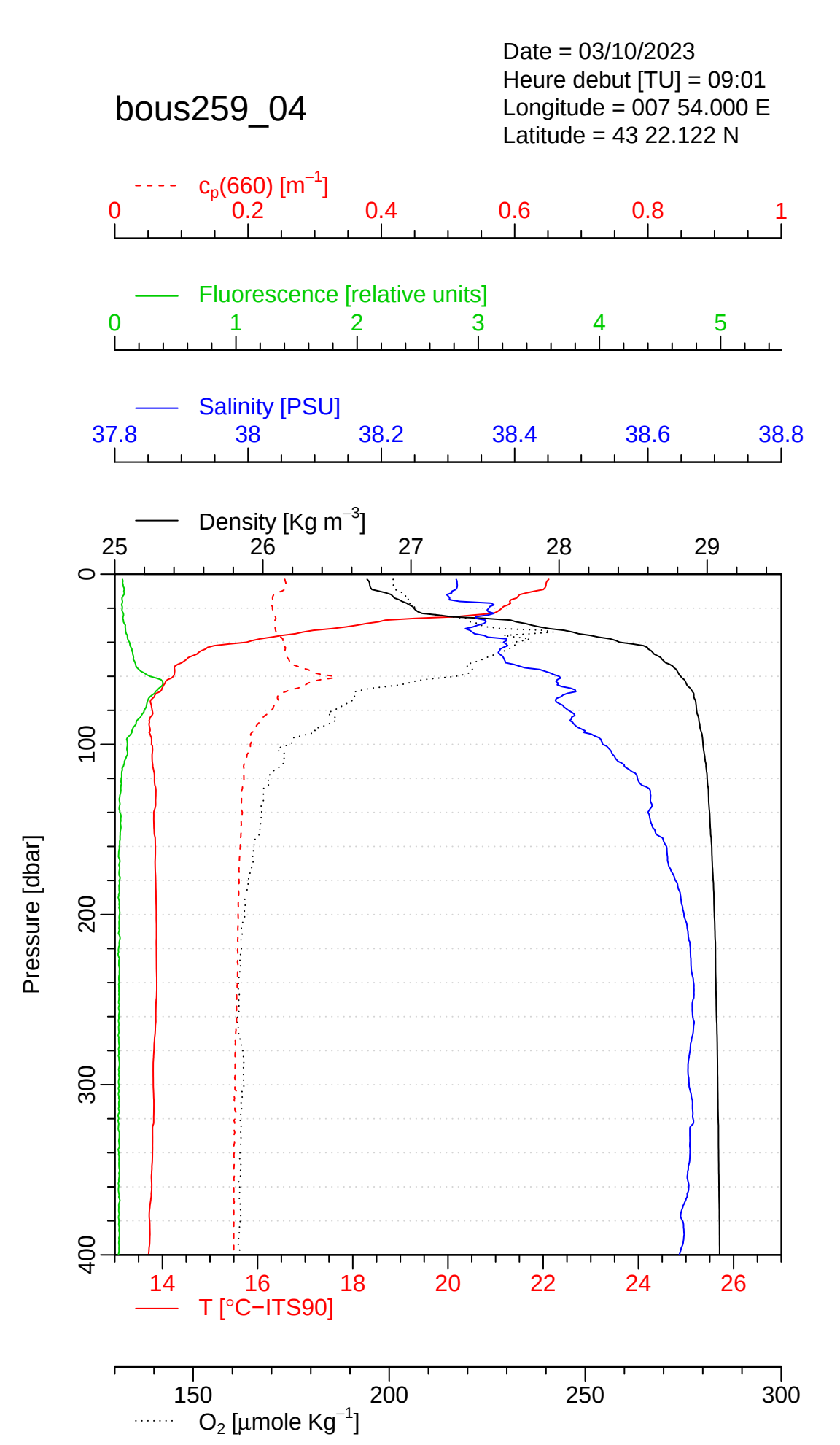
Heure debut [TU] = 11:14
Longitude = 007 53.875 E
Latitude = 43 22.048 N
cp(660) [m−1]
0
0.2
0.4
0.6
0.8
1
Fluorescence [relative units]
0
1
2
3
4
5
Salinity [PSU]
37.8
38
38.2
38.4
38.6
38.8
Density [Kg m−3]
25
26
27
28
29
Pressure [dbar]
0
100
200
300
400
14
16
18
20
22
24
26
T [°C−ITS90]
150
200
250
300
O2 [µmole Kg−1]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0.4
0.6
0.8
1
Fluorescence [relative units]
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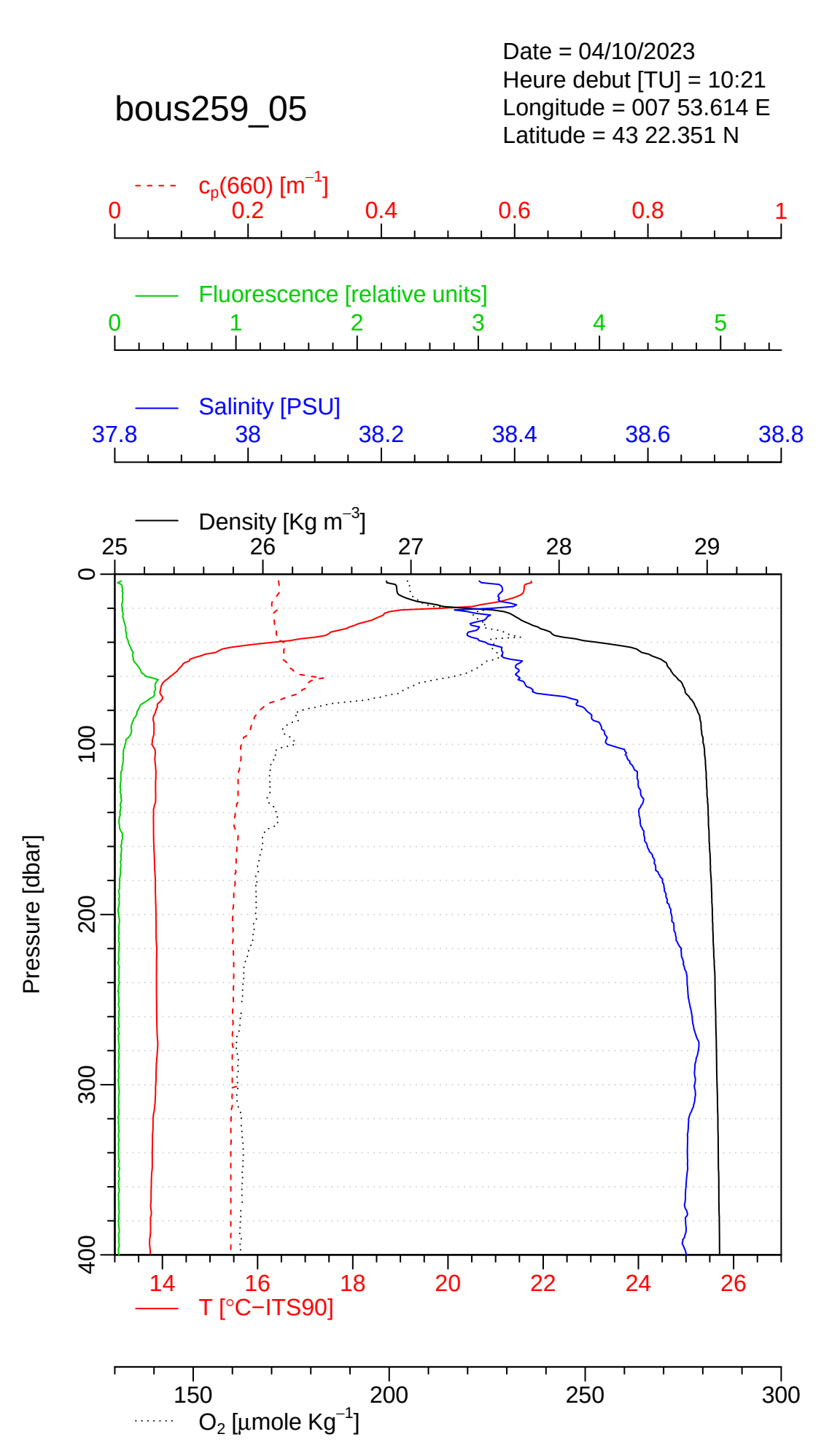
1
2
3
4
5
Salinity [PSU]
37.8
38
38.2
38.4
38.6
38.8
Density [Kg m−3]
25
26
27
28
29
Pressure [dbar]
0
100
200
300
400
14
16
18
20
22
24
26
T [°C−ITS90]
150
200
250
300
O2 [µmole Kg−1]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0.4
0.6
0.8
1
Fluorescence [relative units]
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1
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
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300
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22
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26
T [°C−ITS90]
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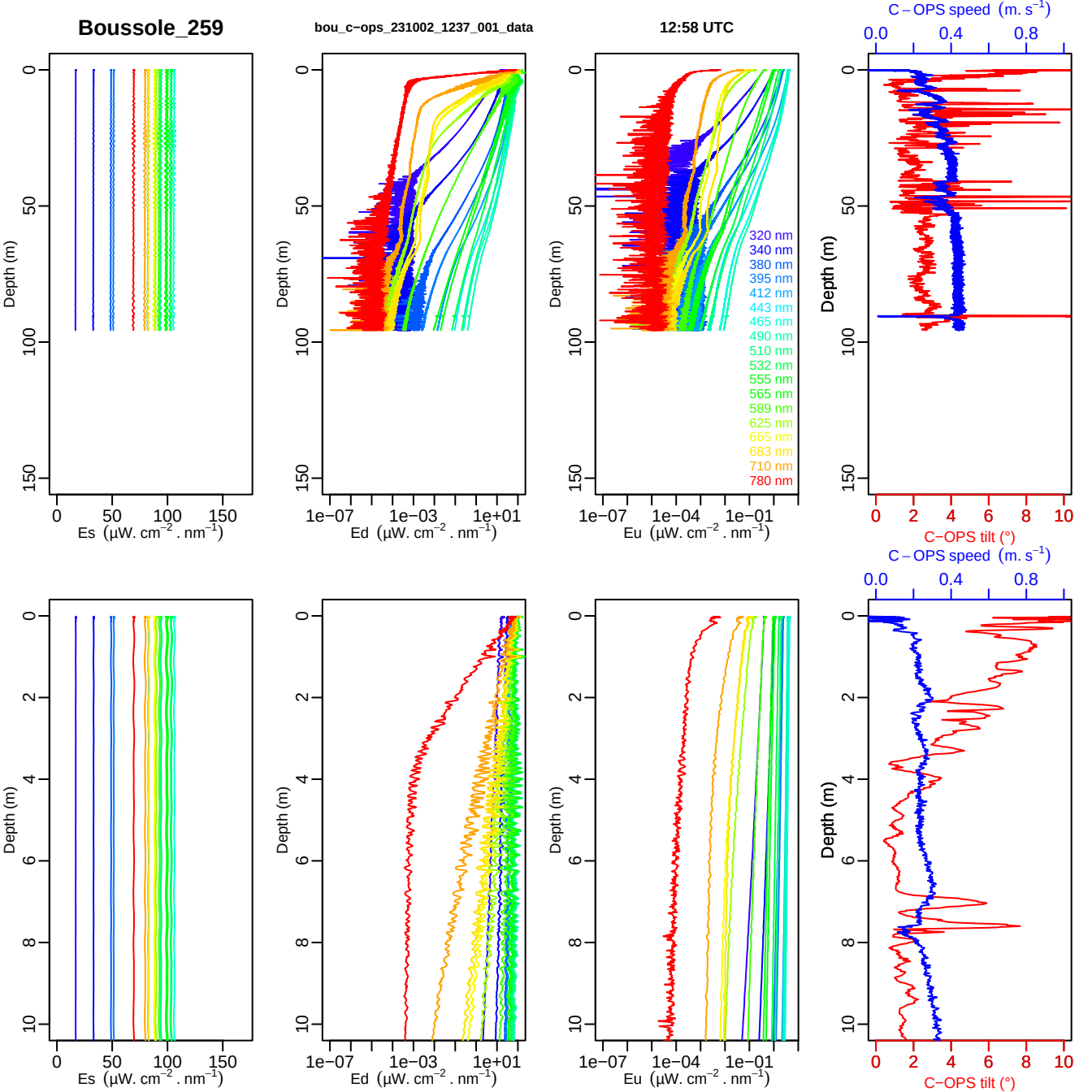
200
250
300
O2 [µmole Kg−1]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Eu (µW. cm^{-2}. nm^{-1})
C-OPS speed (m. s^{-1})
C-OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
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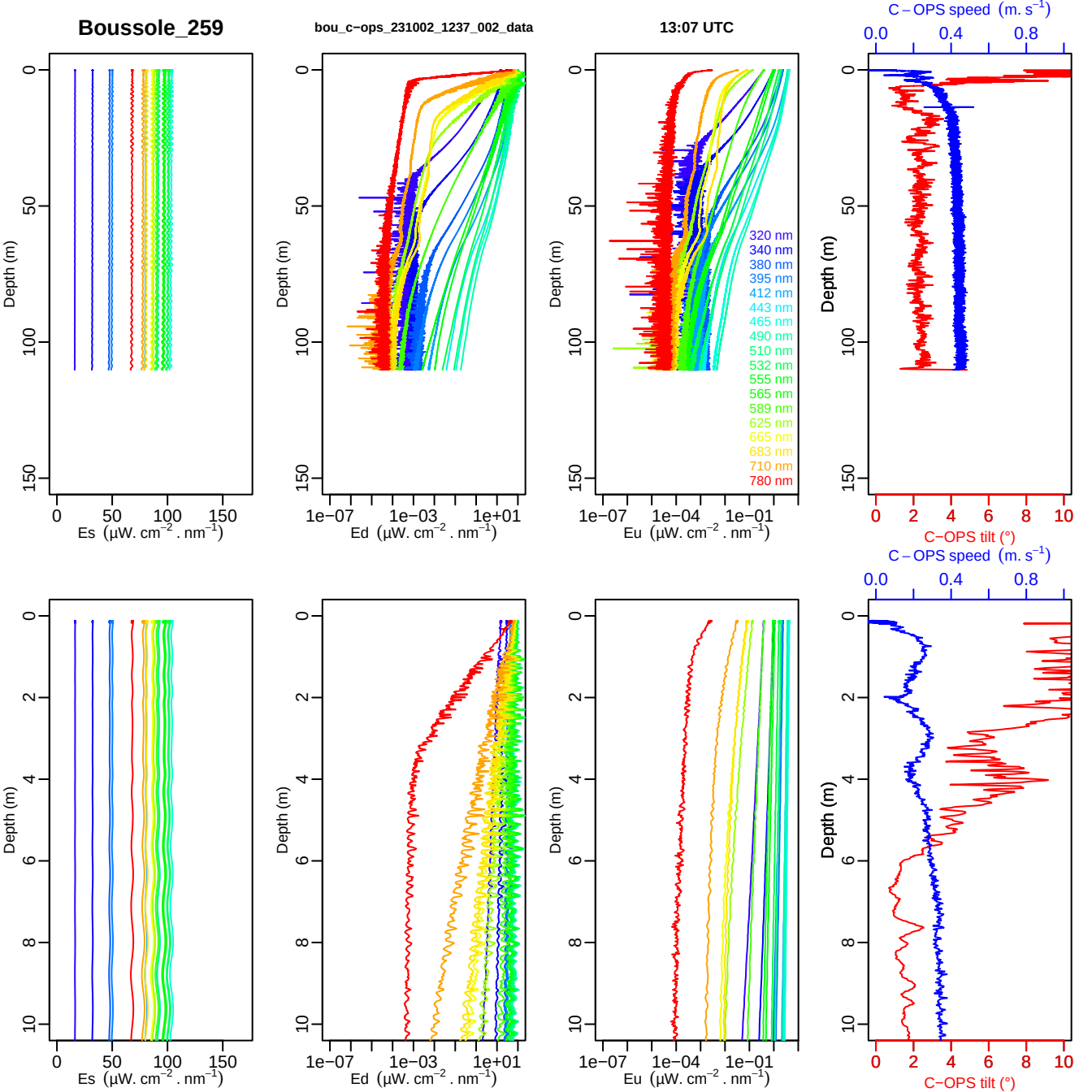
665 nm
683 nm
710 nm
780 nm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Eu (µW. cm⁻². nm⁻¹)
C-OPS speed (m. s⁻¹)
C-OPS tilt (°)
320 nm
340 nm
380 nm
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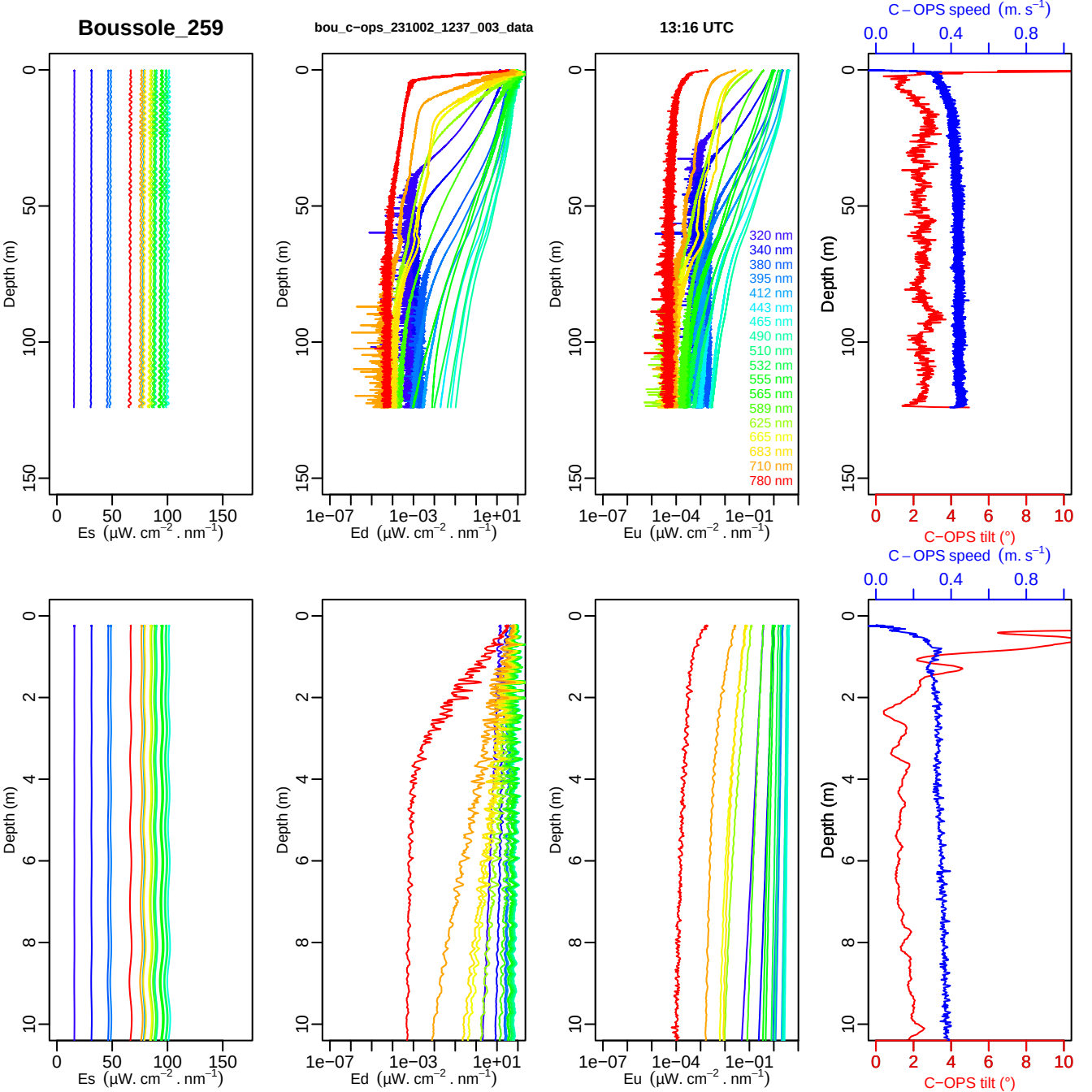
683 nm
710 nm
780 nm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Eu (µW. cm⁻². nm⁻¹)
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C-OPS tilt (°)
320 nm
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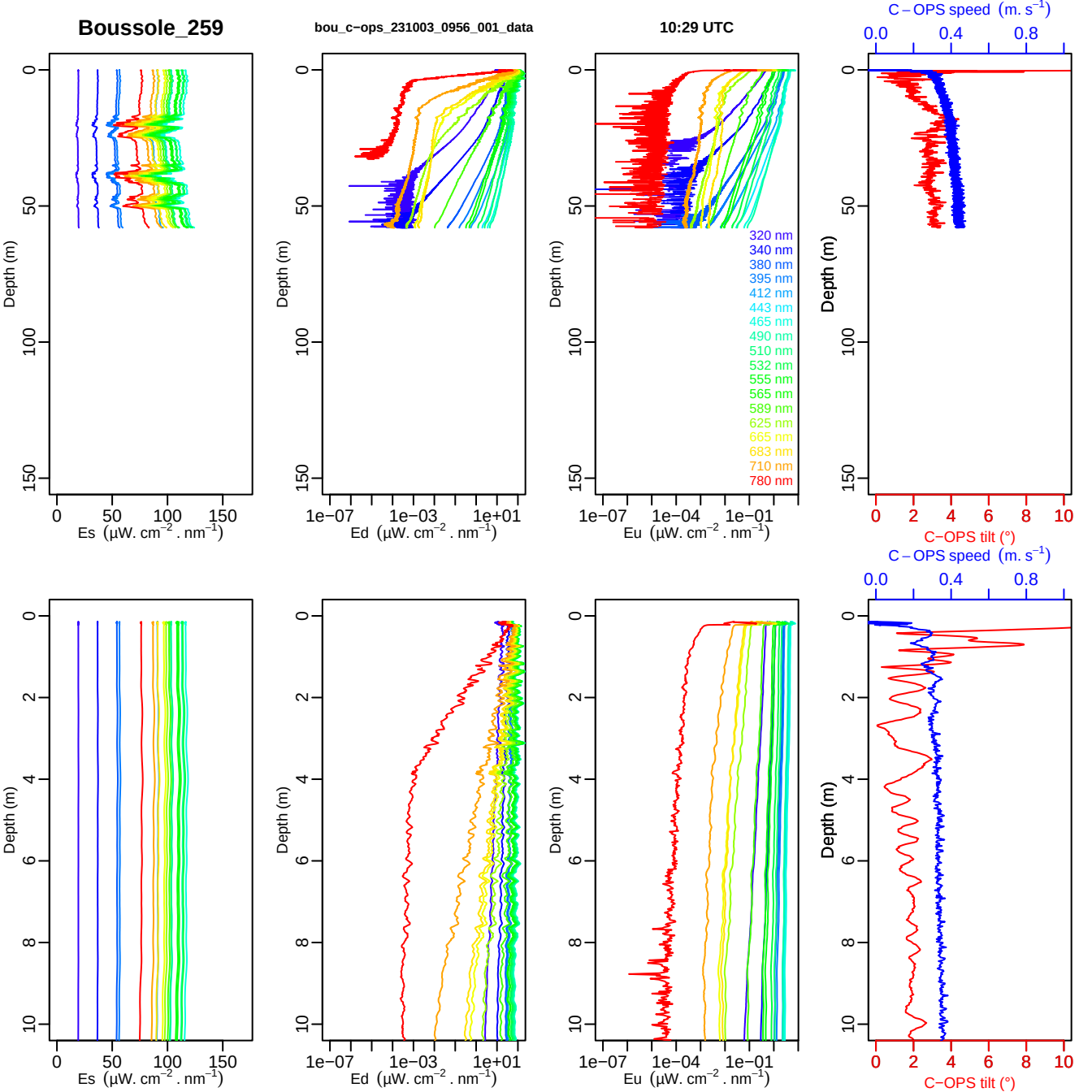
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C-OPS tilt (°)
320 nm
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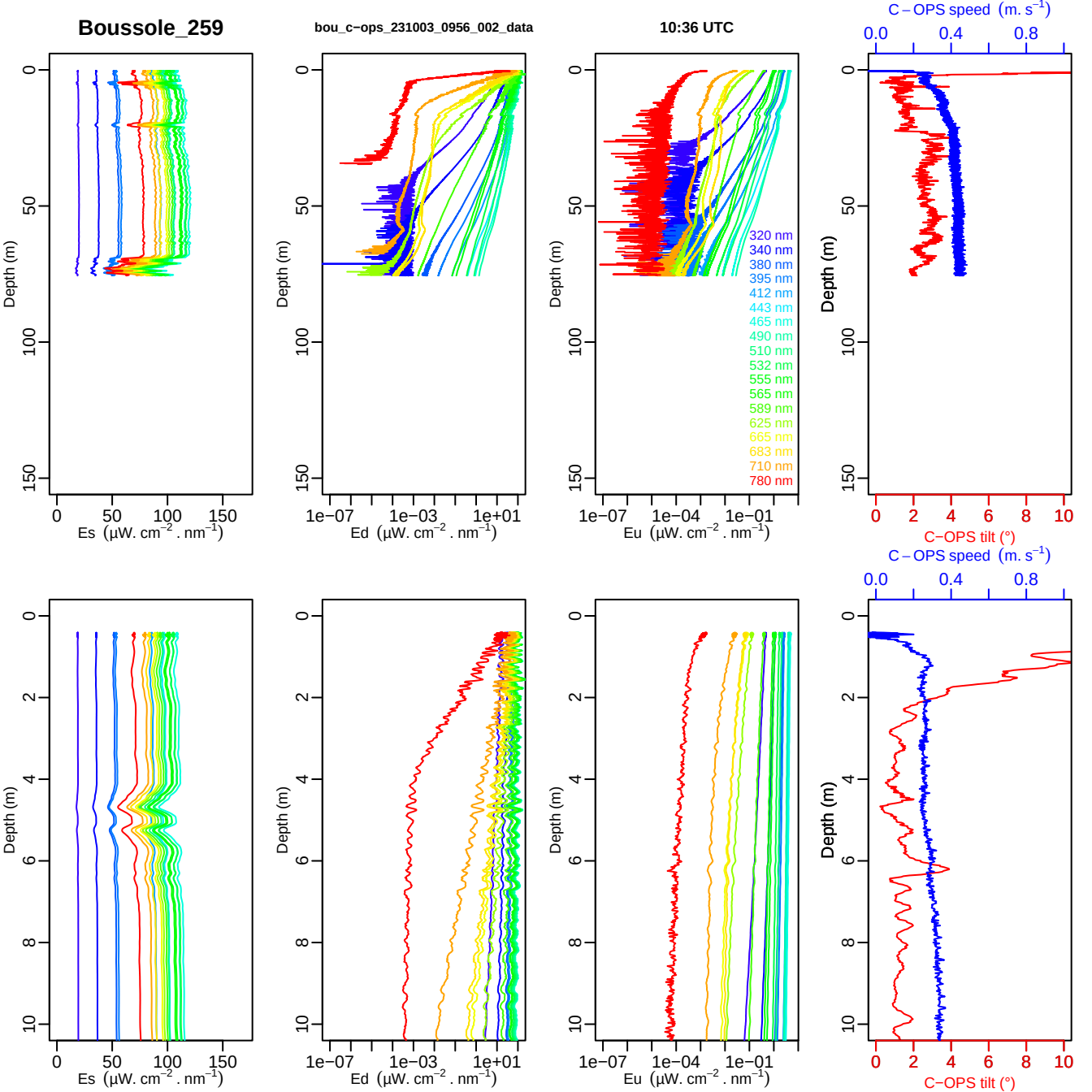
780 nm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Ed (µW. cm⁻². nm⁻¹)
Eu (µW. cm⁻². nm⁻¹)
C-OPS speed (m. s⁻¹)
C-OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
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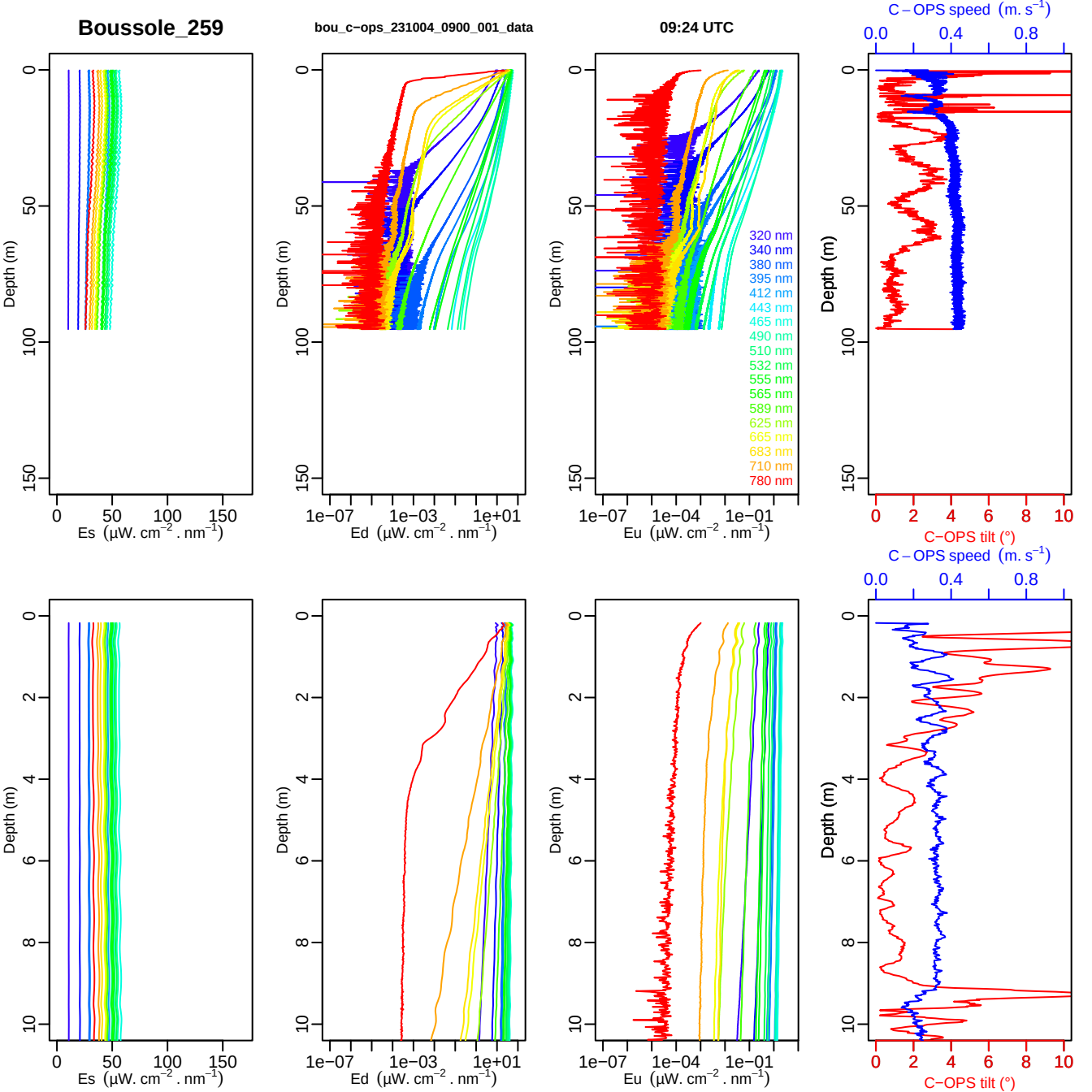
665 nm
683 nm
710 nm
780 nm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Eu (µW. cm⁻². nm⁻¹)
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C-OPS tilt (°)
320 nm
340 nm
380 nm
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532 nm
555 nm
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683 nm
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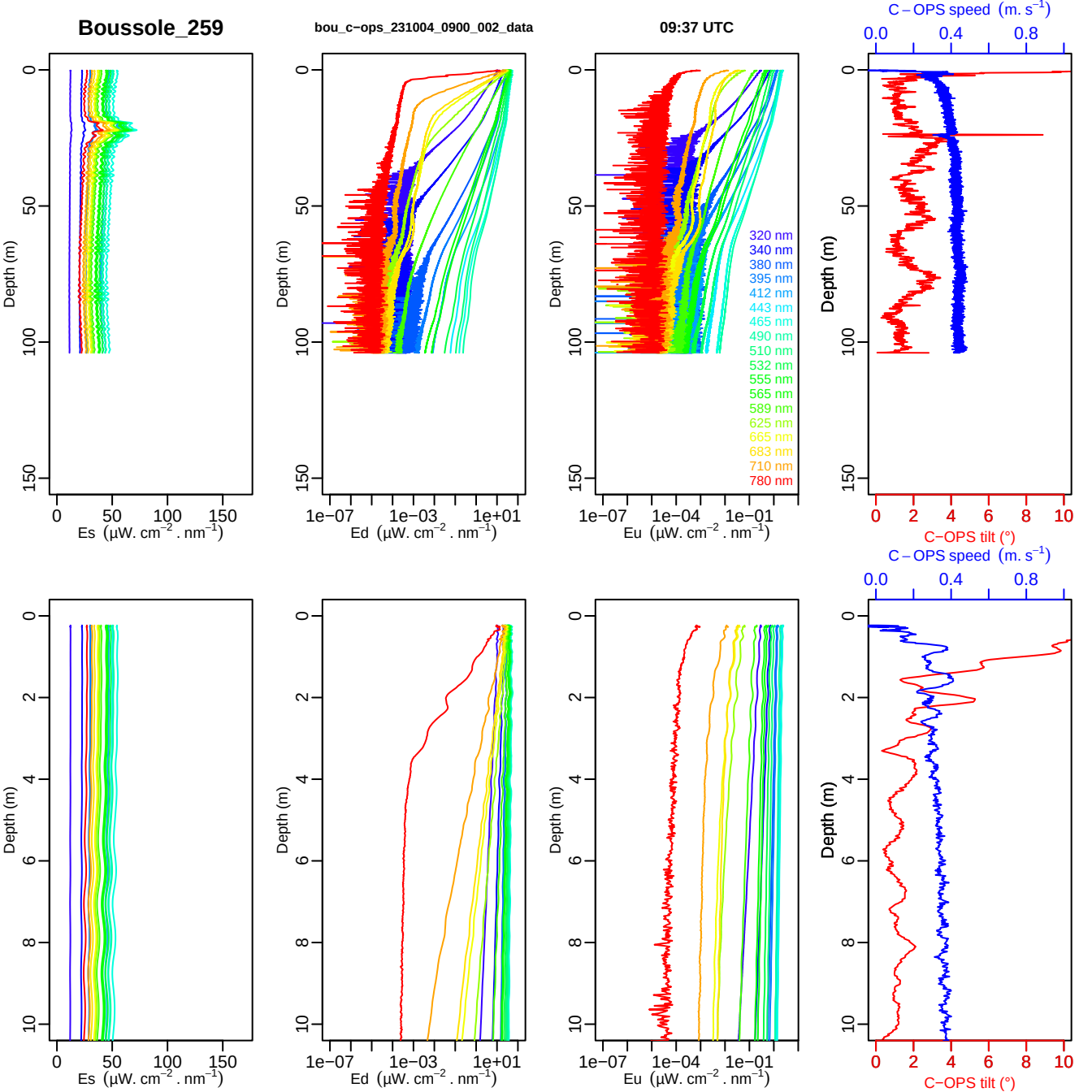
780 nm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C – OPS speed (m. s^{-1})
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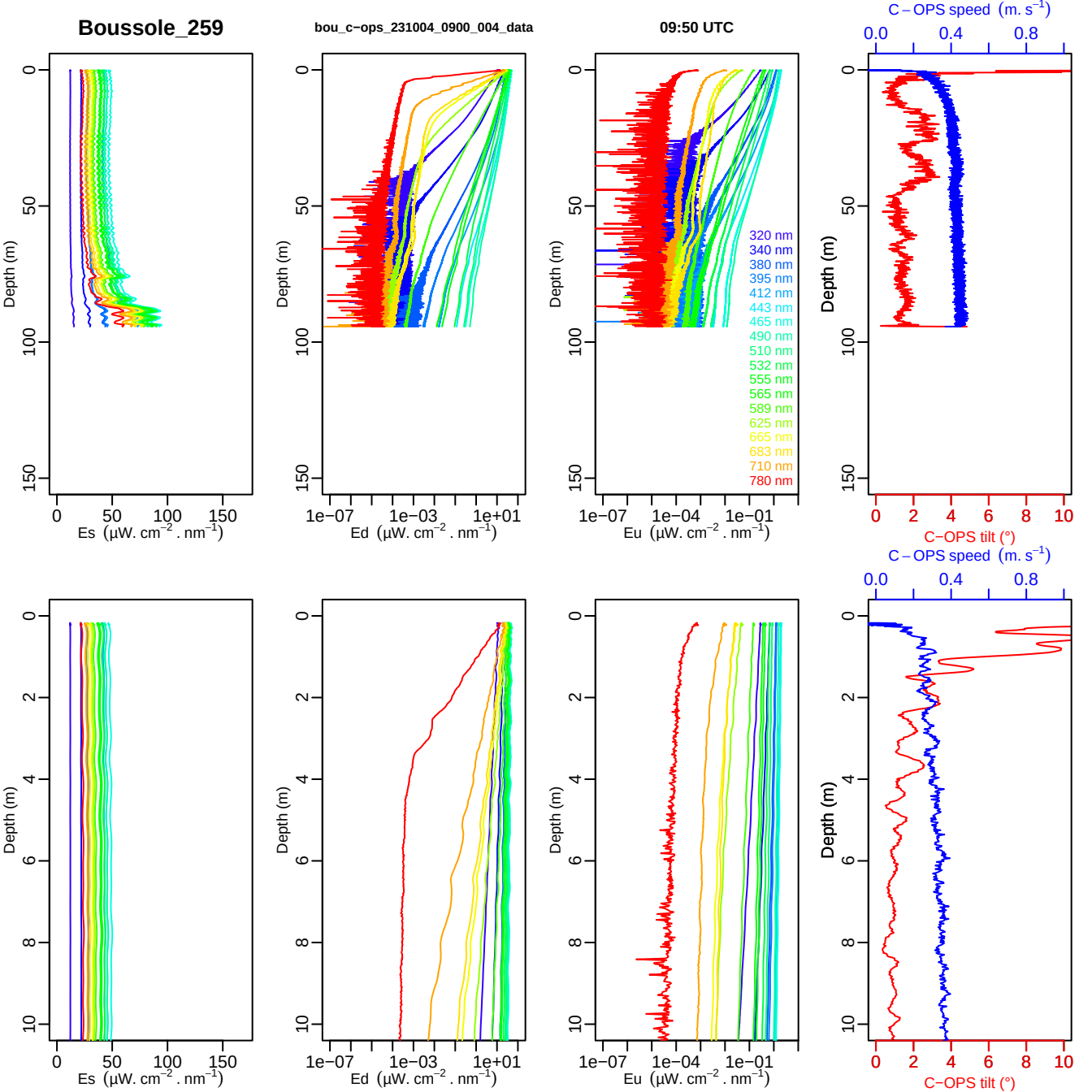
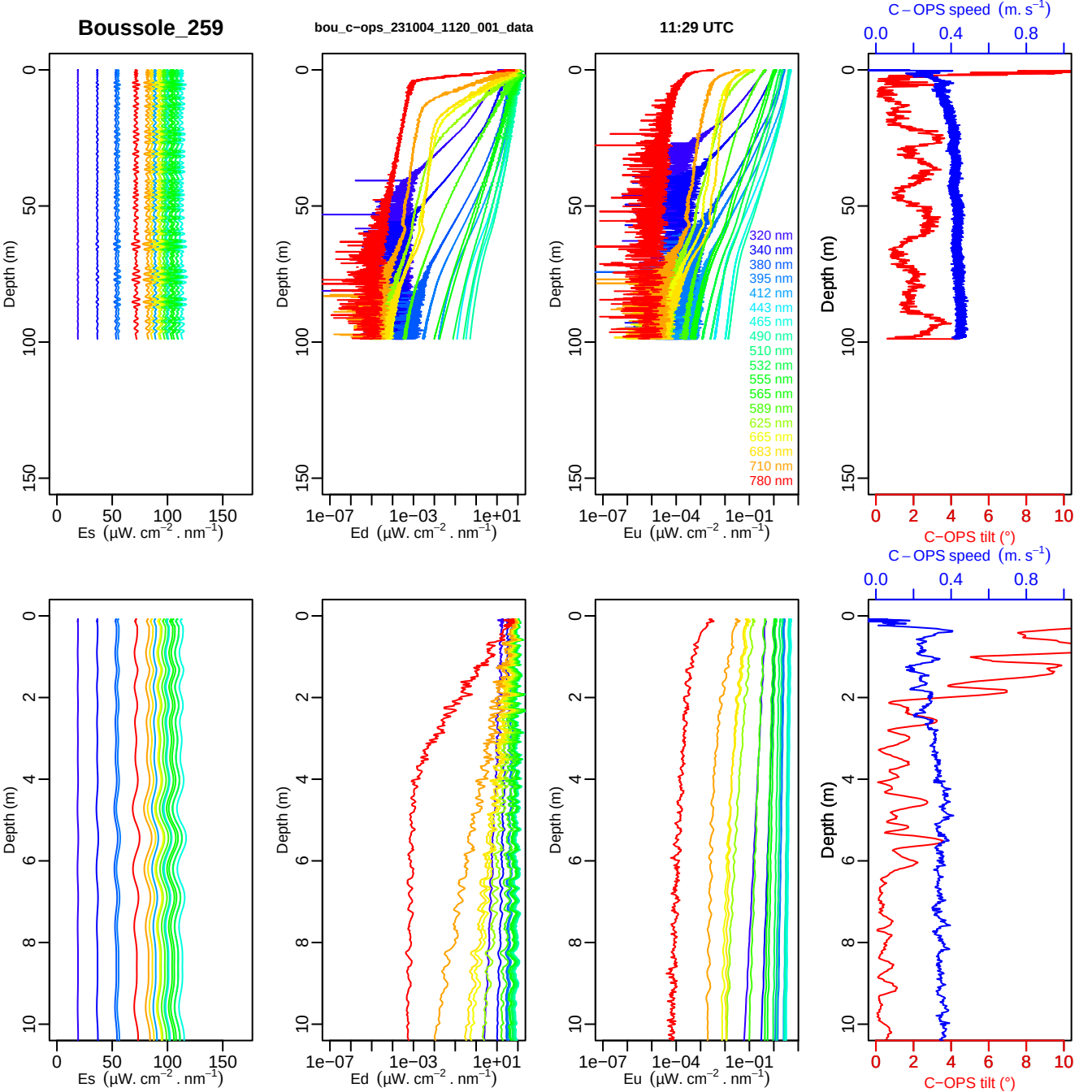
0.4
0.8
Depth (m)
0
50
100
150
0
50
100
150
Es (µW. cm^{-2}. nm^{-1})
1e−07
1e−03
1e+01
Ed (µW. cm^{-2}. nm^{-1})
1e−07
1e−04
1e−01
Eu (µW. cm^{-2}. nm^{-1})
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm
0
2
4
6
8
10
C−OPS 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 (°)


Boussole_259
bou_c−ops_231004_0900_004_data
09:50 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


Boussole_259
bou_c-ops_231004_1120_001_data
11:29 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