BOUSSOLE Monthly Cruise Report

Cruise 178
December 08-10, 2016

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Vessel: R/V Téthys II
(Captain: Joël Perrot)

Science Personnel: Agnieszka Bialek, Guillaume De Liège, Emilie Diamond, Melek Golbol, Judicaël Rivier (plongeur), Didier Robin and Eduardo Soto Garcia.

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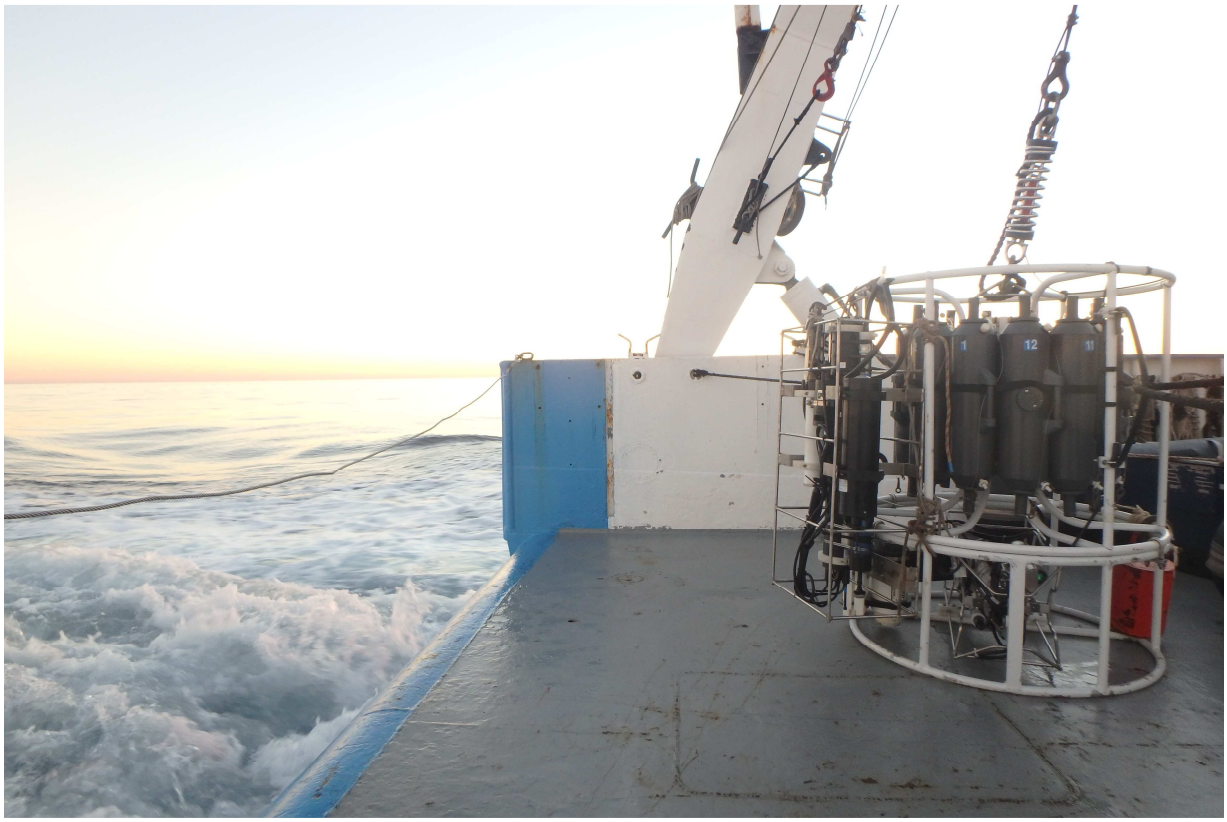

The BOUSSOLE CTD Rosette with attached a provisional IOP package including an absorption and attenuation meter (AC9+), a CDOM fluorimeter, a backscattering meter and a chlorophyll fluorimeter.

BOUSSOLE project

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

December 16, 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

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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). 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.
This fluorimeter was recovered by the divers in order to download the data. It was then reinstalled at the same location.
A new IOP package was used for this cruise because the usual one was unavailable. This package includes a *WET LABS* absorption and attenuation meter (AC9+), a *WET LABS* CDOM fluorometer (WetStar), a *WET LABS* backscattering meter (ECO BB3), a *CHELSEA* Chlorophyll fluorometer (Aqua Tracka), a *SBE* 49 fastCAT CTD and a *SATLANTIC* Alkaline Battery Pack.

The first day, before arriving at the BOUSSOLE site, the METEO-FRANCE buoy was checked after it was reported not functioning.
The MOOSE DYFAMED operations were performed the last day of the BOUSSOLE cruise because bad weather was predicted for the next day.

Cruise Summary

The first day was used to check visually the METEO-FRANCE buoy, to perform CTD casts with water sampling, optical profile and a Secchi disk at the BOUSSOLE site. The second day was used for diving operations, for surface maintenance of the buoy and for downloading data from the fluorimeter and from the buoy. This day was also used for optical profiles, CTD casts with water sampling and for a Secchi disk at the BOUSSOLE site. The last day was used for optical profiles, for CTD casts with water sampling, for a Secchi disk at the BOUSSOLE site and to complete the MOOSE program.

Thursday 08 December 2016

The first day, the sea state was slight with a gentle breeze. The sky was blue and the visibility was excellent. Firstly we went to the METEO-FRANCE buoy site to check visually the top of the buoy. It appeared that one of the two anemometer was broken. Pictures were taken and sent to METEO-FRANCE.
Then, we went to the BOUSSOLE site to perform 2 CTD casts with water sampling. The first CTD cast was performed with a 0.2 µm filter put on the tubing system of the IOP package. Then 3 C-OPS profiles and 1 Secchi disk were performed at the BOUSSOLE site.

Friday 09 December 2016

This day, the sea state was smooth with a light breeze. The sky was cloudy and the visibility was excellent. When arrived at the BOUSSOLE site, divers went at sea to remove the fluorimeter, 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, surface sensors, solar panels and ARGOS connector were cleaned. Fluorimeter data were downloaded on board of the dinghy and then the fluorimeter was reinstalled on the buoy at the same location. Then, 1 C-OPS profile and 2 CTD casts with water sampling were performed at the BOUSSOLE site. The first CTD cast was performed with a 0.2 µm filter put on the tubing system of the IOP package. Finally a Secchi disk was performed before returning to the Nice harbour.

Saturday 10 December 2016

The last day, the sea state was smooth with a light air. The sky was overcast and the visibility was medium. 3 C-OPS profiles, a Secchi Disk and 2 CTD casts with water sampling were performed at the BOUSSOLE site. The last CTD cast was performed with a 0.2 µm filter put on the tubing system of the IOP package. Then, we went to the DYFAMED site to perform 3 zooplankton nets and a deep CTD cast to complete 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/AF1QipMDstFND1DpP00-l57eNVatJ4NsNWvgy14S3kKr

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

Cruise Report

Thursday 08 December 2016 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

0645 Departure from the Nice harbour.
1030 Arrival to the METEO-FRANCE buoy site and checking of the surface sensors.
1050 Arrival at the BOUSSOLE site.
1055 CTD 01, 400 m with water sampling at 5 m for TSM (with 0.2 µm filter on IOP package tubing).
1135 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.
1200 Filtrations.

1345 C-OPS 01, 02, 03.
1420 Secchi 01, 21 m.
1425 Departure to the Nice harbour.
1730 Arrival at the Nice harbour.

Friday 09 December 2016 (UTC)

People on board: Agnieszka Bialek, Guillaume De Liège, Melek Golbol, Judicaël Rivier, Didier Robin and Eduardo Soto Garcia.

0615 Departure from the Nice harbour.
0930 Arrival at the BOUSSOLE site.
0940 Diving operations: remove of the fluorimeter, cleaning, dark measurements, pictures.
1000 Connection with the buoy and data retrieval.
1030 Cleaning of surface sensors, solar panels and ARGOS connector.
1115 Reinstallation of the fluorimeter at 9m depth.
1215 COPS 04.
1255 CTD 03, 400 m with water sampling at 5 m for TSM (with 0.2 µm filter on IOP package tubing).
1330 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.
1400 Secchi 02, 18 m.
1405 Departure to the Nice harbour.
1715 Arrival at the Nice harbour.

Saturday 10 December 2016 (UTC)

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

0635 Departure from the Nice harbour.
0950 Arrival at the BOUSSOLE site.
1005 C-OPS 06, 07, 08.
1100 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.
1105 Secchi 01, 24 m.
1200 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 IOP package tubing).
1235 Departure to the DYFAMED site.
1250 Arrival at the DYFAMED site.
1255 Zooplancton nets x 3 (MOOSE).
1320 Deep CTD cast (MOOSE).
1515 Departure to the Nice harbour.
1800 Arrival at the Nice harbour.

Problems identified during the cruise

- The second day, only 1 C-OPS profile was performed. It was stopped at 40 m because the sky became cloudier with an unstable irradiance.
- The C-OPS commonly used on the BOUSSOLE missions was still under calibration at *Biospherical*. The C-OPS used for this cruise was the one shared among the marine optics and remote sensing group at LOV. The instrument is similar to the BOUSSOLE one, yet has a Lu sensor instead of a Eu one**.**
- Problems appears with the new IOP package alimentation: it appeared that the alkaline battery used is not adapted to the BOUSSOLE operations. The system always cut off when the voltage is below 10V (minimum requirement for the AC9). It was the case for the CTD cast 01, 02, 04. So, some of the IOP profiles are not complete (33m depth for the cast 01 cast and 57 m depth for the cast 02). The next day, the alkaline batteries were changed, the cast 03 and 04 were complete but the system cut off during the ascent of the CTD. The last day, the CTD SBE 49 was removed from the package, the system did not cut off but consume a lot the battery. So, the alimentation system is not well adapted to this protocol.

- The SBE 49 fastCAT used for this cruise was limited in the pressure (100m). But the CTD was deployed accidentally at 400m. We realized this limitation only the second day after the CTD 03 and CTD 04 cast because the cast were complete. It appeared that the sensor pressure blocked at 165 m during the descent for these casts.

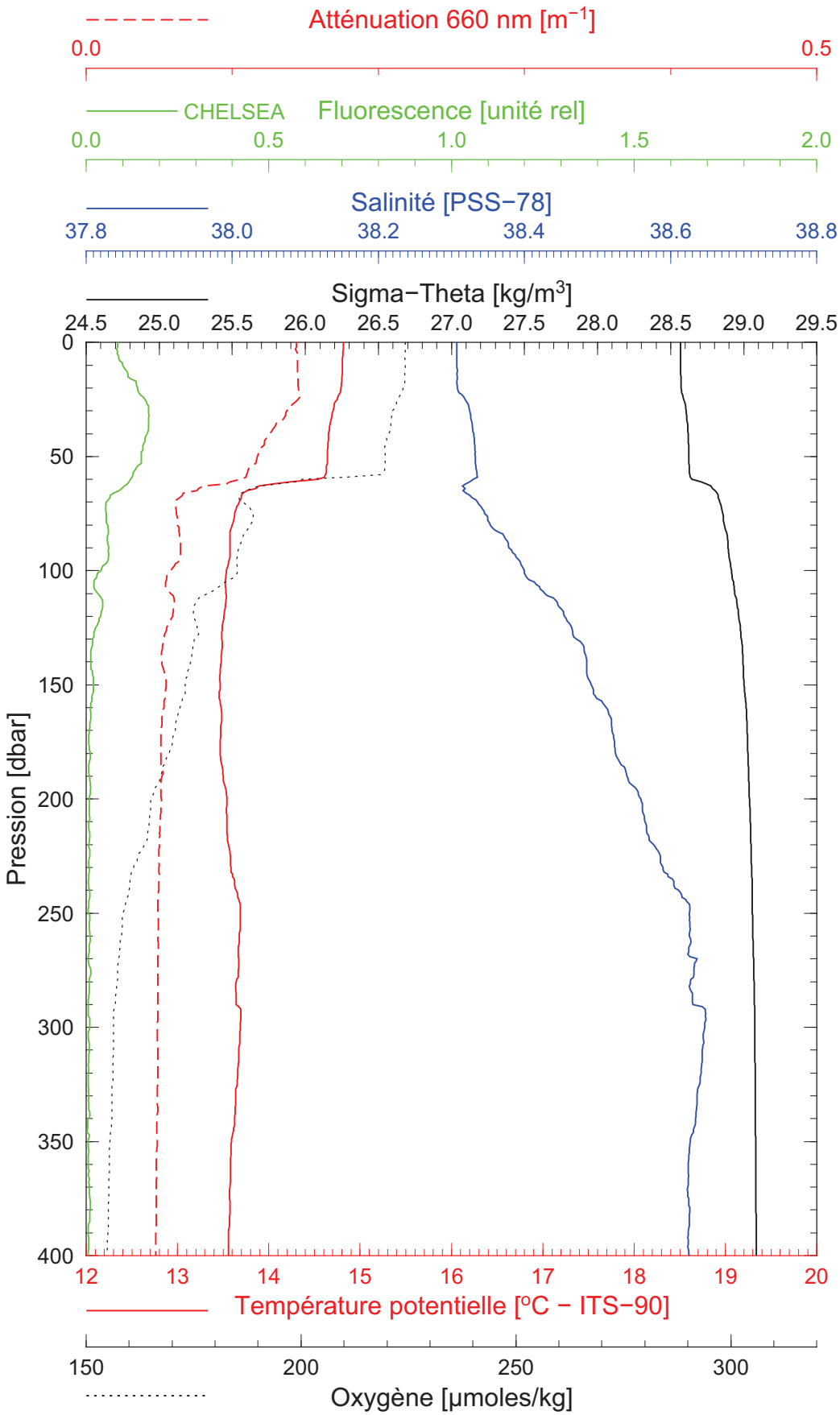
Appendices

Cruise Summary Table for Boussole 178

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
08/12/16			CTDBOUS001	TSM	10:55	23:00	400	43	22.044	7	53.855	blue		1	8	62	1035.5	61		14.7	14.89	calm			
			CTDBOUS002	HPLC & Ap	11:35	26:00	400	43	21.984	7	53.800	blue		1	7	63	1035.5	61		14.7	14.87	calm			
		bou_c-ops_161208_1332_001_data.csv			13:44	4:22	87	43	22.115	7	53.685	blue	None	0	7	54	1034.3	67	excellent	14.4		calm	0.6		no
		bou_c-ops_161208_1332_002_data.csv			13:55	3:55	79	43	22.375	7	53.588	blue	None	0	7	54	1034.3	67	excellent	14.4		calm	0.6		no
		bou_c-ops_161208_1332_003_data.csv			14:05	3:52	79	43	22.621	7	53.537	blue	None	0	7	54	1034.3	67	excellent	14.4		calm	0.6		no
				Secchi01	14:20	4:00	21	43	22	7	54	blue		0					excellent			calm			
09/12/16		bou_c-ops_161209_1159_002_data.csv			12:27	2:19	42	43	22.558	7	54.092	cloudy	Sc	5	5	240	1031.8	74	excellent	13.9		calm	0.4		no
			CTDBOUS003	TSM	12:54	21:00	400	43	22.087	7	54.253	blue		3	5	240	1031.8	74		13.9	14.90	calm			no
			CTDBOUS004	HPLC & Ap	13:32	25:00	400	43	22.207	7	54.152	blue		3	6	220	1031.6	76		13.8	14.90	calm			
				Secchi02	14:00	4:00	18	43	22	7	54	blue		5					excellent			calm			
10/12/16		bou_c-ops_161210_0941_001_data.csv			10:03	3:42	72	43	22.030	7	53.630	overcast	Sc	7	2	51	1028.9	77	medium	14.7		calm	0.2		no
		bou_c-ops_161210_0941_002_data.csv			10:12	3:18	61	43	22.016	7	53.149	overcast	Sc	7	2	51	1028.9	77	medium	14.7		calm	0.2		no
		bou_c-ops_161210_0941_004_data.csv			10:31	3:52	72	43	21.980	7	52.378	overcast	Sc	7	2	51	1028.9	77	medium	14.7		calm	0.2		no
			CTDBOUS005	HPLC & Ap	11:00	24:00	400	43	21.988	7	53.736	overcast		7	1	71	1028.0	79		15.2	15.80	calm			
				Secchi03	11:00	4:00	24	43	22	7	54	overcast		7					medium			calm			
			CTDBOUS006	TSM, TA/TC, O_2 & Cyto	12:04	26:00	400	43	22.063	7	53.740	overcast		7	2	158	1027.8	80		15.1	15.87	calm			

BOUSSOLE 178 **08/12/2016** **BOUS161208_01**

BOUS001

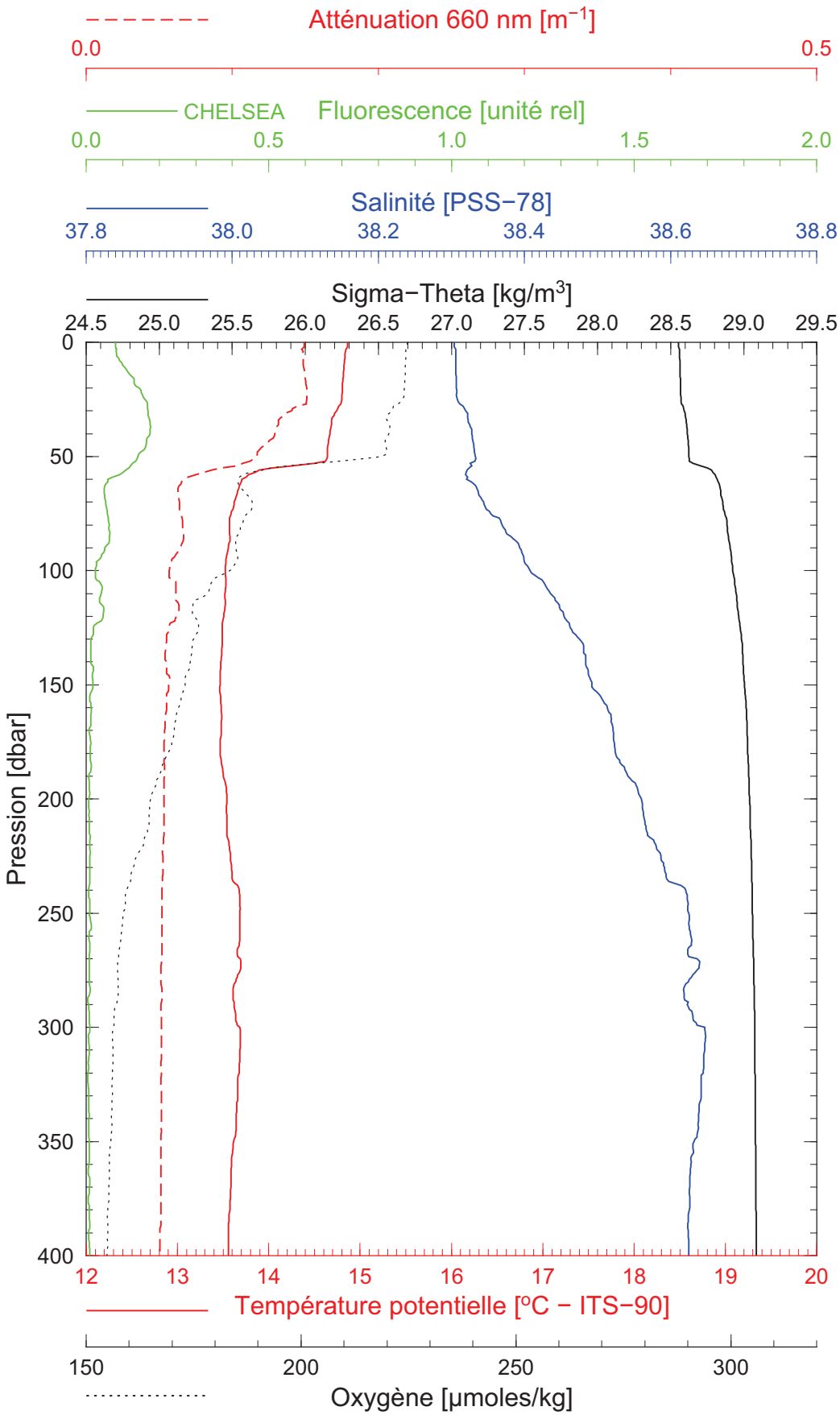


Date *08/12/2016* *Latitude* *43°22.044 N*

Heure déb *10h 55min [TU]* *Longitude* *07°53.855 E*

BOUSSOLE 178 **08/12/2016** **BOUS161208_02**

BOUS002

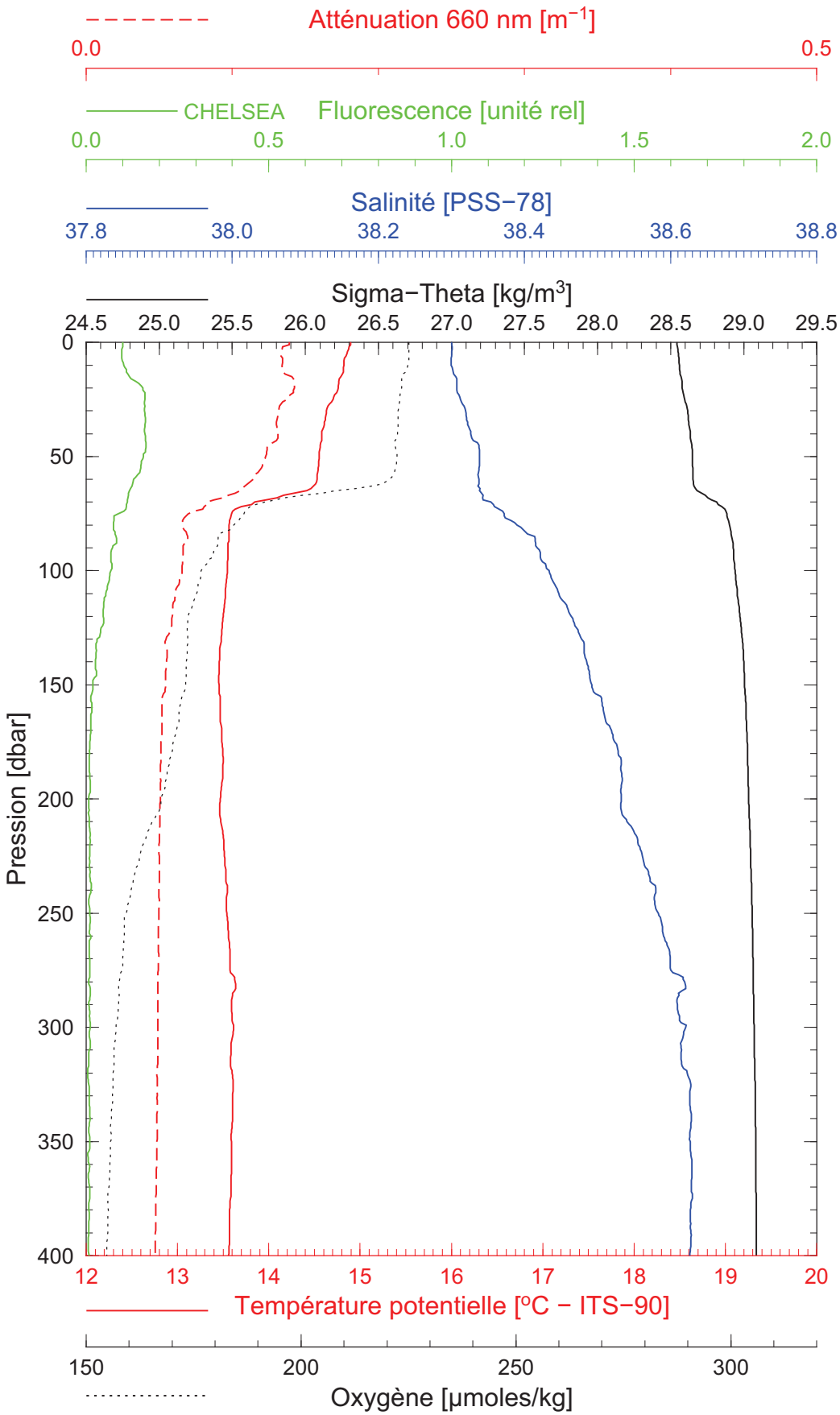


Date *08/12/2016* *Latitude* *43°21.984 N*

Heure déb *11h 35min [TU]* *Longitude* *07°53.800 E*

BOUSSOLE 178 **09/12/2016** **BOUS161209_01**

BOUS003

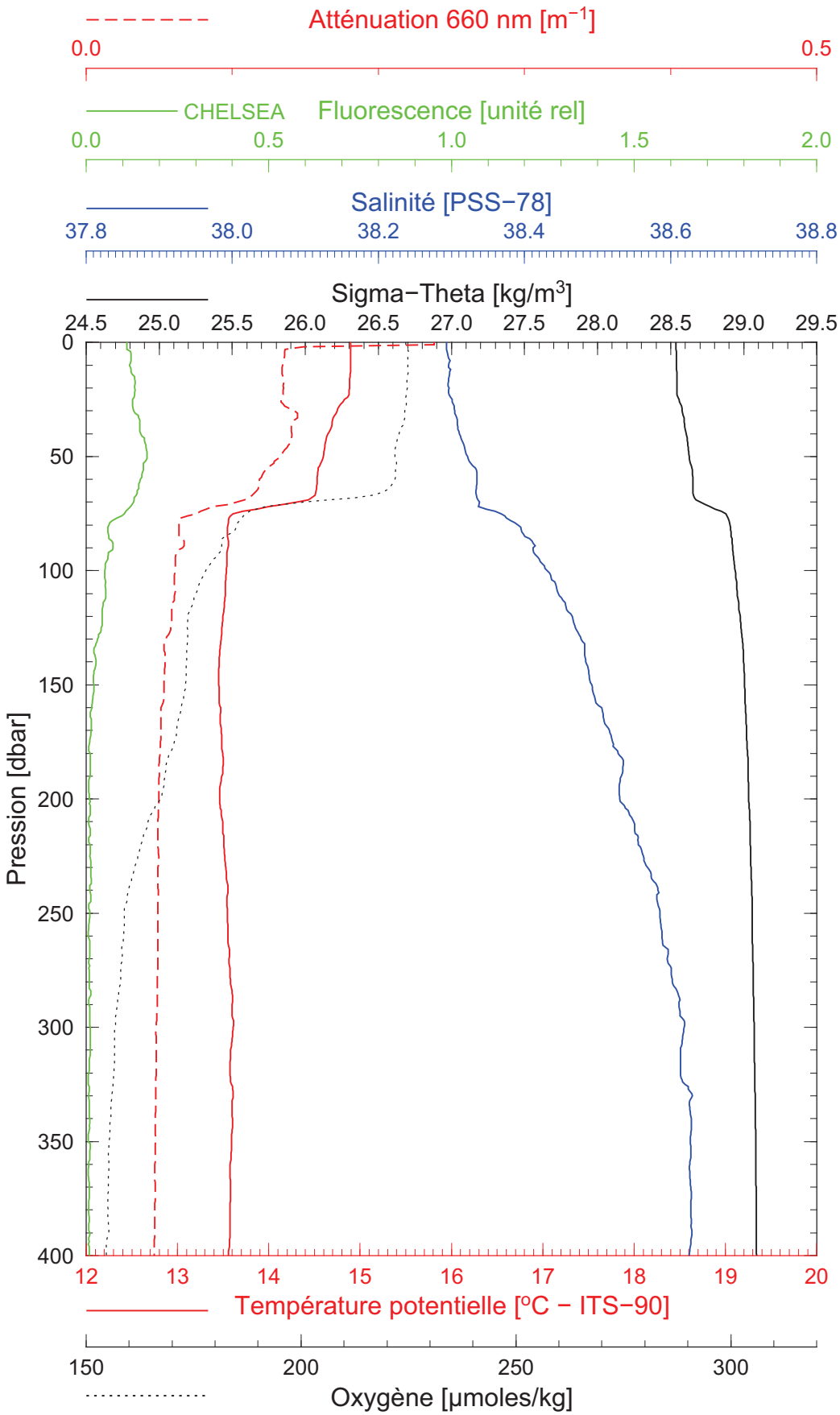


Date *09/12/2016* *Latitude* *43°22.087 N*

Heure déb *12h 54min [TU]* *Longitude* *07°54.233 E*

BOUSSOLE 178 **09/12/2016** **BOUS161209_02**

BOUS004

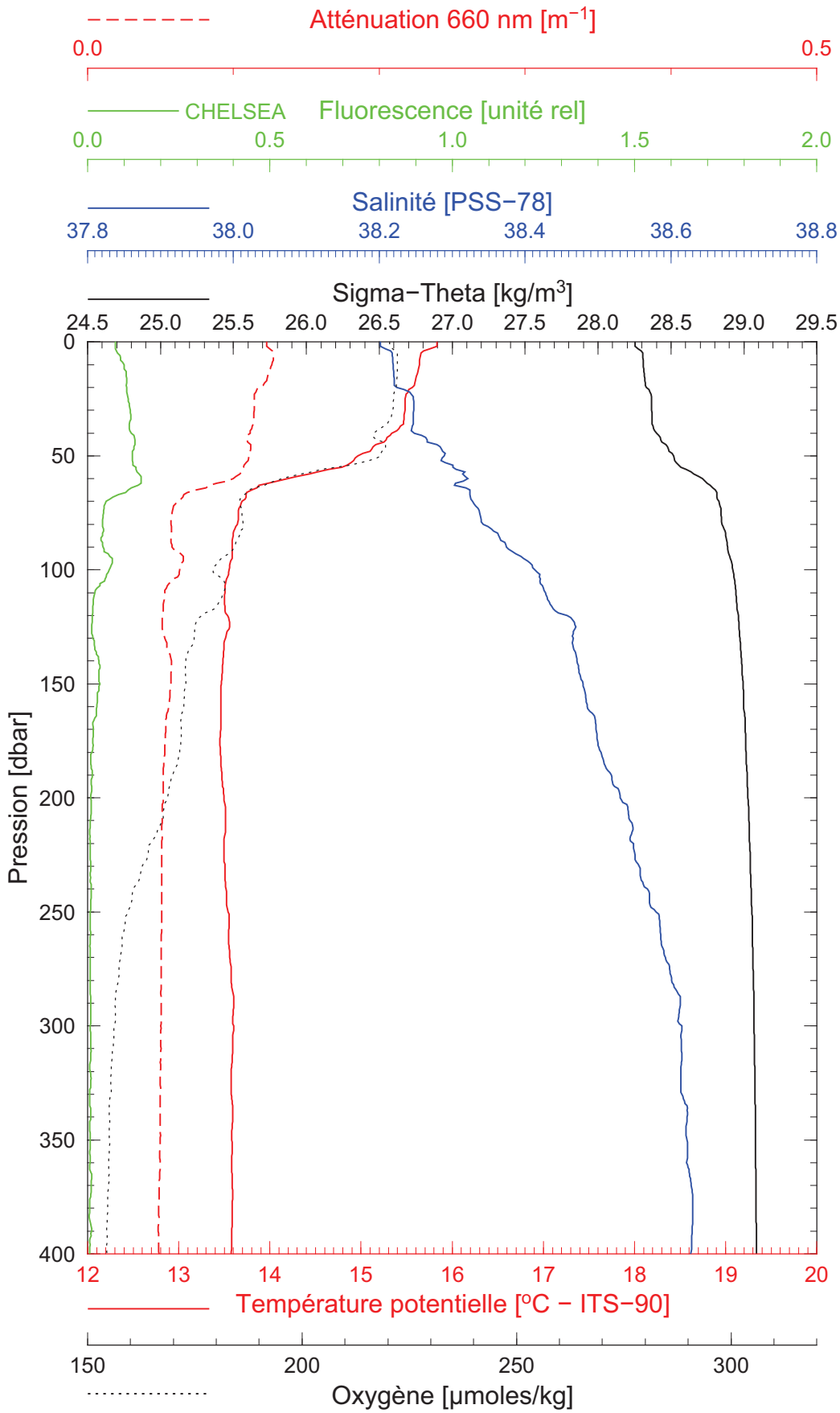


Date *09/12/2016* *Latitude* *43°22.207 N*

Heure déb *13h 31min [TU]* *Longitude* *07°54.152 E*

BOUSSOLE 178 **10/12/2016** **BOUS161210_01**

BOUS005

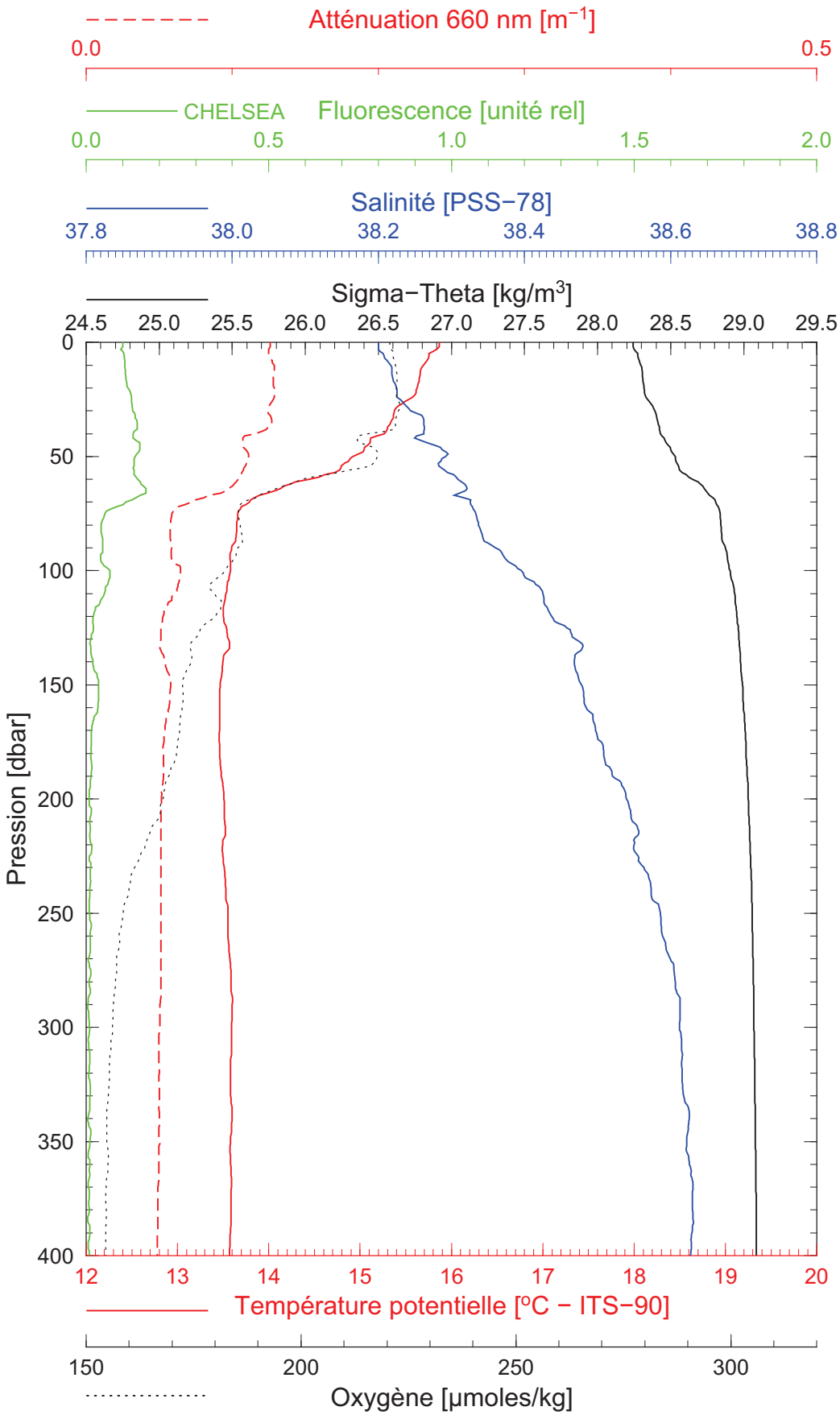


Date *10/12/2016* *Latitude* *43°21.988 N*

Heure déb *11h 00min [TU]* *Longitude* *07°53.736 E*

BOUSSOLE 178 **10/12/2016** **BOUS161210_02**

BOUS006



Date *10/12/2016* *Latitude* *43°22.063 N*

Heure déb *12h 04min [TU]* *Longitude* *07°53.740 E*