BOUSSOLE Monthly Cruise Report

Cruise 238
January 11-14, 2022

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

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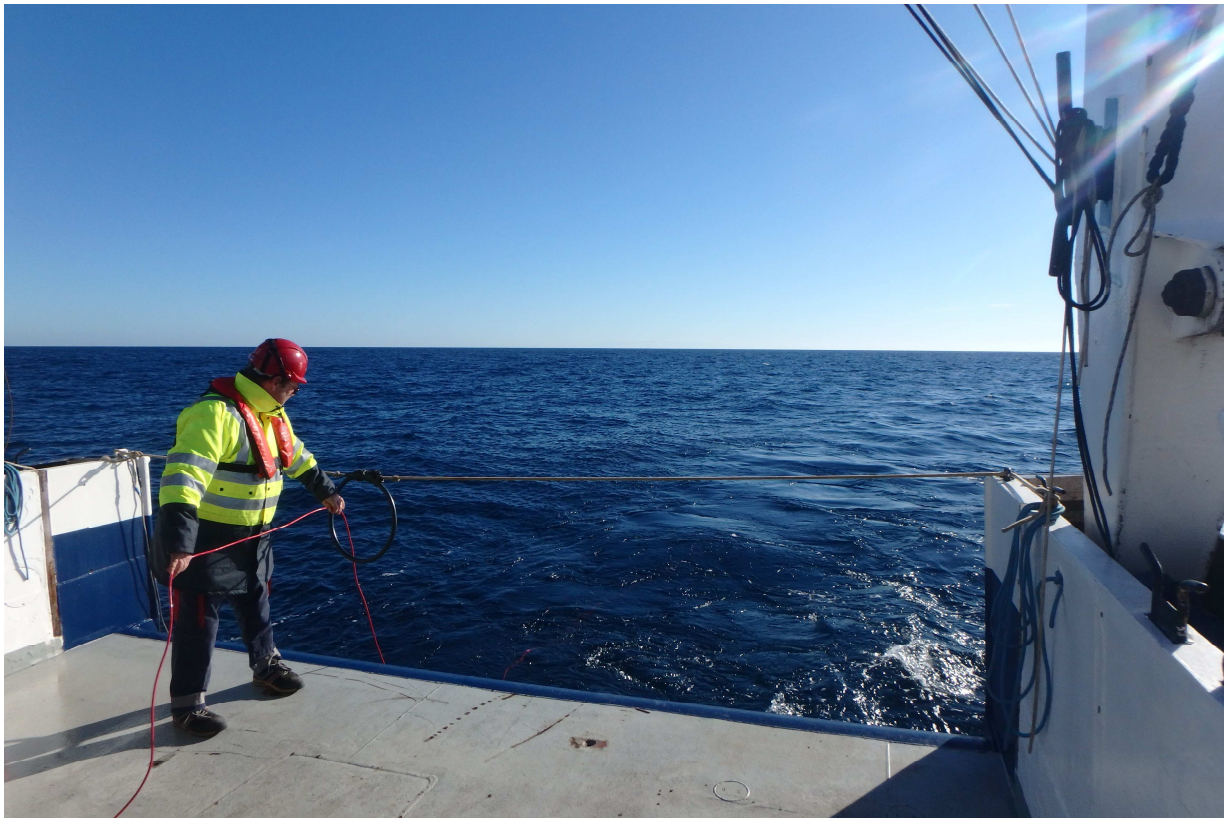

Deployment of the Biospherical C-OPS (Compact Optical Profiling System) from the deck of the R/V *Téthys II* under a clear blue sky.

BOUSSOLE project

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

January 28, 2022

Foreword

This report is part of the technical report series that is being established by the BOUSSOLE project.

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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 two pCO_2 CARIOCA sensors, the two optodes 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 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

Three sensors planned to be deployed on BGC ARGO profiling floats were added to the Rosette CTD in order to be tested by the *Marine optics and remote sensing group* of the *Laboratoire d'Océanographie de Villefranche (LOV)*: 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 and a C-rover transmissometer which measures attenuation at 650 nm.

Cruise Summary

The cruise was planned initially from January 11th to 13th but bad weather prevented departure from Nice harbour during these three days. So, an additional day (January 14th) was given to the BOUSSOLE program and all the operations were performed during that day: CTD casts with water sampling, optical profiles, CIMEL measurements and a Secchi disk at the BOUSSOLE site. Diving and maintenance operations on the buoy were not performed during this cruise because the buoy is currently not working.

Tuesday 11 January 2022

Bad weather prevented departure from the Nice harbour.

Wednesday 12 January 2022

Bad weather prevented departure from the Nice harbour.

Thursday 13 January 2022

Bad weather prevented departure from the Nice harbour.

Friday 14 January 2022

The sea state was slight with a gentle to moderate breeze. The sky was blue and the visibility was excellent. Firstly, a CTD cast with water sampling and 3 C-OPS profiles were performed at the BOUSSOLE site. Then a CTD with water sampling, 3 CIMEL measurements and finally, a Secchi disk were performed at the BOUSSOLE site before returning to the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/paTkFJRPhGYTzgBn7

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

Cruise Report

Tuesday 11 January 2022

Bad weather prevented departure from the Nice harbour.

Wednesday 12 January 2022

Bad weather prevented departure from the Nice harbour.

Thursday 13 January 2022

Bad weather prevented departure from the Nice harbour.

Friday 14 January 2022 (UTC)

People on bord: Ewen Ancel, Céline Dimier, Melek Golbol and Paco Stil.

0745 Departure to the BOUSSOLE site.
1115 Arrival at the BOUSSOLE site.
1130 CTD 01, 400 m with water sampling at 60, 40, 20 and 5 m for TSM, metagenomic, cytometry and nutrients.
1220 C-OPS 01, 02, 03.
1330 CTD 02, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p, TA/TC, O_2, pH and cytometry.

1340 CIMEL measurements.
1420 Secchi disk, 18 m.
1430 Departure to the Nice harbour.
1730 Arrival to the Nice harbour.

Problems identified during the cruise

- The IOP package was not available for this cruise. The instruments were still under calibration at Hobi Instruments Service.

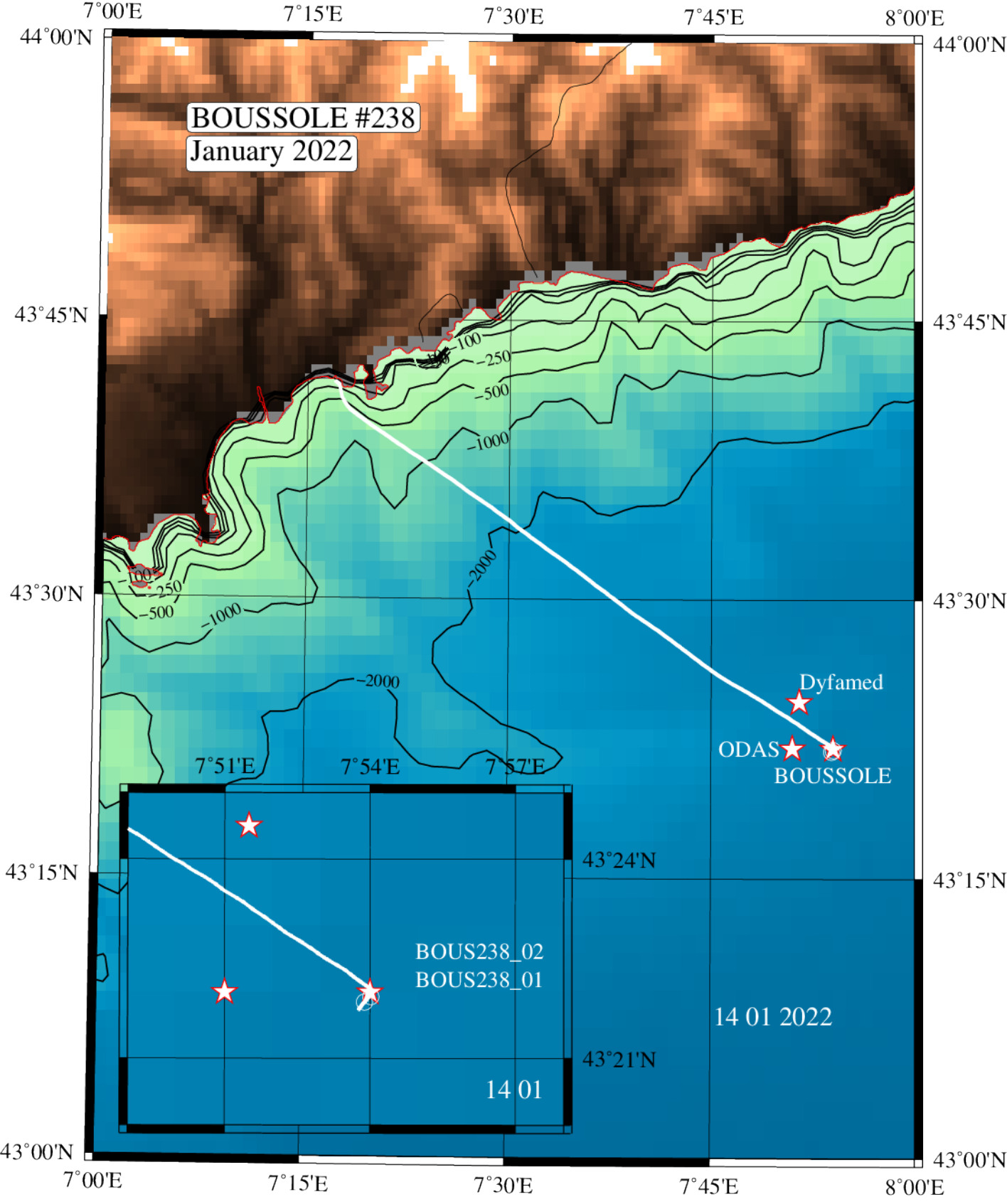
- CTD #02: there was a leak on the Niskin bottle#12, so the volume of seawater for HPLC sampling was reduced.

- The navigation, meteorological and TSG data files were not available from 12.00 pm (UTC) due to a problem on TECHSAS (*TECHnical Sensor Acquisition System*) data acquisition system used by the R/V *Tethys II*.

Appendices

Cruise Summary Table for Boussole 238

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
11/01/22	Bad weather																							
12/01/22	Bad weather																							
13/01/22	Bad weather																							
14/01/22			BOUS238_01	TSM, Metagenomics, Cyto & Nutrients	11:28	00:35:00	400	43	21.847	7	53.891	blue		2	9.7	248	1030.7	63		12.8	13.54	slight			
		bou_c-ops_220114_1204_001_data.csv			12:22	0:06:40	175	43	22.162	7	54.023	blue	Ci	1	8.7	242	1029.8	62.7	excellent	12.8		slight	0.6		few
		bou_c-ops_220114_1204_002_data.csv			12:37	0:06:27	169	43	22.379	7	53.800	blue	Ci	1	8.7	242	1029.8	62.7	excellent	12.8		slight	0.6		few
		bou_c-ops_220114_1204_003_data.csv			12:52	0:05:53	150	43	22.498	7	53.717	blue	Ci	1	8.7	242	1029.8	62.7	excellent	12.8		slight	0.6		few
			BOUS238_02	HPLC, ap, Cyto, TA/TC, O_2 & pH	13:31	0:42:00	400	43	21.93	7	54.018	blue		0	12.6	238	1029.5	57		13.5	13.66	slight			
				CIMEL01	13:41	0:04:00		43	21.92	7	53.005	blue		0			1029.4								
				CIMEL02	13:45	0:04:00		43	21.92	7	53.005	blue		0			1029.4								
				CIMEL03	13:49	0:04:00		43	21.92	7	53.005	blue		0			1029.4								
				Secchi 01	14:20	0:04:00	18	43	22	7	54.000	blue		0					excellent			slight			



GMT 2022 Mar 15 09:21:20

bous238_01

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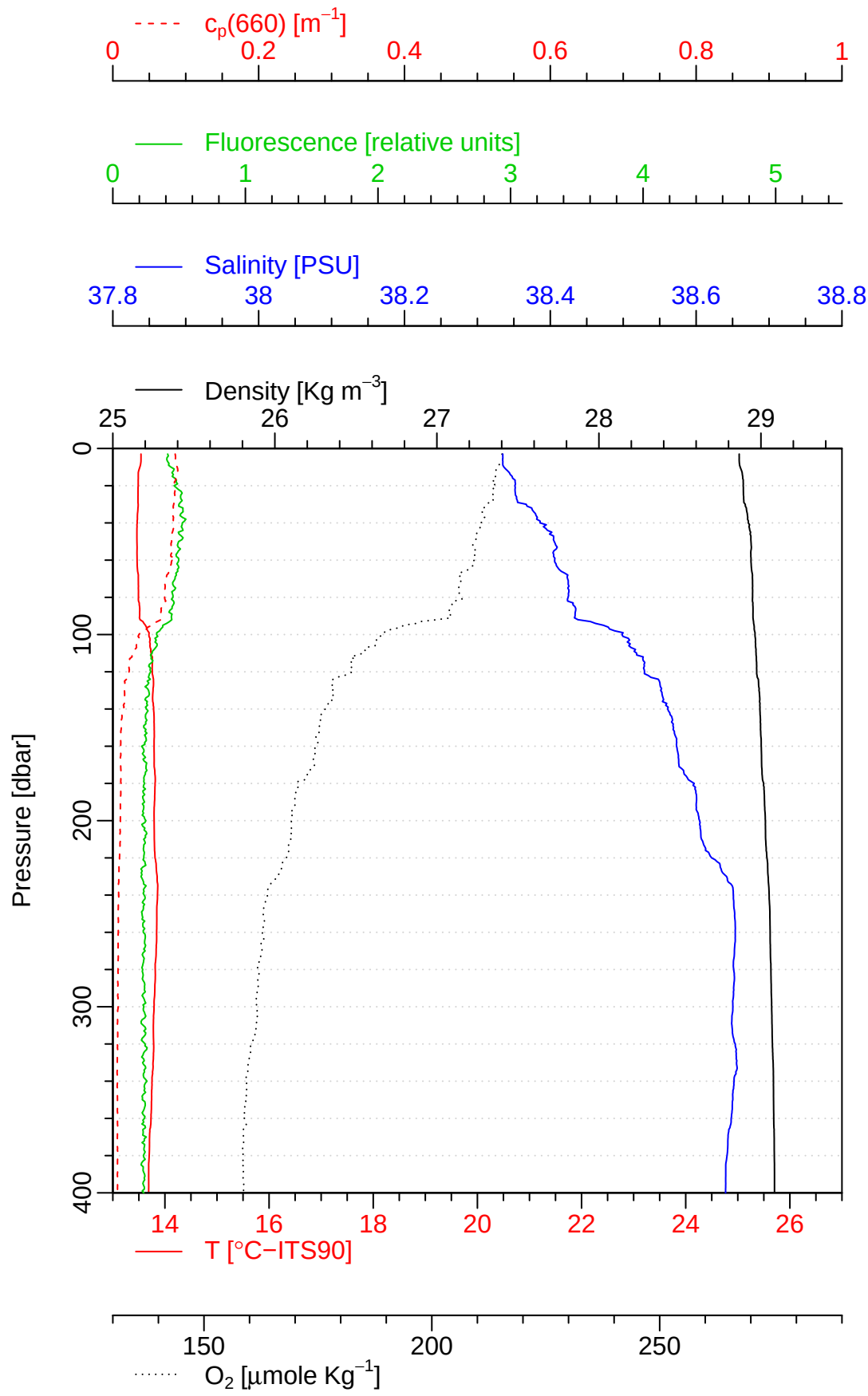
Heure debut [TU] = 11:30
Longitude = 007 53.891 E
Latitude = 43 21.847 N



bous238_02

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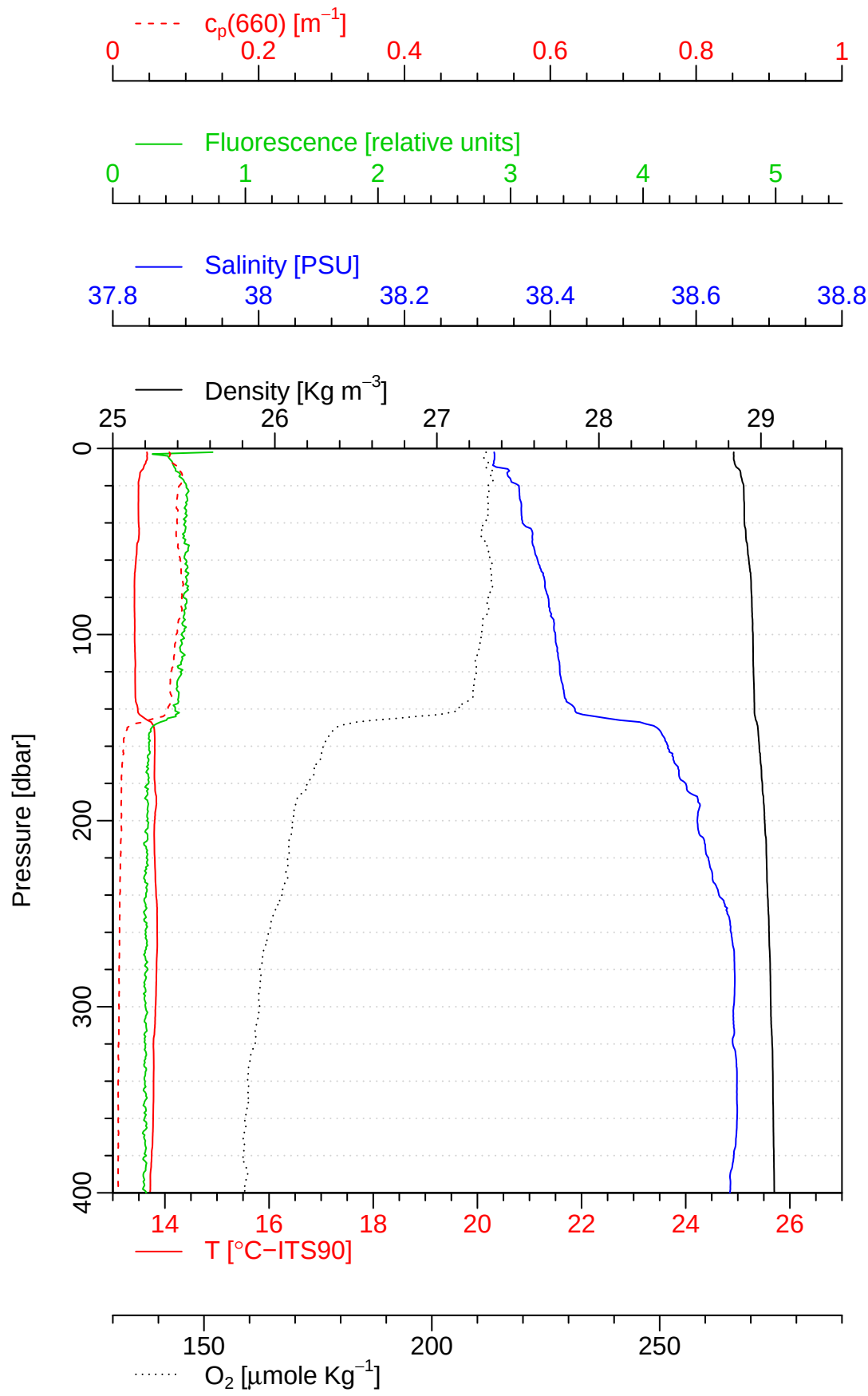
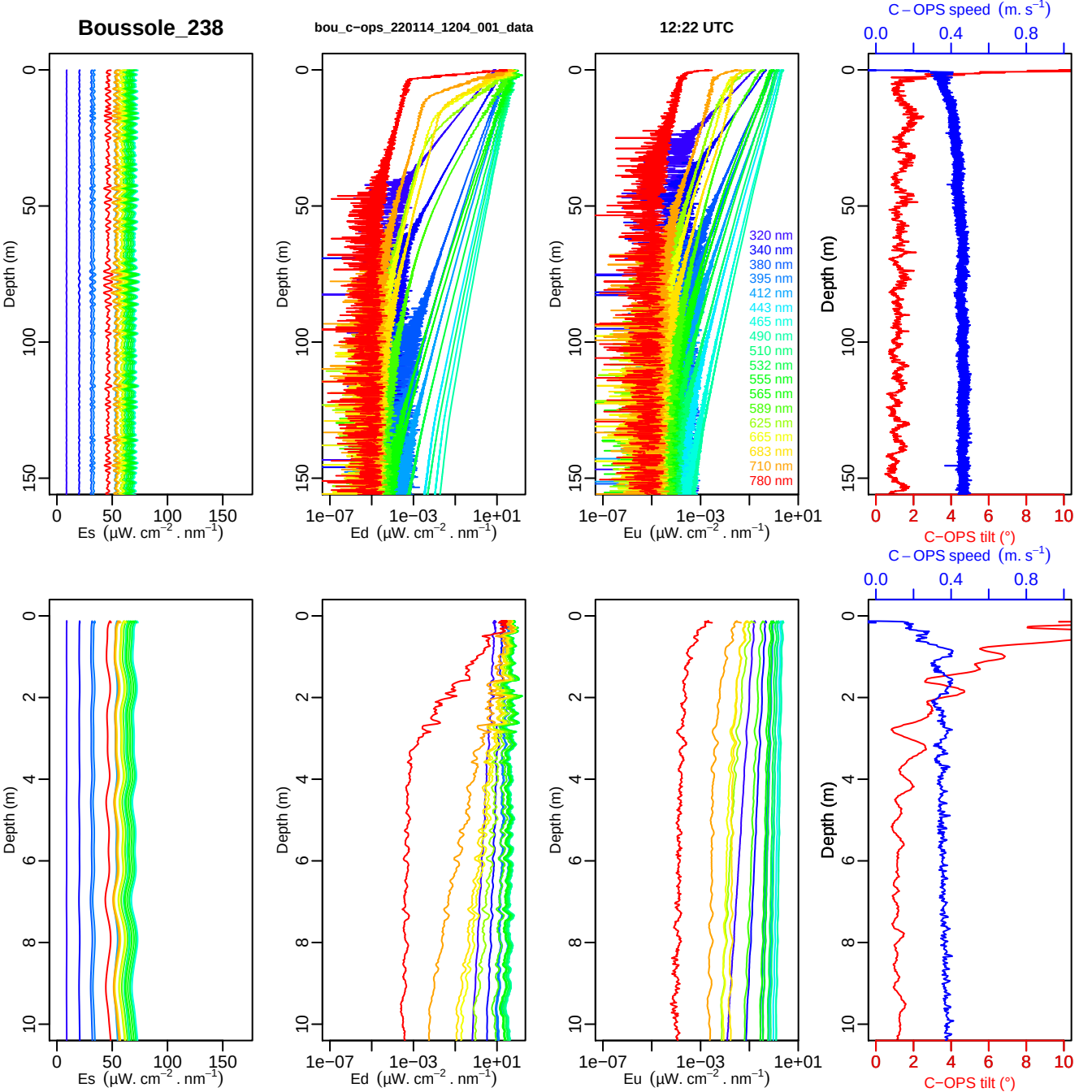
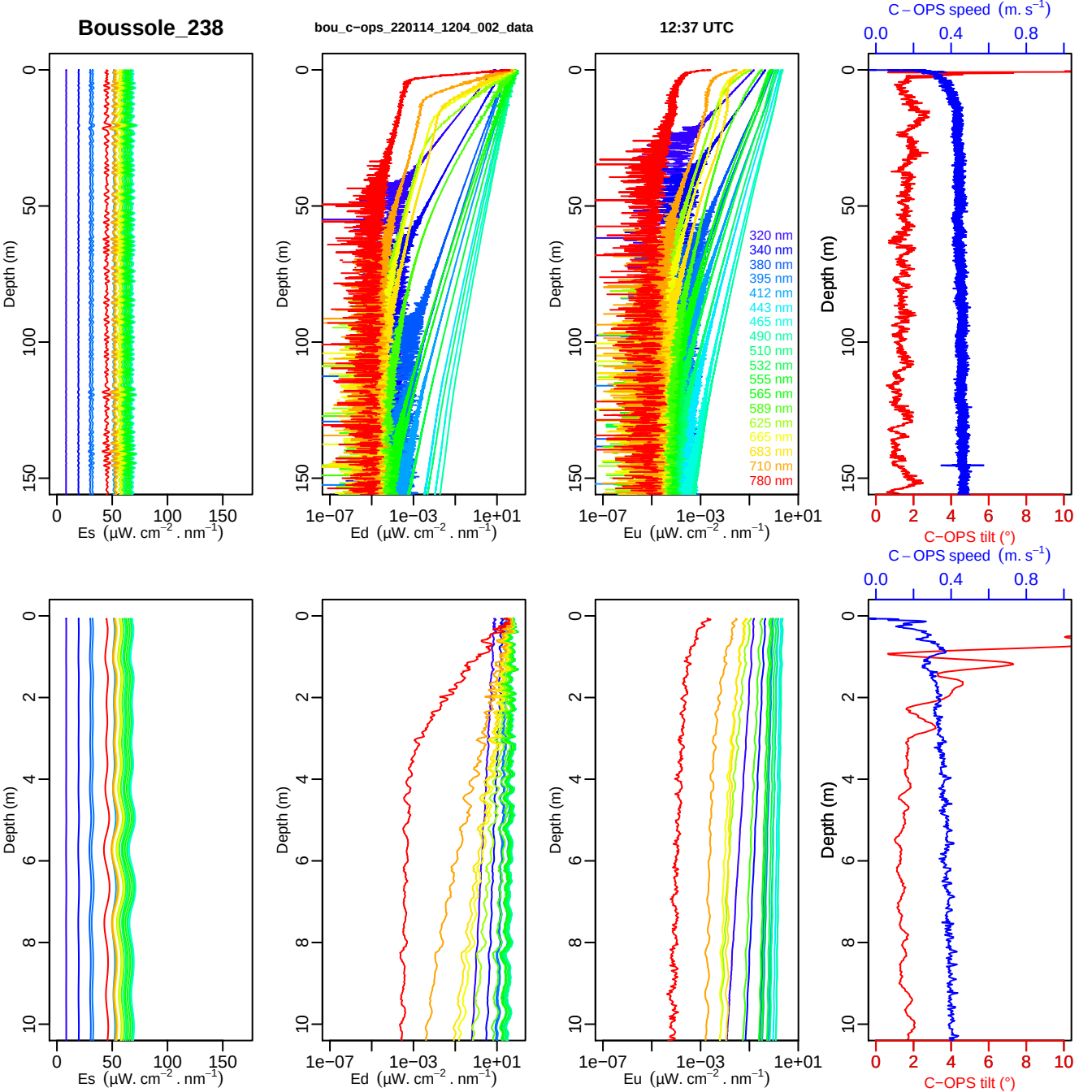
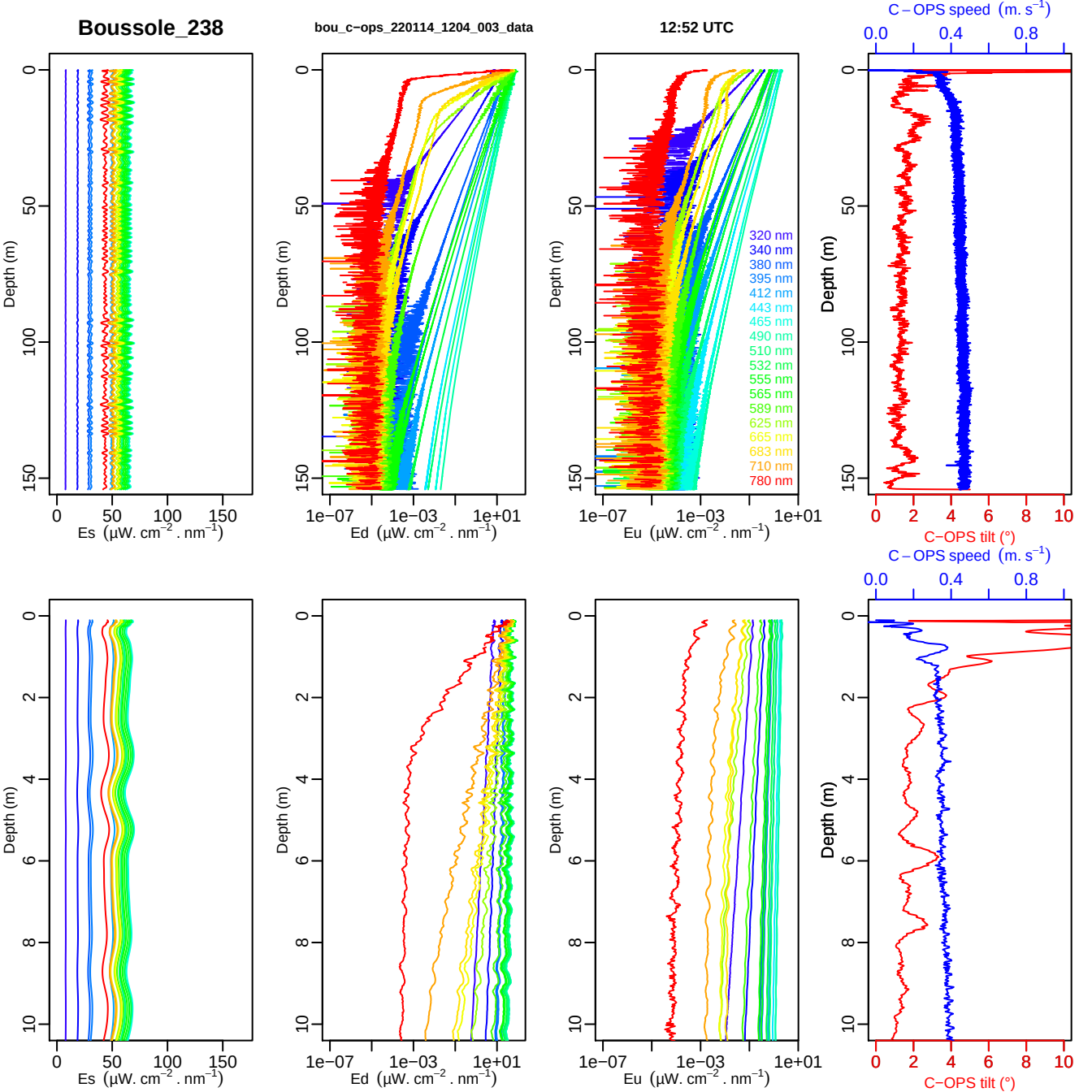
Heure debut [TU] = 13:31
Longitude = 007 54.018 E
Latitude = 43 21.930 N




Boussole_238
bou_c-ops_220114_1204_001_data
12:22 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_238
bou_c-ops_220114_1204_002_data
12:37 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


Boussole_238
bou_c-ops_220114_1204_003_data
12:52 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
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