BOUSSOLE Monthly Cruise Report

Cruise 230
May 13-14, 2021

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

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

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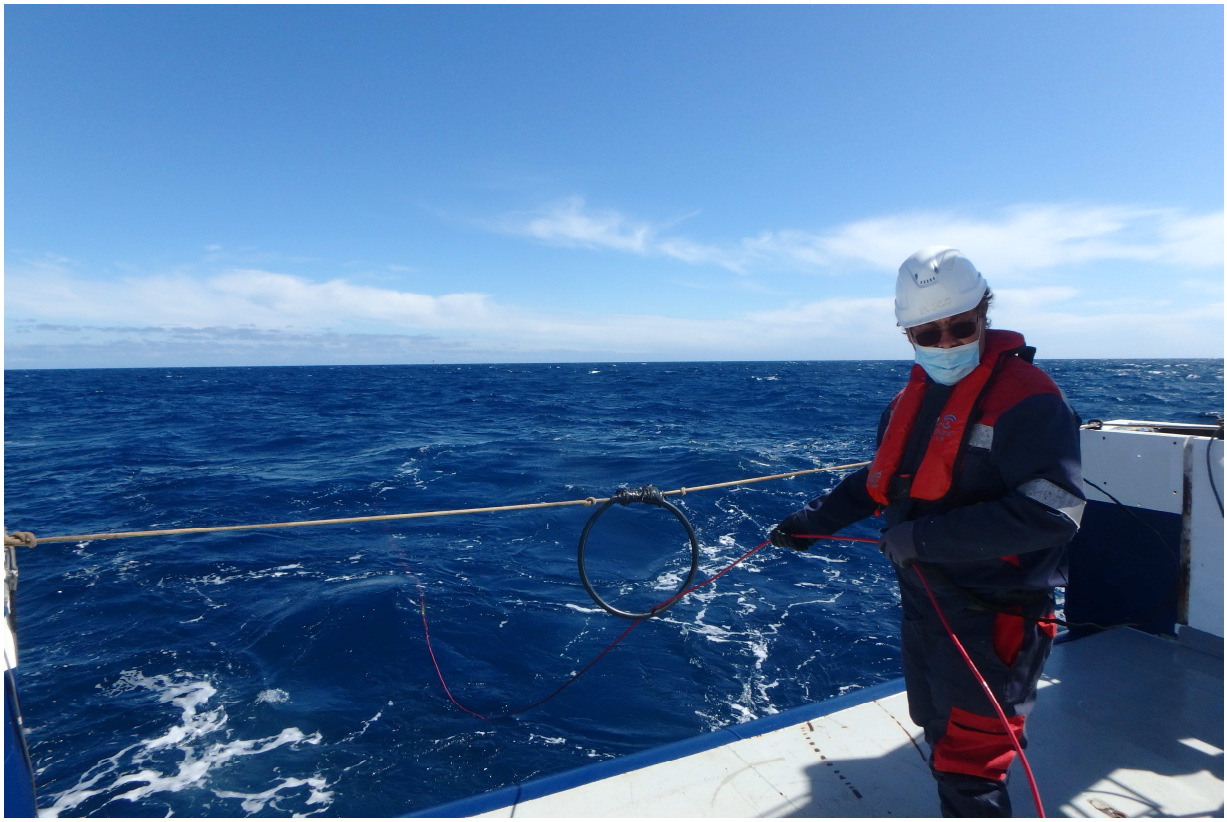

Deployment of the Biospherical COPS (Compact Optical Profiling System) from the deck of the R/V *Téthys II*

BOUSSOLE project

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

May 28, 2021

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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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 is to be sampled 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 that measures fluorescence (excitation at 470 nm, emission at 695 nm) and backscattering at 700 nm, an Eco 3X1M sensor that measures multispectral fluorescence (excitation at 440, 470 et 532 nm, emission at 695 nm) and an ECO V2 B206 sensor that measures chlorophyll fluorescence at 470 and 440 nm, CDOM fluorescence and backscattering at 700 nm.

The "MOOSE DYFAMED" cruise scheduled for 12th May was cancelled because of bad weather, so their operations were performed during the BOUSSOLE cruise.

Cruise Summary

Only the last day was used for BOUSSOLE and DYFAMED operations due to bad weather the days before. It was used for a Secchi disk, optical profiles, sun photometer measurements (CIMEL CE317) and CTD casts with water sampling at the BOUSSOLE site, and for DYFAMED operations.

Thursday 13 May 2021

Bad weather prevented departure from the Nice harbour.

Friday 14 May 2021

The sea state was moderate with a fresh breeze in the afternoon and a gentle breeze in the evening. The sky was blue and the visibility was good. We left the Nice harbour later than usual in the afternoon because the weather forecasts announced bad weather in the morning but better weather conditions in late afternoon. When arrived at BOUSSOLE, we started with the deployment of the Secchi disk because the rough sea did not allow us to deploy the CTD or the C-OPS. Then, 3 C-OPS profiles and a CIMEL measurement were performed at the BOUSSOLE site. It was not possible to continue CIMEL measurements because the sky became cloudy. The zooplankton net was deployed down to 200 m at the BOUSSOLE site for the MOOSE program. During the deployment, the cable of the winch came off its pulley, so the net was recovered via the winch headstock but this operation took a long time. Then, 2 CTD casts with water sampling were performed at the BOUSSOLE site. For the CTD 02 cast, a cap was put on the backscattering meter for dark measurements. Finally, a deep CTD cast with water sampling was performed at the BOUSSOLE site for completing the MOOSE program operations before returning to the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/6tJWD3WgPenLyxuu7

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 13 May 2021 (UTC)

Bad weather prevented departure from the Nice harbour.

Friday 14 May 2021 (UTC)

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

1020 Departure from the Nice harbour.
1330 Arrival at the BOUSSOLE site.
1335 Secchi 01, 17 m.
1400 C-OPS 01, 02, 03.
1410 CIMEL 01.
1450 Zooplankton net, 200 m (MOOSE program).
1600 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5m for HPLC, $a_{p,}$ phytoplankton microscopy, cytometry, PIC and POC.
1725 CTD 02, 100 m with water sampling at 60, 28, 20 and 5m for O_2, TA/TC, TSM, metagenomic, cytometry and nutrients analyses (with cap on the HS6).
1740 Departure to the DYFAMED site.
1810 Arrival at the DYFAMED site.
1900 Deep CTD cast, 2350 m with water sampling (MOOSE 152).
2035 Departure to the Nice harbour.
0000 Arrival to the Nice harbour.

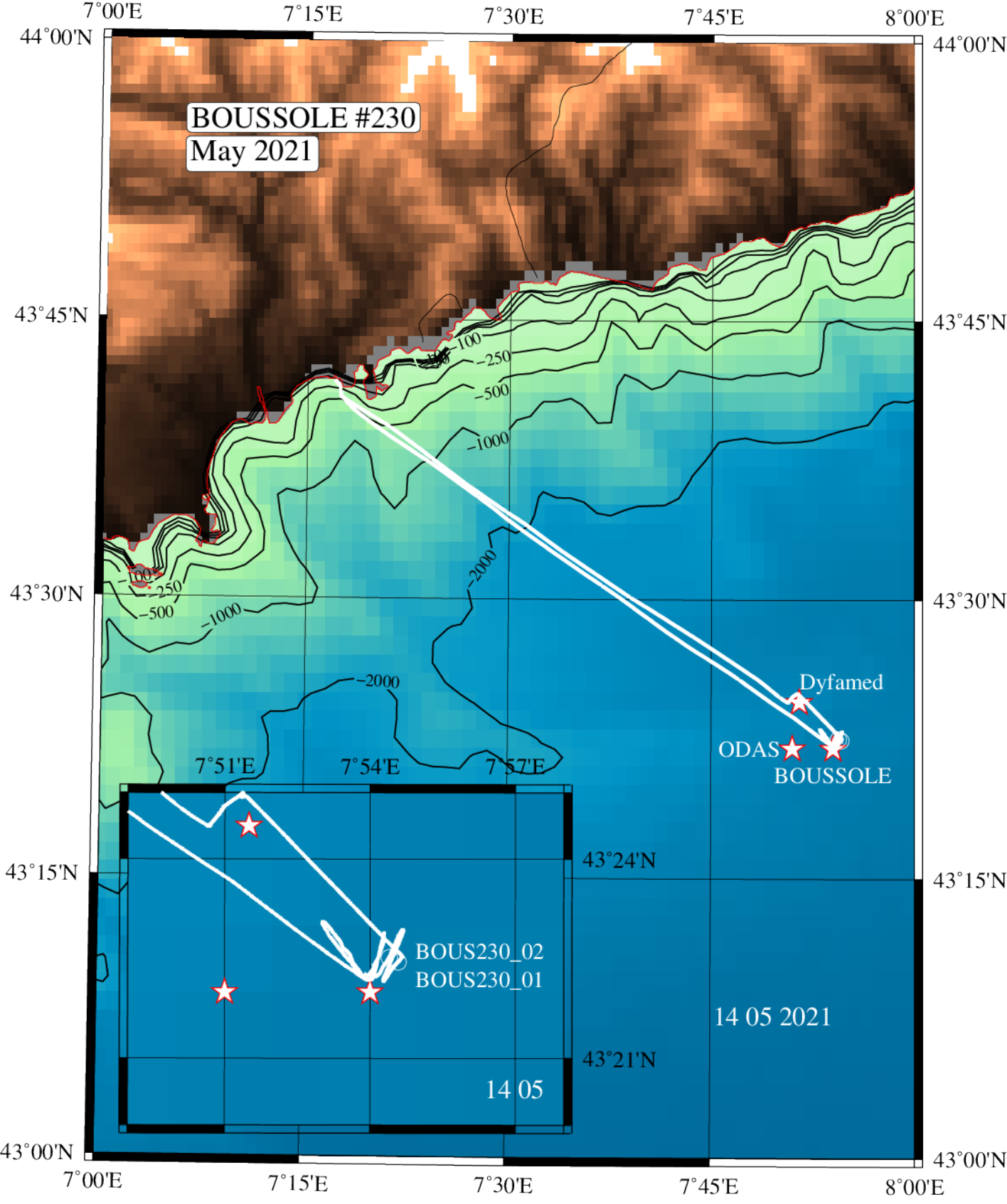
Problems identified during the cruise

- Bad weather did not allow us to plan diving and maintenance operations on the buoy during this cruise.
- Secchi 01: the Secchi disk did not descend vertically. The measurement is unreliable
- Only 1 CIMEL measurement could be performed due to clouds quickly forming after measurements were started.
- There were some spikes in oxygen data (CTD 01) and in transmissometer data (CTD 02): outliers were removed.
- Because of the lack of time due essentially to bad weather, it was not possible to perform the CTD cast including a 0.2 µm filter installed on the inlet tube of the a-Sphere for the dissolved matter absorption measurements.
- During the deployment of the zooplankton net at 200 m, the cable of the winch came off its pulley. Solving this issue took a long time because the cable had to be reassembled with the winch headstock.

Appendices

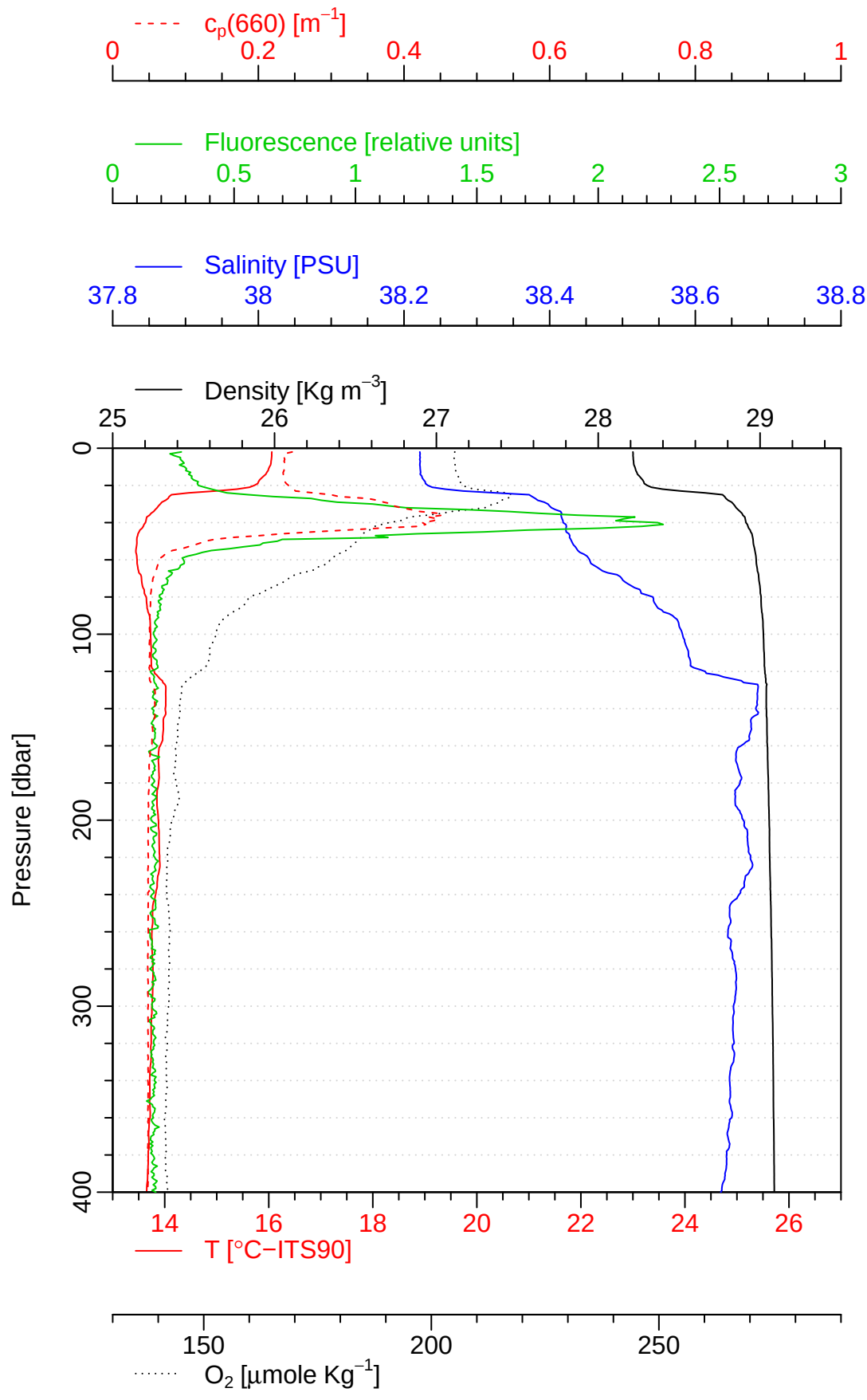
Cruise Summary Table for Boussole 230

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
13/05/21	Bad weather																								
14/05/21				Secchi 01	13:35	0:04:00	12	43	22	7	54	blue		2					good			moderate			
		bou_c-ops_210514_1214_001_data.csv			13:56	0:04:02	102	43	22.341	7	53.75	blue	Cu/Cs	2	16.5	189	1007.1	79.9	good	15.5		moderate	1.3		yes
				CIMEL01	14:08	0:11:00		43	22.808	7	53.324	blue		2			1007.2								
		bou_c-ops_210514_1214_002_data.csv			14:10	0:04:13	106	43	22.599	7	53.535	blue	Cu/Cs	2	16.5	189	1007.1	79.9	good	16.5		moderate	2.3		yes
		bou_c-ops_210514_1214_003_data.csv			14:21	0:04:35	118	43	22.793	7	53.346	blue	Cu/Cs	2	16.5	189	1007.1	79.9	good	17.5		moderate	3.3		yes
			BOUS230_01	HPLC, ap & Phytofloat (PIC, POC, Cyto, phyto)	16:02	0:31:00	400	43	22.52	7	54.397	blue		2	10	144	1007	82.6		15.7	16.057	moderate			
			BOUS230_02	TSM, O2, TA/TC, Metagenomics, Cyto & Nutrients	17:26	0:10:00	100	43	22.453	7	54.582	blue		3	8	86	1007.4	84		16.8	16.126	slight			


BOUSSOLE #230
May 2021
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
BOUS230_02
BOUS230_01
14 05 2021
14 05

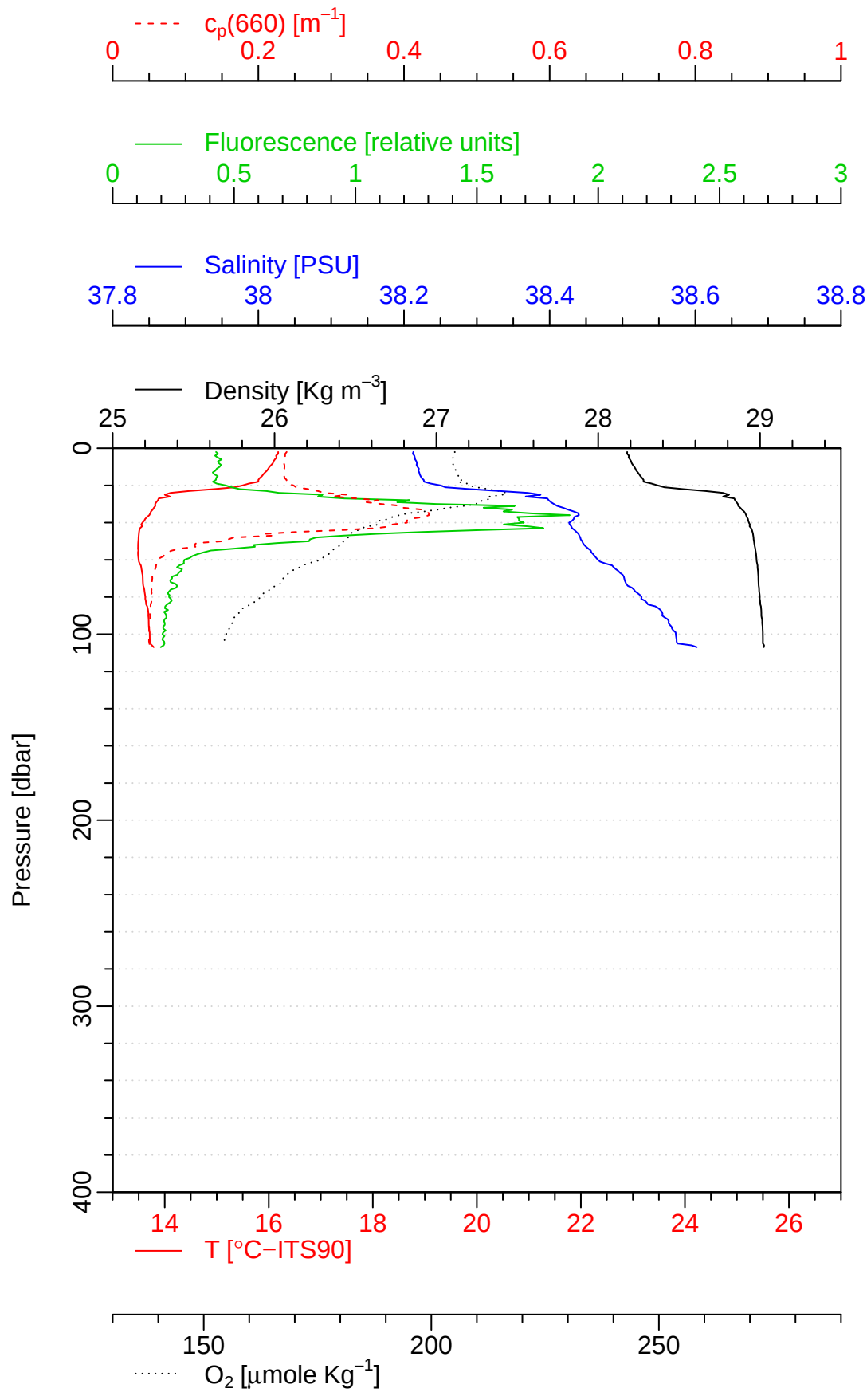
bous230_01

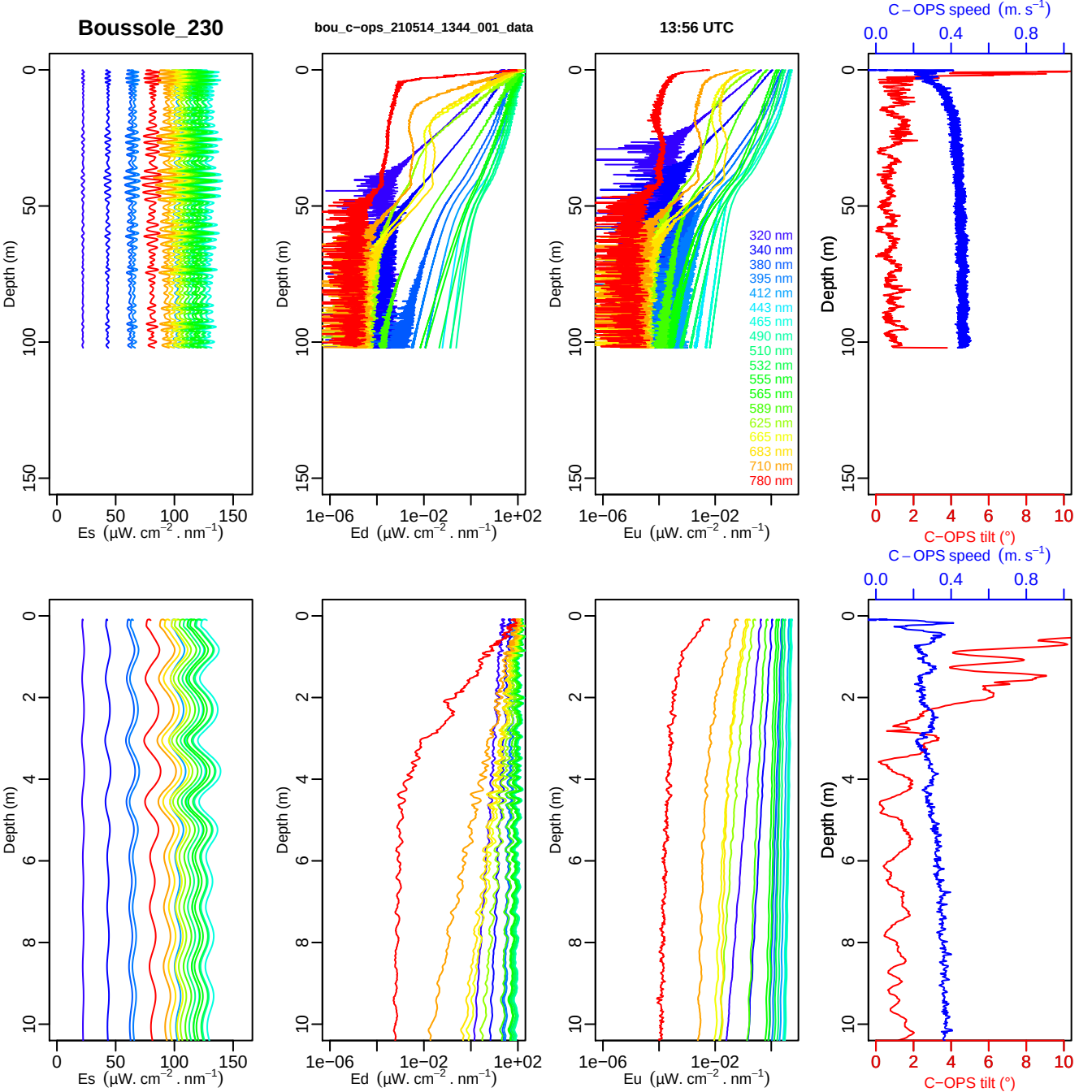
Date = 14/05/2021
Heure debut [TU] = 16:02
Longitude = 007 54.397 E
Latitude = 43 22.520 N

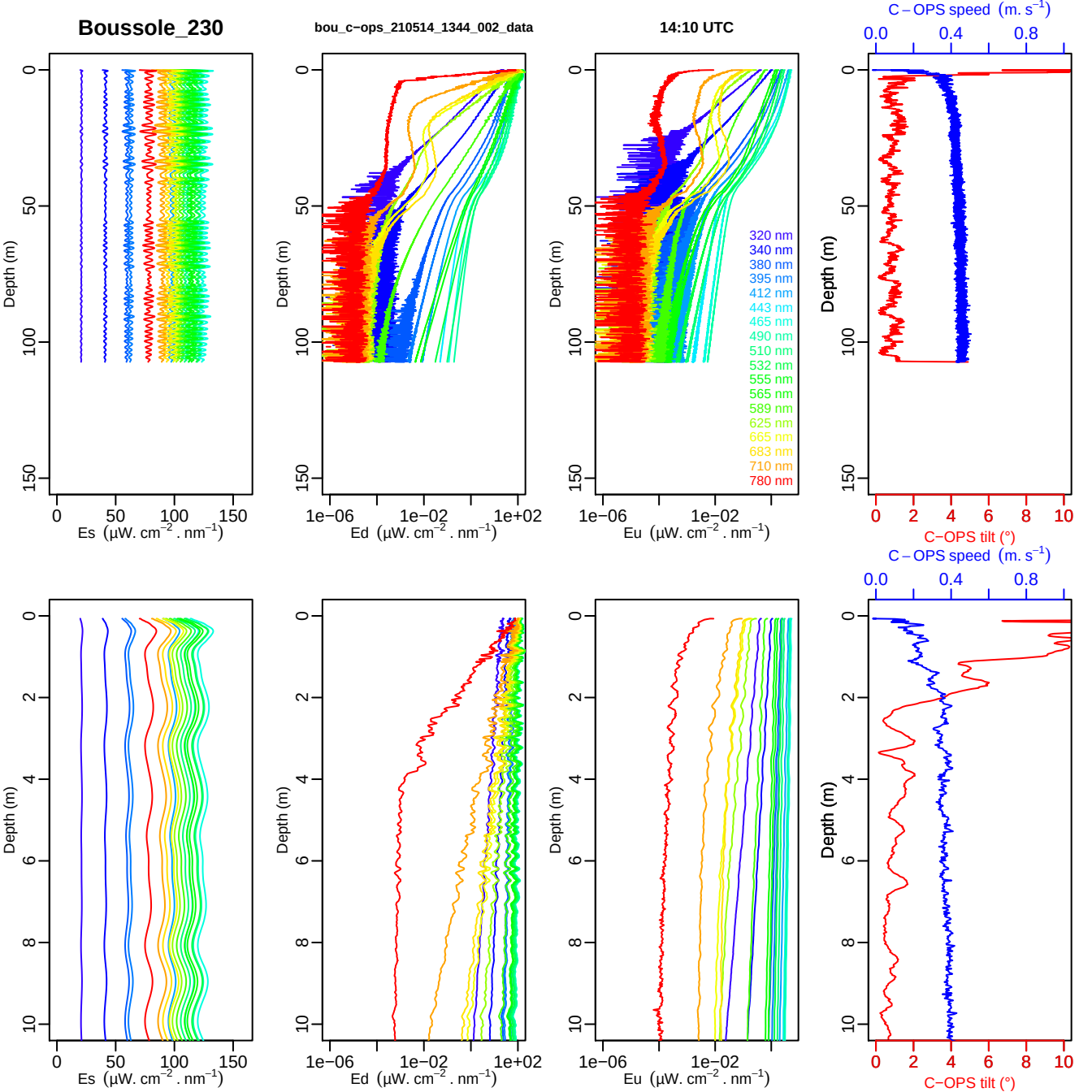


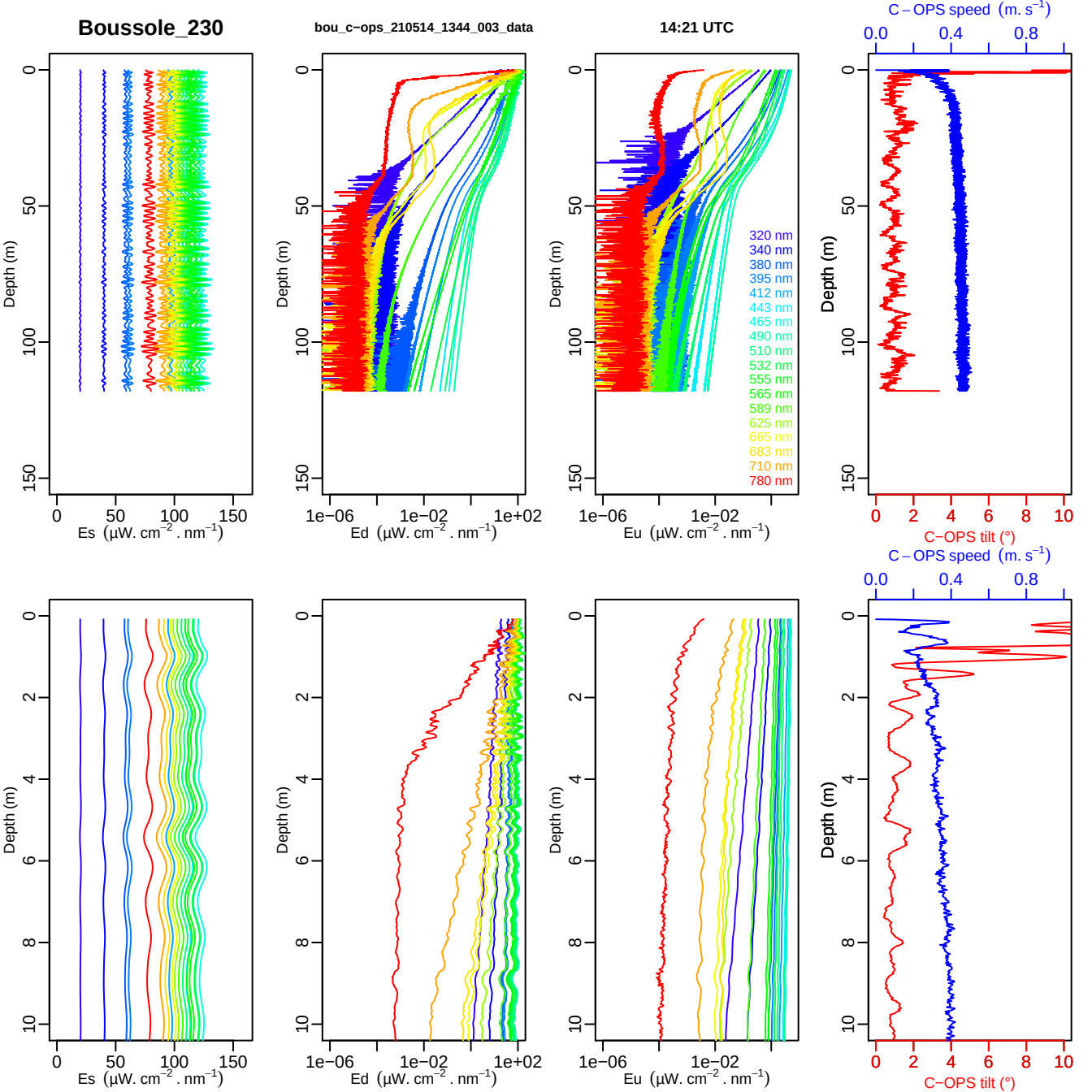
bous230_02

Date = 14/05/2021
Heure debut [TU] = 17:26
Longitude = 007 54.582 E
Latitude = 43 22.453 N




Boussole_230
bou_c-ops_210514_1344_001_data
13:56 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_230
bou_c-ops_210514_1344_002_data
14:10 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_230
bou_c-ops_210514_1344_003_data
14:21 UTC
Depth (m)
Es (µW. cm⁻². nm⁻¹)
Ed (µW. cm⁻². nm⁻¹)
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C-OPS speed (m. s⁻¹)
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