BOUSSOLE Monthly Cruise Report

Cruise 243
June 07-08, 2022

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Vessel: R/V Téthys II
(Captain: Dany Deneuve)

Science Personnel: Ewen Ancel, Melek Golbol, Antoine Granier-Parra, Paco Stil and Clara Villain

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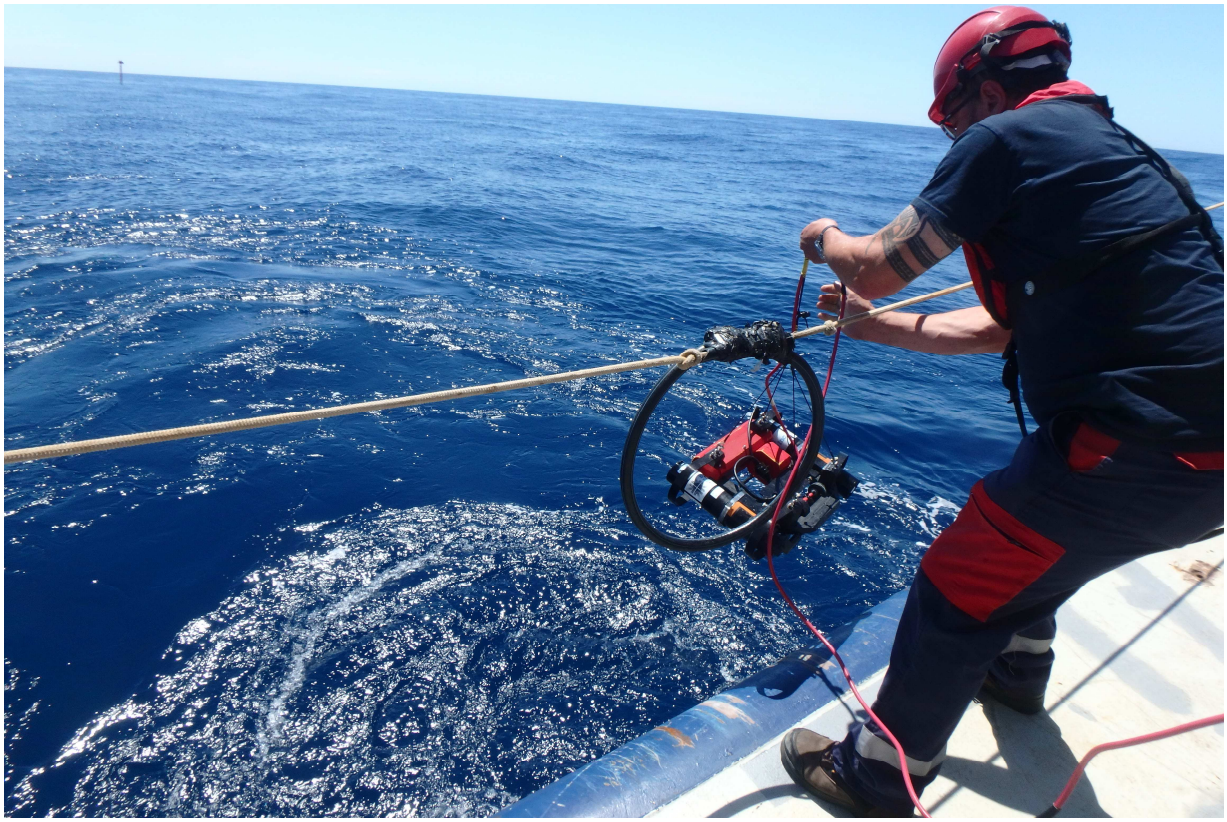

Deployment of the Biospherical Compact Optical Profiler System (C-OPS) from the deck of the R/V *Téthys II* under clear blue sky at the BOUSSOLE site.

BOUSSOLE project

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

June 23, 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. If the sky is clear and sea conditions are reasonably calm (no whitecaps or large swell), handheld CIMEL sun photometer measurements are to be performed consecutively where possible with C-OPS profiles. If sea conditions are poor but sky is good, handheld 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 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.
Water samples are to be collected at four depths for metagenomic analyses of different types of Synechococcus, cytometry and nutrients (from March 2020). Additional samples for cytometry analyses are to be collected at ten depths during the BOUSSOLE CTD sampling (from November 2021). These operations are 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, nutrients and metagenomics 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

Data were downloaded from the SeapHOx sensor installed on the buoy at 3 m depth for the MOOSE program via the communication cable on the top of the buoy. It combines a pH sensor with a Sea-Bird SBE37 MicroCAT CTD+DO sensor.
The second day was used entirely for MOOSE/DYFAMED operations, which could not happen the day before the BOUSSOLE cruise because of the bad weather.

Cruise Summary

The first day was used for C-OPS profiles, for CTD casts with water sampling, for downloading data from the SeapHox installed on the buoy and for a Secchi disk at the BOUSSOLE site.
The second day was used entirely for MOOSE/DYFAMED operations.

Monday 07 June 2022

The sea state was slight with a moderate breeze. The sky was blue and the visibility was good. Firstly, 3 C-OPS profiles and a CTD cast with water sampling were performed at the BOUSSOLE site. A CIMEL measurement was attempted but failed because of a problem in the instrument. Then, SeapHox data were downloaded from the top of the buoy using the communication cable. Then a second CTD cast was performed 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 only at 6 depths during the ascent of the CTD (400, 150, 80, 60, 50 and 40 m) because of the arrival of the bad weather. Finally, a Secchi disk was performed at the BOUSSOLE site before returning to the Nice harbour.

Tuesday 08 June 2022

This day was given to the MOOSE DYFAMED program.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/UyjRK2oLYZ2Ke11z7

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 07 June 2022 (UTC)

People on board: Ewen Ancel, Melek Golbol, Antoine Granier-Parra (student), Paco Stil and Clara Villain (student).

0645 Departure from the Nice harbour.
1000 Arrival at the BOUSSOLE site.
1015 C-OPS 01, 02, 03.
1120 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, cytometry, TA/TC, DO and pH.
1130 Attempt of CIMEL measurements: failed.
1215 SeapHOx data downloading.
1330 CTD 02, 400 m with water sampling at 60, 50, 20 and 5 m for TSM, metagenomics, nutrients and cytometry (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).
1440 Secchi 01, 18 m.
1450 Departure to the Nice harbour.
1810 Arrival to the Nice harbour.

Tuesday 08 June 2022

MOOSE operations.

Problems identified during the cruise

- Problems appeared in the C-OPS EdZ radiometer: some wavelengths were not recorded (565 and 780 nm) and some wavelength were unstable (665 and 710 nm). After the cruise, the radiometer was tested in the lab: the voltage and the current draw were too low. So, it was sent to the manufacturer for repair. It appeared that the failure was due to a leak in the instrument but it was not possible to determine its cause.

- CTD 02: the cast was performed with a 0.2µm filter put on the a-Sphere absorption meter for the dissolved matter absorption measurements. Nevertheless, this cast was stopped only at 6 depths during the ascent of the CTD (400, 150, 80, 60, 50 and 40 m) because of the arrival of the bad weather.

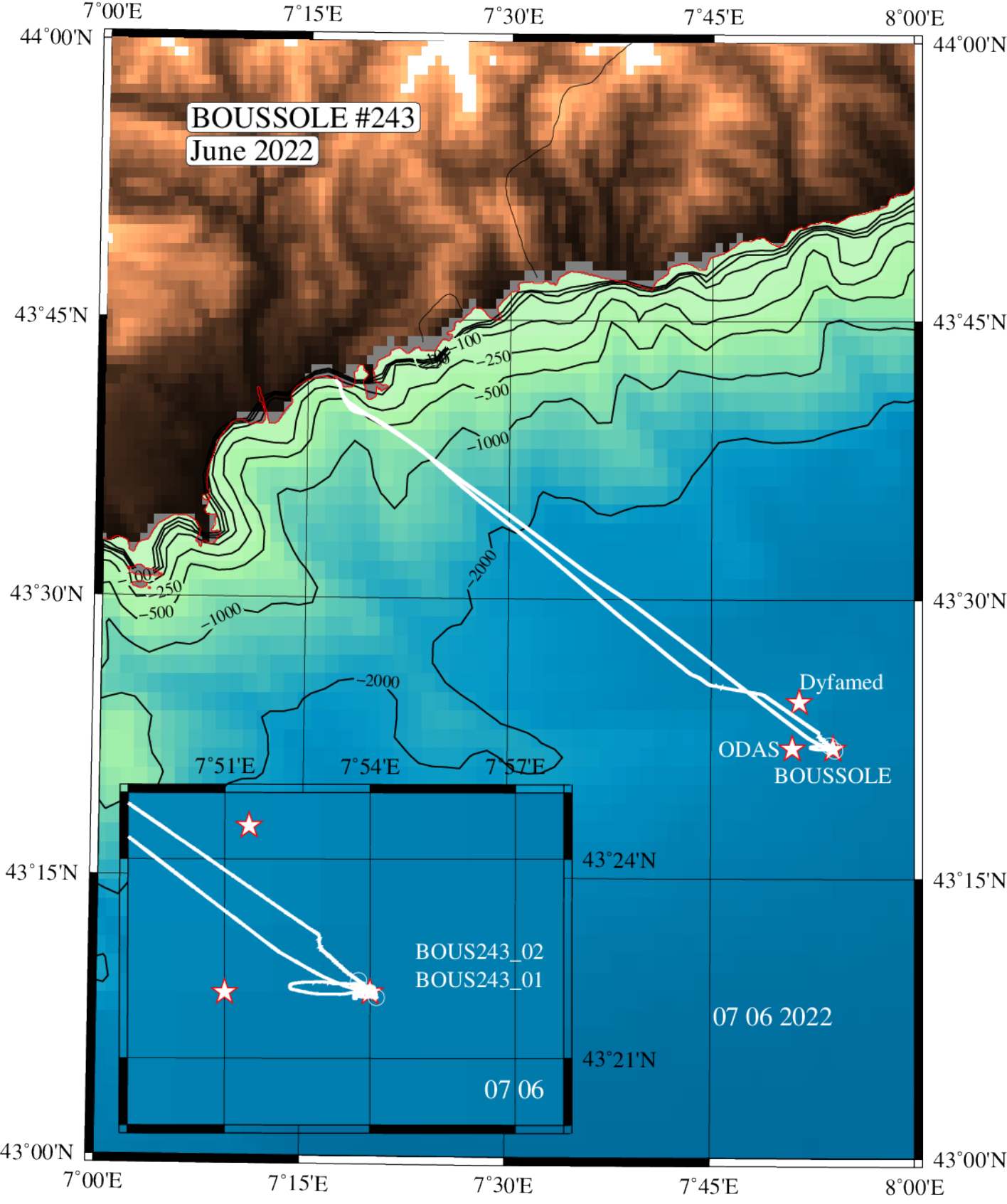
- The CIMEL photometer did not work. It was already noticed during the previous cruise. It was supposed that the battery was dead, so the batteries were replaced before the cruise. But the photometer still did not work. Unfortunately, it is not possible to send at the manufacturer for maintenance because of its obsolescence.

- The ship fluorometer is out of service. It is not repairable because of its obsolescence. It will be replaced during the works planned on the R/V *Téthys* in 2023.

Appendices

Cruise Summary Table for Boussole 243

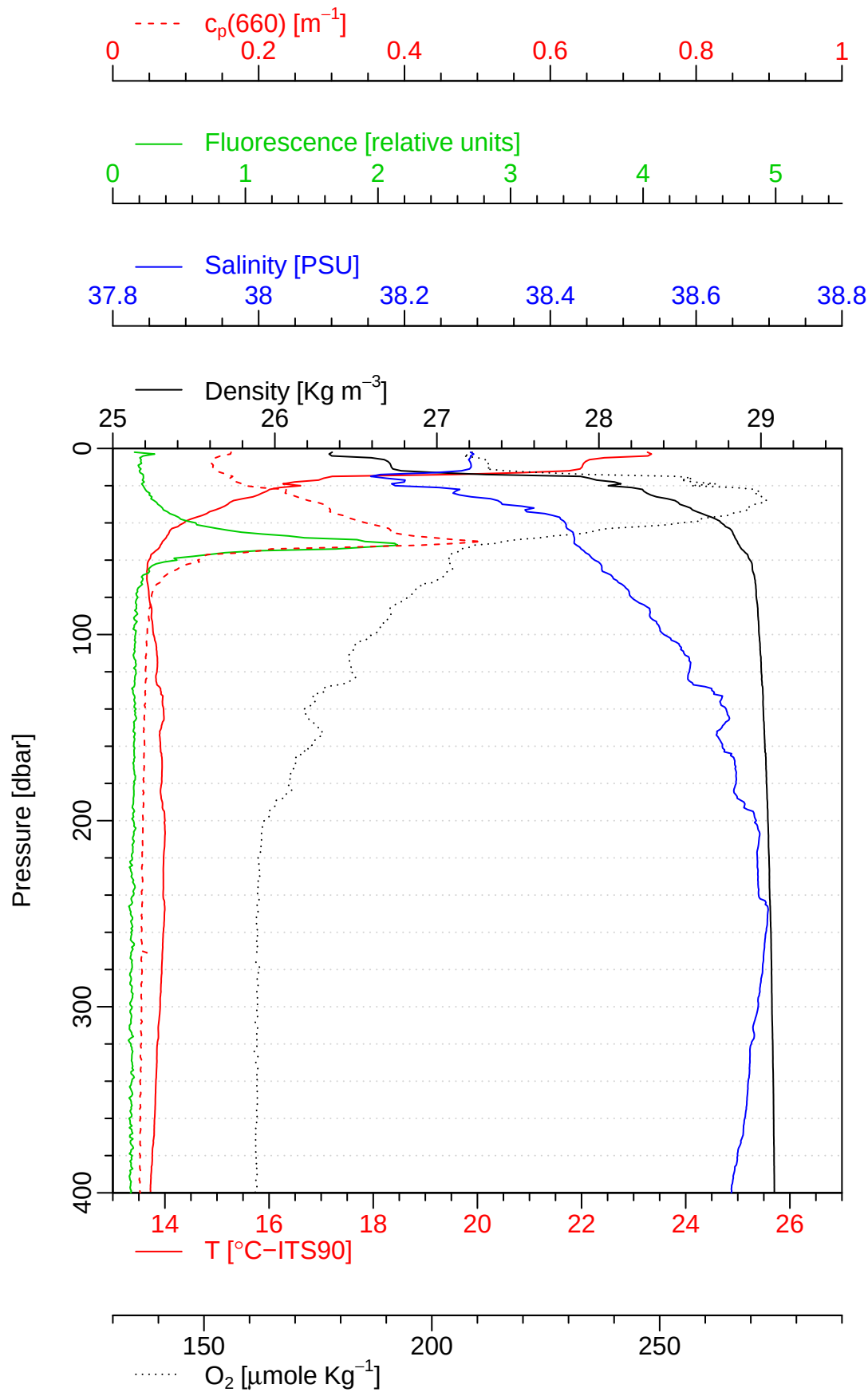
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather							Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(hour.min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
07/06/22		bou_c-ops_220607_1001_002_data.csv			10:14	0:04:17	108	43	22.11	7	53.778	blue	none	0	6	53	1011	70.5	good	24.5		slight	0.6		no
		bou_c-ops_220607_1001_003_data.csv			10:27	0:04:25	115	43	22.127	7	53.364	blue	none	0	6	53	1011	70.5	good	24.5		slight	0.6		no
		bou_c-ops_220607_1001_004_data.csv			10:39	0:04:33	118	43	22.152	7	52.895	blue	none	0	6	53	1011	70.5	good	24.5		slight	0.6		no
			BOUS243_01	HPLC, ap, O_2, TA/TC, pH & cyto	11:20	0:39:00	400	43	21.919	7	54.133	blue		0	6.6	60	1010	76		23.3	23.20	slight			
			BOUS243_02	TSM, metagenomics, cyto & nutrients	13:27	1:05:00	400	43	22.169	7	53.764	blue		0	8.6	120	1009	74		23.9	23.10	slight			
				Secchi 01	14:40	0:04:00	18	43	22	7	54	blue		0					good			slight			
08/06/22	DYFAMED operations																								



GMT 2022 Oct 06 16:07:42

bous243_01

Date = 07/06/2022
Heure debut [TU] = 11:20
Longitude = 007 54.133 E
Latitude = 43 21.919 N



bous243_02

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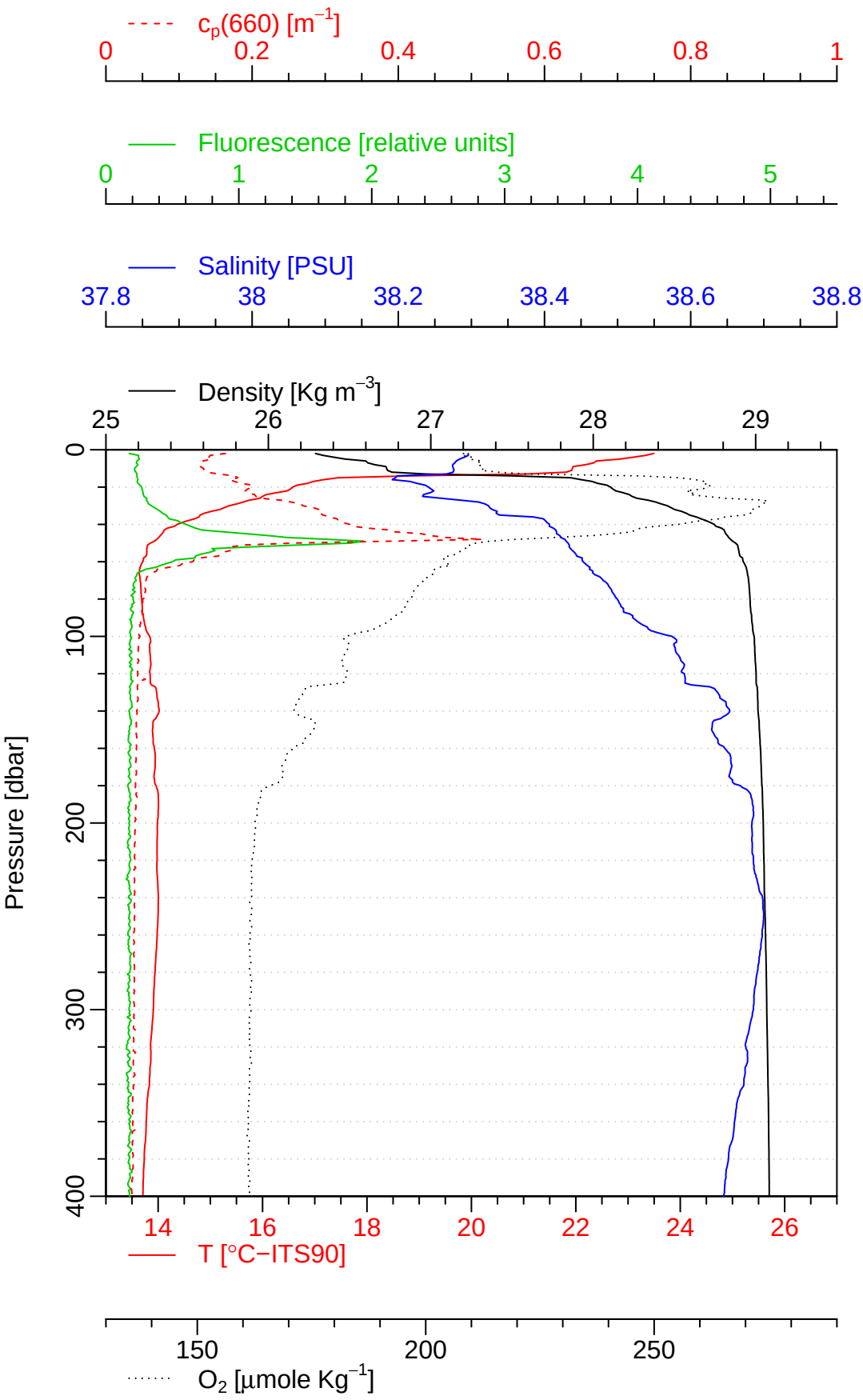
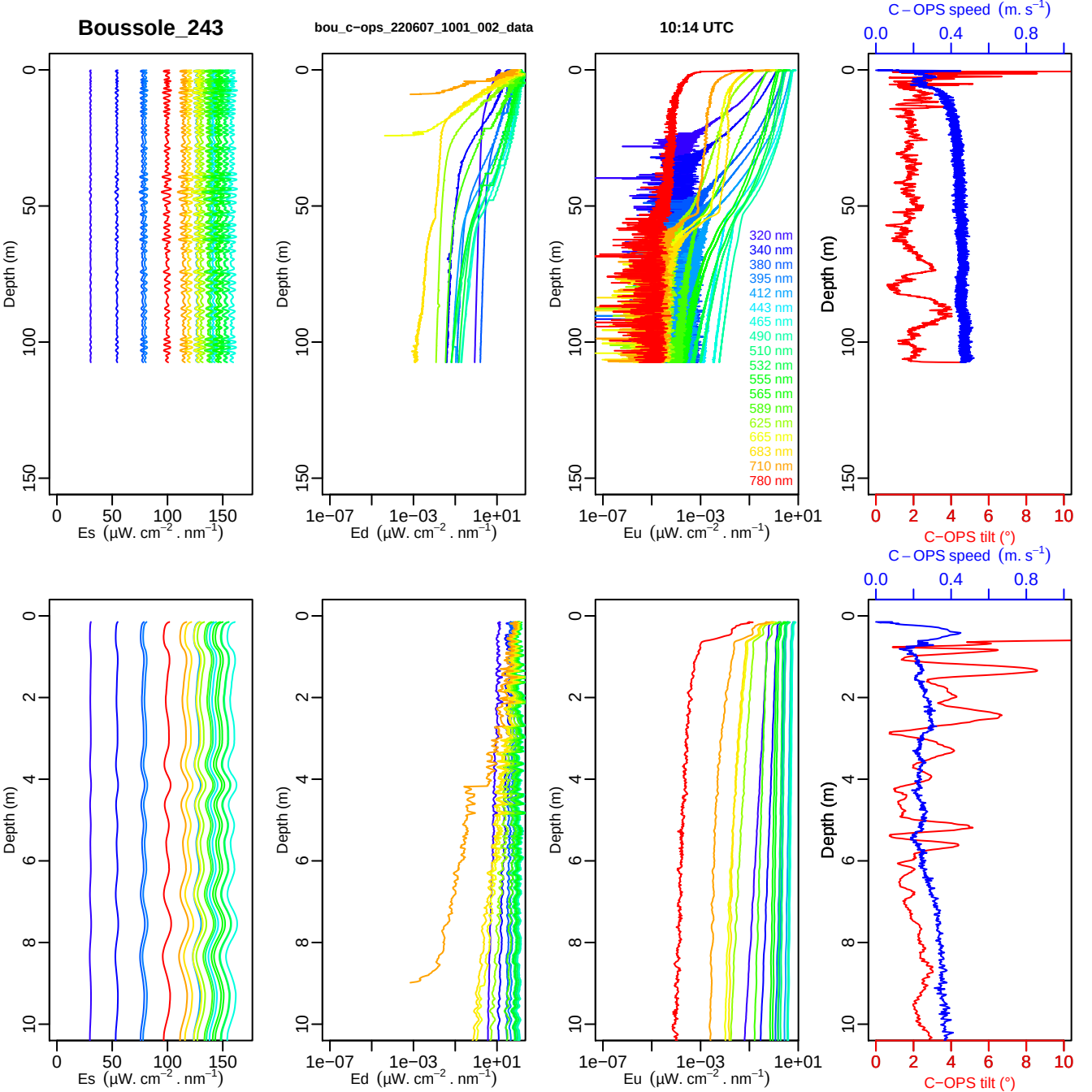
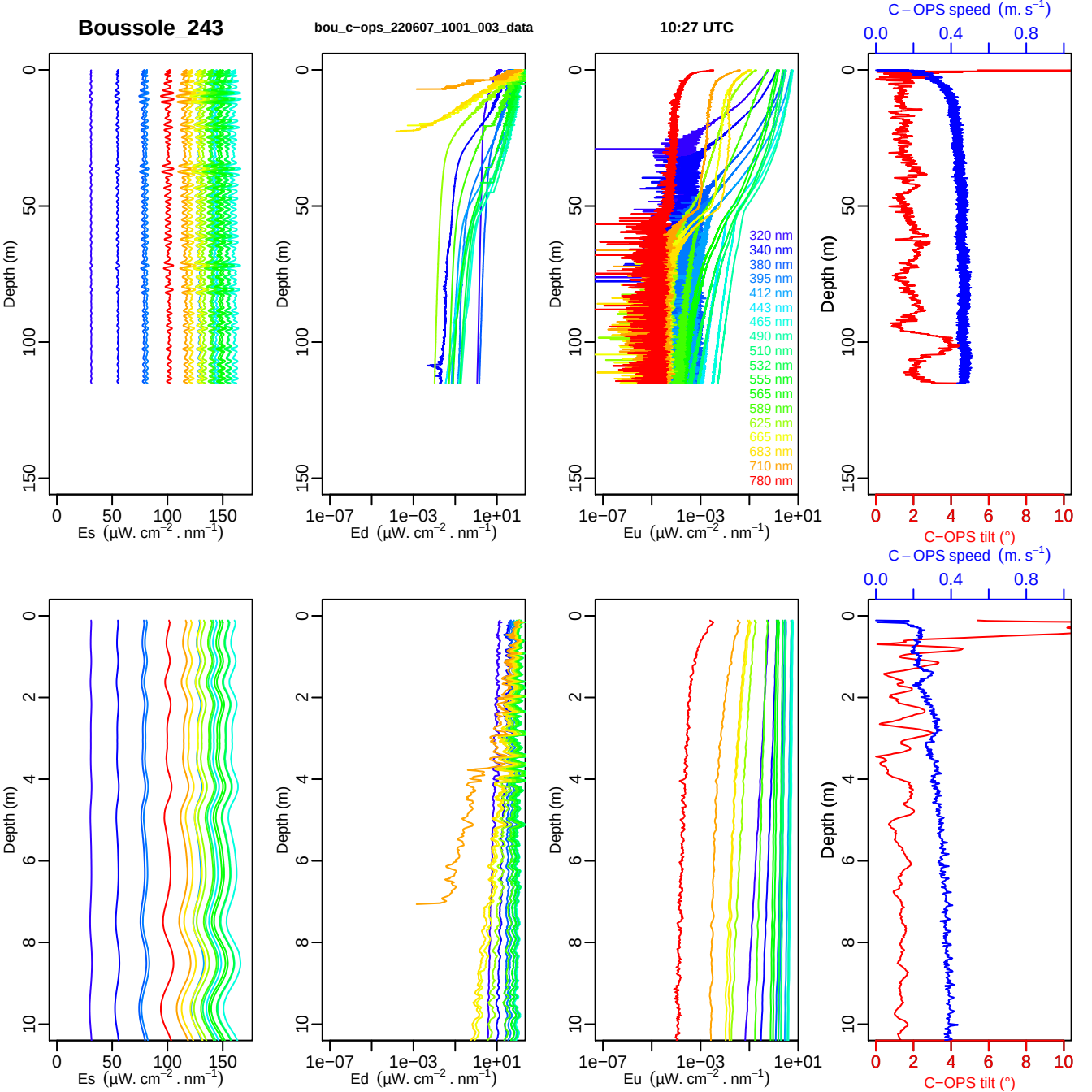
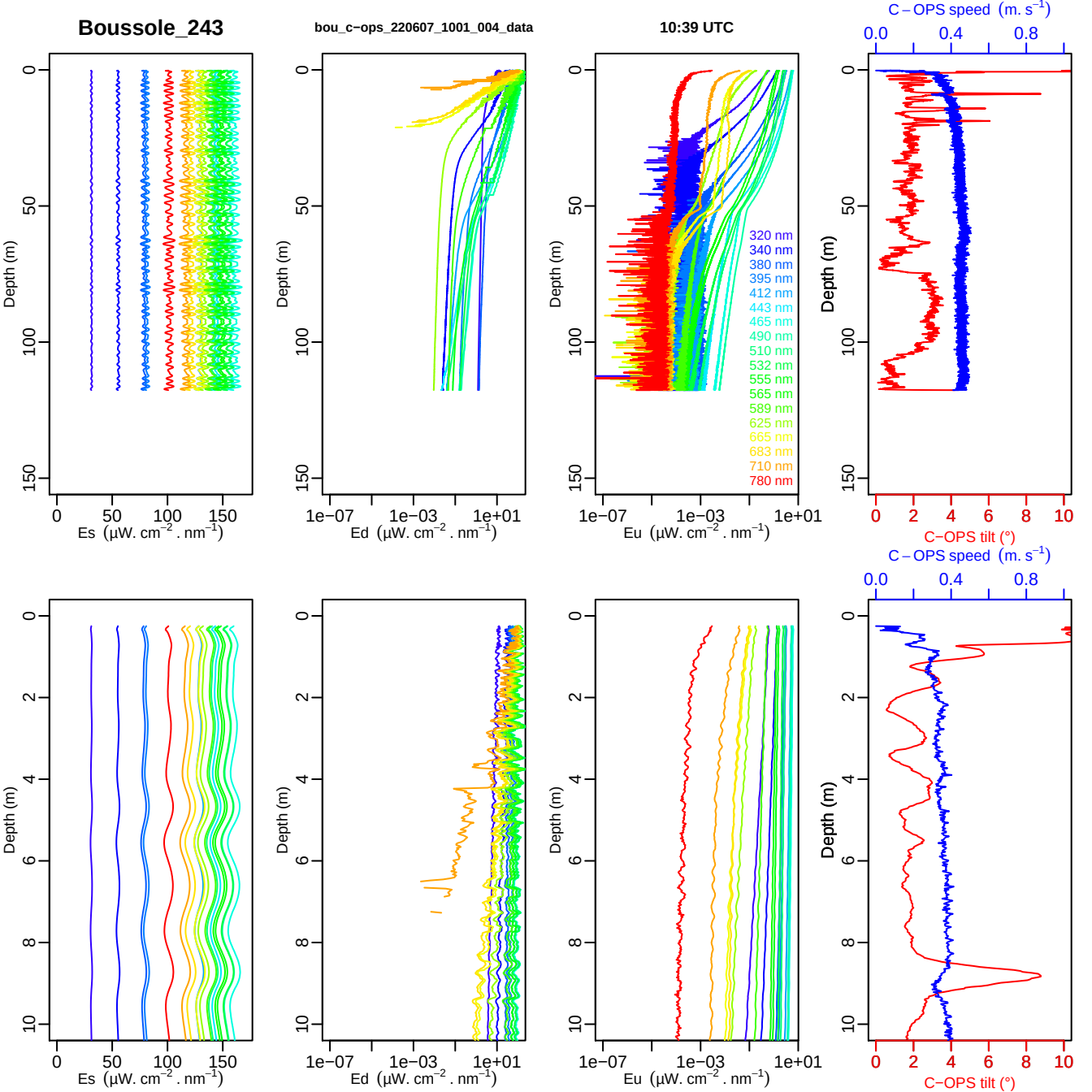
Longitude = 007 53.764 E
Latitude = 43 22.169 N




Boussole_243
bou_c-ops_220607_1001_002_data
10:14 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_243
bou_c-ops_220607_1001_003_data
10:27 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_243
bou_c-ops_220607_1001_004_data
10:39 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
665 nm
683 nm
710 nm
780 nm
C−OPS tilt (°)
0
2
4
6
8
10