BOUSSOLE Monthly Cruise Report

Cruise 221
August 26, 2020

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Vessel: R/V Sagitta III
(Captain: Jean-Yves Carval)

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The R/V *Sagitta III* at the BOUSSOLE site.

BOUSSOLE project

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

August 31, 2020

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

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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). This operation is part of the BIOCAREX ANR project, in collaboration with the LOCEAN in Paris (J. Boutin and collaborators). 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. 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

Monthly servicing cruises could not be carried out as normal on the R/V *Téthys*-II from April to May 2020 because of the restrictions due to the Covid-19 pandemic (all activities on the R/V *Téthys II* were cancelled until September). We were allowed to use the R/V *Sagitta III* instead, for joint operations of the BOUSSOLE and MOOSE programs during 2 days per month from June. The first day was dedicated to BOUSSOLE and DYFAMED operations and the second day to BOUSSOLE and its current adjunct operations (OBOO and EFFICACY project).

Cruise Summary

There was only one day allocated to BOUSSOLE operations, which was used for maintenance on the top of the buoy, for CTD and IOP casts, for water sampling with Niskin bottles, for optical profiles and for a Secchi disk at the BOUSSOLE site.

Tuesday 26 August 2020

The sea state was slight with a gentle to light breeze. The sky was cloudy and the visibility was good. Firstly, the buoy functioning was checked on the top of the buoy. The upper structure of the buoy was deployed on 11th August with a new data acquisition system ("DL3" data loggers from In-Situ Marine Optics Pty Ltd"). Unfortunately, the buoy was found not working and it was not possible to download data from the surface DL3. Then, the CTD (SBE25plus) was deployed two times down to 100 m because the first CTD cast failed. Then two IOP casts were performed, the first down to 400 m, the second down to 50 m with a cap on the backscattering meter for dark measurements.
Then, Niskin bottles were deployed at 6 depths for HPLC and a_p measurements and at 4 depths for metagenomic, cytometry and nutrients sampling in the frame of the EFFICACY ANR project. In the meantime, seawater was sampled directly from the surface with a bucket for subsequent TSM measurements.
Then, 2 C-OPS profiles were performed at the BOUSSOLE site. Only the second C-OPS profile was kept because the first profile had to be stopped early during the acquisition (the sky became cloudy with unstable irradiance and the profiler was too tilted). Finally, a Secchi disk was performed at the BOUSSOLE site before returning to the Villefranche-sur-mer harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/Yg1SjvGF3m1auhqv6

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 26 August 2020 (UTC)

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

0600	Departure from the Villefranche-sur-mer harbour.
0915	Arrival at the BOUSSOLE site.
0925	Buoy surface maintenance.
1015	CTD attempt: failed.
1035	CTD 01, 100 m.
1045	IOP 01, 400 m.
1110	IOP 02, 50 m (with cap on the HS6).
1130	Niskin water sampling at 400, 80, 60, 40, 20 and 5 m for HPLC, ap, metagenomic, cytometry and nutrients.
1235	Surface bucket for TSM.
1250	C-OPS 01.
1320	Secchi 01, 19 m.
1325	Departure to the Villefranche-sur-Mer harbour.
1615	Arrival to the Villefranche sur Mer harbour.

Problems identified during the cruise

- The buoy data acquisition was found not working and it was not possible to download data from the surface data logger. A problem with the battery was suspected, and will be tested during a subsequent cruise.

- It is not possible to use the main BOUSSOLE Rosette on the deck of the *Sagitta III*. The main CTD could not be deployed separately from the Rosette because the electro carrier cable was not operational. So, a CTD SBE25plus was lent by the *Institut de la Mer de Villefranche*, and could be deployed down to 100 m. However, the IOP package also includes a CTD and was deployed down to 400 m. Water sampling was performed directly with Niskin bottles and messengers at six depths.

- Two C-OPS profiles were performed at the BOUSSOLE site but only one profile was kept because the first profile had to be stopped during the acquisition (unstable irradiance) and the profiler was too tilted.

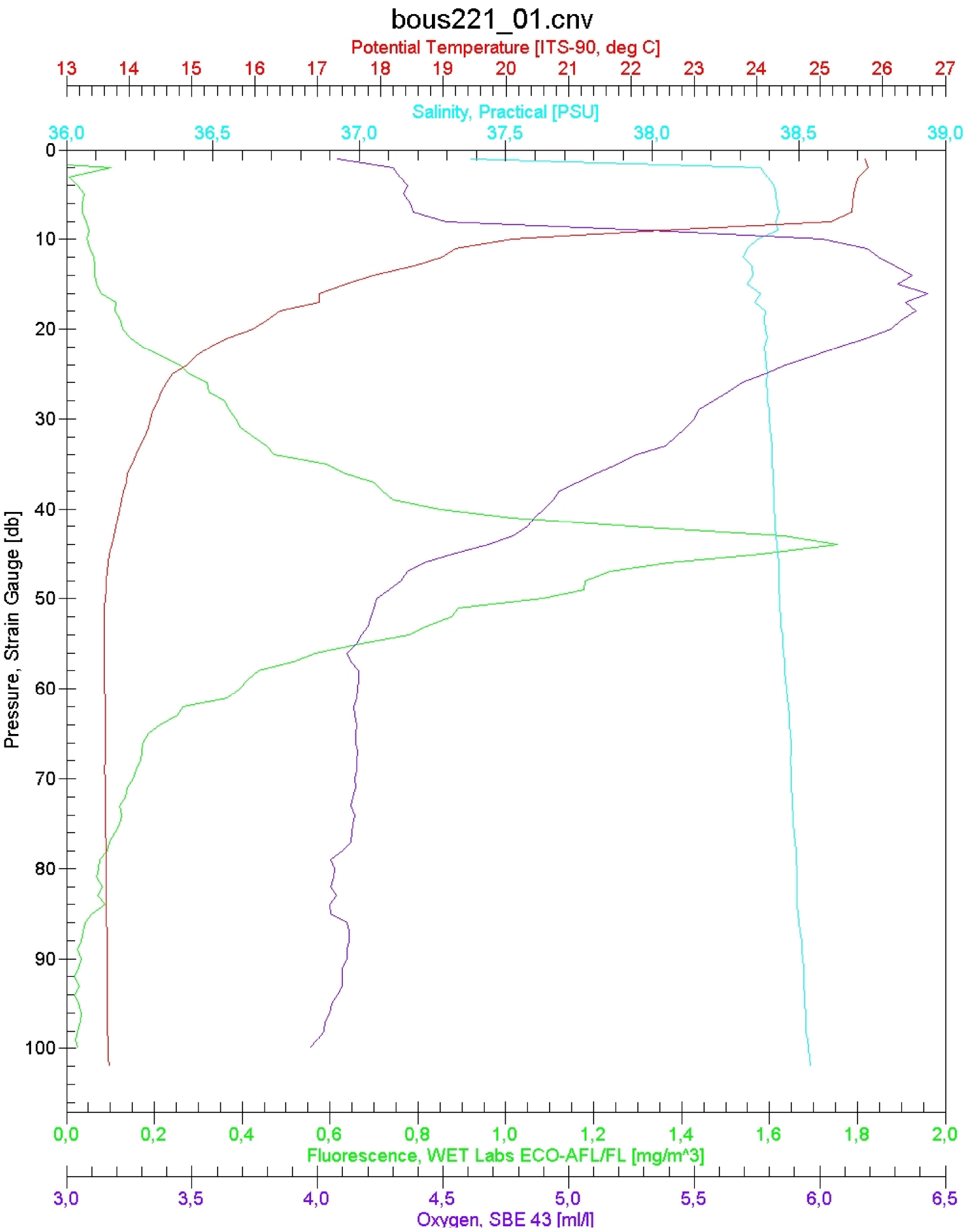
- It was not possible to perform the IOP cast including a 0.2 µm filter installed on the inlet tube of the a-Sphere for the dissolved matter absorption measurements because of the lack of time.

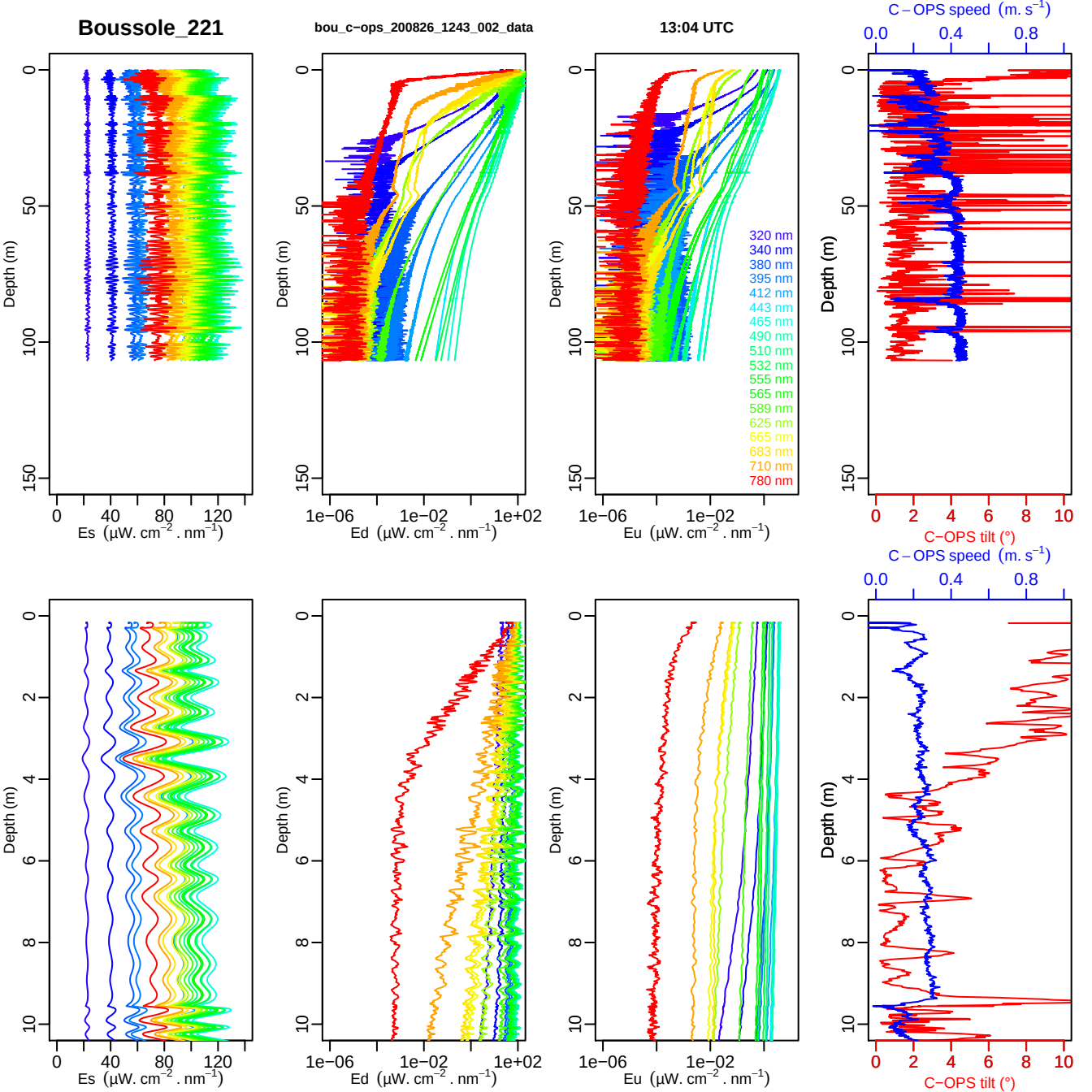
- Sampling for the OBOO project revealed impossible from the Sagitta III (time and space constraints).

Appendices

Cruise Summary Table for Boussole 221

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
26/08/20			BOUS221_01		10:36	08:00	400	43	22.015	7	53.353	cloudy		5	8	219	1015.0	NA		25.3	25.81	slight			
				IOP_BOUS221_01.csv	10:45	25:00	400	43	22.034	7	53.357	cloudy		3	10	228	1014.0	NA		25.4	25.82	slight			
				IOP_BOUS221.dark	11:11	8:00	50	43	22	7	54	cloudy										slight			
				Niskins: HPLC, a_p, Metagenomic, Nutrients & Cyto	11:30	1:00:00	60	43	22	7	54	cloudy										slight			
				Bucket for TSM	12:35	4:00	1					cloudy										slight			
		bou_c-ops_200826_1243_002_data.csv			13:04	5:31	107	43	22	7	54	cloudy		3	2	183	1014.0	NA	good	26.5		slight	0.8		No
				Secchi01	13:20	4:00	19	43	22	7	54	cloudy							good			slight			


bous221_01.cnv
Potential Temperature [ITS-90, deg C]
13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Salinity, Practical [PSU]
36,0 36,5 37,0 37,5 38,0 38,5 39,0
Pressure, Strain Gauge [db]
0 10 20 30 40 50 60 70 80 90 100
0,0 0,2 0,4 0,6 0,8 1,0 1,2 1,4 1,6 1,8 2,0
Fluorescence, WET Labs ECO-AFL/FL [mg/m^3]
3,0 3,5 4,0 4,5 5,0 5,5 6,0 6,5
Oxygen, SBE 43 [ml/l]


Boussole_221
bou_c-ops_200826_1243_002_data
13:04 UTC
C – OPS speed (m. s^{-1})
0.0
0.4
0.8
Depth (m)
0
50
100
150
0
40
80
120
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 (°)