BOUSSOLE Monthly Cruise Report

Cruise 203
December 05-07, 2018

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

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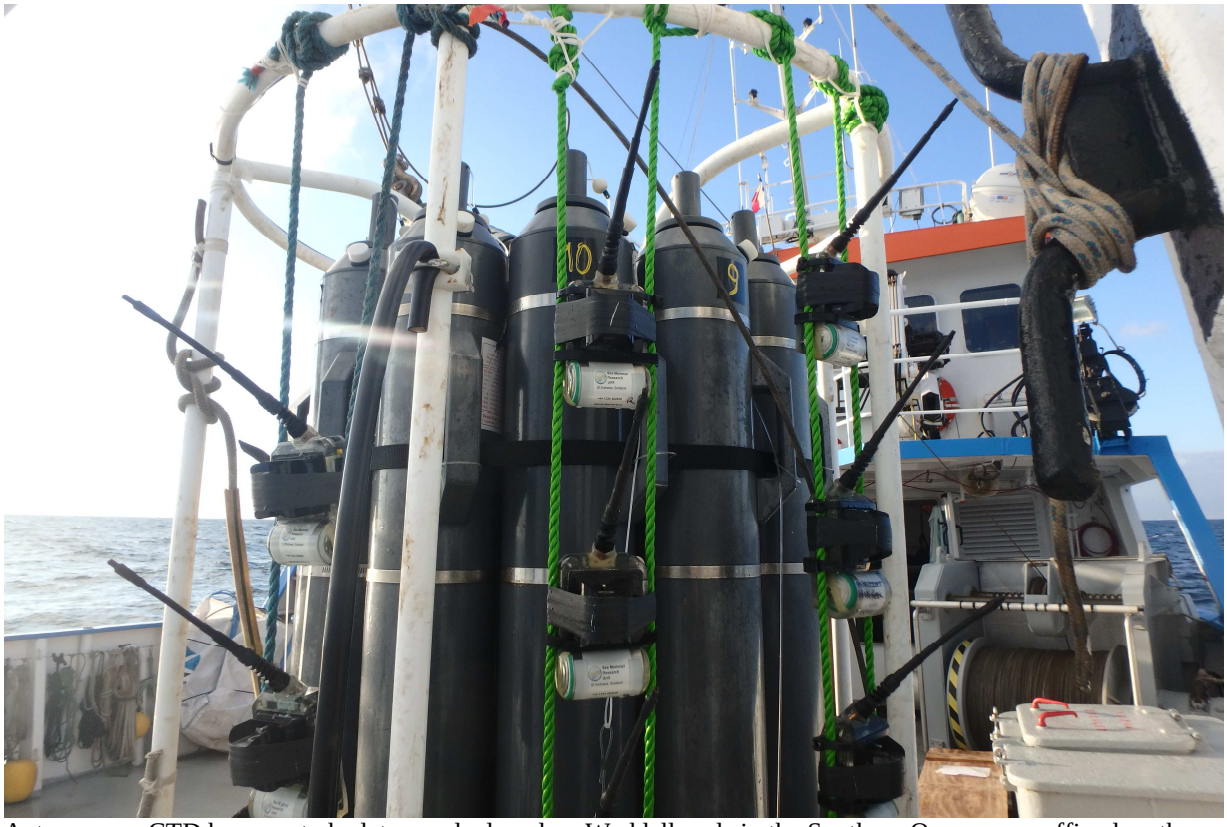
Laboratoire d'Océanographie de Villefranche (LOV), 06230 Villefranche-sur-Mer, France



Autonomous CTD beacons to be later on deployed on Weddell seals in the Southern Ocean were affixed on the CTD Rosette for testing and for data intercomparison with the main CTD.

BOUSSOLE project

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

December13, 2018

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.

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

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

During diving operations, a PCO_2 CARIOCA sensor freshly calibrated was installed at 3 meters depth. The previous sensor is still affixed on the buoy. It will be recovered during the next diving operation.

The MOOSE DYFAMED cruise of 4th December was cancelled due to bad weather, so their operations were performed during the first day of the BOUSSOLE cruise (5th December).
That day, a BGC-Argo profiling float (WMO: 6902901) was deployed by the *Marine optics and remote sensing group* of the *Laboratoire d'Océanographie de Villefranche* (LOV) at the DYFAMED site. This float is equipped with the following biogeochemical and bio-optical sensors: Chla a and CDOM fluorescence, particulate backscattering b_{bp} (700 nm), dissolved oxygen, downward plane irradiance, E_d, at 380, 410, and 490 nm, and PAR.

The last day, Céline Dimier, working in 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 intercomparison study on the protocols with other labs.

It was noticed that in the previous cruises, there were problems with absorption data acquisition when the 0.2 µm filter was installed on the inlet tube of the a-sphere for the dissolved matter absorption measurements. In fact when the filter is installed, the cavity of the a-Sphere needs significant time to be completely filled and therefore to stabilize data acquisition. This time was determined during the previous cruise. A new protocol for the absorption profiles of dissolved matter was established: the filter will be added to the a-Sphere during one CTD cast per cruise and this CTD cast will be stopped at ten depths (400, 150, 80, 60, 50, 40, 30, 20, 10 and 5 m) during 2 or 7 min depending on the depth during the ascent of the CTD.

Cruise Summary

The first day of the cruise was used for diving operations, for optical profiles, for CTD casts with water sampling and for a Secchi disk at the BOUSSOLE site. It was also used for the deployment of the BGC-Argo profiling float and for MOOSE operations at the DYFAMED site. The second day, the bad weather prevented departure from the Nice harbour. The last day of the cruise was used for CTD casts with water sampling, for optical profiles and for a Secchi disk at the BOUSSOLE site.

Wednesday 05 December 2018

The sea state was smooth with a light air. The sky was blue and the visibility was excellent. The CTD beacons were affixed on the CTD Rosette during the way up to the BOUSSOLE site. When arrived, divers went at sea to install the PCO_2 CARIOCA sensor at 3 m depth. They also cleaned the sensors but they could not take pictures because of the strong currents. In the meantime, a Secchi disk was performed. Then 3 C-OPS profiles and 2 CTD casts were performed at the BOUSSOLE site. Then we went to the DYFAMED site to deploy the profiling float and to perform the deep CTD cast. Finally 2 zooplankton nets were performed at the DYFAMED site before returning to the Nice harbour.

Thursday 06 December 2018

Bad weather prevented departure from the Nice harbour.

Friday 07 December 2018

The sea state was slight with a moderate breeze. The sky was cloudy in the morning and overcast in the afternoon and the visibility was good. Firstly, 2 CTD casts with water sampling and a Secchi disk were performed at the BOUSSOLE site. For the first CTD cast (CTD 03), a cap was put on the Hydroscat-6 for dark measurements and a 0.2 µm filter put on the a-Sphere absorption meter for the dissolved matter absorption measurements. This CTD cast was stopped at 10 depths (400 and 150 m during 2 minutes and 80, 60, 50, 40, 30, 20, 10 and 5 m during 7 minutes) during the ascent of the CTD. Finally, 3 C-OPS profiles 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/tFe1P6aNWbTEDJm3A

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

Cruise Report

Wednesday 05 December 2018 (UTC)

People on board: Emilie Diamond, Melek Golbol, David Luquet, Juliette Maury (LOV), Didier Robin, Eduardo Soto Garcia and Martin Tournier (CEBC).

0615 Departure from the Nice harbour.
0940 Arrival at the BOUSSOLE site.
0945 Diving operations (installation of PCO_2 sensor at 3 m and cleaning of the sensors).
0950 Secchi disk 01, 19 m.
1040 C-OPS 01, 02, 03.
1130 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.
1240 CTD 02, 400 m with water sampling at 10 and 5 m for TA/TC and O_2.
1305 Departure to the DYFAMED site.
1330 Arrival at the DYFAMED site.
1355 Deployment of the profiling float.
1430 CTD MOOSE 126, 2400 m.
1605 Zooplankton nets x 2, 100 and 200 m.
1635 Departure to the Nice harbour.
2000 Arrival at the Nice harbour.

Thursday 06 December 2018

Bad weather prevented departure from the Nice harbour.

Friday 07 December 2018 (UTC)

People on board: Céline Dimier, Melek Golbol, Eduardo Soto Garcia and Martin Tournier.

0600 Departure from the Nice harbour.
0930 Arrival at the BOUSSOLE site.
0940 CTD 03, 400 m with water sampling at 50 m for HPLC (intercomparison study) and 5 m for TSM (with 0.2 µm filter on a-Sphere and cap on HS-6 and 2 minutes stop at 400 and 150 m and 7 minutes stop at 80, 60, 50, 40, 30, 20, 10 and 5 m).
1130 Secchi 02, 19 m.
1015 CTD 04, 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.
1245 C-OPS 04, 05, 06.
1325 Departure to the Nice harbour.
1635 Arrival to the Nice harbour.

Problems identified during the cruise

- The buoy is currently not functioning. The faulty data acquisition system will be replaced during the next rotation of the upper superstructure of the buoy.

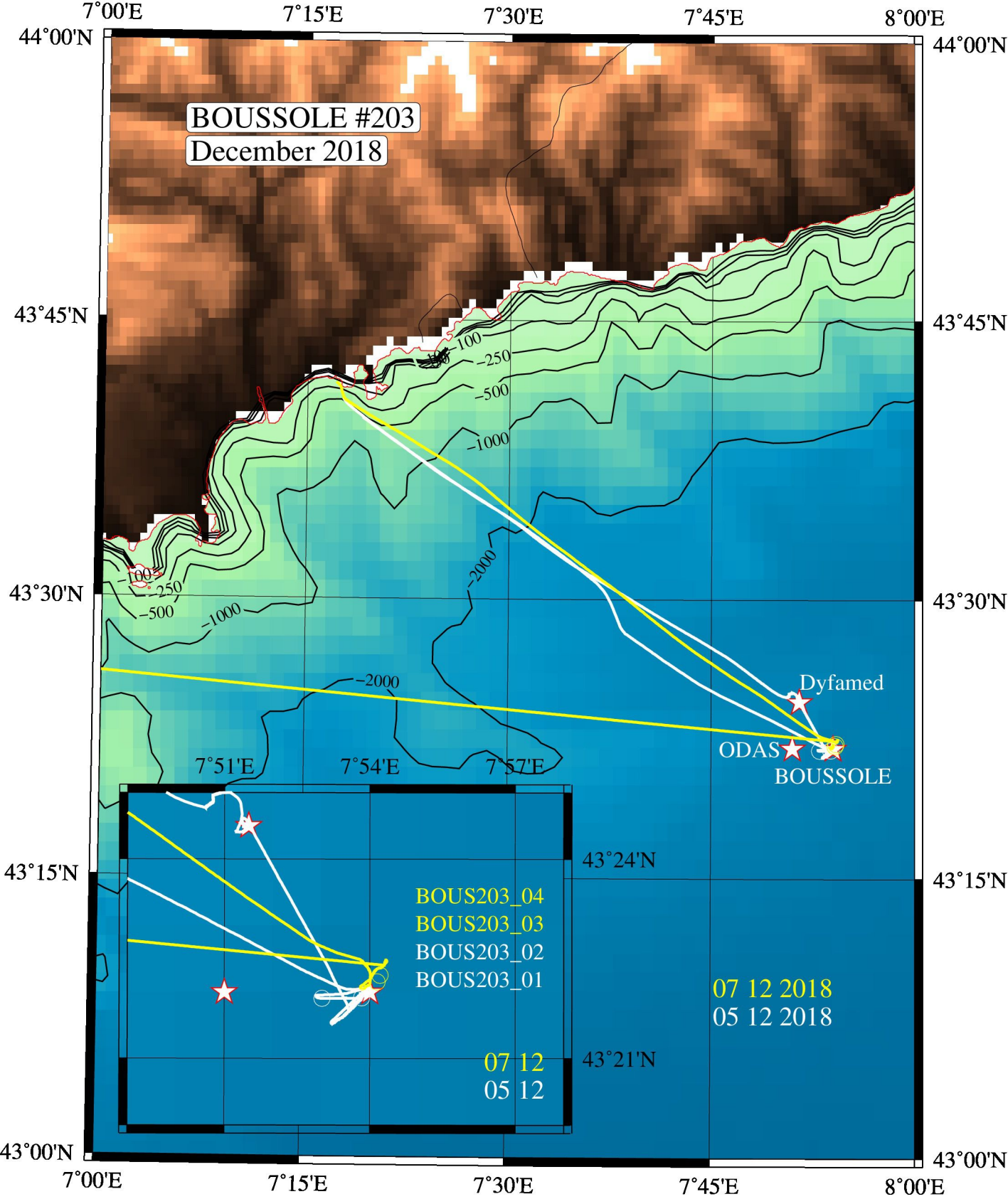
- Underwater pictures of the buoy could not be taken by the divers because of the strong currents.

- C-OPS profiles were shallower (around 30 meters) than those usually performed (around 100 meters) because the usual 300m sea cable was broken and a shorter one (125m) had to be used instead.

Appendices

Cruise Summary Table for Boussole 203

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
05/12/18				Secchi01	09:50	4:00	19	43	22	7	54	cloudy		4					excellent			smooth			
		bou_c-ops_181205_1000_001_data.csv			10:41	1:29	33	43	21.912	7	53.492	blue	Cu	1	2	308	1024.2	79	excellent	16.9		smooth	0.4		no
		bou_c-ops_181205_1000_002_data.csv			10:46	1:12	26	43	21.907	7	53.273	blue	Cu	1	2	308	1024.2	79	excellent	16.9		smooth	0.4		no
		bou_c-ops_181205_1000_003_data.csv			10:50	1:11	27	43	21.907	7	53.164	blue	Cu	1	2	308	1024.2	79	excellent	16.9		smooth	0.4		no
			BOUS203_01	HPLC & Ap	11:28	31:00	400	43	21.908	7	53.014	blue		3	2	146	1024.6	76		17.3	17.62	smooth			
			BOUS203_02	TA/TC, O2 & TSM	12:40	23:00	400	43	21.912	7	53.833	blue		0	3	278	1023.5	78		16.7	17.60	smooth			
06/12/18	Bad weather																								
07/12/18			BOUS203_03	TSM	09:40	26:00	400	43	22.154	7	54.152	blue		2	8	210	1022.5	71		15.6	16.71	slight			
				Secchi02	11:30	4:00	19	43	22	7	54	cloudy		4					good			slight			
			BOUS203_04	HPLC & Ap	11:42	39:00	400	43	22.253	7	54.214	cloudy		4	14	102	1020.7	73		15.7	16.80	slight			
		bou_c-ops_181207_1235_001_data.csv			12:42	1:02	22	43	22.280	7	54.009	overcast	Sc	7	14	217	1020.1	73	good	16.2		slight	0.7		few
		bou_c-ops_181207_1235_002_data.csv			12:48	1:13	27	43	22.387	7	53.937	overcast	Sc	7	14	217	1020.1	73	good	16.2		slight	0.7		few
		bou_c-ops_181207_1235_003_data.csv			12:52	1:24	31	43	22.437	7	53.875	overcast	Sc	7	14	217	1020.1	73	good	16.2		slight	0.7		few



GMT 2018 Dec 15 09:46:47

bous203_01

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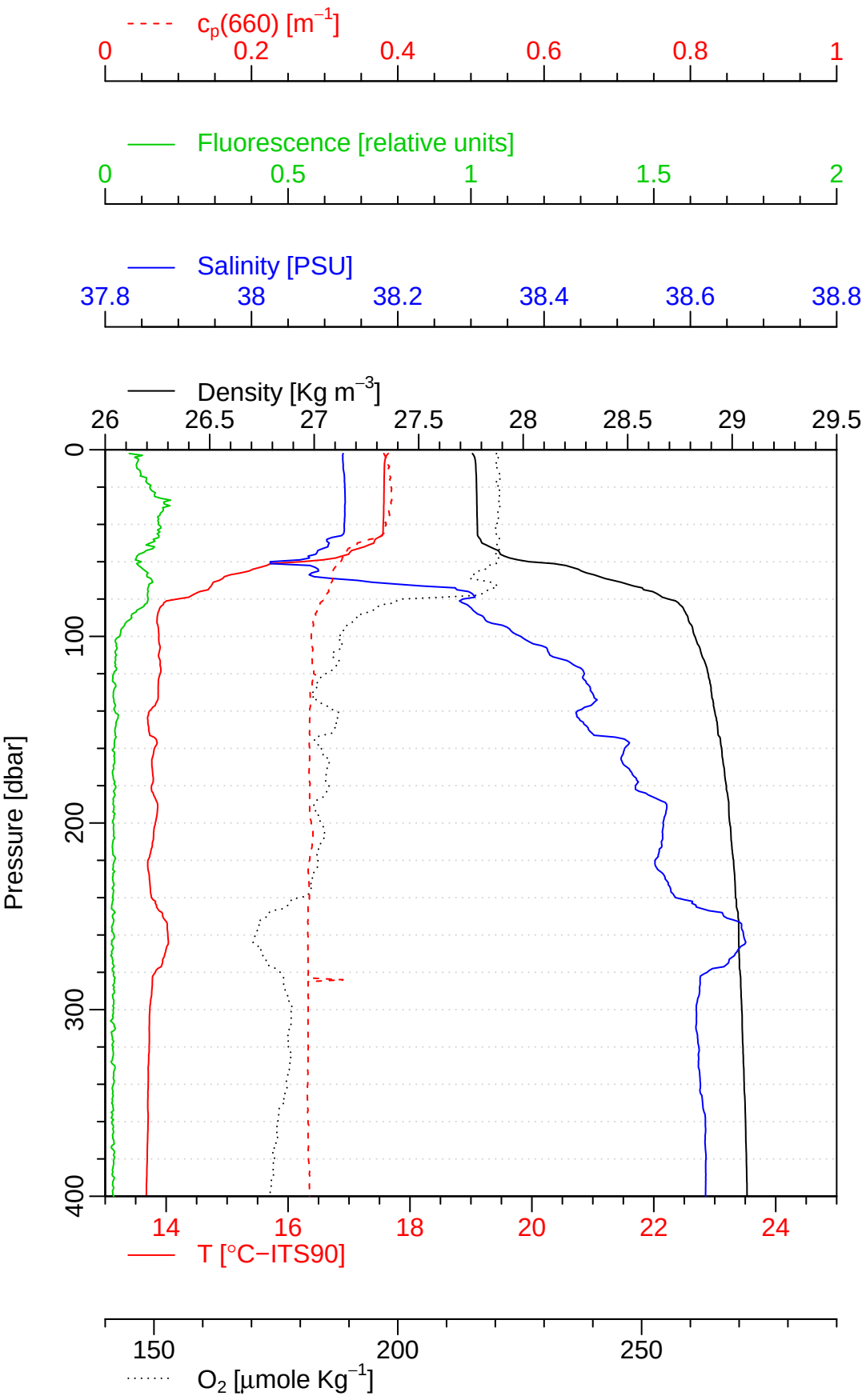
Latitude = 43 21.908 N



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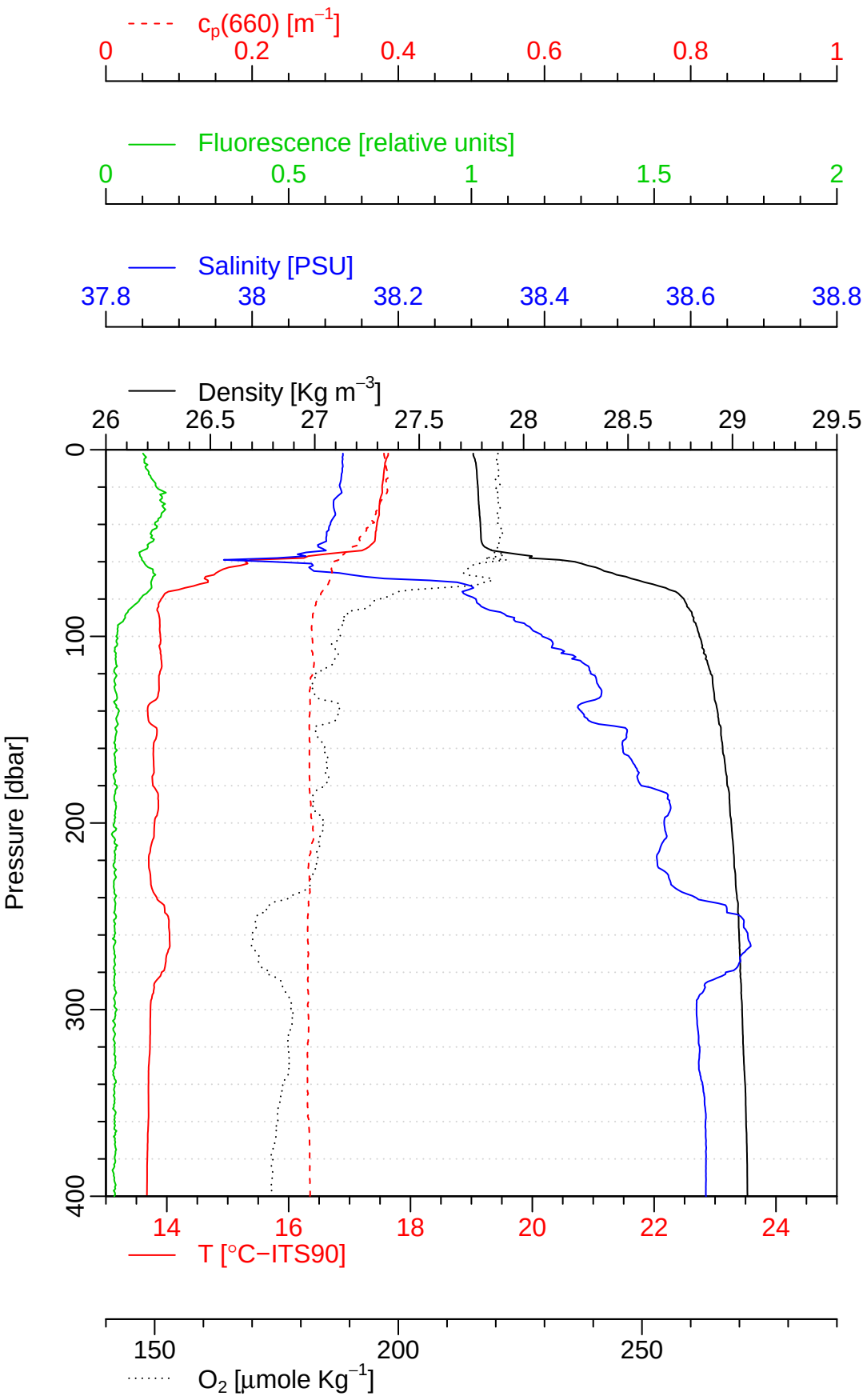

bous203_03

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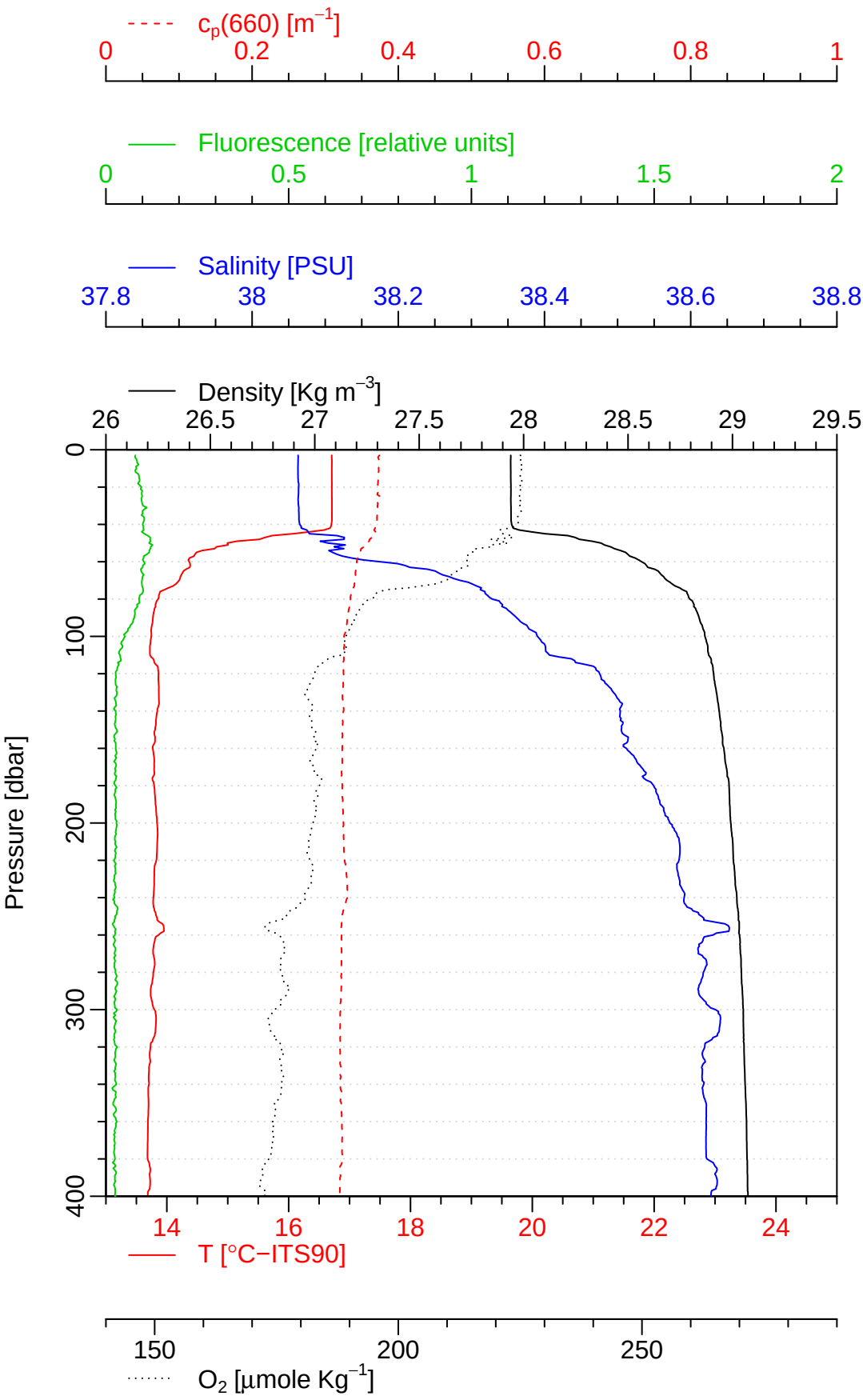
Longitude = 007 54.152 E
Latitude = 43 22.154 N



bous203_04

Date = 07/12/2018
Heure debut [TU] = 11:42
Longitude = 007 54.214 E
Latitude = 43 22.253 N