BOUSSOLE Monthly Cruise Report

Cruise 218
March 10-12, 2020

Duty Chief: Melek Golbol (golbol@obs-vlfr.fr)
Vessel: R/V Téthys II
(Captain: Joël Le Guennec)

Science Personnel: Céline Dimier, Bastien Gaucher, Melek Golbol, Didier Robin and Eduardo Soto Garcia.

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The PCO_2 CARIOCA sensor located at 10 m depth on the BOUSSOLE buoy after its recovery by divers.

BOUSSOLE project

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

March 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

Centre National de la Recherche Scientifique, 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). 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 cytometry and metagenomic analyses of different types of Synechococcus. 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

The MOOSE DYFAMED cruise of 9th March was cancelled because of a bad weather forecast, so the first day of the BOUSSOLE cruise (10th March) was given to the MOOSE program so that they could perform all their operations.

The second day, Céline Dimier, working for the *Service d'Analyse de Pigments par HPLC (SAPIGH)* of the *Institut de la Mer de Villefranche (IMEV)* was onboard to sample additional water for HPLC analyses. These samples will be used for an international intercomparison study on the protocols involving other labs.

The second day, divers replaced the PCO_2 CARIOCA sensor at 10 m depth with a newly calibrated one. The Argos beacon located under the buoy floatation sphere was recovered because it was not functioning since its installation during the last mooring rotation. It will be sent to the manufacturer for repair. Otherwise, a hydrophone that was installed on the lower buoy superstructure was recovered. It was installed in the frame of a collaboration with the Geoazur Lab. Divers put self-amalgamating tape on a little part of the lower superstructure of the buoy in order to secure the structure where the painting was damaged during the last mooring rotation.

The last day, seawater was sampled at 3 depths for micro-, nano- and pico-phytoplancton 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).*

Cruise Summary

The first day of the cruise was planned for DYFAMED operations. The second day of the cruise was used for diving operations, for CTD casts with water sampling, for optical profiles and for a Secchi disk at the BOUSSOLE site. The last day was used for CTD casts with water sampling, for an optical profile and for a Secchi disk at the BOUSSOLE site.

Tuesday 10 March 2020

This day was entirely given to the MOOSE program because the bad weather did not allow performing DYFAMED operations the day before.

Wednesday 11 March 2020

The sea state was slight with a light breeze. The sky was blue and the visibility was good. When arrived at BOUSSOLE, divers went at sea in order to replace the PCO_2 CARIOCA sensor at 10 m depth. They recovered the Argos beacon located at 20 m depth (under the buoy sphere) and the hydrophone located on the lower buoy superstructure. They also cleaned all the sensors. They put self-amalgamating tape on a little part of the lower buoy superstructure in order to secure the structure were the painting was damaged during the last mooring rotation. Then, two CTD casts with water sampling and three C-OPS profiles were performed at the BOUSSOLE site. For the second cast, a cap was put on the Hydroscat-6 for dark measurements. Finally, a Secchi disk was performed at the BOUSSOLE site before returning to the Nice harbour.

Thursday 12 March 2020

The sea state was smooth with a gentle breeze in the morning and a light breeze in the afternoon. The sky was overcast yet the visibility was good. Firstly, a CTD cast with water sampling was performed at the BOUSSOLE site. Then a Secchi disk and two CTD casts at 100 m depth were performed at the BOUSSOLE site. The first cast (CTD 04) was dedicated to sampling for the OBOO project. For the second cast (CTD 05), we forgot to switch on the IOP package. So the CTD was stopped at 100 m depth and deployed again down to 400 m (CTD 06). 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 9 depths during the ascent of the CTD. Finally only one C-OPS profile could be 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/i9Y7HSze4TGxoBCh6

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 10 march 2020

MOOSE DYFAMED operations.

Wednesday 11 March 2020 (UTC)

People on board: Céline Dimier, Melek Golbol, Bastien Gaucher (diver), Didier Robin and Eduardo Soto Garcia.

0630 Departure from the Nice harbour.
0940 Arrival at the BOUSSOLE site.
0950 Start of diving operations.
1120 End of diving operations.
1145 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5m for HPLC and a_p.
1240 C-OPS 01, 02, 03.
1330 CTD 02, 100 m with water sampling at 30 m (DCM) for HPLC intercomparison study and 10 and 5 m for TA/TC, O_2 and TSM (with cap on the HS6).
1335 Secchi disk 01, 12 m.
1345 Departure to the Nice harbour.
1700 Arrival to the Nice harbour.

Thursday 12 March 2020 (UTC)

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

0615 Departure from the Nice harbour.
0915 Arrival at the BOUSSOLE site.
0925 CTD 03, 400 m with water sampling at 400, 200, 150, 70, 60, 50, 40, 30, 10 and 5m for HPLC and a_p.
1010 Secchi disk 01, 9 m.
1040 CTD 04, 100 m with water sampling at 80, 20 m for HPLC & a_p, 5 m for TSM and 50, 20, 5 m for OBOO project sampling.
1155 CTD 05, 100 m.
1220 CTD 06, 400 m with water sampling at 60, 40, 20 and 5 m for metagenomic and cytometry 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, 40, 30, 20, 10 and 5 m).
1350 C-OPS 04.
1400 Departure to the Nice harbour.
1730 Arrival to the Nice harbour.

Problems identified during the cruise

- CTD 03: Niskin bottles #4 and #10 (80 and 20 m) did not close. So, only 10 depths were sampled for HPLC analyses. However, these depths were sampled again during CTD cast 04.

- Because of a lack of time, the CTD cast 06 was stopped only at 9 depths (400, 150, 80, 60, 40, 30, 20, 10, 5 m) during the ascent of the CTD.

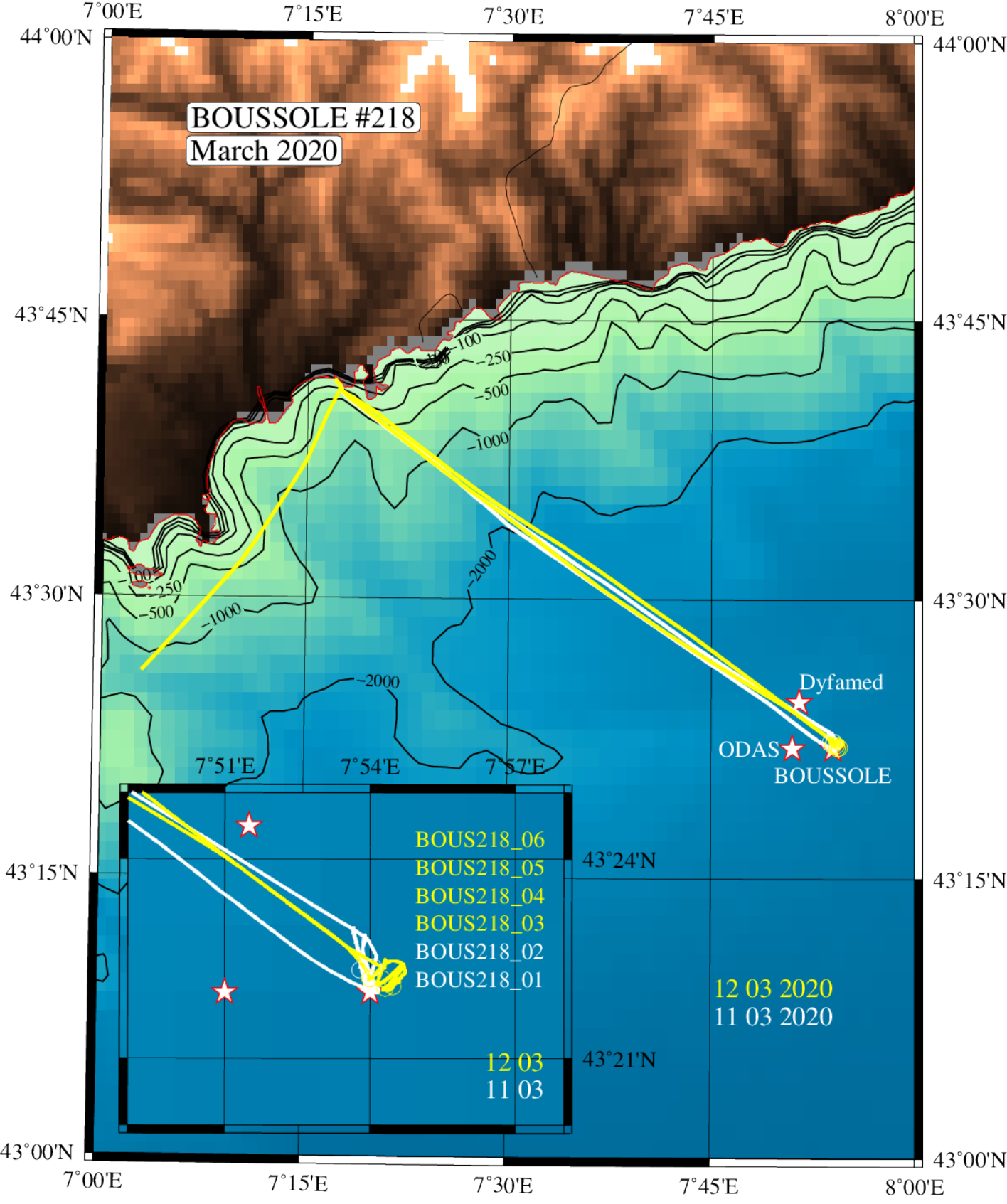
- The second day, because of a lack of time, only one C-OPS profile could be performed at the BOUSSOLE site.

- Dark measurements of buoy transmissometers and backscattering were not carried out during the diving because the buoy currently does not function. Data acquisition will not resume until replacement of the data acquisition system is possible.

Appendices

Cruise Summary Table for Boussole 218

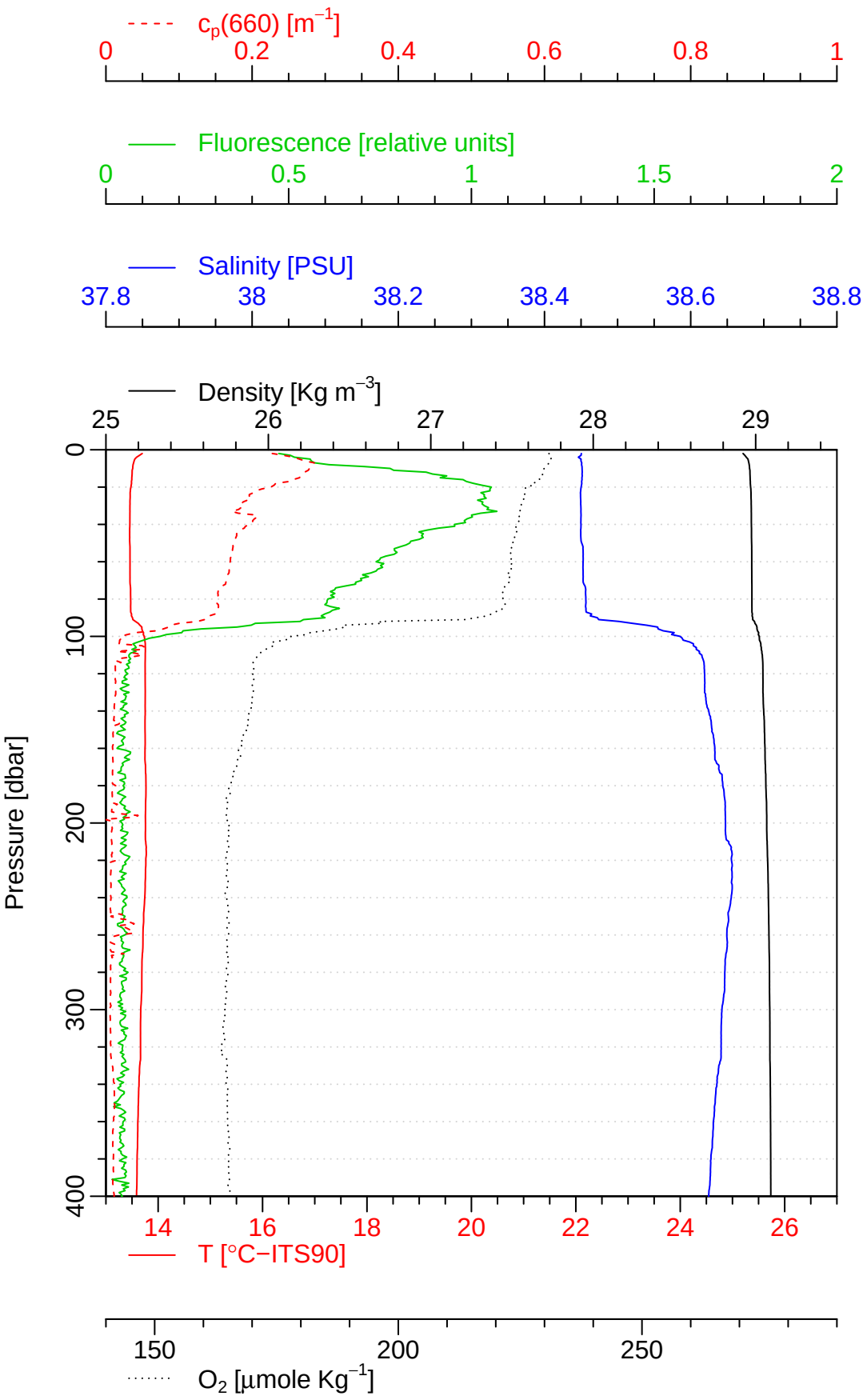
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather						Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
10/03/20	DYFAMED operations																								
11/03/20			BOUS218_01	HPLC & ap	11:43	32:00	400	43	22.334	7	53.792	cloudy		3	5	203	1021.6	82		14.5	13.683	slight			
		bou_c-ops_200311_1223_001_data.csv			12:39	3:00	71	43	22.232	7	53.865	blue	None	0	6	202	1021.3	80	good	14.6		slight	0.7		No
		bou_c-ops_200311_1223_002_data.csv			12:49	2:42	64	43	22.457	7	53.785	blue	None	0	6	202	1021.3	80	good	14.6		slight	0.7		No
		bou_c-ops_200311_1223_003_data.csv			12:57	2:44	67	43	22.673	7	53.732	blue	None	0	6	202	1021.3	80	good	14.6		slight	0.7		No
			BOUS218_02	TA/TC, O_2 & TSM	13:29	21:00	100	43	22.372	7	54.073	cloudy		3	7	169	1020.9	77		14.8	13.554	slight			
				Secchi01	13:35	4:00	12	43	22	7	54	cloudy							good			slight			
12/03/20			BOUS218_03	HPLC & ap	9:23	37:00	400	43	22.202	7	54.000	overcast		7	10	232	1023.0	88		13.7	13.826	smooth			
				Secchi02	0:00	4:00	9	43	22	7	54	overcast							good			smooth			
			BOUS218_04	Phytofloat (PIC, POC, Cyto, phyto) and TSM	10:38	13:00	100	43	22.199	7	54.252	overcast		7	10	239	1022.4	86		13.6	13.875	smooth			
			BOUS218_05		11:55	12:00	100	43	22.078	7	54.469	overcast		7	11	214	1022.3	87		13.9	13.924	smooth			
			BOUS218_06	Metagenomics & Cyto	12:19	1:20:00	400	43	22.058	7	54.316	overcast		7	9	224	1021.9	86		13.6	13.914	smooth			
		bou_c-ops_200312_1318_001_data.csv			13:48	2:34	61	43	22.405	7	54.679	ovecast		7	6	234	1020.6	86	good	13.6		smooth	0.4		No



GMT 2020 Apr 22 17:19:50

bous218_01

Date = 11/03/2020
Heure debut [TU] = 11:42
Longitude = 007 53.792 E
Latitude = 43 22.334 N



bous218_02

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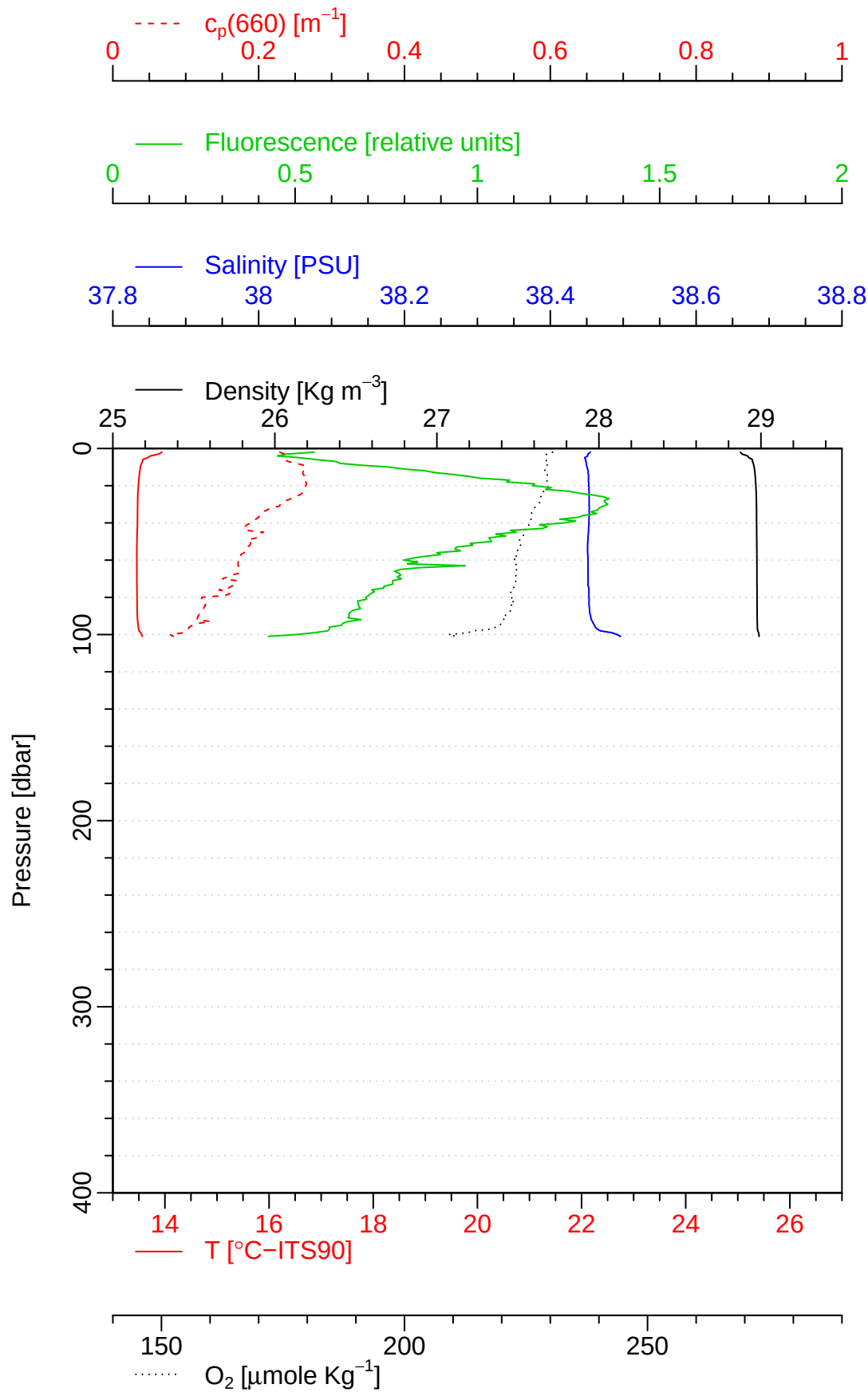
Heure debut [TU] = 13:29
Longitude = 007 54.073 E
Latitude = 43 22.372 N



bous218_03

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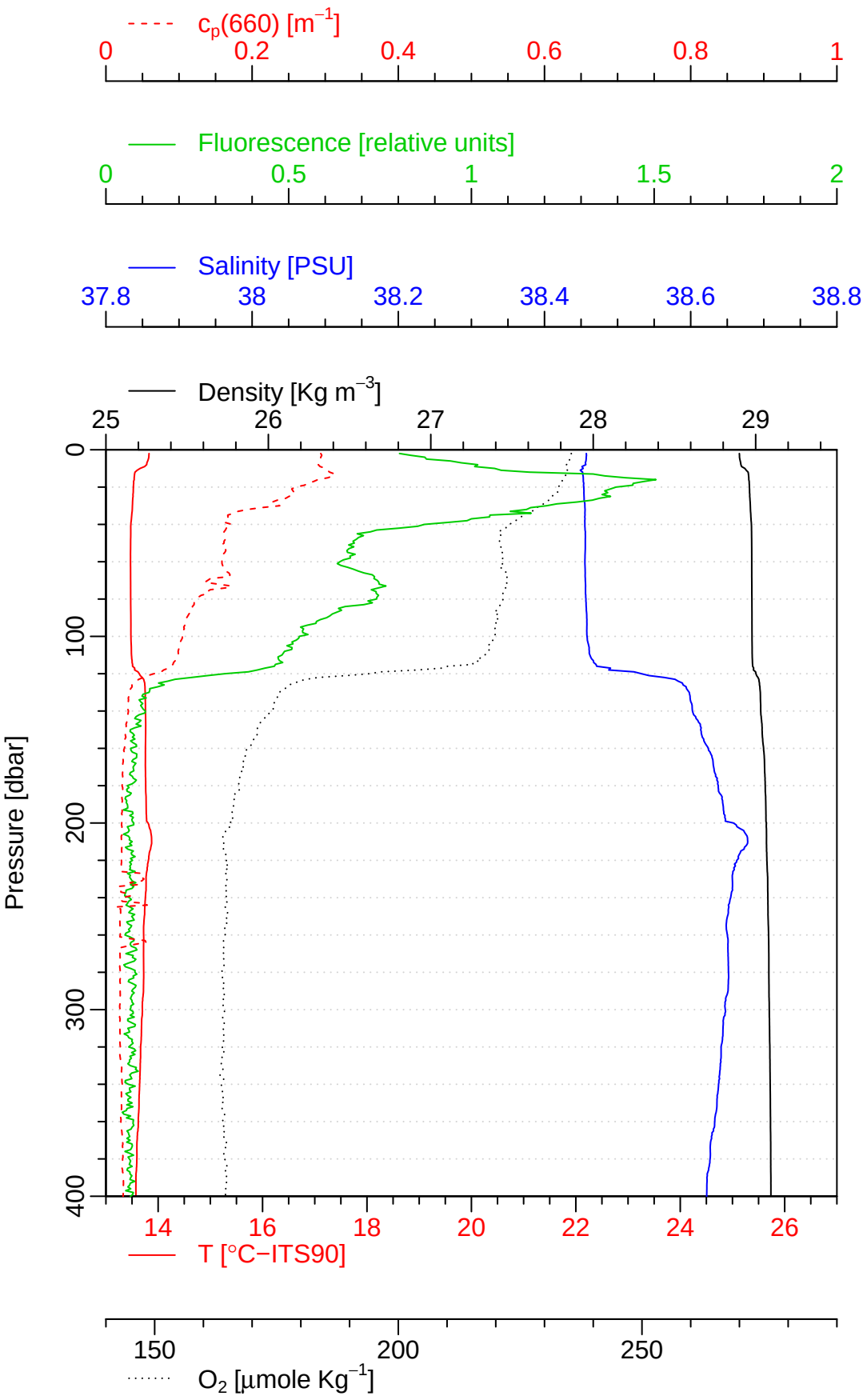
Latitude = 43 22.202 N



bous218_04

Date = 12/03/2020
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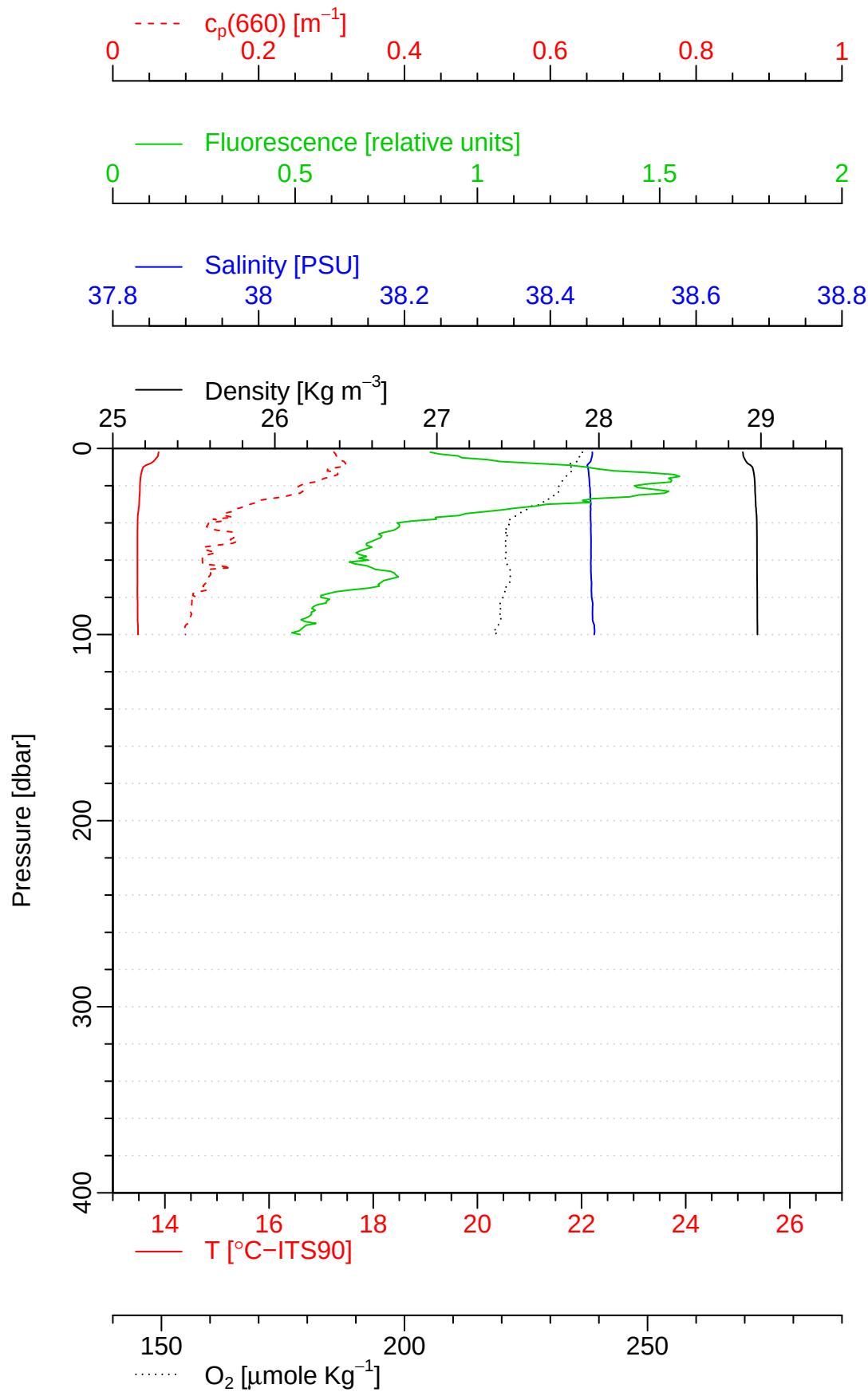
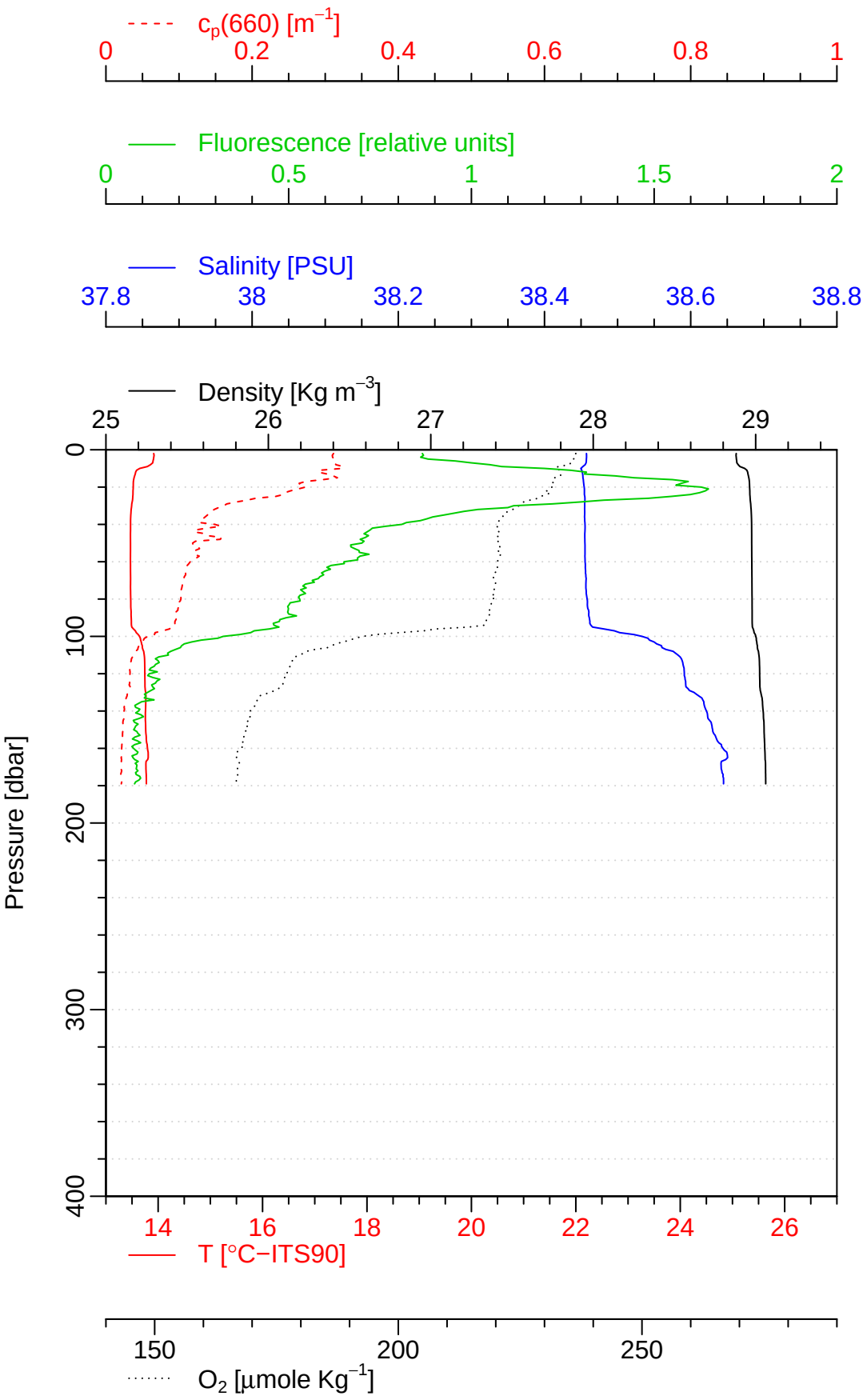
Latitude = 43 22.199 N



bous218_05

Date = 12/03/2020
Heure debut [TU] = 11:55
Longitude = 007 54.469 E
Latitude = 43 22.078 N



bous218_06

Date = 12/03/2020
Heure debut [TU] = 12:19
Longitude = 007 54.316 E
Latitude = 43 22.058 N