BOUSSOLE Monthly Cruise Report

Cruise 210
July 23-25, 2019

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

Science Personnel: Jean De Vaugelas, Céline Dimier, Melek Golbol, David Luquet, Franck Petit and Eduardo Soto Garcia.

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A view of the BOUSSOLE buoy from the top of the buoy: the water was extremely clear with a visibility up to 26 m depth. We could see clearly the structure of the buoy from the surface.

BOUSSOLE project

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

July 26, 2019

Foreword

This report is part of the technical report series that is being established by the BOUSSOLE project.

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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 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 second day, a Manta net was deployed for the MOOSE DYFAMED program during the way back to Nice harbour.

The diving operations were planned during the DYFAMED day on July 25th July because of the unavailability of the divers during the BOUSSOLE cruise days. They replaced the PCO_2 CARIOCA sensor at 3 m depth with a freshly calibrated one, in the frame of the collaboration with the LOCEAN. The recovered sensor will be sent to LOCEAN for servicing and calibration.

Cruise Summary

The first day of the cruise was used for optical profiles, for surface chlorophyll measurement transect, for CTD cast with water sampling, for CIMEL measurements and for a Secchi disk at the BOUSSOLE site. The last 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. This day was also used to deploy the Manta net in surface water. The last day (DYFAMED day) was used for diving operations and for MOOSE operations.

Tuesday 23 July 2019

The sea state was calm with a light breeze. The sky was blue and the visibility was good. Firstly, surface sensors of the buoy, solar panels and the ARGOS connector were cleaned at the top of the buoy. Buoy data were retrieved using the cable available on the top of the buoy. During lunchtime, the sea surface chlorophyll measurements grid was performed, centered on the BOUSSOLE site. Then, a CTD cast was attempted but failed: the conductivity sensor was not functioning. Then, 3 C-OPS profiles were performed at the BOUSSOLE site. After that, the CTD was redeployed after testing it and replacing the conductivity sensor. However, this conductivity sensor was not either functioning. We nevertheless decided to continue the cast because the fluorimeter, pressure and temperature sensors and IOP package were all working correctly. In the meantime, CIMEL measurements were performed. Finally the Secchi disk was performed at the BOUSSOLE site before returning to the Nice harbour.

Wednesday 24 July 2019

The sea state was calm with a light air. The sky was blue and the visibility was good. Another CTD unit was brought on the ship and installed during the way up to BOUSSOLE because of the failure that we had the day before. Firstly, 3 C-OPS profiles were performed. Then a Secchi disk and 2 CTD casts with water sampling were performed at the BOUSSOLE site. For the second cast, a cap was put on the Hydroscat-6 for dark measurements and 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 (to allow for the A-sphere to stabilize and make good measurements). The downcasts of these two CTDs were normal but failures on the conductivity sensor and pump appeared during the upcasts between 400 and 300 m depth. In the meantime, 3 CIMEL measurements were performed. Finally, a MANTA net was deployment in water surface during the way back to the Nice harbour for the MOOSE DYFAMED program.

Thursday 25 July 2019

This day was planned for MOOSE operations. The sea state was calm with a light breeze. Firstly, divers went at sea in order to perform dark measurements on the buoy backscattering meter and on the transmissometers, to clean the sensors and to take pictures. They also replaced the pCO_2 CARIOCA sensor at 3 m depth. Then, the operations for the MOOSE program (deep CTD cast and plankton nets) were performed at the DYFAMED site.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/KAqyQG2SwX3LPAgW8

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 23 July 2019 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

0600 Departure from the Nice harbour.
0945 Arrival at the BOUSSOLE site.
1000 Connexion with the buoy and data retrieval.
Cleaning of surface sensors, solar panels and ARGOS connector.
1240 Surface chlorophyll fluorescence grid.

1145 CTD attempt: failed.
1210 C-OPS 01, 02, 03.
1310 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.
1310 CIMEL 01, 02, 03.
1340 Secchi disk 01, 26 m.
1400 Departure to the Nice harbour.
1740 Arrival to the Nice harbour.

Wednesday 24 July 2019 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

0540 Departure from the Nice harbour.
0910 Arrival at the BOUSSOLE site.
0920 C-OPS 03, 04, 05.
1045 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.
1145 Secchi disk 02, 21 m.
1245 CTD 03, 400 m with water sampling at 10 and 5 m for O_2, TA/TC and 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).
1305 CIMEL 04, 05, 06.
1425 Manta Net deployment.
1600 Departure to the Nice harbour.
1900 Arrival to the Nice harbour.

Thursday 25 July 2019 (UTC)

People on board: Jean De Vaugelas, Céline Dimier, David Luquet, Franck Petit and Eduardo Soto Garcia.

0600 Departure from the Nice harbour.
0920 Arrival at the BOUSSOLE site.
0930 Diving operations: cleaning, dark measurements, pictures, replacement of the PCO_2 CARIOCA sensor at 3 m.
1105 Departure to the DYFAMED site.
1130 Arrival to DYFAMED site.
1135 Zooplankton nets x 2, 100 and 200 m.
1210 CTD MOOSE 132, 2350 m with water sampling.
1355 Departure to the Nice harbour.
1645 Arrival to the Nice harbour.

Problems identified during the cruise

- Failure of the conductivity sensor and pump of the CTD was detected for all the CTD casts:

  The first day, a CTD cast was attempted but failed because the conductivity sensor was not functioning. Many tests were performed. First, the cable and connections between the conductivity sensor and the CTD were checked and cleaned, then the cable was replaced. The conductivity sensor was changed with another one. Unfortunately failure appeared also using this second conductivity sensor. However, the other CTD sensors functioned correctly (pressure, temperature, fluorimeter sensor and carousel of the Niskin), we decided to perform and to keep the CTD 01 cast. Therefore, we suspected a failure on the CTD, we returned to the lab after the first day in order to bring our spare CTD and we used it for the CTD 02 and CTD 03 cast. Another conductivity sensor was used. These casts were better than the CTD 01 cast but the problem was not solved entirely: the downcasts were ok but during the upcasts, the conductivity sensor functioned incorrectly between 400 m and 300 m depth. As the previous day, the other sensors functioned correctly. We then suspected a failure on the pump: the pump and its cable were replaced the last day before the DYFAMED deep cast, but the same issue was detected during the ascent of the CTD.

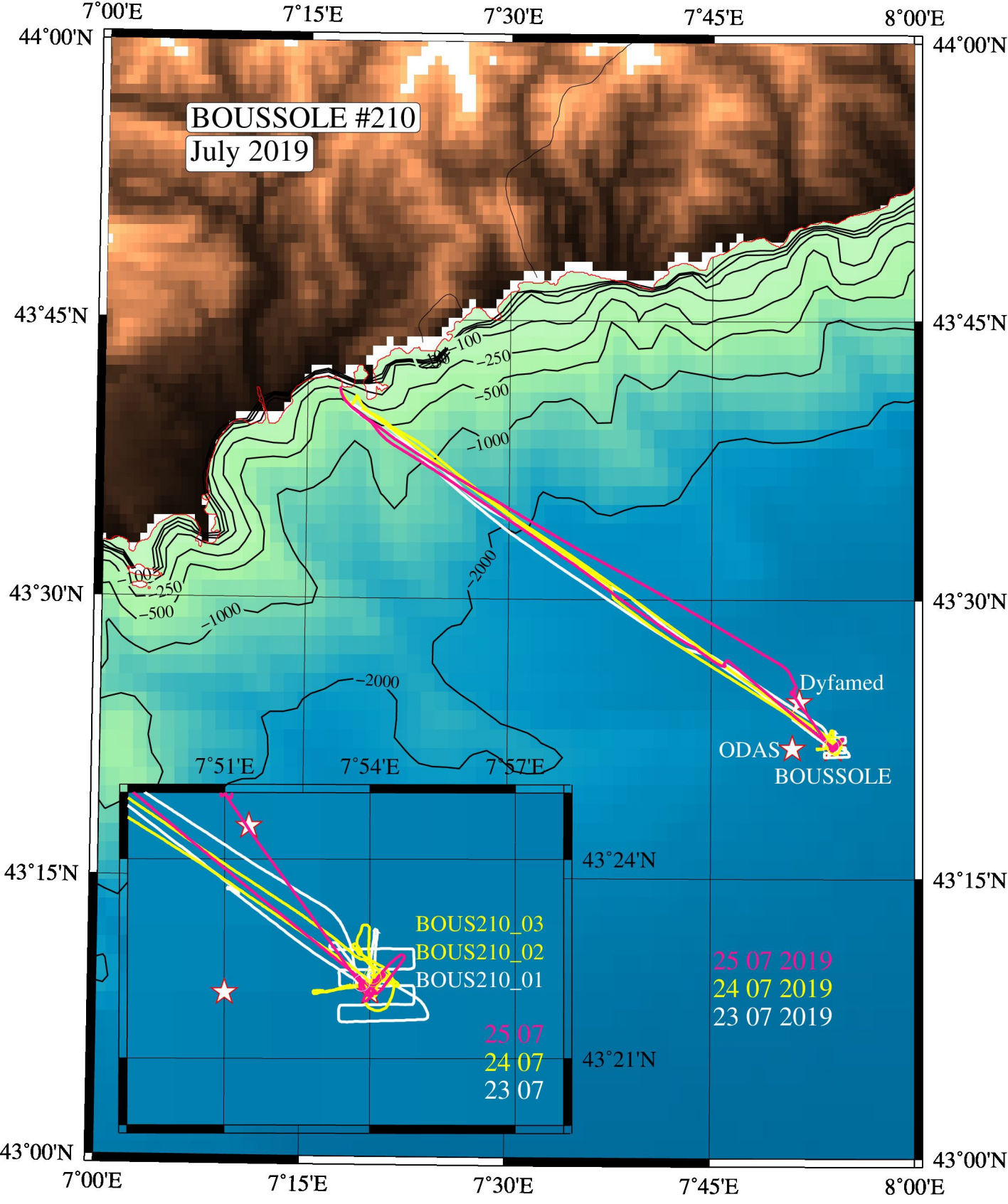
So the problem could originate from the electrocarrier cable of the ship. We will ask the crew for testing it during the next cruise.

- 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 210

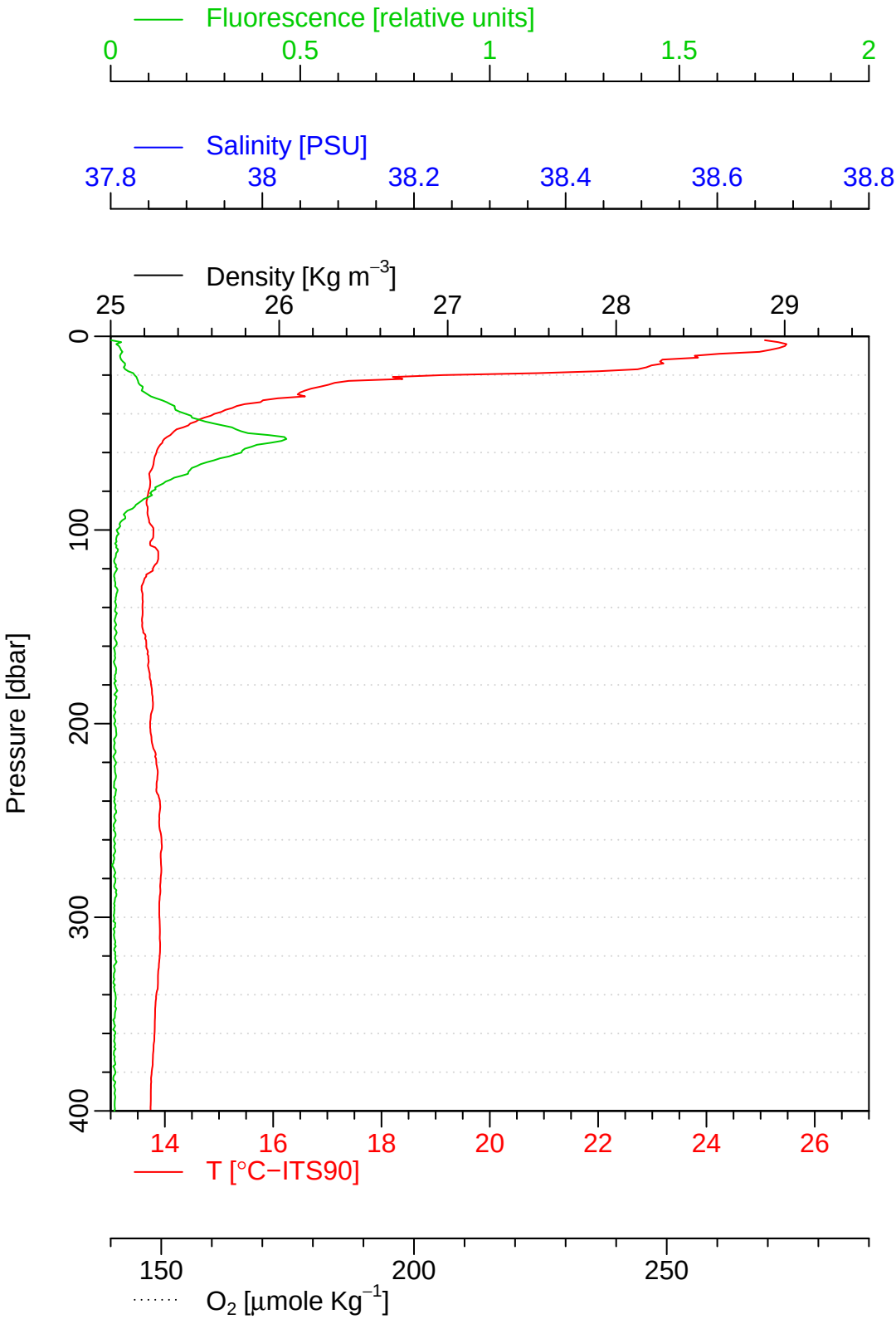
Date	Black names	Profile names	CTD notées	Other sensors	Start Time	Duration	Depth max	Latitude (N)		longitude					Weather								Sea		
	(file ext: ".raw")	(file extension: ".raw")			GMT (hour.min)	(min.sec)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)	Sky	Clouds	Quantity (#/8)	Wind sp. (kn)	Wind dir.	Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea	Swell H (m)	Swell dir.	Whitecaps
23/07/19		bou_c-ops_190723_1159_001_data.csv			12:08	4:41	116	43	22.296	7	54.097	blue	None	0	4	102	1018.6	74	good	27.3		calm	0.1		No
		bou_c-ops_190723_1159_002_data.csv			12:19	4:40	115	43	22.497	7	54.110	blue	None	0	4	102	1018.6	74	good	27.3		calm	0.1		No
		bou_c-ops_190723_1159_003_data.csv			12:29	4:46	120	43	22.702	7	54.126	blue	None	0	4	102	1018.6	74	good	27.3		calm	0.1		No
			BOUS210_01	HPLC & Ap	13:08	27:00	400	43	22.134	7	53.833	blue		1	3	231	1018.5	68		28.6	24.49	calm			
				CIMEL01	13:12	4:00		43	22.134	7	53.836	blue		0			1018.5								
				CIMEL02	13:20	3:00		43	22.134	7	53.836	blue		0			1018.5								
				CIMEL03	13:24	4:00		43	22.134	7	53.836	blue		0			1018.5								
				Secchi01	13:40	4:00	26	43	22	7	54	blue		0					good			calm			
24/07/19		bou_c-ops_190724_0915_001_data.csv			09:20	3:43	90	43	22.106	7	53.863	blue	None	0	1	1	1016.7	75	good	27.1		calm	0.1		No
		bou_c-ops_190724_0915_002_data.csv			09:32	4:15	104	43	22.062	7	53.395	blue	None	0	1	1	1016.7	75	good	27.1		calm	0.1		No
		bou_c-ops_190724_0915_003_data.csv			09:42	5:25	137	43	22.005	7	53.120	blue	None	0	1	1	1016.7	75	good	27.1		calm	0.1		No
			BOUS210_02	HPLC & Ap	10:44	34:00	400	43	22.198	7	54.075	blue		1	2	193	1016.6	64		28.8	25.57	calm			
				Secchi02	11:45	4:00	21	43	22	7	54	blue		1					good			calm			
			BOUS210_03	O_2, TA/TC &TSM	12:45	1:25:00	400	43	22.243	7	54.055	blue		1	5	249	1016.4	71		28.4	25.96	calm			
				CIMEL04	13:05	3:00		43	22.242	7	54.127	blue		0			1016.4								
				CIMEL05	13:09	3:00		43	22.242	7	54.127	blue		0			1016.4								
				CIMEL06	13:12	3:00		43	22.242	7	54.127	blue		0			1016.4								



GMT 2019 Sep 26 03:49:57

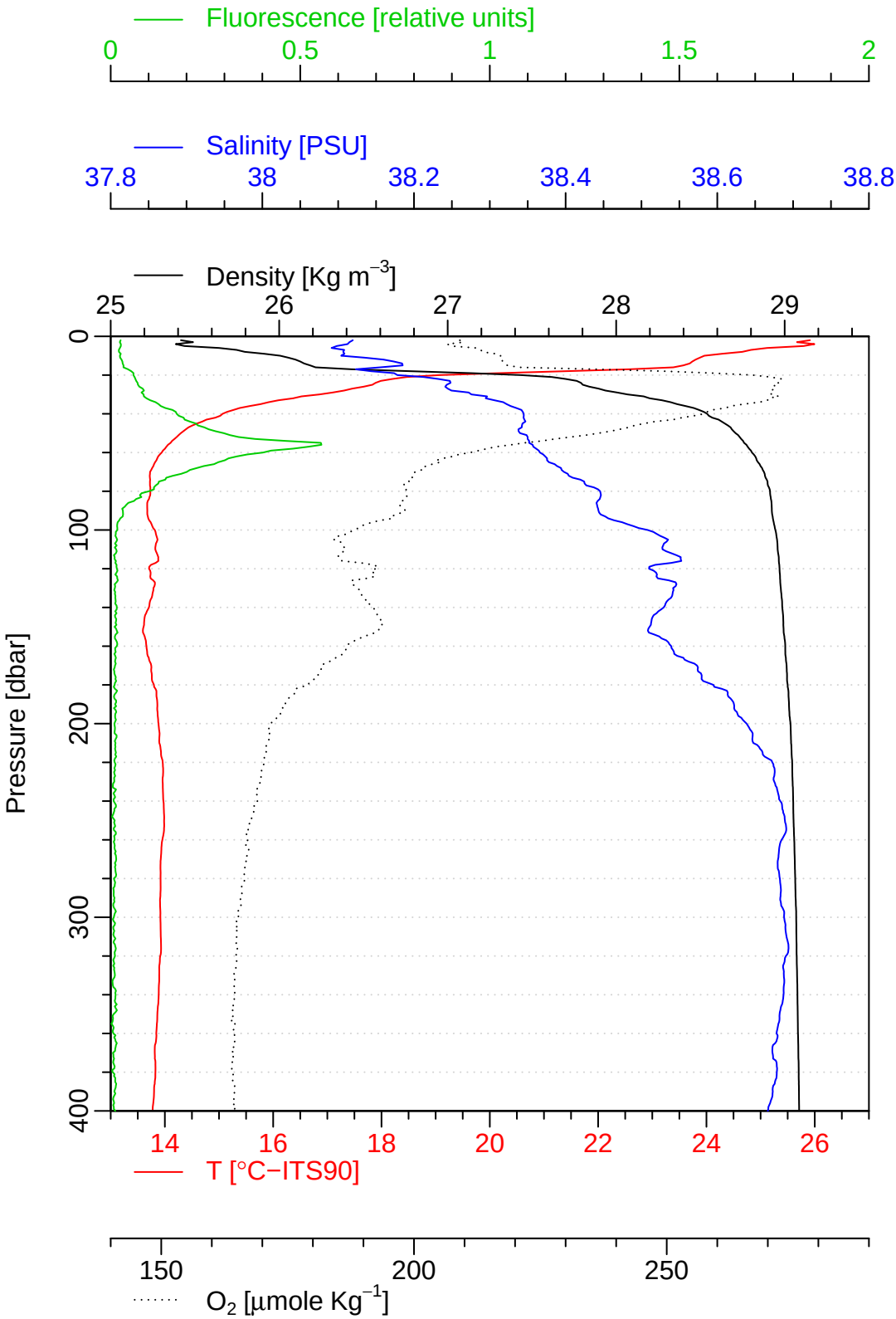
bous210_01

Date = 23/07/2019
Heure debut [TU] = 13:08
Longitude = 007 53.833 E
Latitude = 43 22.134 N



bous210_02

Date = 24/07/2019
Heure debut [TU] = 10:44
Longitude = 007 54.075 E
Latitude = 43 22.198 N



bous210_03

Date = 24/07/2019
Heure debut [TU] = 12:45
Longitude = 007 54.055 E
Latitude = 43 22.243 N