BOUSSOLE Monthly Cruise Report

Cruise 212
September 17-18, 2019

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

Science Personnel: Melek Golbol and Eduardo Soto Garcia.

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The R/V *Castor 02* was on the BOUSSOLE site to perform the full mooring line and buoy lower superstructure rotation at the time the BOUSSOLE monthly cruise was carried out.

BOUSSOLE project

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

September 30, 2019

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.

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 first day, a second pressure test was performed for the a-Sphere absorption meter. The first test was performed during the Boussole#205 cruise. A drift of the sensor was observed when the pressure is increasing. It was decided to test again this effect because the temperature of the pure water filled in the cavity of the a-Sphere was not measured during the previous test and it is an important parameter for the data processing.

The second day, a square grid survey was performed with the *R/V Téthys II* in order to characterize the spatial variability of the surface chlorophyll concentration in the vicinity of the BOUSSOLE buoy. Data were acquired by the underway fluorimeter installed on the ship. This operation will be performed once per cruise until the end of 2019 in the frame of the ROSACE project (Radiometry for Ocean Colour SAtellites Calibration & Community Engagement). This project aims to propose a preliminary design of the new European infrastructure dedicated to System Vicarious Calibration (SVC) for the European Copernicus Ocean Colour missions.

The MOOSE deep CTD cast could not be performed during the MOOSE DYFAMED cruise because of problems with the CTD (dysfunction of the conductivity sensor and pump), so it was decided to perform a UVP cast during

CTD 04 and to sample additional parameters (O2, TA/TC, nutrients and cytometry) at 7 depths during CTD 05 for MOOSE program.

Cruise Summary

The first day of the cruise was used for optical profiles, for CTD casts with water sampling and for a Secchi disk at the BOUSSOLE site. The pressure effect on the a-Sphere absorption measurements was tested. Eduardo Soto, engineer responsible for the CTD on BOUSSOLE cruises was on the R/V *Castor 02* for helping during the full mooring rotation of BOUSSOLE. He joined the R/V *Téthys II* during the cruise after he was done with his work on the *Castor 02*.
The last day of the cruise was used for CTD casts with water sampling, for optical profiles, for surface chlorophyll measurement grid and for a Secchi disk at the BOUSSOLE site. Similarly to what happened during the previous cruises, we observed problems with the pump and the conductivity sensor during the CTD deployments. Before the cruise, we had installed a second Temperature and Conductivity sensor on the CTD in order to identify faulty sensors. But unfortunately the problems were detected for the two TC sensors installed on the CTD.

Diving operations and maintenance of the buoy were not planned because the mooring line and buoy lower superstructure rotation occurred during this cruise and it was not necessary to perform these operations.

Tuesday 17 September 2019

The sea state was smooth with a light breeze. The sky was blue and the visibility was good. Firstly, 3 C-OPS profiles were performed. Then a Secchi disk and 2 CTD casts were performed at the BOUSSOLE site. For the first cast, the cavity of the a-Sphere was completely filled with pure water in order to test the pressure effect on the measurements. A cap was put on the Hydroscat-6 for dark measurements. Failures were observed on the conductivity sensors and pump for all the CTD casts. Then, Eduardo Soto joined the R/V *Téthys II* from the R/V *Castor 02* directly by dinghy. The ship stayed on BOUSSOLE site during the night.

Wednesday 18 September 2019

The sea state was smooth with a light air. The sky was cloudy and the visibility was good. Firstly, two CTD casts with water sampling were performed at the BOUSSOLE site. For the first cast, a 0.2 µm filter was put on the a-Sphere absorption meter for the dissolved matter absorption measurements. This CTD cast was stopped at 10 depths during the ascent of the CTD. For the second cast, a UVP cast was performed simultaneously for MOOSE program. Then, 3 C-OPS profiles were performed. During the lunchtime, the sea surface chlorophyll measurements grid was performed, centered on the BOUSSOLE site. After that, a CTD with water sampling was performed at the BOUSSOLE site. Failures were observed on the conductivity sensors and pump for all the CTD casts. Finally a Secchi disk was performed before returning to the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/4sgdzMQF61wVQNfJ8

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 17 September 2019 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

0630 Departure from the Nice harbour.
1000 Arrival at the BOUSSOLE site.
1040 C-OPS 01, 02, 03, 04.
1200 Secchi disk 01, 24 m.

1230 CTD 01, 400 m with water sampling at 5 m for TSM and a-Sphere pressure effect testing.
1345 CTD 02, 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.
1445 Eduardo Soto came on board from the R/V *Castor 02*.
1500 Filtrations.

Wednesday 18 September 2019 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

0620 CTD 03, 400 m with water sampling at 5 m for TSM (with 0.2 µm filter on a-Sphere and 2 minutes stop at 400 and 150 m and 7 minutes stop at 80, 60, 50, 40, 30, 20, 10 and 5 m).
0825 CTD 04, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p and UVP cast.
0920 C-OPS 05, 06, 07.
1010 Surface chlorophyll fluorescence grid.
1130 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 52 (DCM), 10 and 5 m for O2, TA/TC, nutrients and cytometry (MOOSE program).
1130 Secchi 02, 27 m.
1200 Departure to the Nice harbour.
1530 Arrival to the Nice harbour.

Problems identified during the cruise

- For all CTD casts, failures on the conductivity sensors and the pump were detected all along the profiles as during the previous cruises. However, one of the conductivity sensor seemed to work better than the other. After the cruise, all the conductivity sensors were tested in the bay of Villefranche and it appeared that only one of our three sensors is functioning. This sensor (S/N 2929) was installed on the CTD and used a few days after this BOUSSOLE cruise during a teaching mission on the *Téthys II*. For all the casts, the CTD functioned correctly and no failures were detected. The two faulty sensors were sent to Seabird for diagnostic and repair.

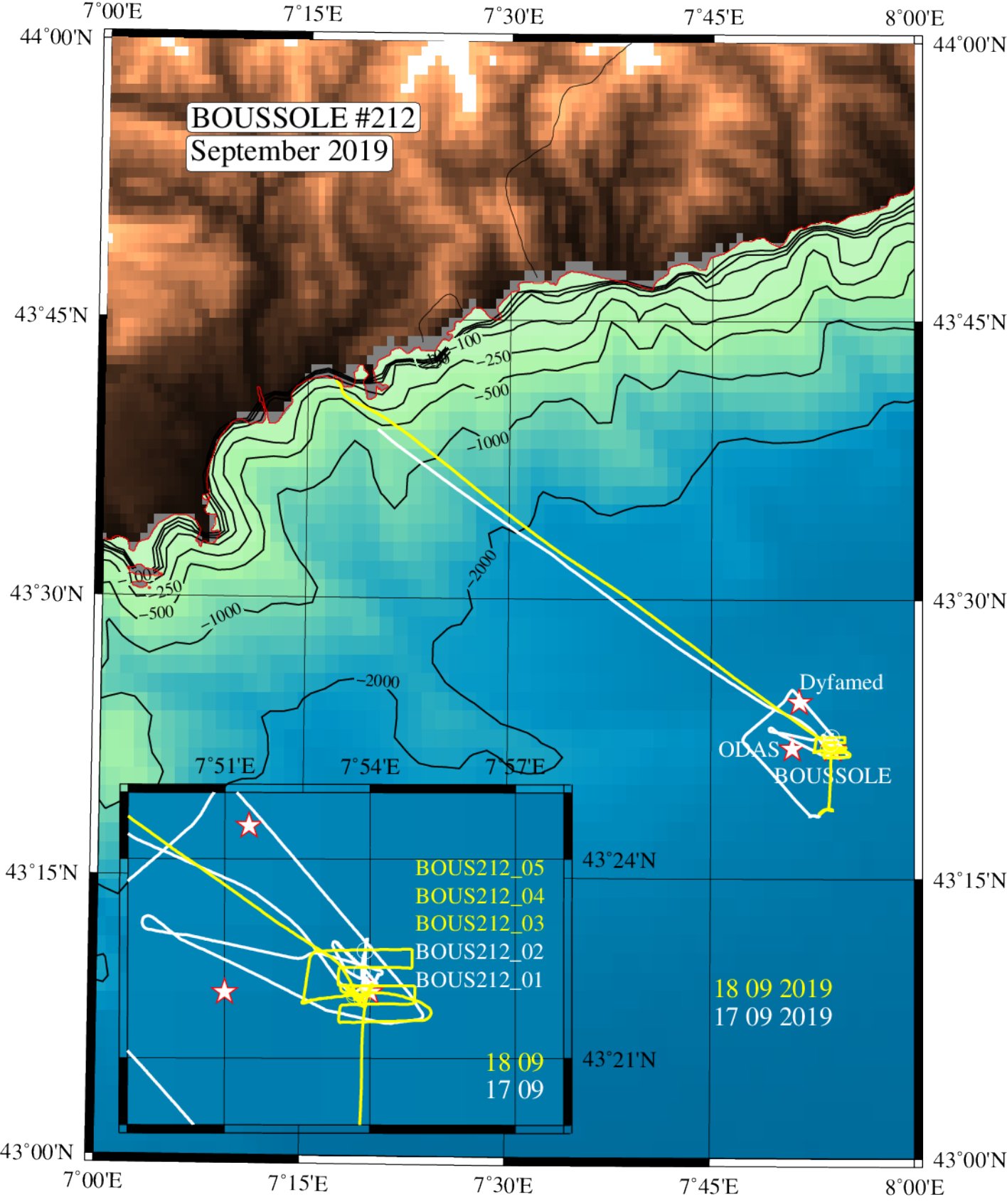
  However, the IOP package, which is deployed simultaneously to the CTD-rosette, includes a SBE 49 FastCat CTD, the T&S data of which could be used as an alternative solution.

- The C-Star transmissometer of the CTD package was not available because the instrument was sent to *Seabird – WET Labs* for calibration. The instrument was not returned in time for this cruise.

Appendices

Cruise Summary Table for Boussole 212

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
17/09/19		bou_c-ops_190917_1035_001_data.csv			10:40	4:17	105	43	22.287	7	53.945	blue	As,Cu	2	3	183	1016.6	78	good	23.7		smooth	0.4		No
		bou_c-ops_190917_1035_002_data.csv			10:52	4:19	115	43	22.451	7	53.714	blue	As,Cu	2	3	183	1016.6	78	good	23.7		smooth	0.4		No
		bou_c-ops_190917_1035_004_data.csv			11:04	4:44	114	43	22.533	7	53.594	blue	As,Cu	2	3	183	1016.6	78	good	23.7		smooth	0.4		No
		bou_c-ops_190917_1035_005_data.csv			11:06	4:46	119	43	22.629	7	53.461	blue	As,Cu	2	3	183	1016.6	78	good	23.7		smooth	0.4		No
				Secchi01	12:00	4:00	24	43	22	7	54	blue		2					good			smooth			
			BOUS212_01	TSM	12:29	20:00	400	43	22.308	7	53.836	blue		2	6	197	1015.8	79		23.6	24.20	smooth			
			BOUS212_02	HPLC & Ap	13:45	32:00	400	43	22.621	7	53.902	cloudy		5	6	187	1015.3	80		23.4	24.54	smooth			
18/09/19			BOUS212_03	TSM	06:21	1:25:00	400	43	21.946	7	53.678	cloudy		5	2	128	1014.1	79		22.5	23.60	smooth			
			BOUS212_04	HPLC & Ap	08:23	34:00	400	43	21.994	7	53.668	cloudy		4	2	113	1015.0	78		23.6	23.50	smooth			
		bou_c-ops_190818_0911_001_data.csv			09:18	4:03	98	43	21.942	7	53.510	cloudy	Ci	4	2	108	1015.6	73	good	24.2		smooth	0.4		No
		bou_c-ops_190818_0911_002_data.csv			09:28	3:48	95	43	21.910	7	53.157	cloudy	Ci	4	2	108	1015.6	73	good	24.2		smooth	0.4		No
		bou_c-ops_190818_0911_003_data.csv			09:39	2:56	71	43	21.879	7	52.840	cloudy	Ci	4	2	108	1015.6	73	good	24.2		smooth	0.4		No
			BOUS212_05	O_2, TA/TC, Nutrients & Cyto	11:29	27:00	400	43	21.898	7	53.836	cloudy		5	3	43	1015.6	76		23.3	23.86	smooth			
				Secchi02	11:30	4:00	27	43	22	7	54	cloudy		5					good			smooth			



GMT 2019 Nov 06 08:40:54

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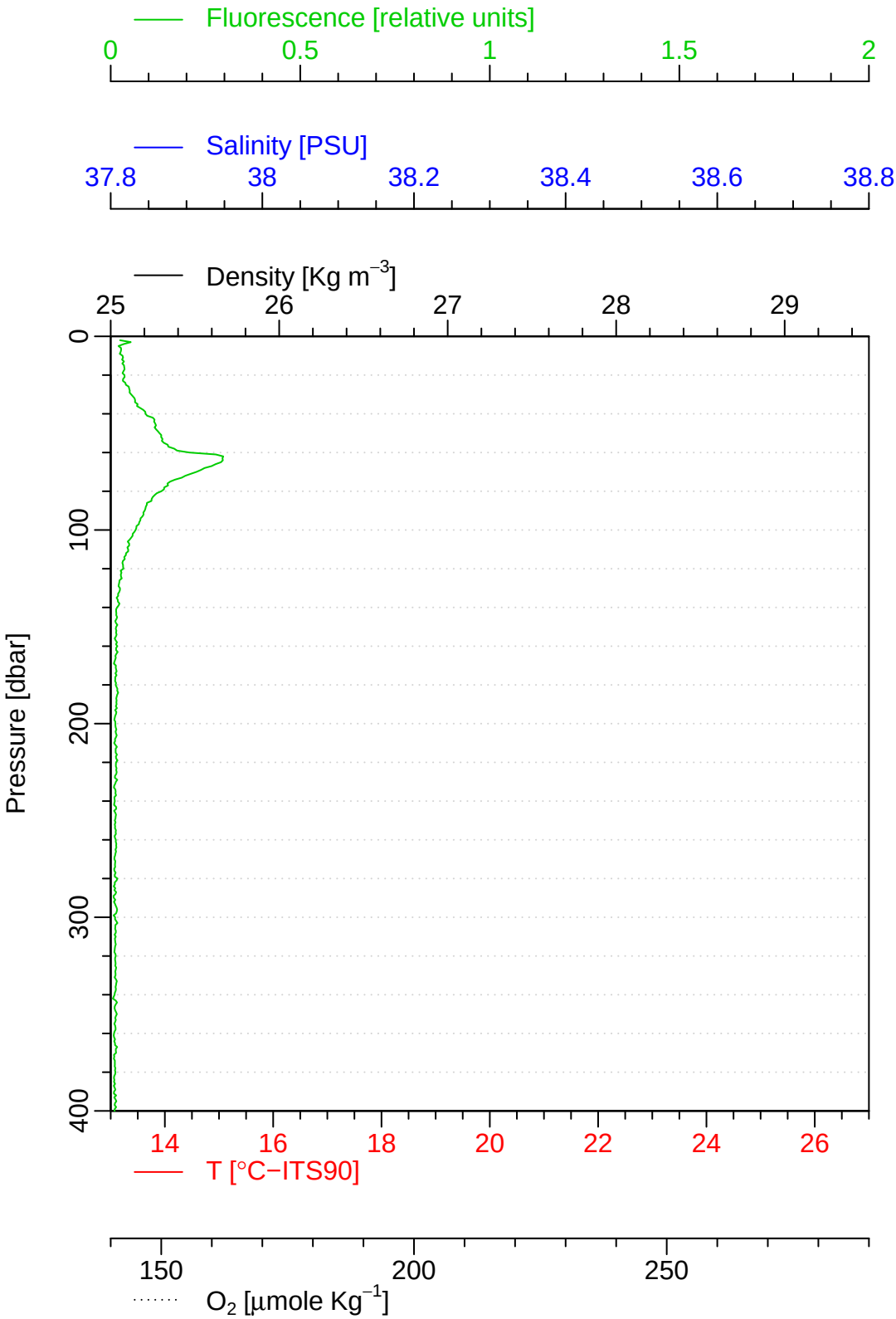
Latitude = 43 22.308 N



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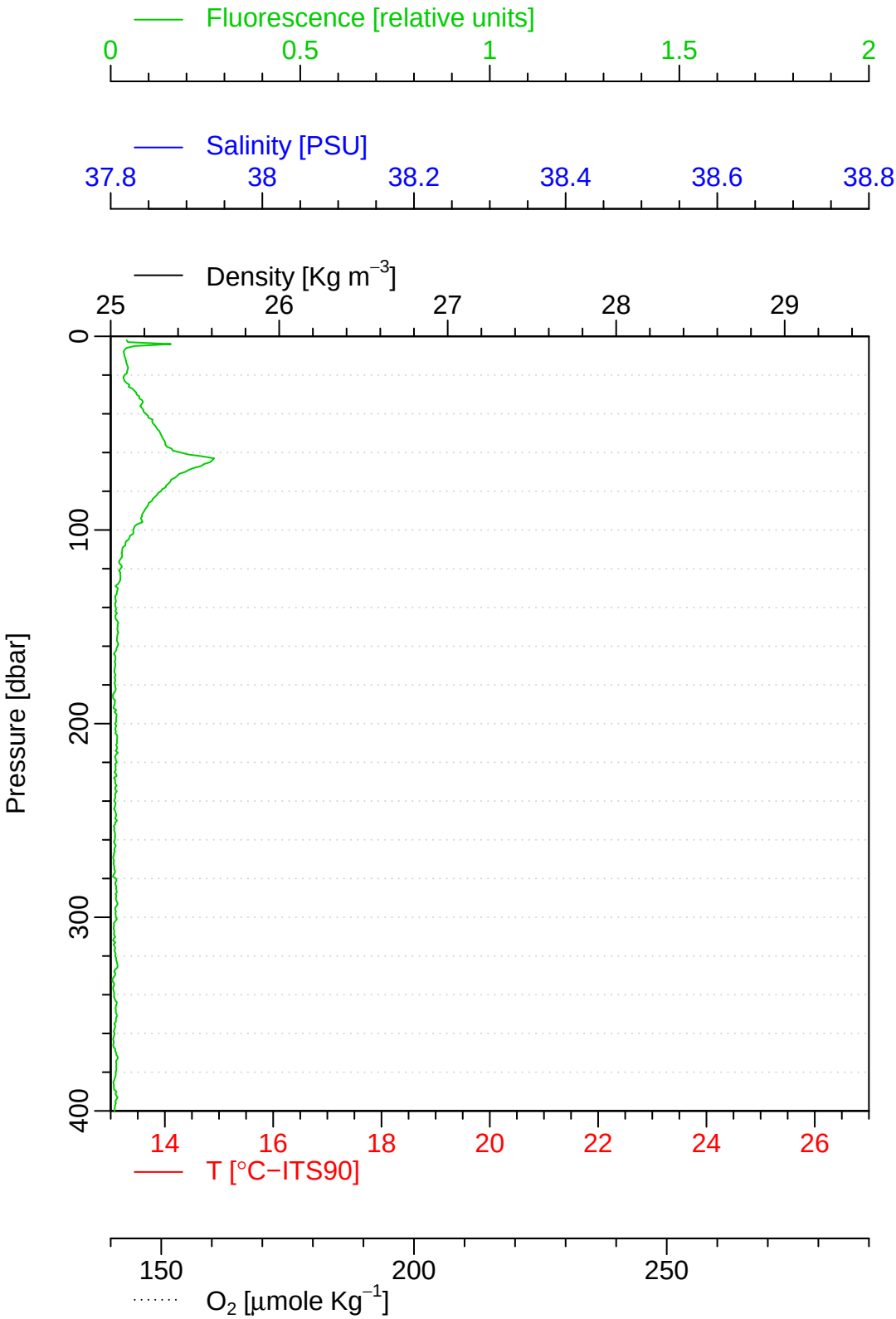

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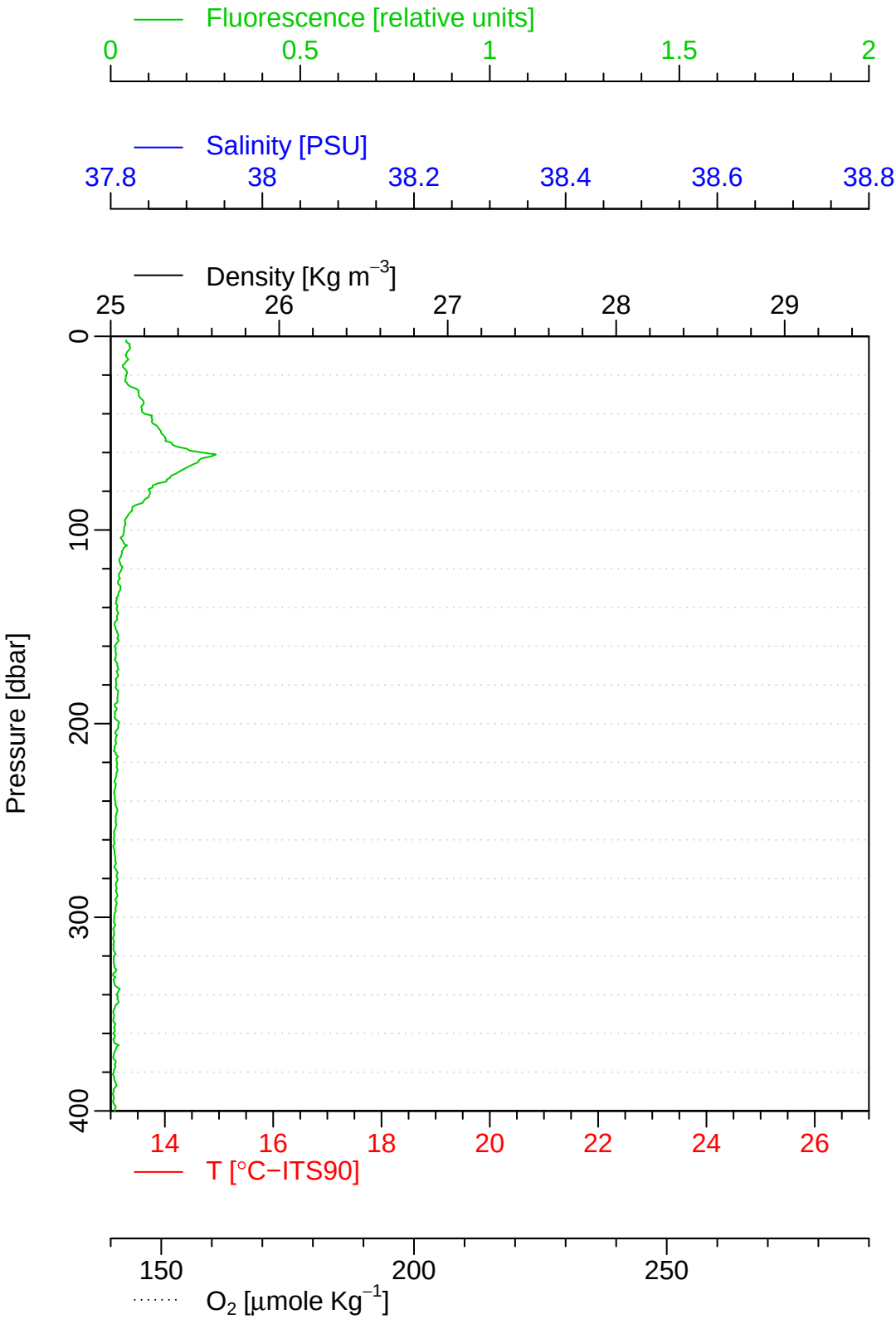
Latitude = 43 21.946 N



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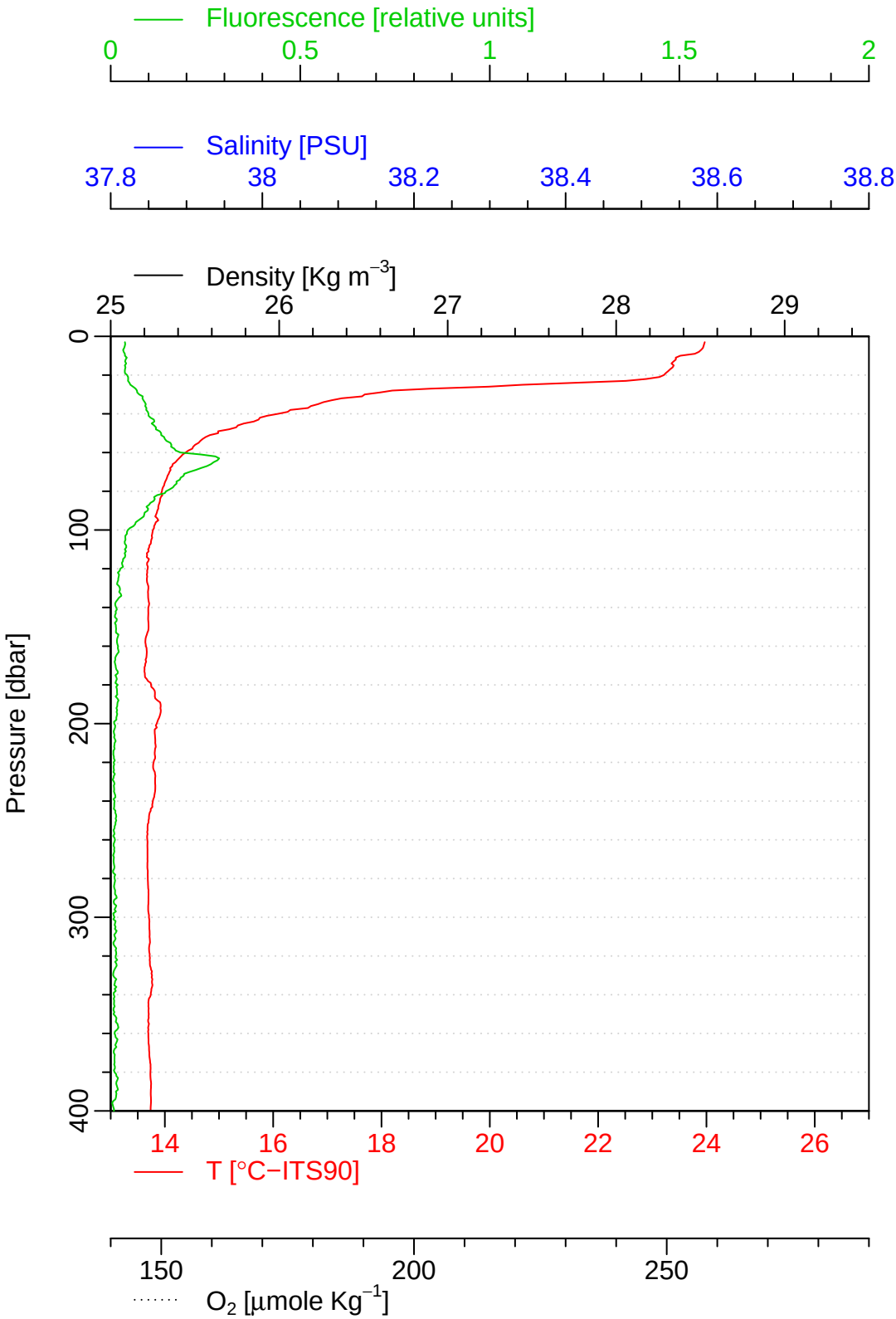
Latitude = 43 21.994 N



bous212_05

Date = 18/09/2019
Heure debut [TU] = 11:29
Longitude = 007 53.836 E
Latitude = 43 21.898 N