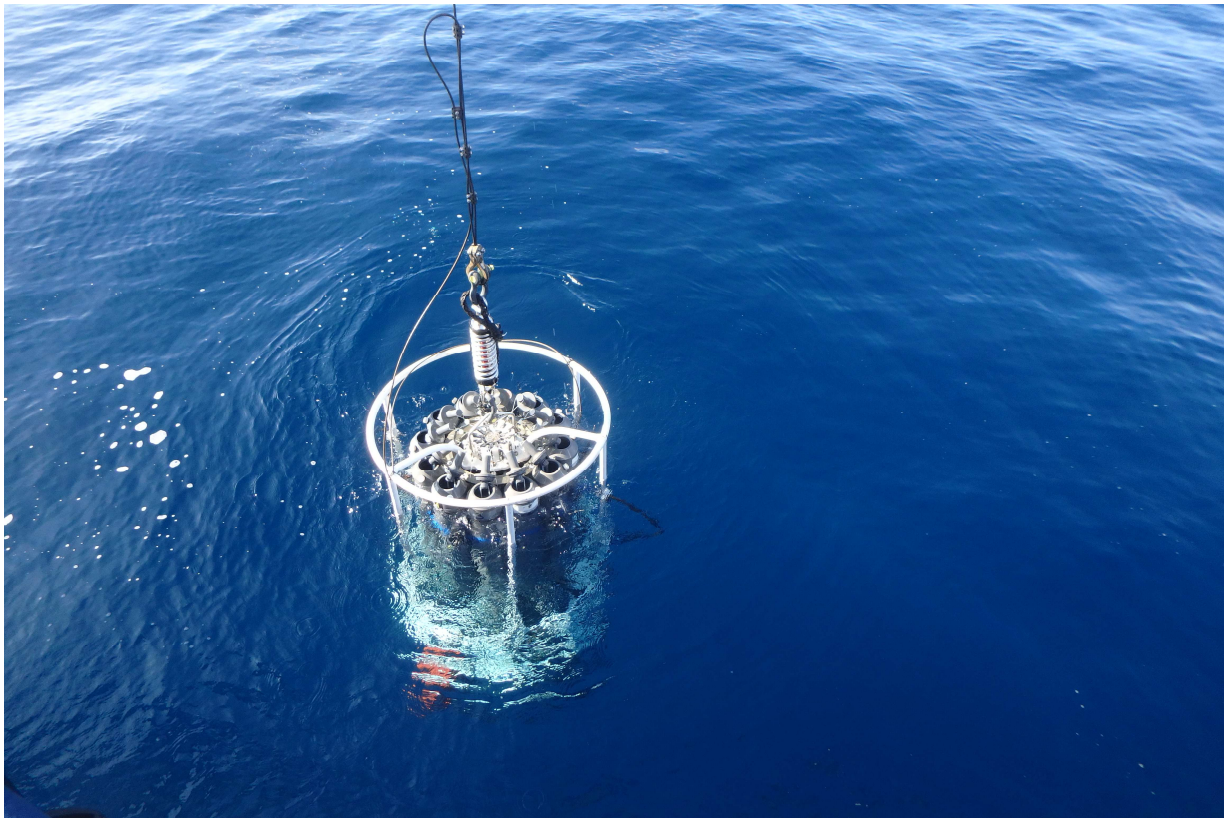
BOUSSOLE Monthly Cruise Report

Cruise 235
October 12-14, 2021

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

Science Personnel: Céline Dimier, Jean-Baptiste Forestier, Melek Golbol and Flavien Petit.

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



Deployment of the CTD Rosette from the deck of the R/V *Téthys II* at the BOUSSOLE site.

BOUSSOLE project

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

October 29, 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

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. 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).

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). 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.
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, two 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 and an Eco 3X1M sensor that measures multispectral fluorescence (excitation at 440, 470 et 532 nm, emission at 695 nm).

Several CTD beacons equipped with fluorometers that are planned to be deployed on Weddell seals in the Southern Ocean by the *Laboratoire d'Océanographie et du Climat* (LOCEAN) and the *Centre d'Etudes Biologiques de Chizé* (CEBC) were tested during this cruise. They were installed on the CTD Rosette for comparison with the BOUSSOLE main CTD.

Cruise Summary

Because of bad weather forecasts for the second and third days, all operations were performed the first day. It was used for CTD casts with water sampling, for optical profiles and for 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 12 October 2021

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 then 8 C-OPS profiles were performed at the BOUSSOLE site. Only four of them were kept because the C-OPS was too much tilted during the descent for the other profiles. Then, a Secchi disk and two CTD casts with water sampling were performed at the BOUSSOLE site. For the second cast (CTD #02), a 0.2µm filter was put on the a-Sphere absorption meter for the dissolved matter absorption measurements. The cast was stopped at 10 depths during the ascent of the CTD. For the last CTD cast (CTD #03), a cap was put on the backscattering meter for dark measurements.

Wednesday 13 October 2021

Bad weather prevented departure from the Nice harbour.

Thursday 14 October 2021

Bad weather prevented departure from the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/3WJBtkehwjen7N7w8

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 12 October 2021 (UTC)

People on bord: Céline Dimier, Melek Golbol, Jean-Baptiste Forestier (engineer at LOCEAN) and Flavien Petit.

0610 Departure to the BOUSSOLE site.
0925 Arrival at the BOUSSOLE site.
0935 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.
1040 C-OPS 01, 02, 03, 04.
1210 CTD 02, 400 m with water sampling at 60, 40, 20 and 5 m for metagenomic, cytometry and nutrients analyses (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 and 5 m).
1305 Secchi 02, 24 m.
1410 CTD 03, 300 m with water sampling at 60, 40 and 5 m for TSM, O_2, TA/TC and phytoplankton microscopy, cytometry, PIC, POC, HPLC (with cap on the HS6).
1430 Departure to the Nice harbour.
1740 Arrival to the Nice harbour.

Wednesday 13 October 2021

Bad weather prevented departure from the Nice harbour.

Thursday 14 October 2021

Bad weather prevented departure from the Nice harbour.

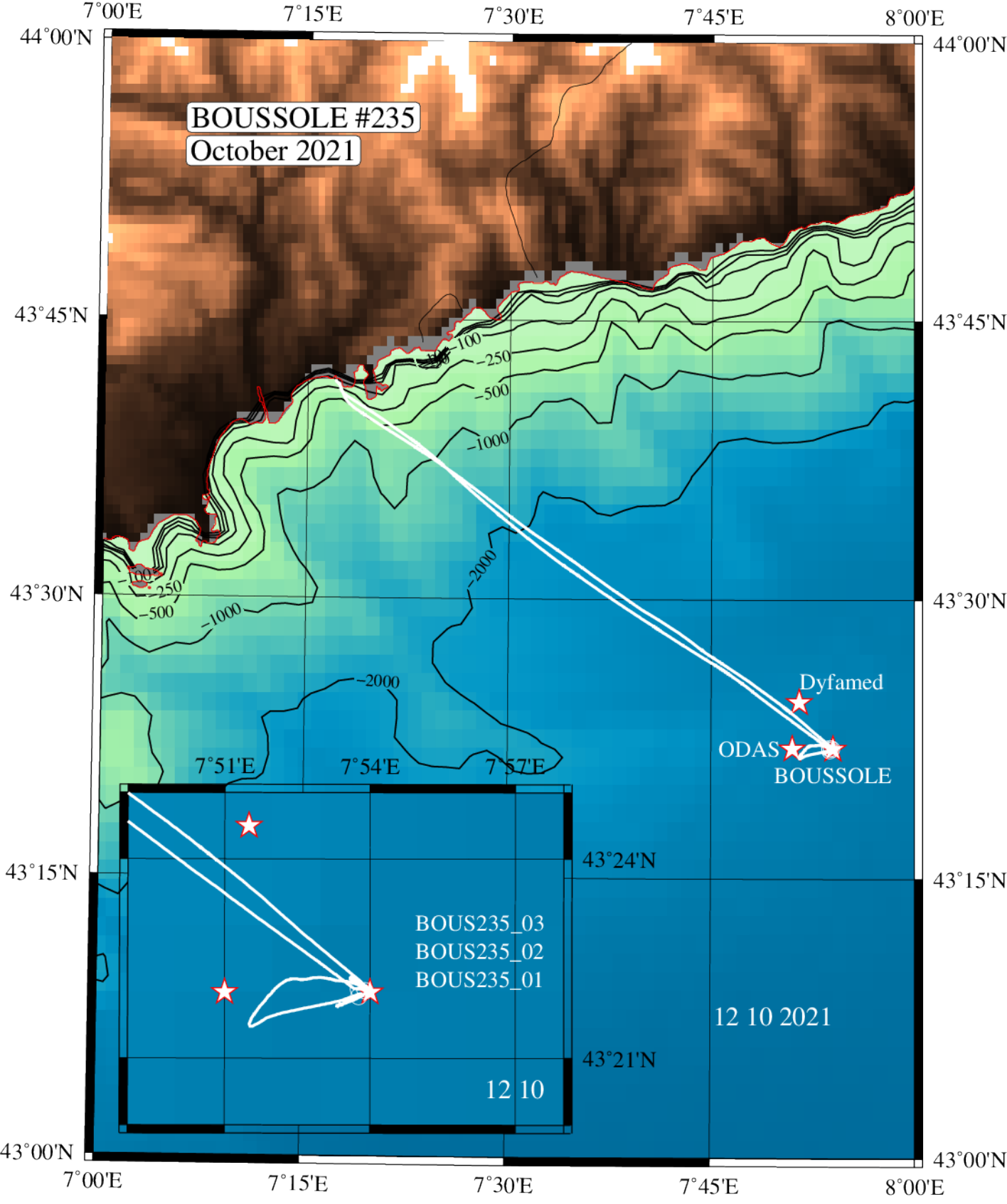
Problems identified during the cruise

- Several C-OPS profiles were performed at the BOUSSOLE site but only four of them were kept because the C-OPS was too much tilted during the descent for the other profiles.

Appendices

Cruise Summary Table for Boussole 235

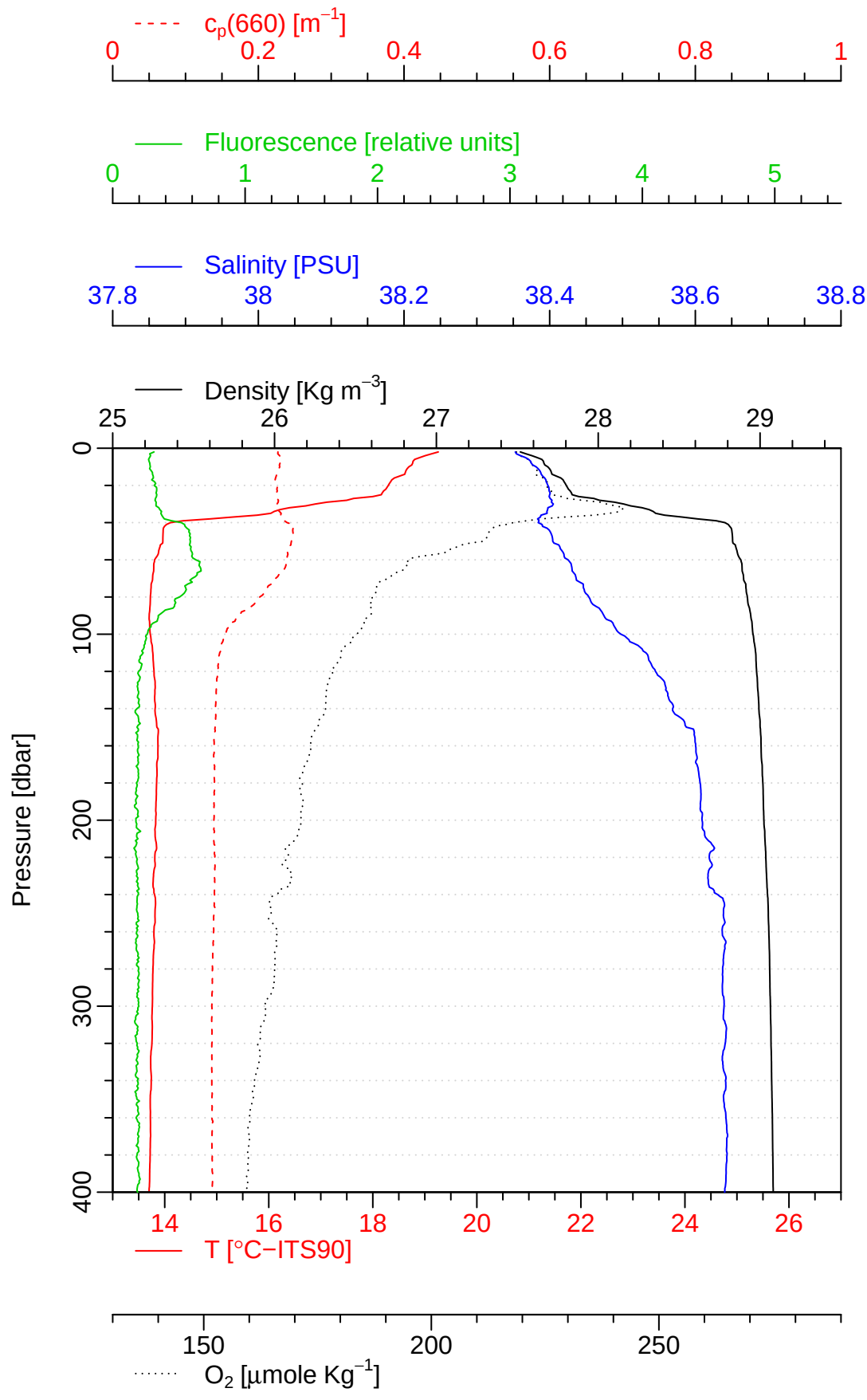
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather							Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(hour.min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
12/10/21			BOUS235_01	HPLC & ap	9:37	0:29:00	400	43	22.019	7	53.9	blue		1	3.8	170	1014.6	68.6		19.7	19.17	smooth			
		bou_c-ops_211012_1022_002_data.csv			10:40	0:03:33	89	43	22.157	7	53.513	blue	Ci	2	4.2	176	1013.9	69.4	medium	19.7		smooth	0.5		no
		bou_c-ops_211012_1022_005_data.csv			11:01	0:03:53	98	43	22.198	7	53.735	blue	Ci	2	4.2	176	1013.9	69.4	medium	19.7		smooth	0.5		no
		bou_c-ops_211012_1022_006_data.csv			11:14	0:03:40	95	43	22.196	7	52.424	blue	Ci	2	4.2	176	1013.9	69.4	medium	19.7		smooth	0.5		no
		bou_c-ops_211012_1022_008_data.csv			11:35	0:03:41	89	43	21.82	7	51.765	blue	Ci	2	4.2	176	1013.9	69.4	medium	19.7		smooth	0.5		no
			BOUS235_02	Metagenomics, Cyto & Nutrients	12:10	1:25:00	400	43	21.932	7	53.766	blue		1	3.1	230	1013.2	70.6		19.8	19.68	smooth			
				Secchi 01	13:05	0:04:00	26	43	22	7	54	blue		1					medium			smooth			
			BOUS235_03	TSM, O_2, TA/TC, pH & Phytofloat (PIC, POC, Cyto, phyto)	14:09	0:19:00	300	43	22.046	7	53.761	blue		1	7	163	1011.8	65.9		20.2	19.92	smooth			
13/10/21	Bad weather																							
14/10/21	Bad weather																							



GMT 2021 Nov 19 10:22:01

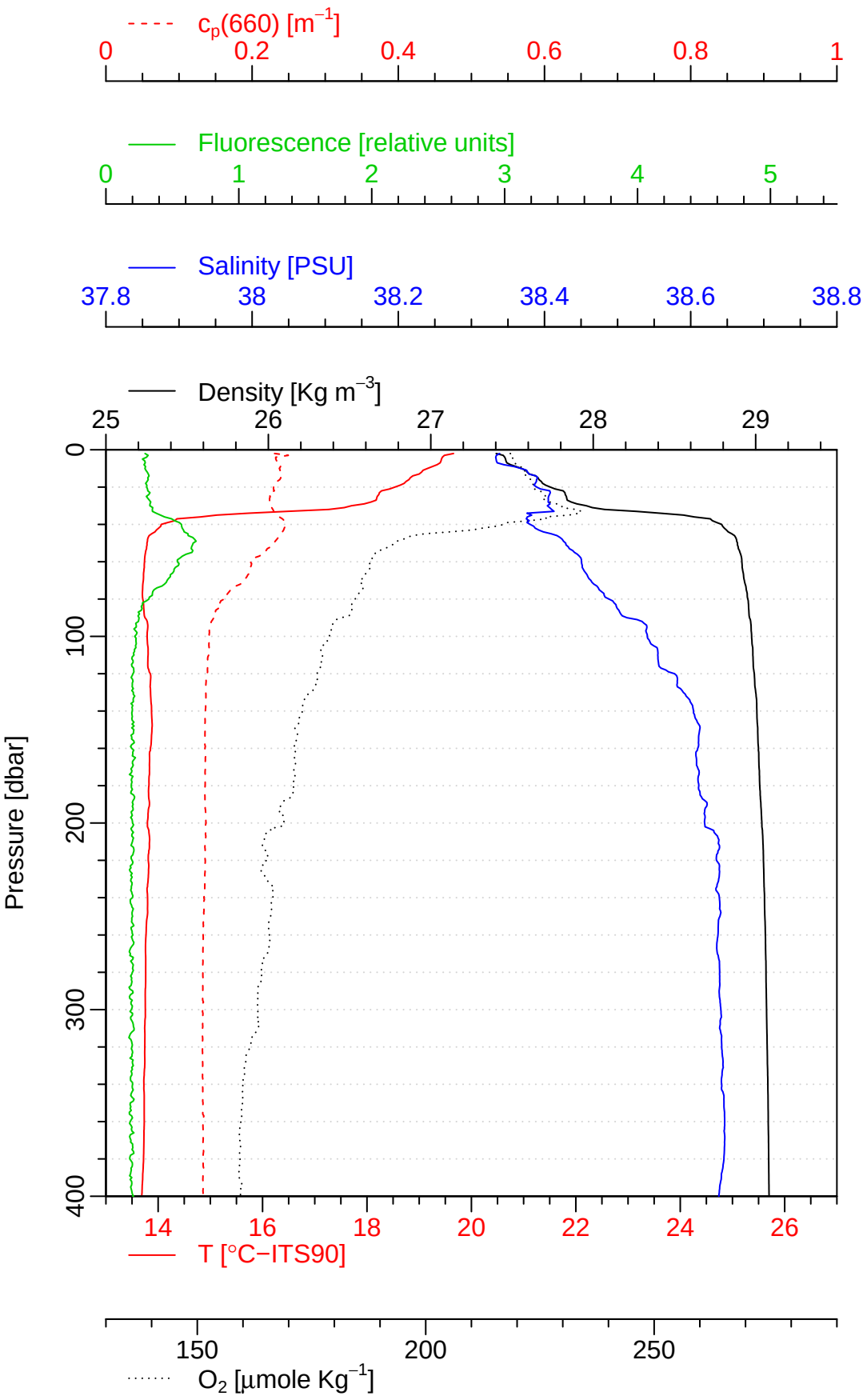
bous235_01

Date = 12/10/2021
Heure debut [TU] = 09:37
Longitude = 007 53.900 E
Latitude = 43 22.019 N



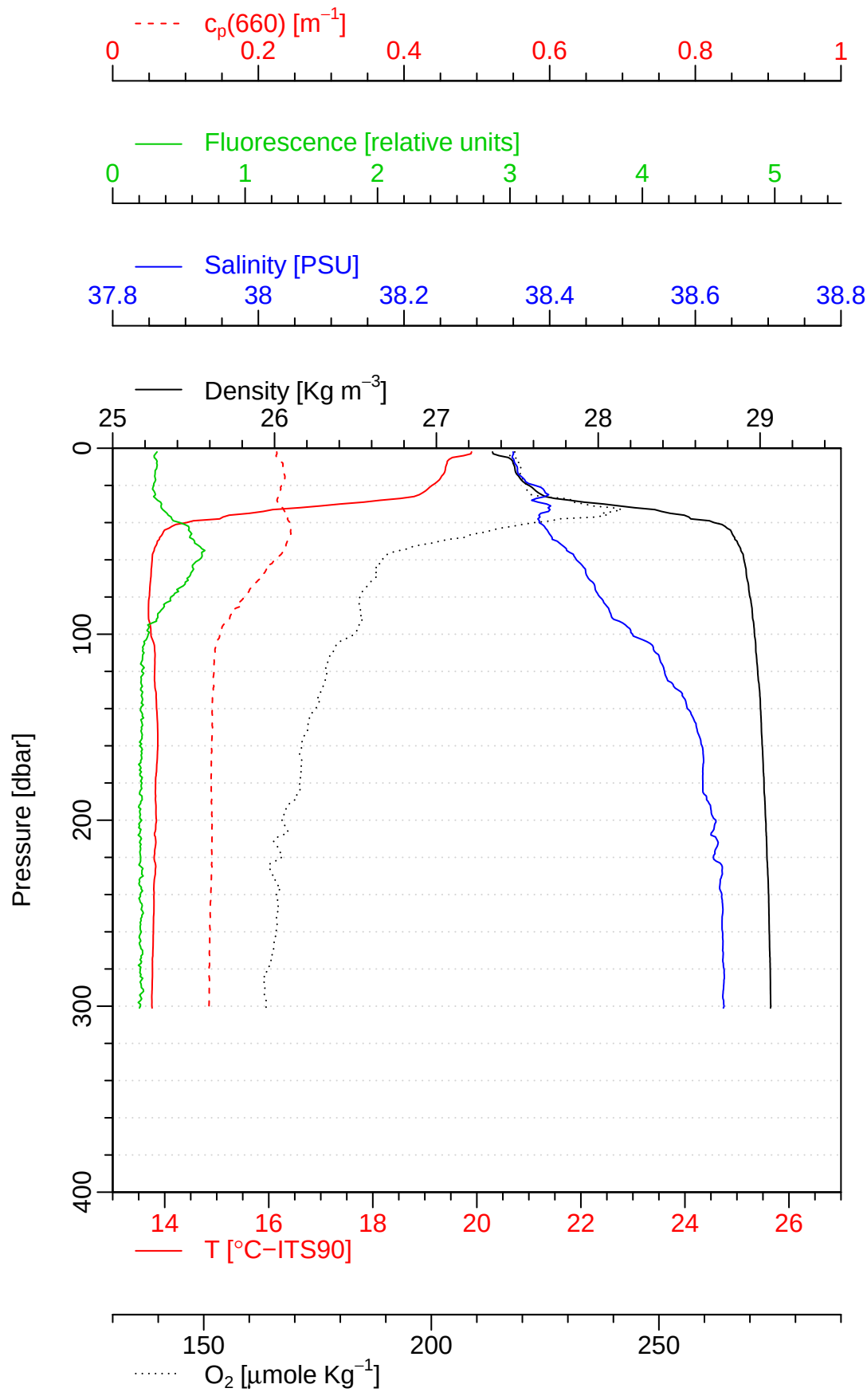
bous235_02

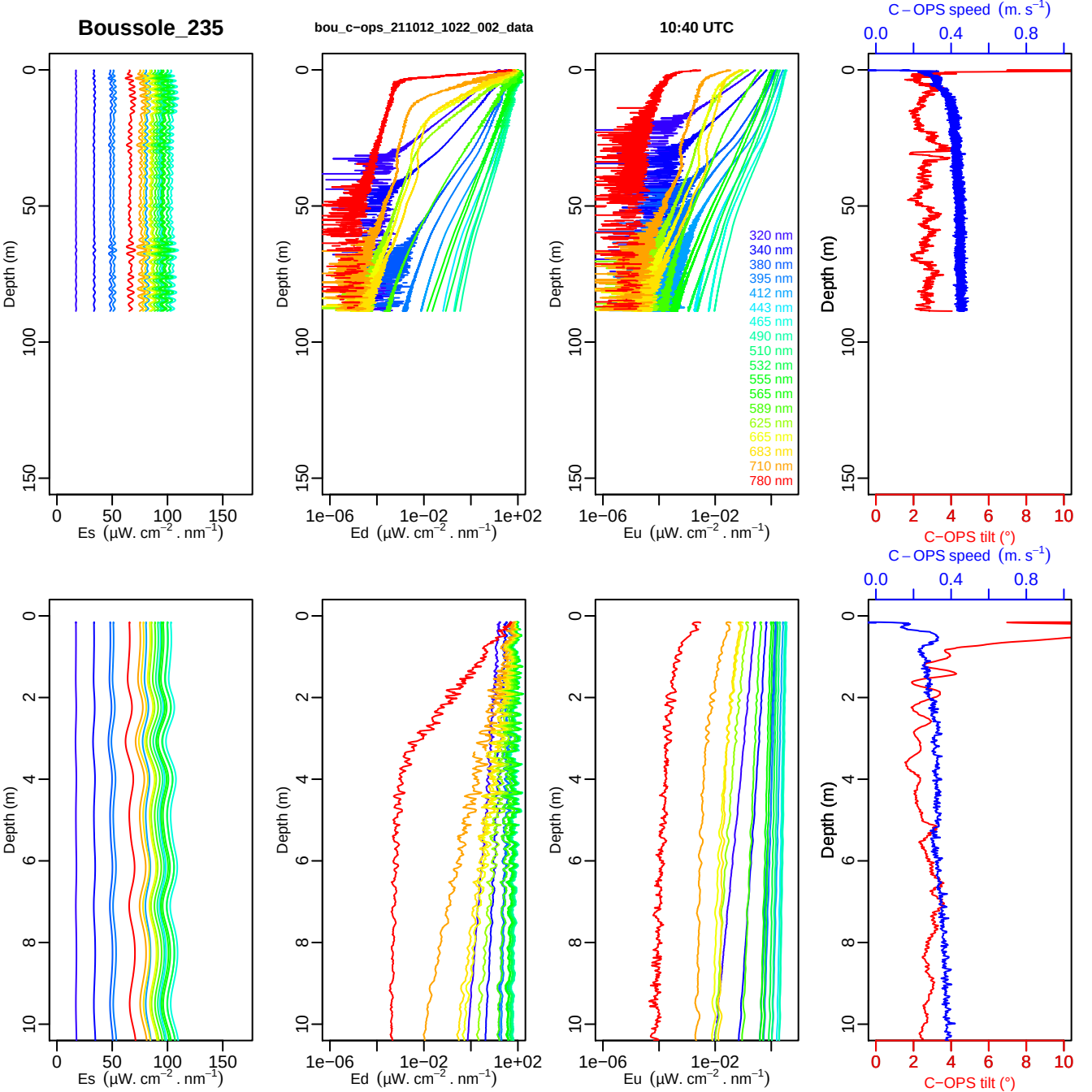
Date = 12/10/2021
Heure debut [TU] = 12:10
Longitude = 007 53.766 E
Latitude = 43 21.932 N

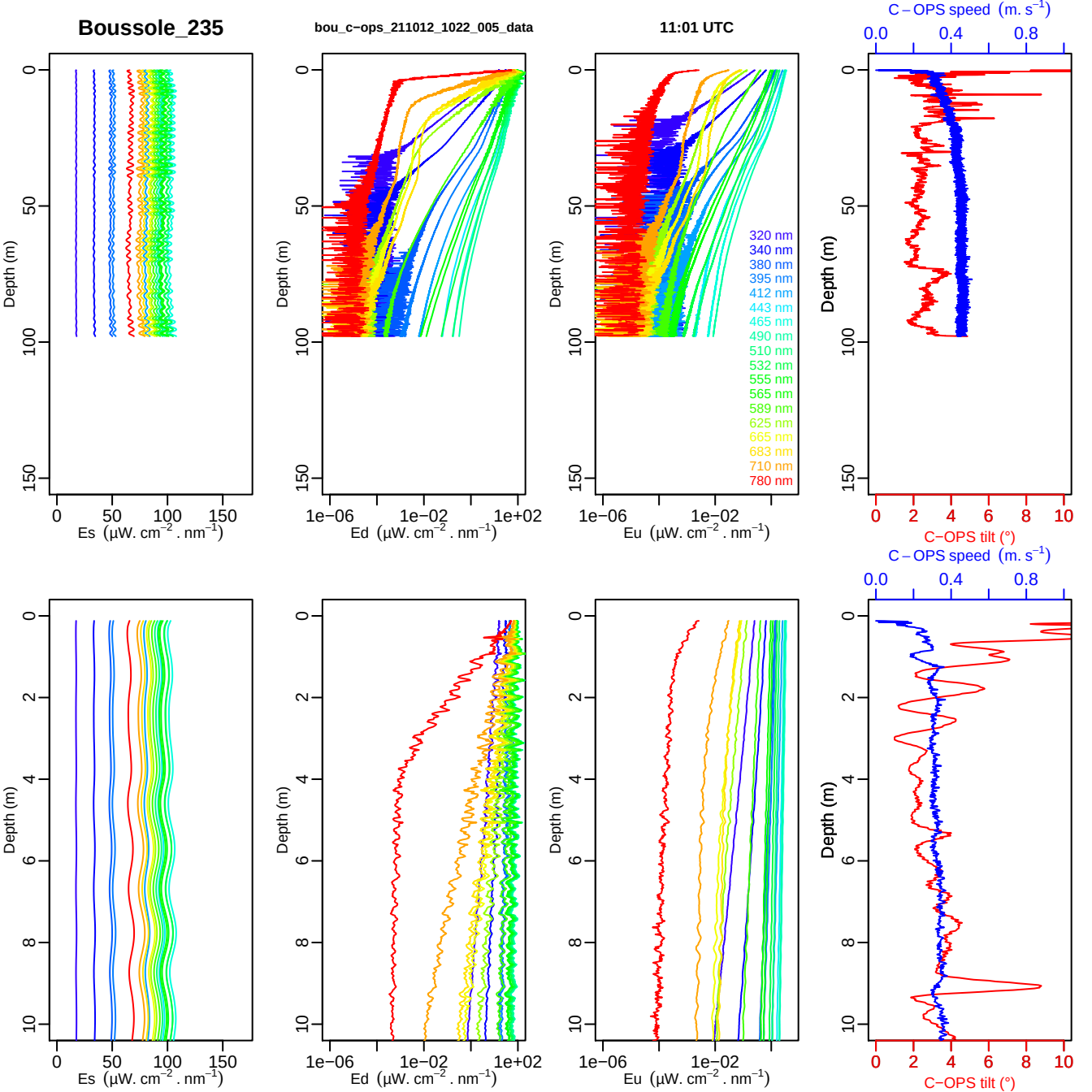


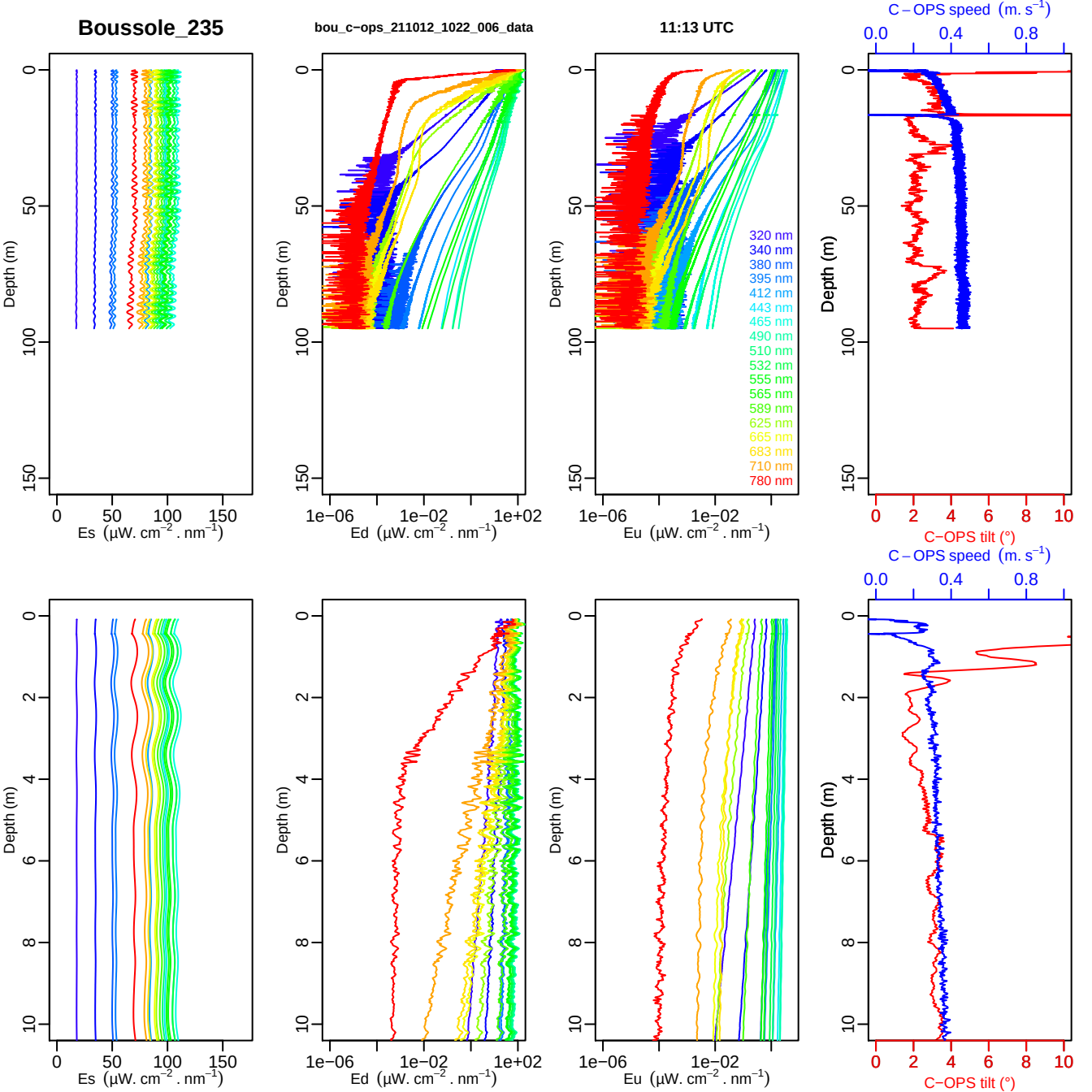
bous235_03

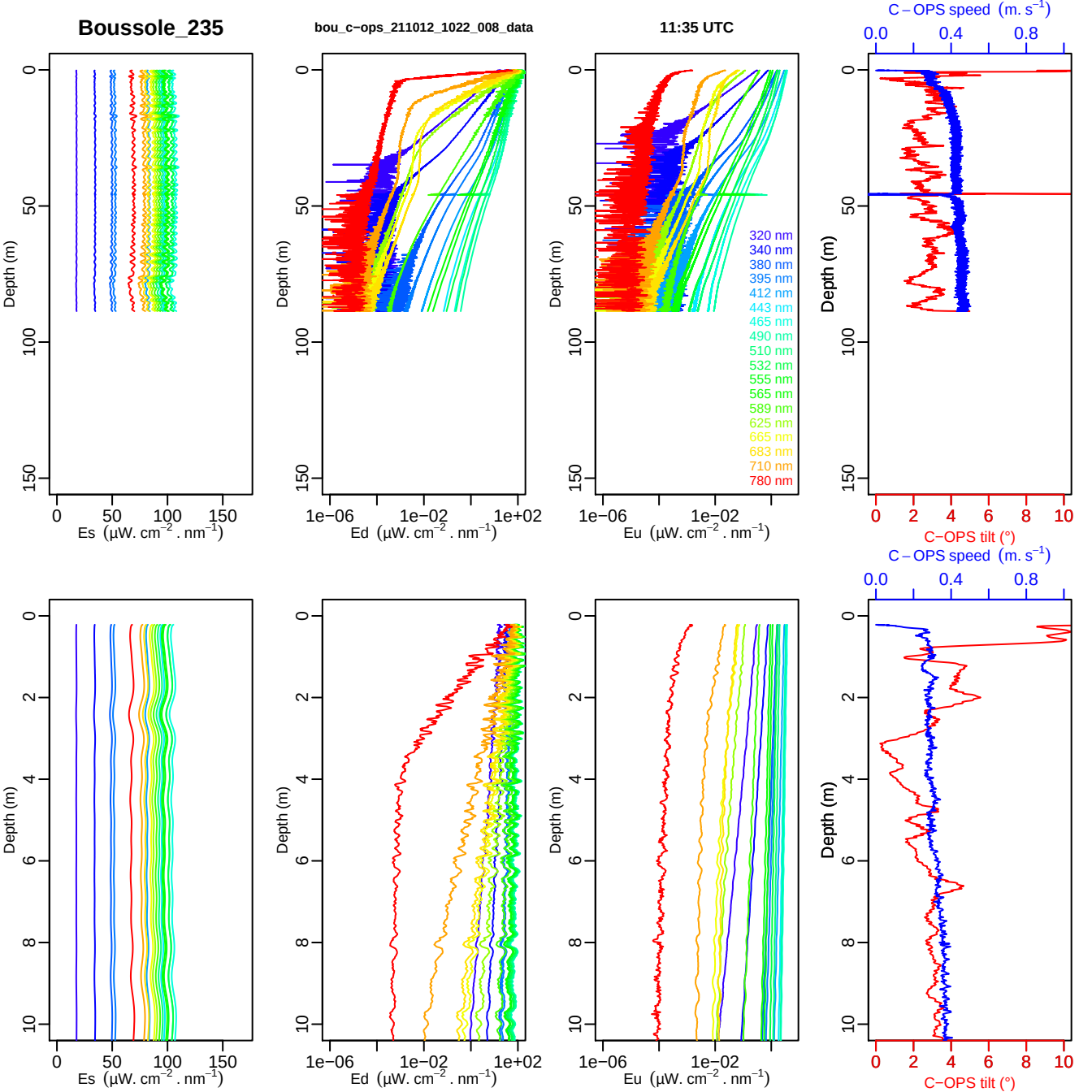
Date = 12/10/2021
Heure debut [TU] = 14:09
Longitude = 007 53.761 E
Latitude = 43 22.046 N




Boussole_235
bou_c-ops_211012_1022_002_data
10:40 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_235
bou_c-ops_211012_1022_005_data
11:01 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_235
bou_c-ops_211012_1022_006_data
11:13 UTC
C – OPS speed (m. s^{-1})
0.0
0.4
0.8
Depth (m)
0
50
100
150
0
50
100
150
Es (µW. cm^{-2}. nm^{-1})
1e−06
1e−02
1e+02
Ed (µW. cm^{-2}. nm^{-1})
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 (°)


Boussole_235
bou_c-ops_211012_1022_008_data
11:35 UTC
C – OPS speed (m. s^{-1})
0.0
0.4
0.8
Depth (m)
0
50
100
150
0
50
100
150
Es (µW. cm^{-2}. nm^{-1})
1e−06
1e−02
1e+02
Ed (µW. cm^{-2}. nm^{-1})
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 (°)