BOUSSOLE Monthly Cruise Report

Cruise 226
January 18, 2021

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

Science Personnel: Melek Golbol, Emilie Riquier Diamond and Eduardo Soto Garcia.

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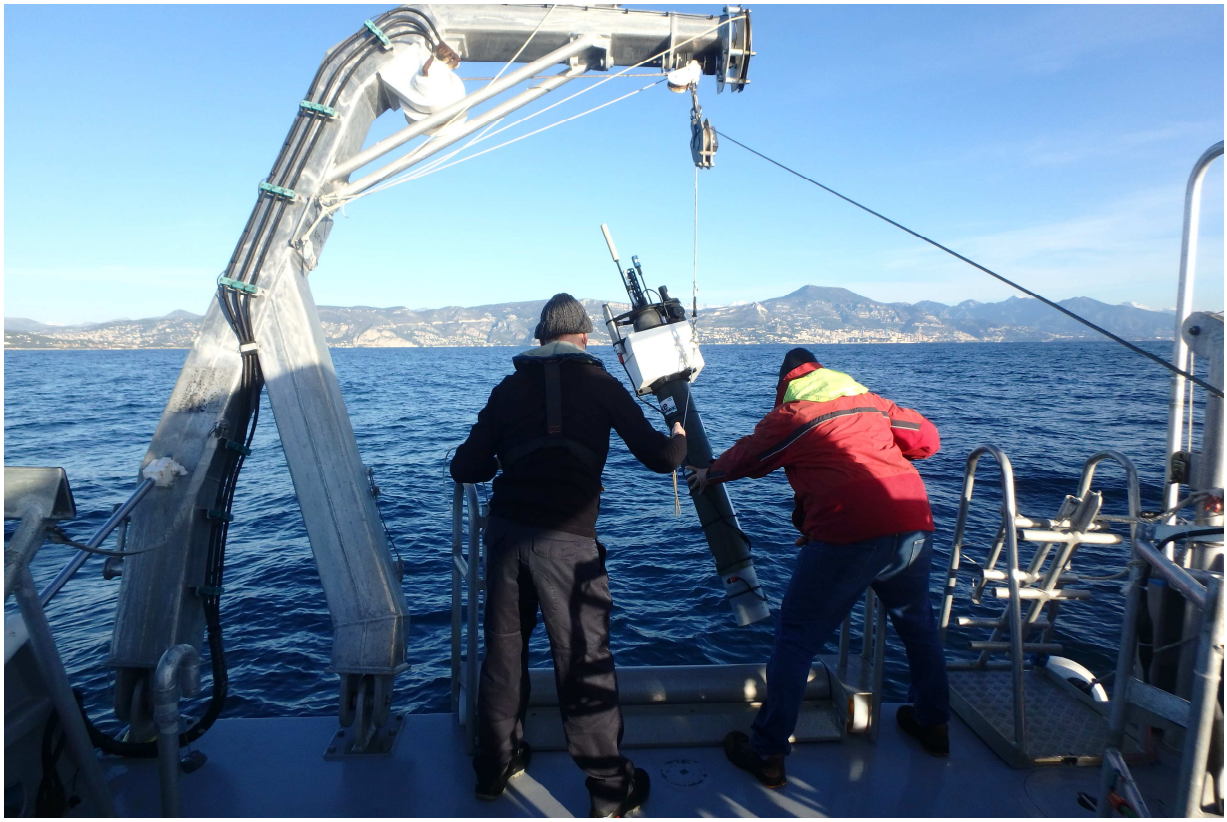

Deployment of an ARGO profiling float from the deck of the R/V *Sagitta III* on the way to BOUSSOLE.

BOUSSOLE project

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

January 29, 2021

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

Sorbonne Université, France

Institut de la Mer de Villefranche, 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). 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 (from March 2020). 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

Seawater is to be sampled at 3 depths for micro-, nano- and pico-phytoplankton 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).* In addition, three sensors were added to the Rosette CTD from September 2020 in the frame of this project: an Eco FLBB2 sensor that measures fluorescence (excitation at 470 nm, emission at 695 nm) and backscattering at 700 nm, an Eco 3X1M sensor that measures multispectral fluorescence (excitation at 440, 470 et 532 nm, emission at 695 nm) and an ECO V2 B206 sensor that measures chlorophyll fluorescence at 470 and 440 nm, CDOM fluorescence and backscattering at 700 nm.

A BGC Argo - Provor CTS5 profiling float (codename LOVUSE005) was deployed by the Marine optics and remote sensing group of the Laboratoire d'Océanographie de Villefranche (LOV) on the way to the BOUSSOLE

site for testing in the frame of the European program EARISE. This float is equipped with a TRIOS (RAMSES) hyperspectral radiometer.

Two zooplankton nets were performed and water was collected for the MOOSE DYFAMED program.

Cruise Summary

The annual technical servicing of the R/V *Tethys II* was not yet completed so that the cruise was carried out on the R/V *Sagitta III*, with BOUSSOLE and MOOSE DYFAMED operations having to occurred during one single day. That day was used for a profiling float deployment during the way to BOUSSOLE, for CTD casts with water sampling, for zooplankton nets and for a Secchi disk. There were technical problems during the CTD casts but the CTD could nevertheless be deployed.

Monday 18 January 2021

The sea state was slight with a light breeze. The sky was blue and the visibility was excellent. Firstly, the profiling float was deployed during the way to BOUSSOLE at about five miles from Villefranche-sur-Mer harbour. Then, two CTD casts were attempted at the BOUSSOLE site, but there were technical problems during the descent of the CTD: the alarm of the deck unit sounded when the CTD was in the water. The CTD Rosette was brought back on deck. The sea cable was cleaned after the first cast. We suspected that the problem could also originate from the uplink connection so it was removed. But the same problem appeared during the second cast. Nevertheless, it appeared that the data were correct, so the next cast was performed with water sampling and the data were saved even if the alarm of the deck unit sounded again. During the CTD 01 cast, it appeared that the oxygen data were not correct, so the SBE 43 oxygen sensor was replaced. The uplink connection was reinstalled for the CTD 02 cast. In addition, a Niskin was deployed separately for TSM sampling because there was not enough water in the Niskin bottles from the Rosette. Then two zooplankton nets were performed at the BOUSSOLE site for the MOOSE program. Finally, a second CTD with water sampling was performed at the BOUSSOLE site jointly for BOUSSOLE and MOOSE program before returning to the Villefranche-sur-Mer harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/nAYVaLpAgNtGAmUB6

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

Cruise Report

Monday 18 January 2021 (UTC)

People on board: Melek Golbol, Emilie Riquier-Diamond, Eduardo Soto Garcia.

0730 Departure from the Villefranche-sur-Mer harbour.
0825 Profiling float deployment (43°38.290'N, 07°23.602'E)
1100 Arrival at the BOUSSOLE site.
1105 First CTD attempt: failed.
1120 Second CTD attempt: failed.
1135 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5m for HPLC and $a_{p.}$
1130 Secchi disk 01, 18 m.
1215 Zooplankton nets, 100 and 200 m (MOOSE program).
1235 Niskin, 5 m for TSM.
1300 CTD 02, 500 m with water sampling at 40, 25 and 5 m for TA/TC, O_2 and phytoplankton microscopy, cytometry, PIC, POC, HPLC (OBOO project) and for MOOSE sampling.
1350 Departure to the Villefranche-sur-Mer harbour.
1645 Arrival to the Villefranche-sur-Mer harbour.

Problems identified during the cruise

- Two CTD casts were attempted at the BOUSSOLE site but failed: the alarm of the deck unit sounded when the CTD was in the water. It was decided to bring the CTD Rosette back on deck. The sea cable was cleaned after the first attempt. The uplink connection was suspected and removed. But the same problem appeared during the second attempt. Nevertheless, it appeared that the data were correct. So, the two CTD casts (CTD 01 and CTD 02) were performed with water sampling and the data were saved even if the alarm of the deck unit sounded again.

- The oxygen sensor of the CTD (Seabird SBE 43 - S/N: 0033) did not function correctly during the CTD 01 cast. It was replaced by the Seabird SBE 43 oxygen sensor - S/N: 0587 for the CTD 02 cast.

- The transmissometer of the CTD did not function correctly during the CTD 02 cast.

- The optical profiles could not be performed because the C-OPS was still under calibration at Biospherical.

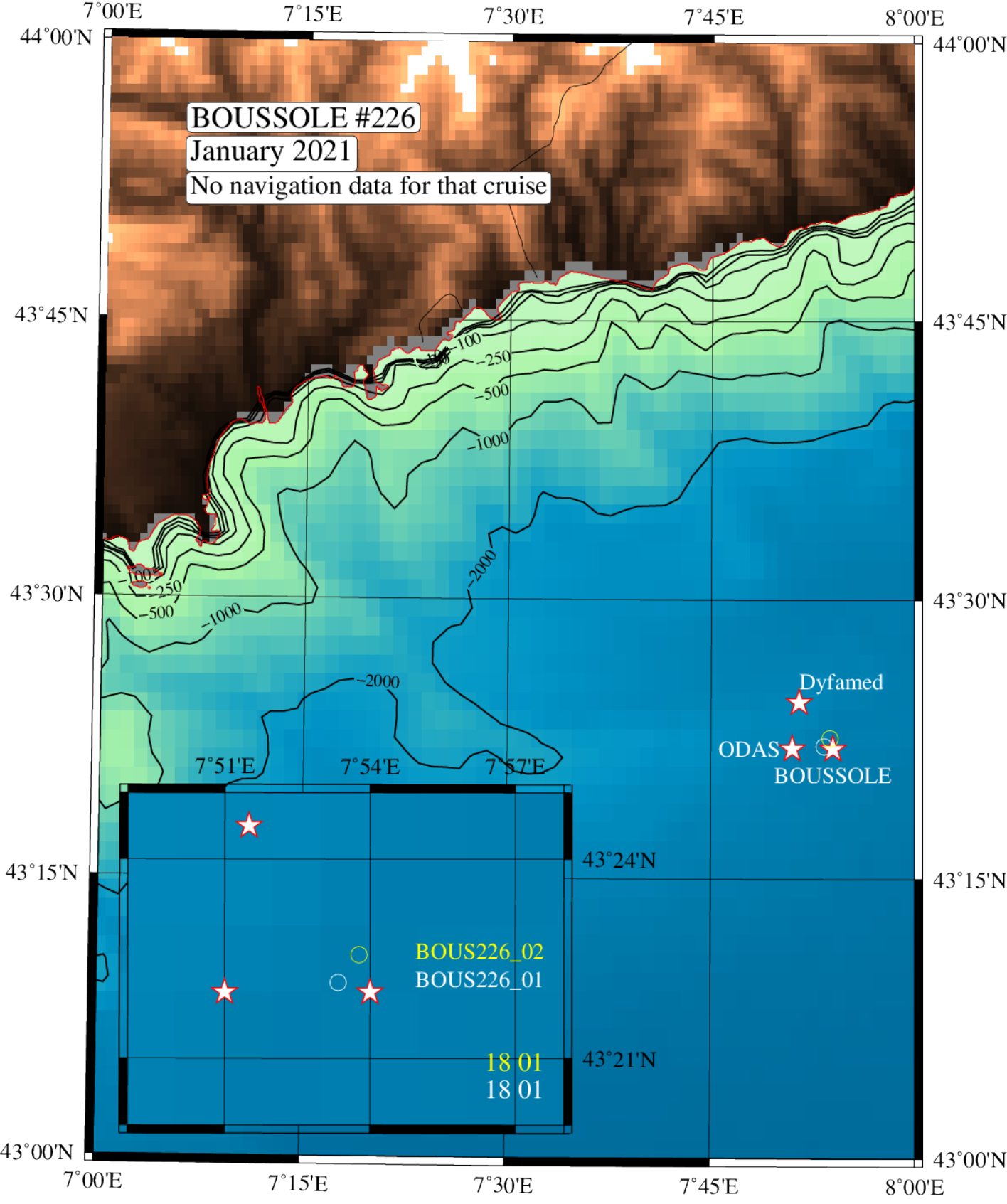
- The IOP package was not available for this cruise. The instruments were still under calibration at Hobi Instruments Service.

- The carousel water sampler installed on the Rosette-CTD for this cruise was smaller than the one commonly used on the BOUSSOLE cruises because of the smaller space available on the R/V Sagitta III. So, a Niskin was deployed separately from the Rosette for TSM sampling because there was not enough water in the Niskin bottles from the Rosette to sample for all parameters.

Appendices

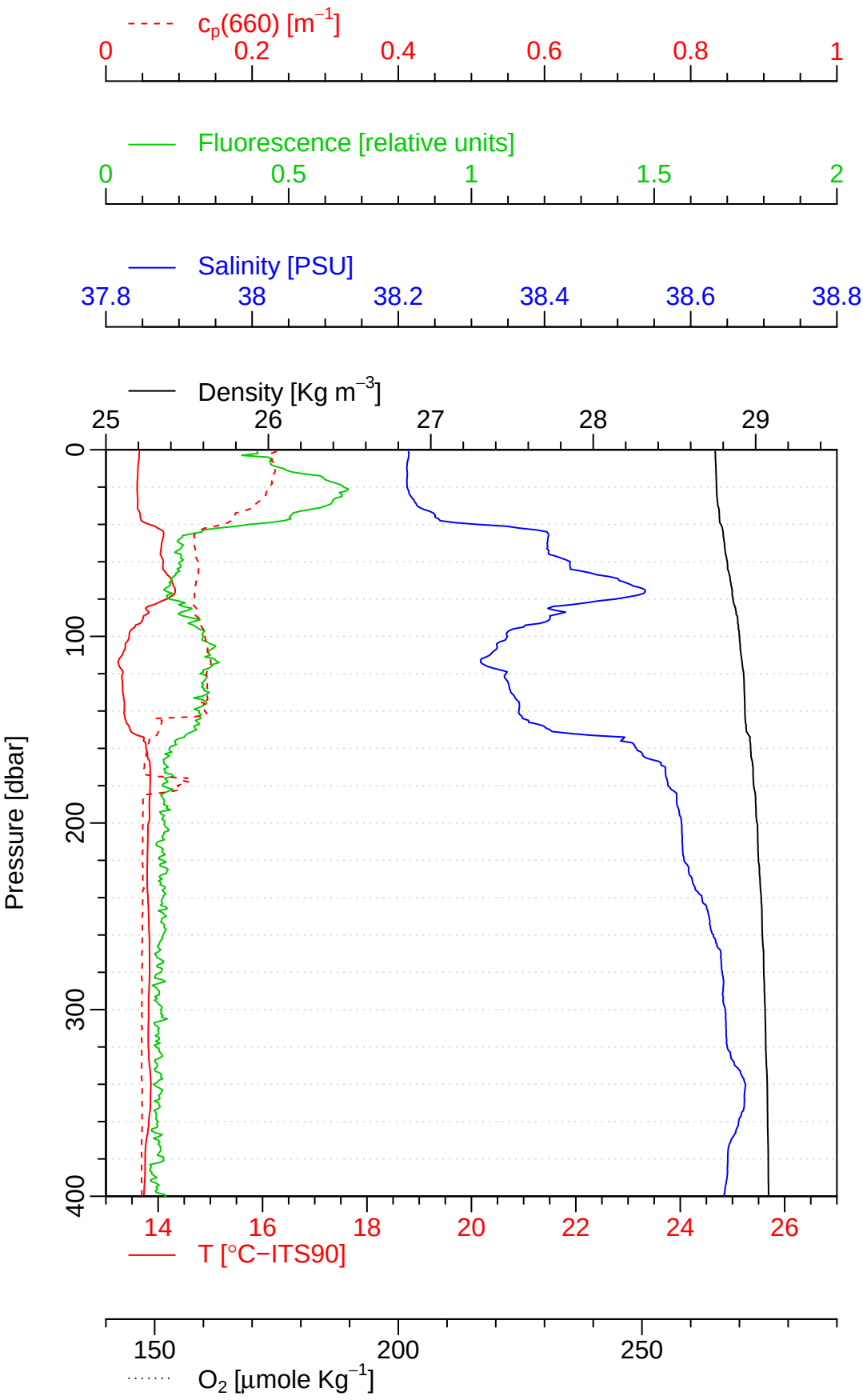
Cruise Summary Table for Boussole 226

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)	(hour.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
18/01/21			BOUS226_01	HPLC, ap	11:37	0:31:00	400	43	22.138	7	53.344	blue		2	6.5	225	1021	61		10.6	13.64	slight			
				Secchi 01	11:30	0:04:00	18	43	22	7	54	blue										slight			
				Niskin for TSM	12:35	0:05:00	1	43	22	7	54	blue										slight			
			BOUS225_02	O_2, TA/TC & Phytofloat (HPLC, PIC, POC, Cyto, phyto)	13:10	0:32:00	500	43	22.502	7	53.776	blue		1	4.8	181	1021	64		11.3	13.67	slight			


BOUSSOLE #226
January 2021
No navigation data for that cruise
7°00'E
7°15'E
7°30'E
7°45'E
8°00'E
44°00'N
43°45'N
43°30'N
43°15'N
43°00'N
-100
-250
-500
-1000
-2000
Dyfamed
ODAS
BOUSSOLE
7°51'E
7°54'E
7°57'E
43°24'N
43°21'N
BOUS226_02
BOUS226_01
18 01
18 01

bous226_01

Date = 18/01/2021
Heure debut [TU] = 11:37
Longitude = 007 53.344 E
Latitude = 43 22.138 N



bous226_02

Date = 18/01/2021
Heure debut [TU] = 13:10
Longitude = 007 53.776 E
Latitude = 43 22.562 N