BOUSSOLE Monthly Cruise Report

Cruise 223
October 22-24, 2020

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

Science Personnel: Emilie Diamond Riquier, Céline Dimier, Melek Golbol, Flavien Petit and Eduardo Soto Garcia.

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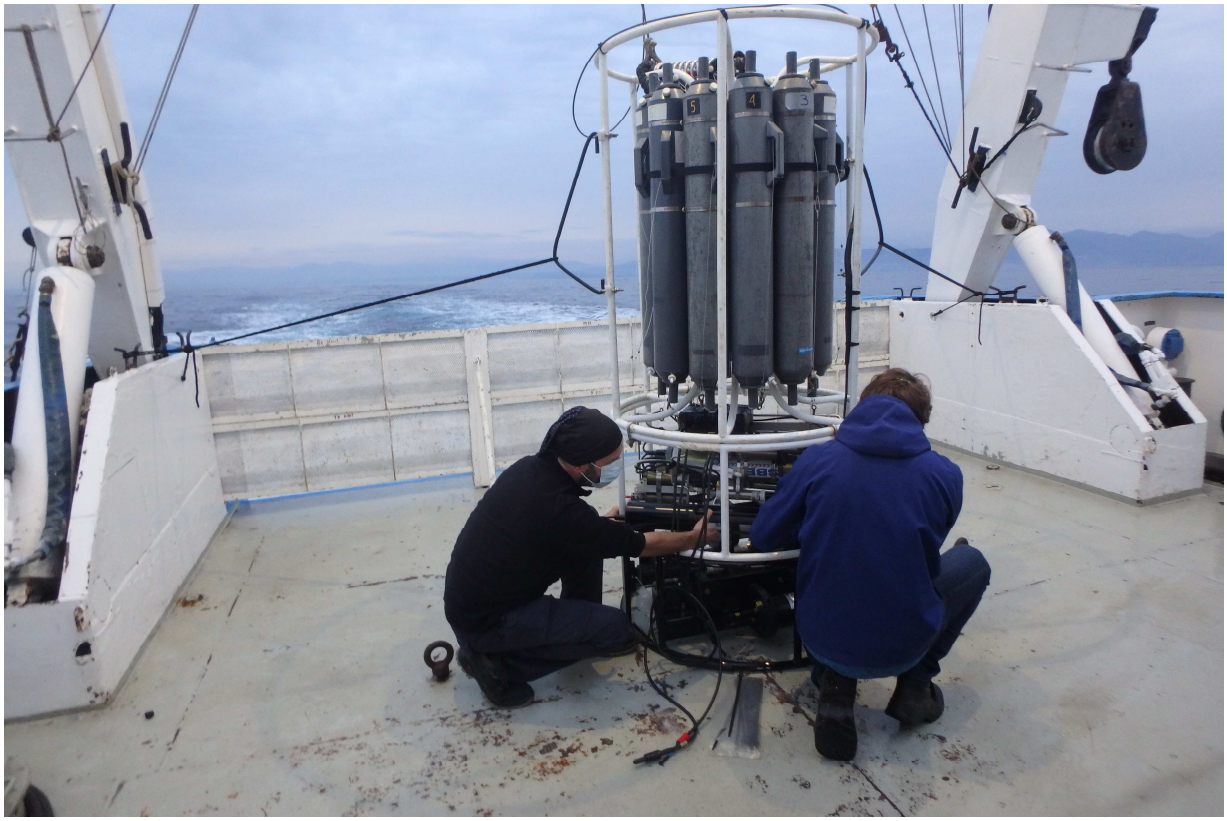

Installation of additional optical sensors on the CTD Rosette on the deck of the R/V *Téthys II* in the frame of the OBOO LEFE-CYBER project

BOUSSOLE project

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

October 30, 2020

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

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Sorbonne Université, 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), 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). 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 (from March 2020). 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

Seawater samples are to be collected 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 from September 2020 in the frame of this project: an Eco FLBB2 sensor which measures fluorescence (excitation at 470 nm, emission at 695 nm) and backscattering 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.

The "MOOSE DYFAMED" cruise scheduled for October 21st was cancelled because of a bad weather forecast, so their operations were performed during the BOUSSOLE cruise.

Cruise Summary

Only the second day was used for BOUSSOLE operations due to bad weather the first and the last days. It was used for CTD casts with water sampling, for optical profiles, for a Secchi disk at the BOUSSOLE site and for DYFAMED operations.

Thursday 22 October 2020

Bad weather prevented departure from the Nice harbour.

Friday 23 October 2020

The sea state was slight with a gentle to moderate breeze. The sky was overcast and the visibility was medium. When arrived at the BOUSSOLE site, the CTD was deployed but the cast had to be stopped at 78 m because an alarm sounded on the deck unit. The CTD was recovered and the connectors between the CTD and the sea cable were cleaned. The CTD functioned correctly during the second cast. Then, three C-OPS profiles were performed before the third CTD cast with water sampling. For this last cast, a 0.2µm filter was put on the a-Sphere absorption meter for the dissolved matter absorption measurements. The cast was stopped at 8 depths during the ascent of the CTD. Finally, a Secchi disk was performed before DYFAMED operations: locating of DYFAMED mooring, a deep CTD cast and two zooplankton nets.

Saturday 24 October 2020

Bad weather prevented departure from the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/A8Rtp2UVZ1k7DXid7

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 22 October 2020

Bad weather prevented departure from the Nice harbour.

Friday 23 October 2020 (UTC)

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

0510 Departure from the Nice harbour.
0830 Arrival at the BOUSSOLE site.
0845 Attempted of CTD cast: failed.
IOP 01, 78m.
0900 CTD 02, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 35, 20, 10 and 5m for HPLC, a_p, O_2, TA/TC and TSM and for phytoplankton microscopy, cytometry, PIC, POC and HPLC (OBOO project).
0950 C-OPS 01, 02, 03.
1100 CTD 03, 400 m with water sampling at 60, 35, 20 and 5 m for metagenomic, cytometry and nutrients analyses (EFFICACY project) (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, 35, 20 and 5 m).
1130 Secchi disk 01, 17 m.
1215 Departure to the DYFAMED site.
1245 Localization of the DYFAMED mooring.
1400 Deep CTD cast, MOOSE 145, 2350 m.
1540 Zooplankton nets, 100 and 200 m.
1610 Departure to the Nice harbour.

1900 Arrival to the Nice harbour.

Saturday 24 October 2020

Bad weather prevented departure from the Nice harbour.

Problems identified during the cruise

- The connector of the uplink on the CTD, which allows the connection between the three additional optical sensors of the OBOO project and the CTD, was broken during the installation of the sensors. So, these sensors were not operational during this cruise.

- The first CTD cast had to be stopped at 78 m because an alarm sounded on the deck unit. The CTD was recovered and the connectors between the CTD and the sea cable were cleaned. This CTD cast could not be processed but the data of the IOP package which was deployed simultaneously were kept and processed.

- CTD cast 02: there were outliers in oxygen data between 239 and 257 m: these data were removed.

- Diving and maintenance operations of the buoy were not carried out because the buoy currently does not function.

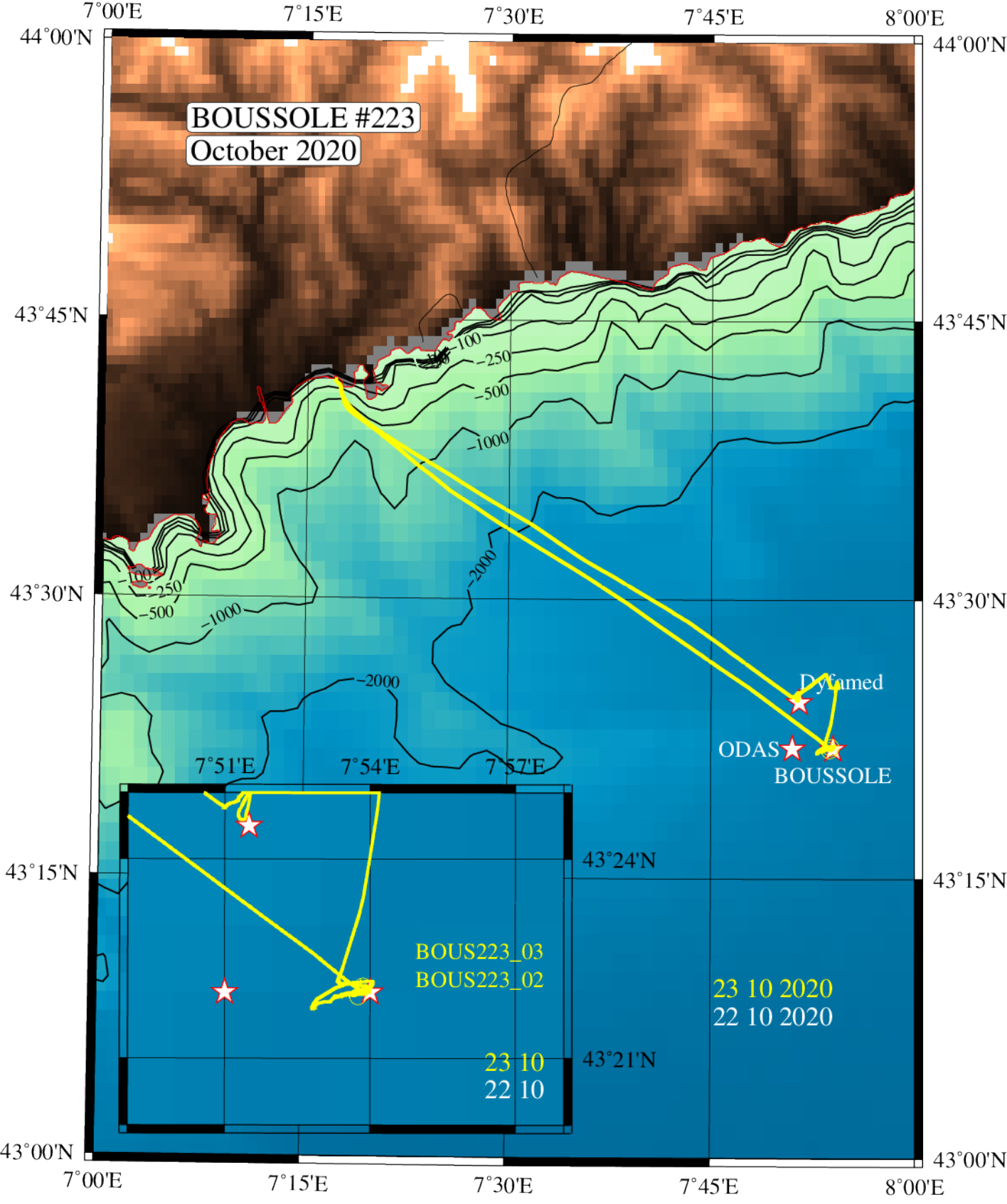
- Dark measurements were not taken for the backscattering meter during this cruise.

- Because of a lack of time, the CTD cast 03 was stopped only at 8 depths (400, 150, 80, 60, 50, 35, 20 and 5m) during the ascent of the CTD.

Appendices

Cruise Summary Table for Boussole 223

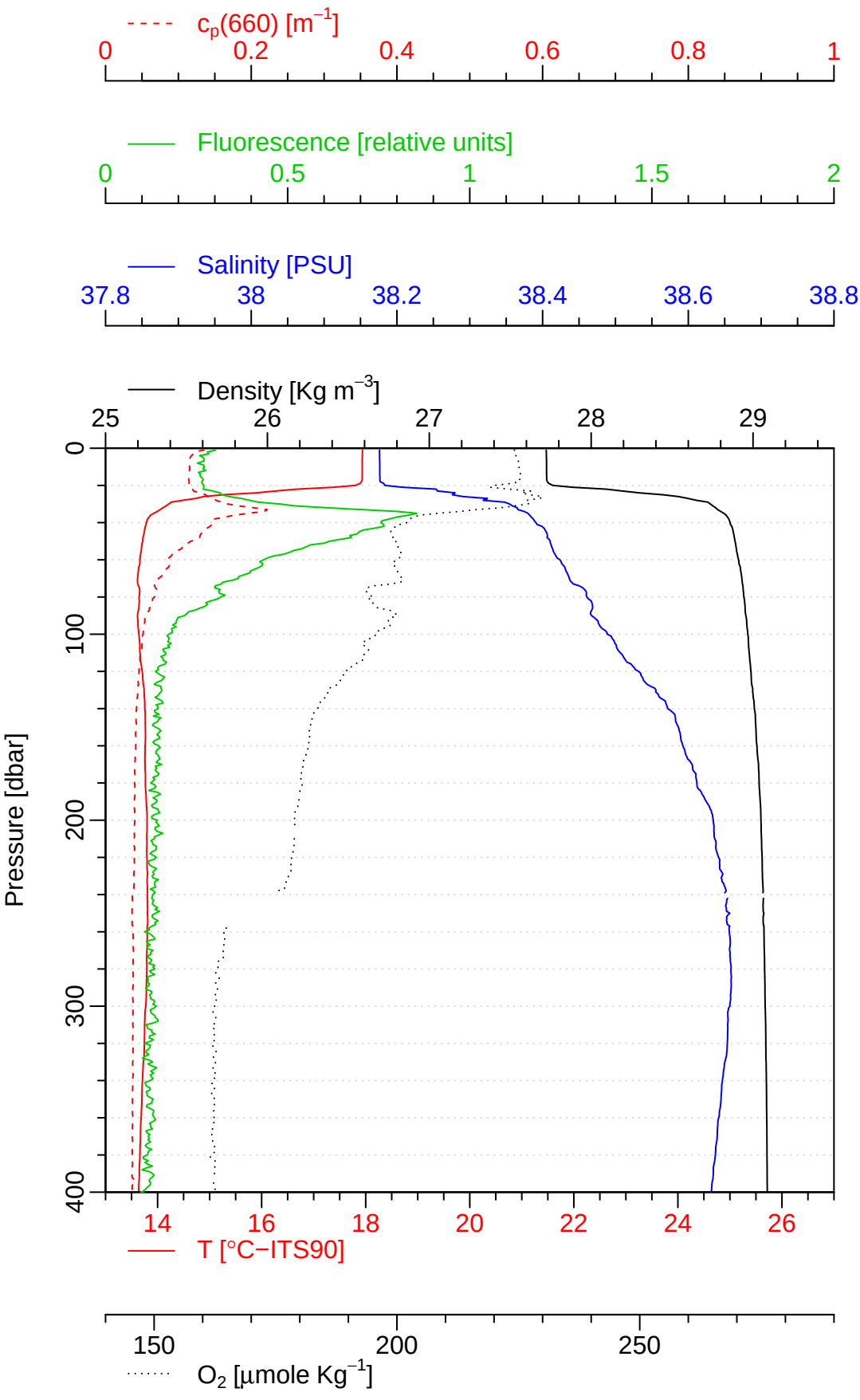
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather							Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
22/10/20	Bad weather																							
23/10/20				IOP_bous223_01	8:44	2:31	78	43	21.972	7	53.774	overcast		8	10	27	1019.4	93		18.3	18.6	slight			
			BOUS223_02	HPLC, ap, Phytofloat (HPLC, PIC, POC, Cyto, phyto) & TSM	9:00	35:00	400	43	21.928	7	53.751	overcast		8	8	40	1019.3	93		18	17.93	slight			
		bou_c-ops_2010_0928_001_data.csv			9:48	3:51	92	43	21.996	7	53.755	overcast	St	8	11	18	1019	93	medium	18.4		slight	0.8		Yes
		bou_c-ops_2010_0928_002_data.csv			10:00	3:30	86	43	21.974	7	53.48	overcast	St	8	11	18	1019	93	medium	18.4		slight	0.8		Yes
		bou_c-ops_2010_0928_003_data.csv			10:11	4:06	103	43	21.855	7	53.179	overcast	St	8	11	18	1019	93	medium	18.4		slight	0.8		Yes
			BOUS223_03	Metagenomics, Cyto & Nutrients	10:59	11:00	60	43	22.089	7	53.854	overcast		8	9	8	1019.1	92		17.9	17.96	slight			
				Secchi 01	11:30	4:00	17	43	22	7	54	overcast							medium			slight			
24/10/20	Bad weather																							



GMT 2021 Jan 29 08:39:13

bous223_02

Date = 23/10/2020
Heure debut [TU] = 09:00
Longitude = 007 53.751 E
Latitude = 43 21.928 N



bous223_03

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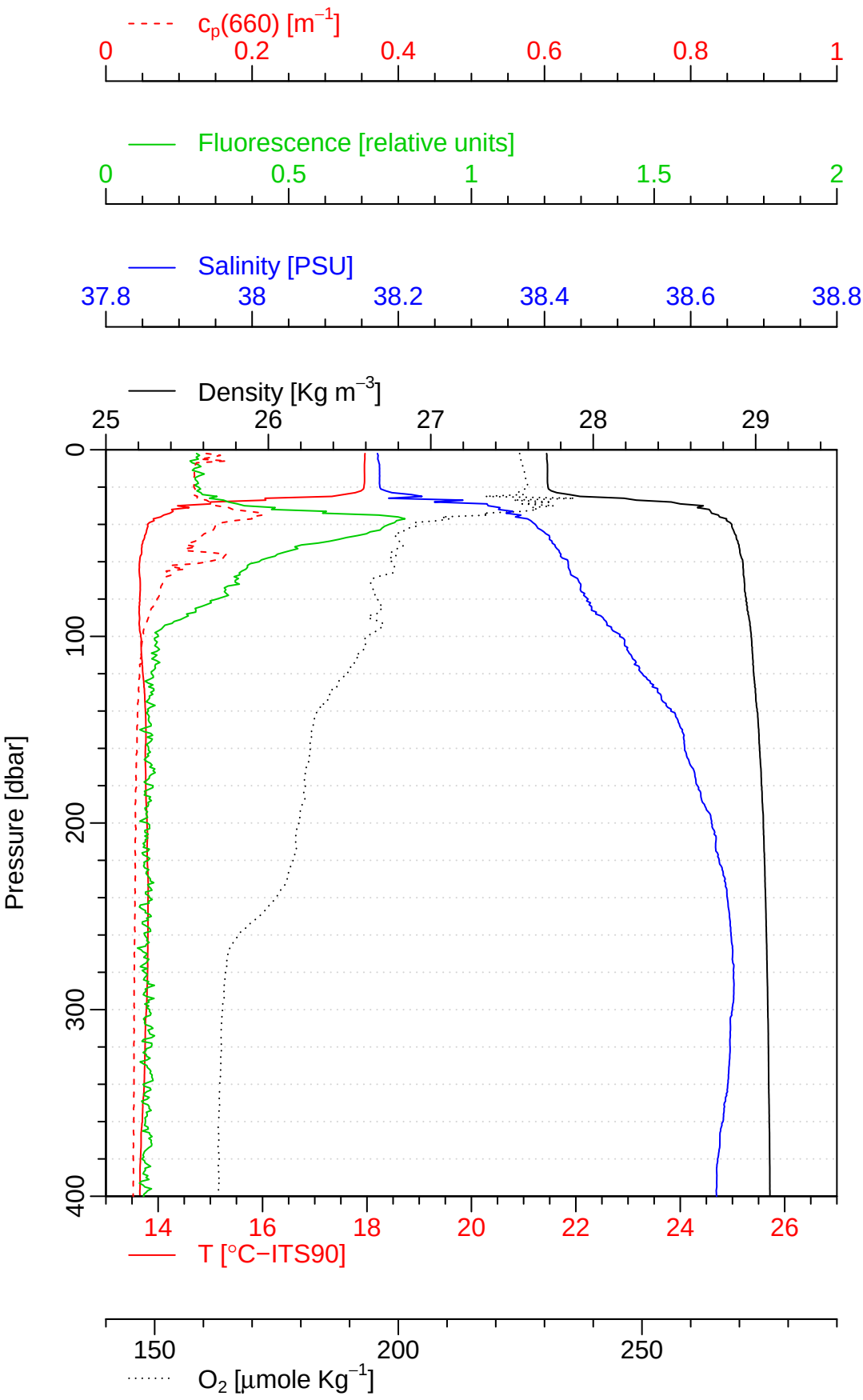
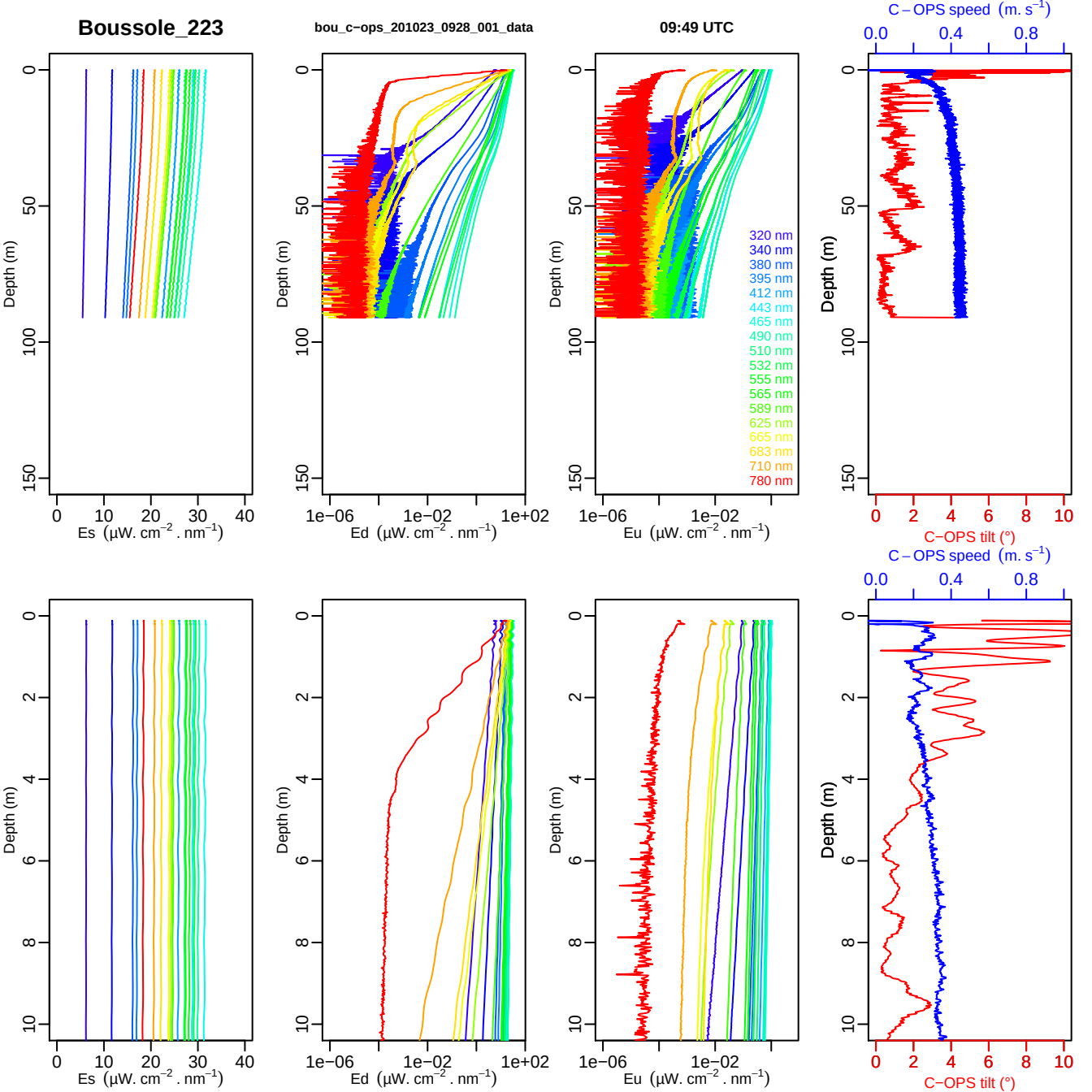
Latitude = 43 22.089 N

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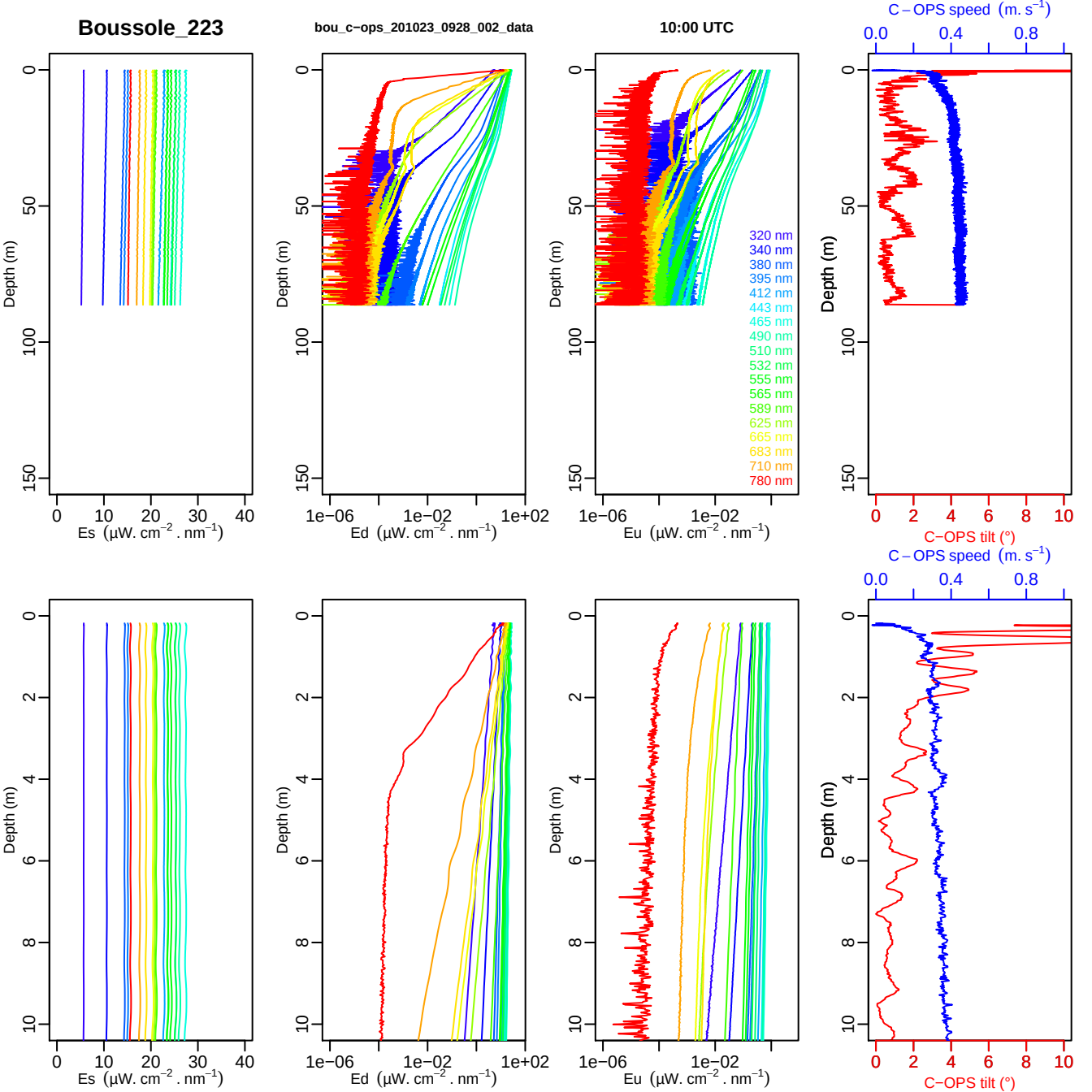
Depth (m)
Es (µW. cm^{-2}. nm^{-1})
Ed (µW. cm^{-2}. nm^{-1})
Eu (µW. cm^{-2}. nm^{-1})
C – OPS speed (m. s^{-1})
C–OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm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Es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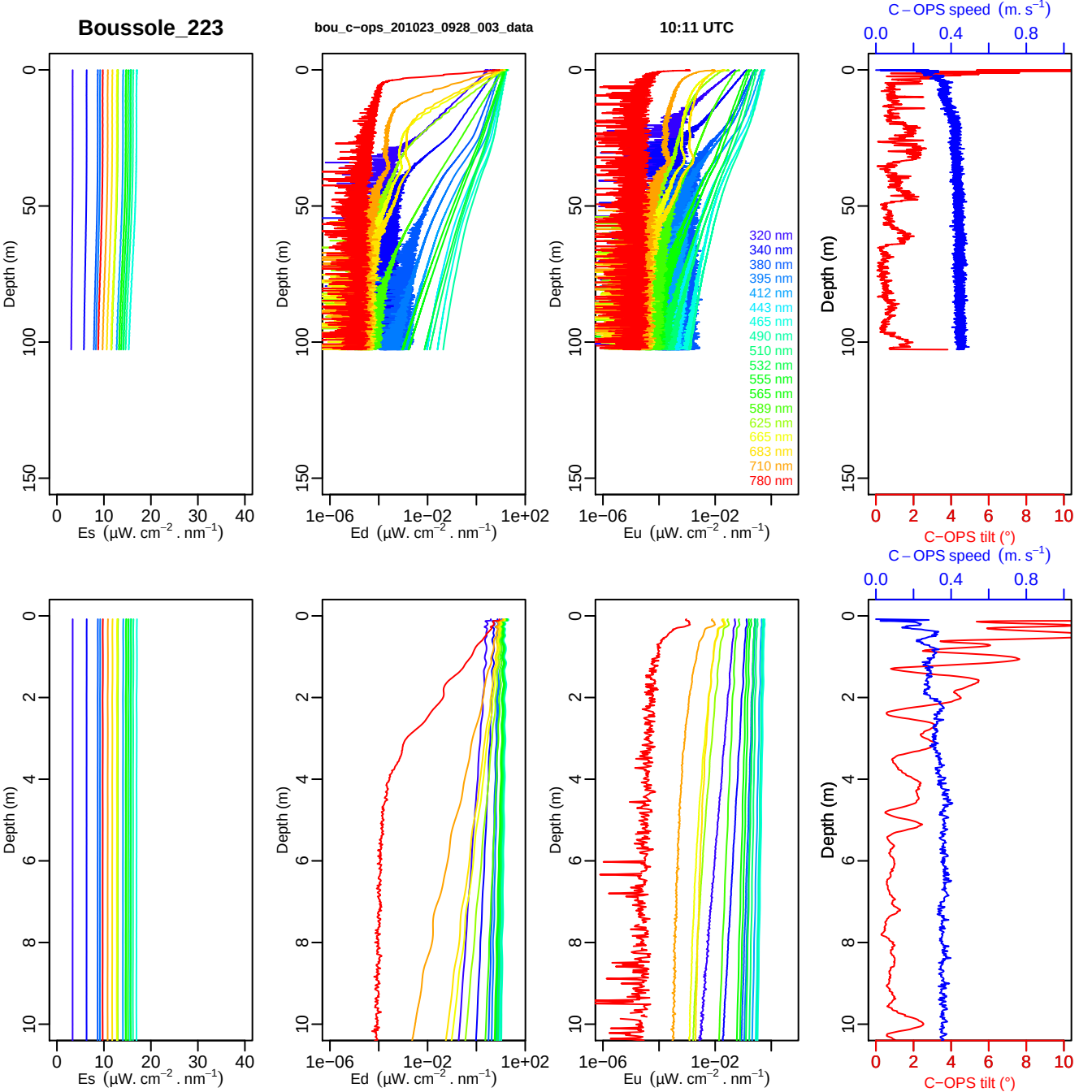
710 nm
780 nm


Boussole_223
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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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