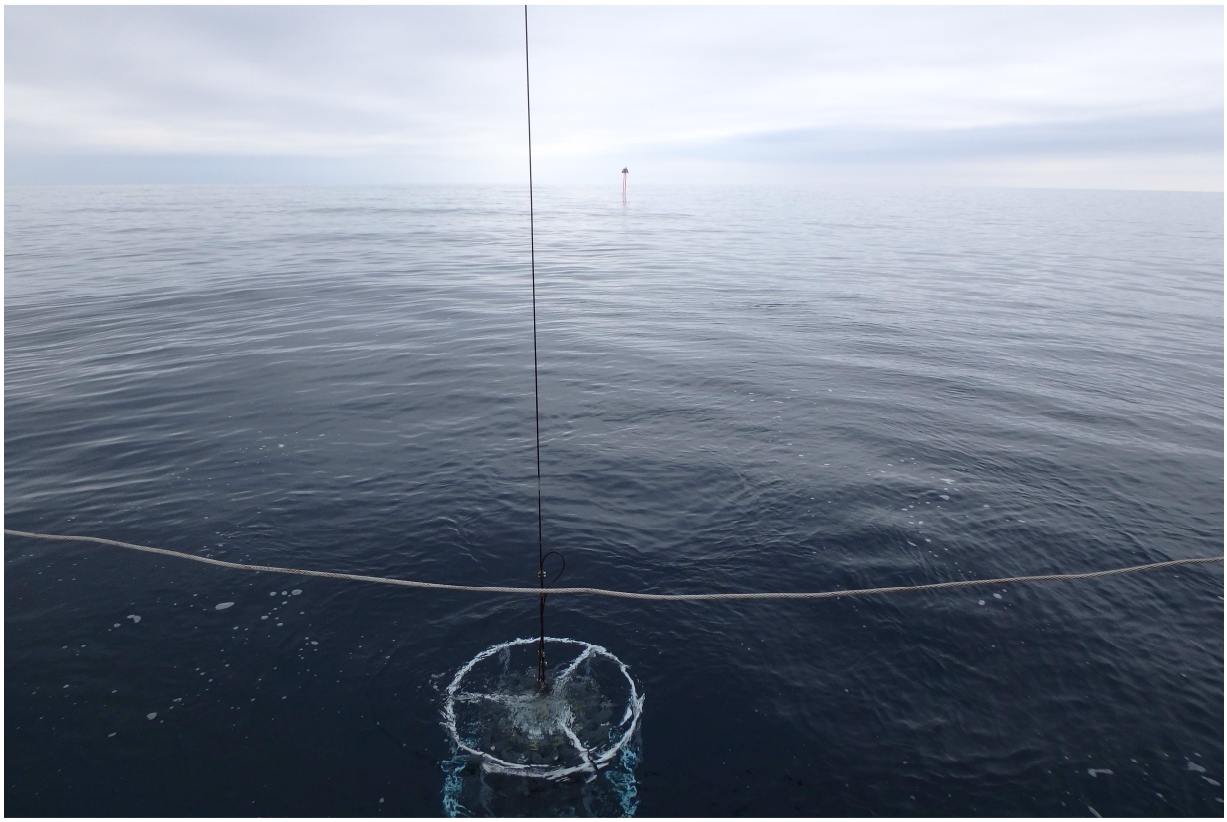
BOUSSOLE Monthly Cruise Report

Cruise 177
November 16-18, 2016

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

Science Personnel: Agnieszka Bialek, Guillaume De Liège, Emilie Diamond, Melek Golbol, David Luquet, Eduardo Soto Garcia and Jeremy Tardif (diver).

Laboratoire d'Océanographique de Villefranche (LOV), 06238 Villefranche sur mer cedex, France



Deployment of the BOUSSOLE CTD Rosette on the BOUSSOLE site. The upper superstructure of the BOUSSOLE buoy is seen on the background of the picture.

BOUSSOLE project

ESA/ESRIN contract N° 4000111801/14/I-NB

November 30, 2016

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

Université Pierre & Marie Curie, France

Observatoire Océanologique de Villefranche/mer, France

Contents

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). Two CTD casts are to be performed at each data acquisition at the BOUSSOLE site: one cast with, and one cast without, a 0.2µm filter added on the a-sphere for the dissolved matter absorption measurements.

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 (5m and 10m) 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 installed on the buoy at 3m and 10m.

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

Two water samples for cytometry analysis was collected at 10 m depth, in the frame of a collaboration with Collin Roesler (Bowdoin College, Maine, USA) concerning the installation of an ECO 3X1M fluorimeter on the BOUSSOLE buoy at 9 m depth.
A broken buoy solar panel was replaced the second day of the cruise.
A deep CTD cast, Manta and zooplankton nets were performed the last day to complete the MOOSE DYFAMED program because bad weather was predicted for the next day.

Cruise Summary

The first day of the cruise was used for maintenance on the top of the buoy. The broken solar panel of the buoy was removed. This day was also used for CTD casts with water sampling, for optical profiles and for a Secchi disk at the BOUSSOLE site. The second day was used for the diving operations and maintenance on the top of the buoy. The new solar panel was installed. This day was also used for optical profiles, CTD casts with water sampling and a Secchi disk at the BOUSSOLE site. The last day was used for CTD casts with water sampling, for optical profiles and a for Secchi disk at the BOUSSOLE site. Bad weather was predicted for the next day,

which was programmed for MOOSE operations. Therefore, the deep CTD cast and plankton nets were performed at the DYFAMED site before returning to the Nice harbour.

Wednesday 16 November 2016

The sea state was smooth with a light breeze. The sky was cloudy and the visibility was medium. Before arriving at the BOUSSOLE site, a C-OPS seawater cable that had not been used for a long time (the one usually used was faulty since the previous cruise) was deployed and completely unwinded to remove loops before the profiles.
Then, the broken solar panel of the buoy was removed. The new one could not be installed in place of the broken one because its structure was not adapted to the structure of the buoy: the holes were not in front of the screws. The surface sensors and the ARGOS connector were cleaned. Then, 2 CTD casts with water sampling were performed at the BOUSSOLE site. The first CTD cast was performed with a 0.2 µm filter on the a-Sphere absorption meter and with a cap on the backscattering meter. Then, 1 C-OPS profile and a Secchi disk were performed at the BOUSSOLE site. It was not possible to perform more optical profiles because the sky became cloudier and the irradiance was unstable.

Thursday 17 November 2016

The sea state was smooth with a light breeze. The sky was blue and the visibility was medium. When arrived at the BOUSSOLE site, divers went at sea to clean the sensors, to perform dark measurements of the transmissiometers and backscattering meter, and to take pictures. In the meantime, buoy data were retrieved directly using the cable available on the top of the buoy. The solar panel was installed on the buoy (new holes were drilled on the new panel in order to adapt it to the structure of the buoy). Then 3 C-OPS profiles and 2 CTD casts with water sampling were performed at the BOUSSOLE site. The second CTD cast was performed with a 0.2 µm filter on the a-Sphere absorption meter. Finally, a Secchi disk was performed before returning to de Nice harbour.

Friday 18 November 2016

The sea state was smooth with a light breeze. The sky was overcast and the visibility was medium. 3 C-OPS profiles and 2 CTD casts with water sampling were performed at the BOUSSOLE site. The second CTD cast was performed with a 0.2 µm filter on the a-Sphere absorption meter. A Secchi disk was performed before going to the DYFAMED site. A Manta net was perform in the way to DYFAMED and finally, a deep CTD cast with water sampling for the MOOSE program, before returning to the Nice harbour.

Pictures taken during this cruise can be found at:
https://get.google.com/albumarchive/114686870380724925974/album/AF1QipOnM74-2-vpRyhH_yAaoo2AsO0aus0_vTbyhIKp

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 16 November 2016 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

0715 Departure from the Nice harbour.
1030 Arrival at the BOUSSOLE site.
Unwinding of the C-OPS seawater cable.
1045 Buoy surface maintenance: remove of the broken sola panel, cleaning of the surface sensors and ARGOS connector.
1225 CTD 01, 400 m with water sampling at 5 m for TSM (with 0.2 µm filter on a-Sphere and cap on HS-6).
1310 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.
1355 C-OPS 01.
1410 Secchi 01, 19m.

1415 Departure to the Nice harbour.
1730 Arrival at the Nice harbour.

Thursday 17 November 2016 (UTC)

People on board: Agnieszka Bialek, Guillaume De Liège, Melek Golbol, David Luquet, Eduardo Soto Garcia, and Jeremy Tardif.

0615 Departure from the Nice harbour.
0930 Arrival at the BOUSSOLE site.
0940 Diving operations: cleaning, dark measurements, pictures.
1000 Connection with the buoy and data retrieval.
1030 Installation of the solar panel.
1115 C-OPS 02, 03, 04.
1220 CTD 03, 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.
1330 CTD 04, 400 m with water sampling at 5 m for TSM (with 0.2 µm filter on a-Sphere).
1335 Secchi 02, 21m.
1400 Departure to the Nice harbour.
1725 Arrival at the Nice harbour.

Friday 18 November 2016 (UTC)

People on board: Agnieszka Bialek, Emilie Diamond, Melek Golbol and Eduardo Soto Garcia.

0610 Departure from the Nice harbour.
0925 Arrival at the BOUSSOLE site.
0930 CTD 05, 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.
1005 C-OPS 05, 06, 07.
1100 CTD 06, 400 m with water sampling at 10 and 5 m for TSM, TA/TC, O_2 and cytometry (with 0.2 µm filter on a-Sphere).
1130 Secchi 01, 19 m.
1135 Departure to the DYFAMED site.
1200 Manta net.
1230 Arrival at the DYFAMED site.
1250 Deep CTD cast (MOOSE).
1435 Zooplancton nets x 3 (MOOSE).
1510 Departure to the Nice harbour.
1745 Arrival at the Nice harbour.

Problems identified during the cruise

- The first day, only 1 C-OPS profile was performed because the sky conditions were not optimal (many clouds and unstable irradiance).

- The C-OPS pressure sensor on the Eu radiometer always drift between the profiles. The problem was not resolved: different tests were performed and it appeared that the drift was not stable. It was the same problem than observed in the August cruise (BOUSSOLE 174). The pressure values varied between -0.6 m and -0.9 m, when the C-OPS came back at the sea surface after the first profile of each series of C-OPS measurements. This problem was not detected during the September and October cruise: in September only 1 profile, which was not deep (50 m) was performed. Then, in October, no profiles could be performed because of a failed C-OPS cable. Furthermore, this C-OPS was used during another cruise and the pressure data were compared with data from a depth meter. For these two sensors, differences appeared between data acquired at the same time. So it was decided to send the C-OPS system after the cruise to the manufactory for calibrations and repair.

- The surface fluorimeter of the R/V *Téthys II* was not operational for this cruise.

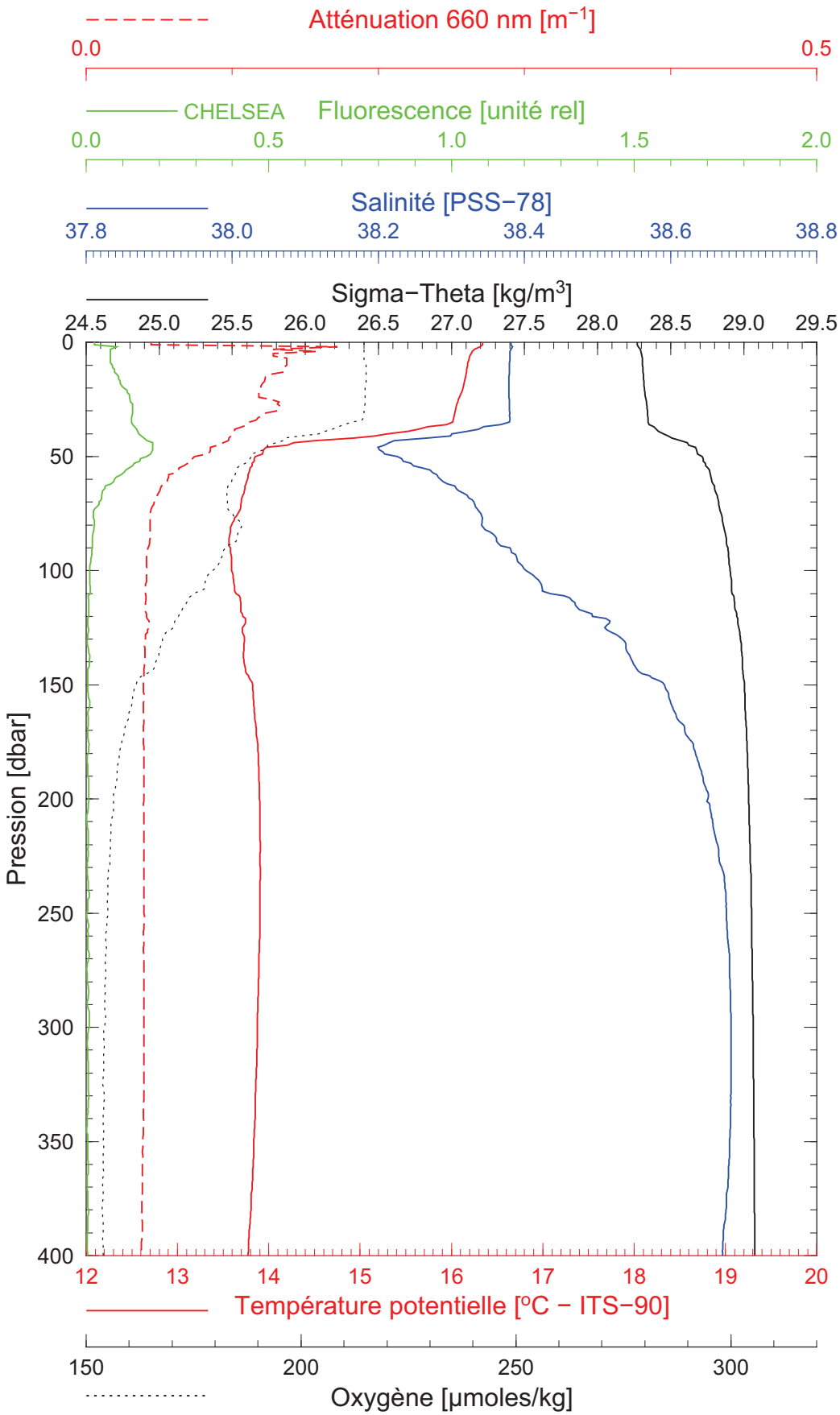
Appendices

Cruise Summary Table for Boussole 177

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
16/11/216			CTDBOUS001	TSM	12:24	23:00	400	43	22.031	7	53.728	blue		3	4	75	1024.3	63		13.7	16.25	calm			
			CTDBOUS002	HPLC & Ap	13:10	28:00	400	43	22.048	7	53.843	blue		3	4	62	1023.8	65		NA	16.25	calm			
		bou_c-ops_161116_1332_001_data.csv			13:55	3:32	89	43	22.323	7	53.831	cloudy	Cu	4	7	360	1023.4	67	medium	13.6		calm	0.2		no
				Secchi01	14:10	4:00	19	43	22	7	54	cloudy		4					medium			calm			
17/11/16		bou_c-ops_161117_1101_001_data.csv			11:16	1:18	29	43	22.263	7	53.799	blue	Ci	1	5	275	1019.0	72	medium	14.4		calm	0.2		no
		bou_c-ops_161117_1101_002_data.csv			11:35	4:13	111	43	22.150	7	53.967	blue	Ci	1	5	275	1019.0	72	medium	14.4		calm	0.2		no
		bou_c-ops_161117_1101_003_data.csv			11:52	4:13	115	43	22.468	7	53.704	blue	Ci	1	5	275	1019.0	72	medium	14.4		calm	0.2		no
			CTDBOUS003	HPLC & Ap	12:19	26:00	400	43	22.043	7	54.029	blue		3	6	287	1018.7	65		15.8	16.20	calm			
			CTDBOUS004	TSM	13:32	20:00	400	43	21.888	7	54.211	blue		3	4	337	1018.2	66		15.1	16.00	calm			
				Secchi02	13:35	4:00	21	43	22	7	54	blue		2					medium			calm			
18/11/16			CTDBOUS005	HPLC & Ap	09:22	31:00	400	43	21.974	7	54.095	overcast		6	3	137	1017.2	71		14.6	16.07	calm			
		bou_c-ops_161118_0948_003_data.csv			10:07	3:48	99	43	22.122	7	53.800	overcast	Sc	8	5	263	1017.2	71	medium	14.8		calm	0.2		no
		bou_c-ops_161118_0948_005_data.csv			10:21	4:01	103	43	22.063	7	53.414	overcast	Sc	8	5	263	1017.2	71	medium	14.8		calm	0.2		no
		bou_c-ops_161118_0948_007_data.csv			10:33	3:55	101	43	21.913	7	53.086	overcast	Sc	8	5	263	1017.2	71	medium	14.8		calm	0.2		no
			CTDBOUS006	TSM, TA/TC, O_2 & Cyto	11:01	24:00	400	43	22.024	7	54.020	overcast		7	2	181	1016.9	73		14.8	16.00	calm			
				Secchi03	11:30	4:00	19	43	22	7	54	overcast		7					medium			calm			

BOUSSOLE 177 **16/11/2016** **BOUS161116_01**

BOUS001

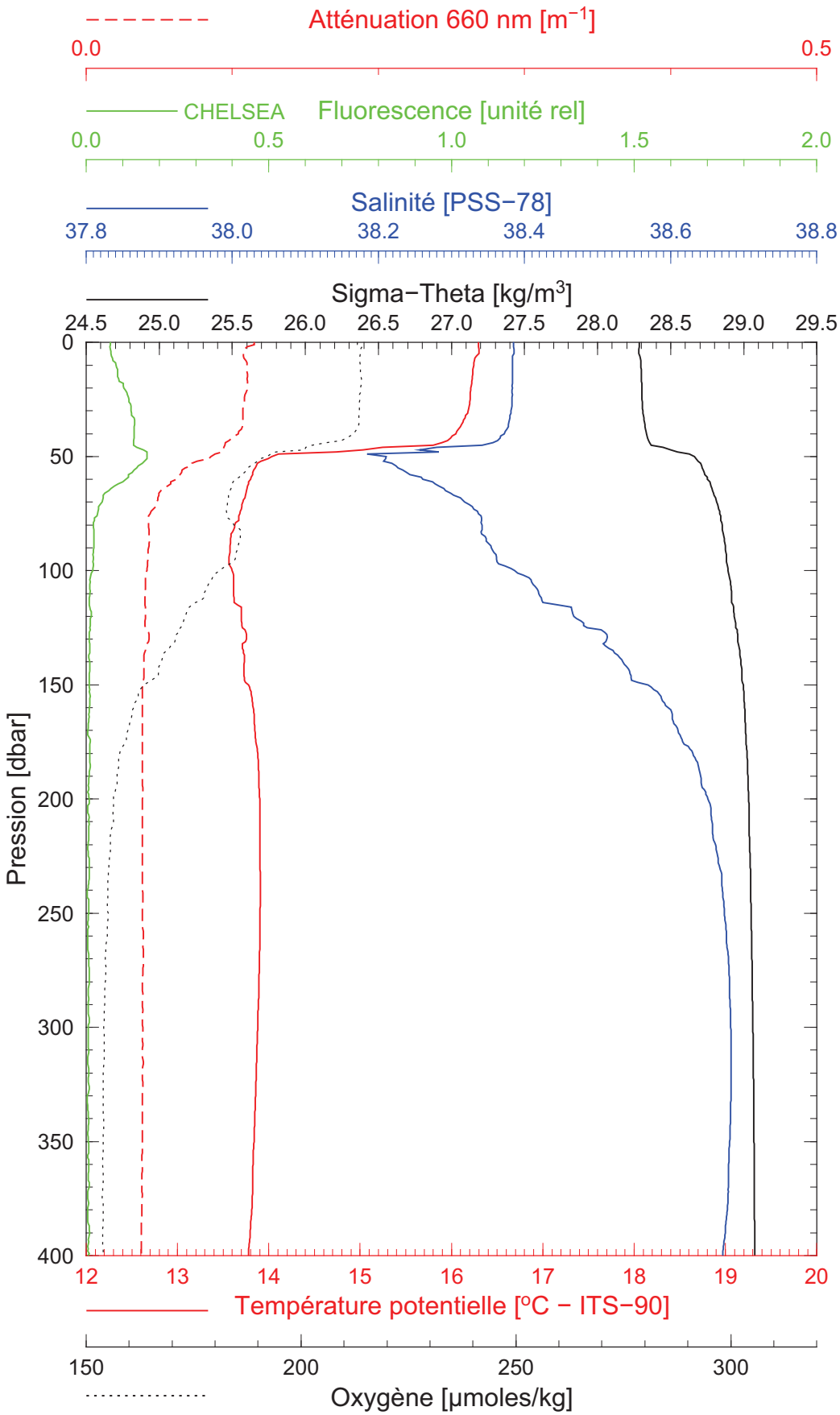


Date *16/11/2016* *Latitude* *43°22.031 N*

Heure déb *12h 24min [TU]* *Longitude* *07°53.728 E*

BOUSSOLE 177 **16/11/2016** **BOUS161116_02**

BOUS002

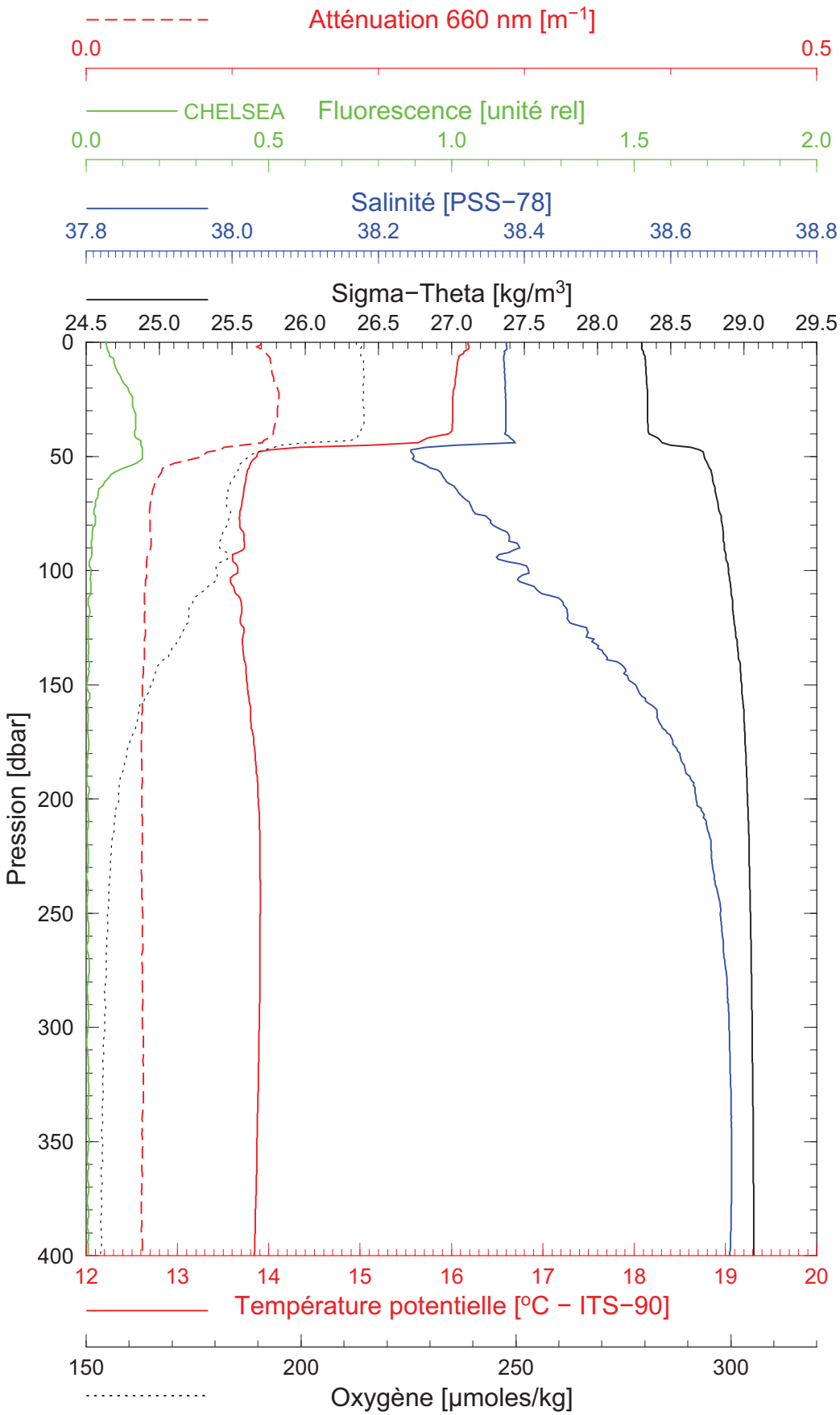


Date *16/11/2016* *Latitude* *43°22.048 N*

Heure déb *13h 10min [TU]* *Longitude* *07°53.843 E*

BOUSSOLE 177 **17/11/2016** **BOUS161117_01**

BOUS003

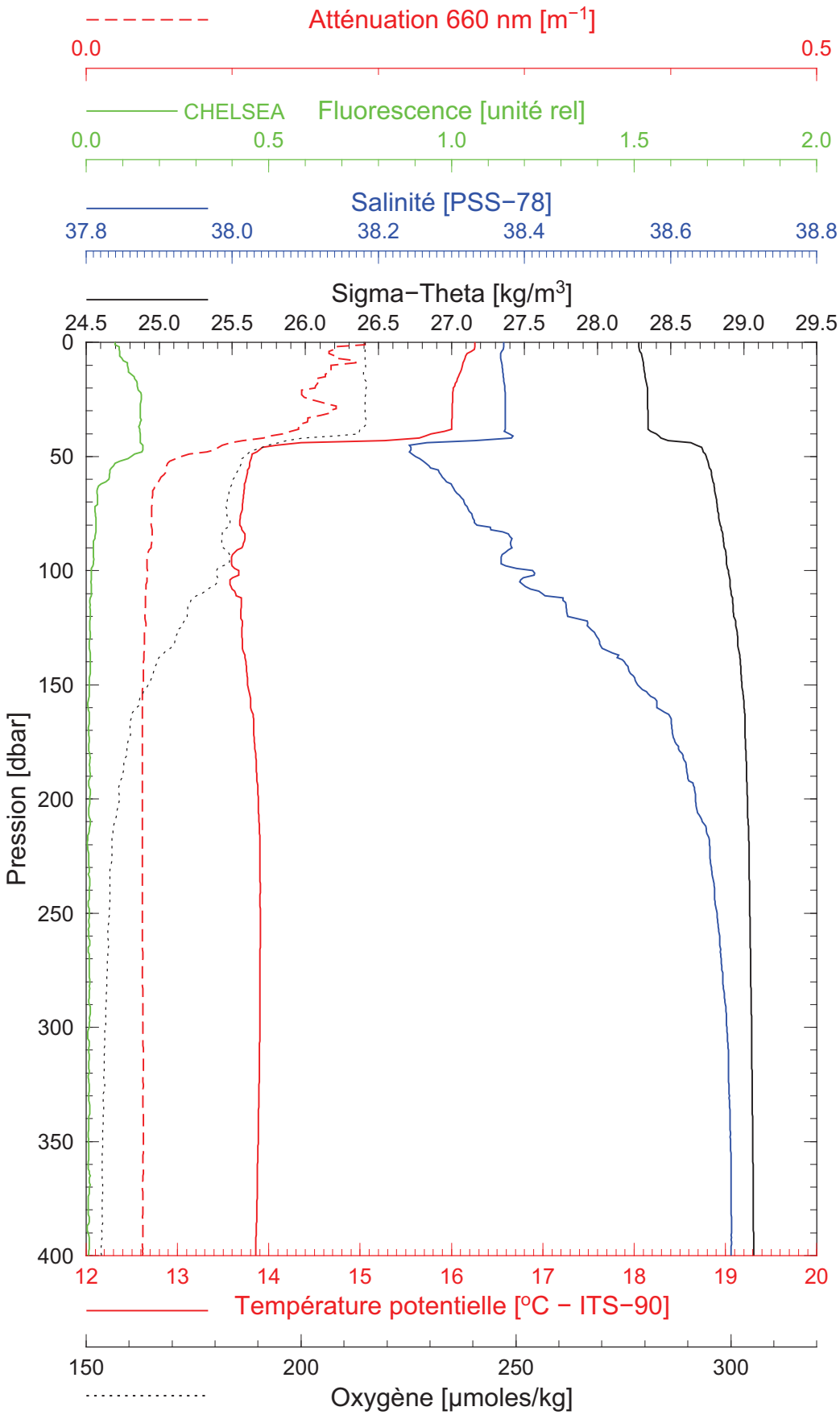


Date *17/11/2016* *Latitude* *43°22.043 N*

Heure déb *12h 19min [TU]* *Longitude* *07°54.029 E*

BOUSSOLE 177 **17/11/2016** **BOUS161117_02**

BOUS004

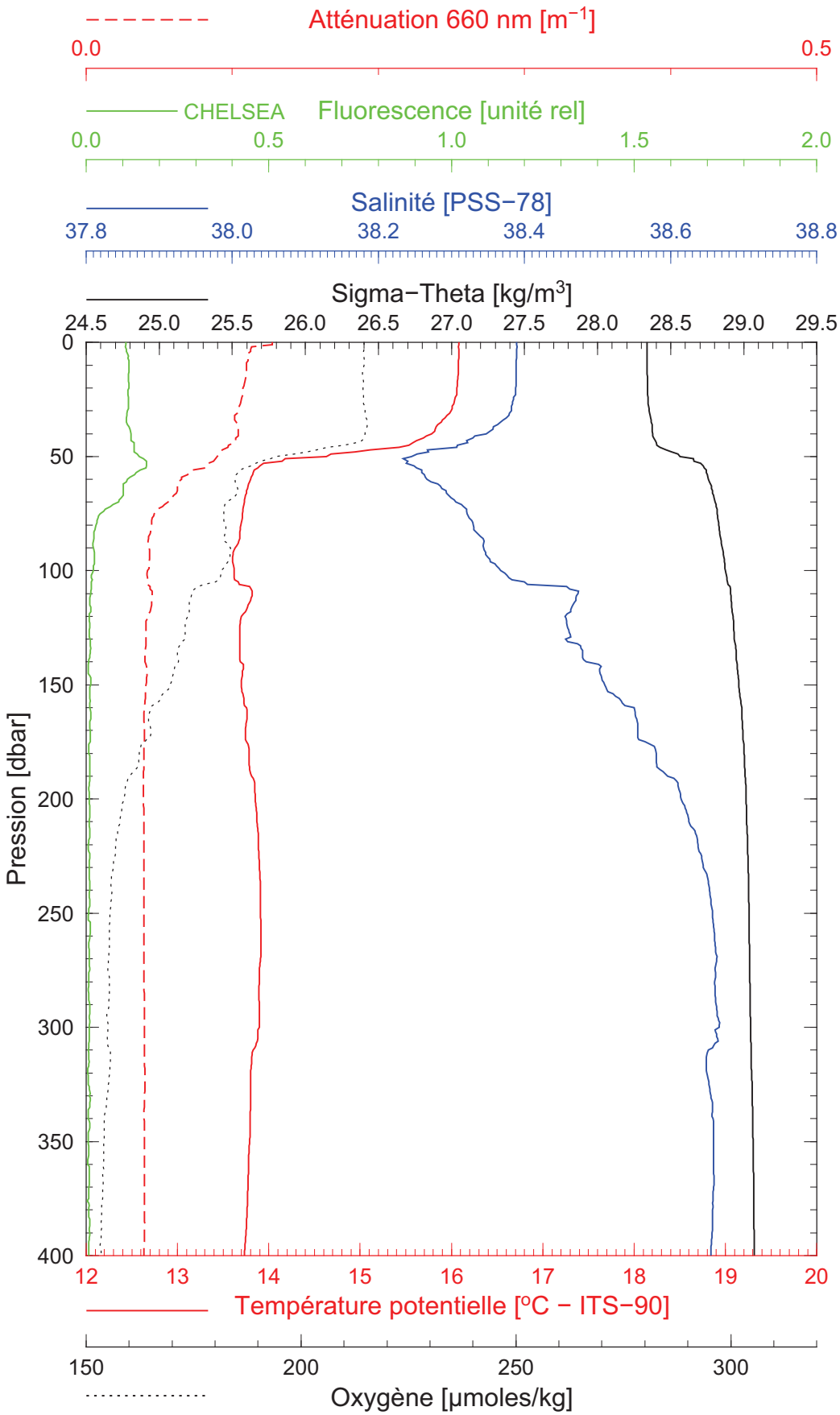


Date *17/11/2016* *Latitude* *43°21.888 N*

Heure déb *13h 32min [TU]* *Longitude* *07°54.211 E*

BOUSSOLE 177 **18/11/2016** **BOUS161118_01**

BOUS005

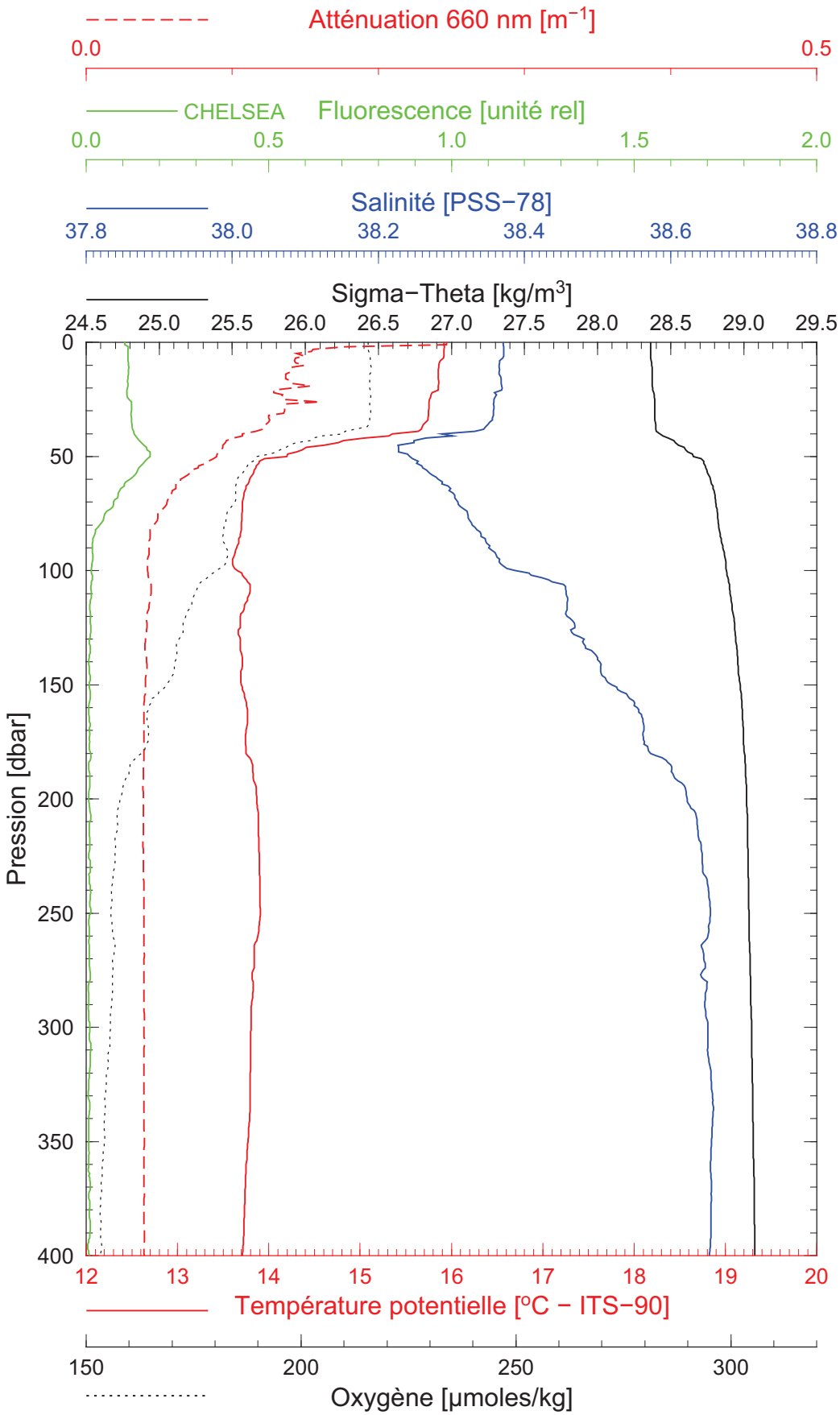


Date *18/11/2016* *Latitude* *43°21.974 N*

Heure déb *09h 22min [TU]* *Longitude* *07°54.095 E*

BOUSSOLE 177 **18/11/2016** **BOUS161118_02**

BOUS006



Date *18/11/2016* *Latitude* *43°22.024 N*

Heure déb *11h 01min [TU]* *Longitude* *07°54.020 E*