BOUSSOLE Monthly Cruise Report

Cruise 161
July 20–22, 2015

Duty Chief: Melek Golbol
Vessel: R/V Téthys II
(Captain: Joël Perrot)

Science Personnel: Guillaume De Liège, Céline Dimier, Jean-Pierre Gattuso, Melek Golbol, David Luquet, Stéfani Novoa, Antoine Poteau and Vincent Taillandier.

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Several whales have been sighted during the summer BOUSSOLE cruises. This picture shows a fin whale (*Balaenoptera physalus*) seen in the vicinity of the BOUSSOLE site during the July cruise.

BOUSSOLE project

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

October 23, 2015

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

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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). 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.

A new sensor ("Master REM A") was added to the IOP package and connected to the CTD. This sensor is identical to the ones installed on the Bio-Argo floats, and is planned to be used as a "gold standard" to inter-calibrate sensors among the Bio-Argo fleet. This sensor measures fluorescence of Chla, fluorescence of Coloured Dissolved Organic Matter (CDOM), and backscattering at 700nm. The objective is to evaluate what this instrument provides in terms of Chl and CDOM fluorescence, by comparing its measurements to those from the BOUSSOLE Chl and CDOM fluorometers (the ones installed on the BOUSSOLE IOP package), to the chlorophyll concentrations from the HPLC analyses, and to the CDOM absorption measurements from the CDOM analyses.

Operations that have to be performed in each cruise include:
- Collection and filtration of seawater samples for colored dissolved organic matter (from June 2005).

- One CTD transect is performed between the BOUSSOLE site and the Port of Nice. This transect consists of six fixed stations on-route from BOUSSOLE. Whenever feasible, this transect should be performed at a similar time for each cruise, in order to minimise the influence of possible diurnal variability.

- 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 pCO2 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

During the diving, the CTD at 3m was removed and swapped with another one.
The divers went to the METEO-FRANCE buoy in order to take pictures and to check the mooring before the installation of an "ISUS V3" sensor (In Situ Ultraviolet Spectrophotometer) at 45 m depth for nitrates measurements. This operation was carried out in the frame of the MOOSE DYFAMED program.

Cruise Summary

The first day, a CTD cast with water sampling, optical profiles, a Secchi disk and the CTD transect were performed at the BOUSSOLE site. The second day was used for downloading data from the buoy and for cleaning sensors and solar panels at the top of the buoy. This day was also used for optical profiles, for a Secchi disk and for CTD casts with water sampling at the BOUSSOLE site. The last day was used for diving operations: cleaning of the sensors, performing dark measurements of the transmissometers and backscattering meter, taking pictures and swapping the CTD at 3m. This day was also used for optical profiles, for a Secchi disk and for a CTD cast with water sampling at the BOUSSOLE site. After the work at BOUSSOLE was finished, divers went to the METEO-FRANCE buoy to take pictures and to check the mooring.

Monday 20 July 2015

The sea state was slight with a light breeze. The sky was blue and the visibility was good. 1 CTD cast with water sampling, 3 C-OPS profiles and 1 Secchi disk were performed at the BOUSSOLE site. Finally, the CTD transect was completed. At station 06, an IOP cast with a cap installed on the backscattering meter for dark measurements was performed before the CTD cast acquisition.

Tuesday 21 July 2015

The sea state was smooth with a gentle breeze on the morning and a light breeze on the afternoon. The sky was blue on the morning and cloudy on the afternoon. The visibility was good. Buoy data were downloaded via the cable available on the top of the buoy. The sensors at the top of the buoy and the solar panels were cleaned. pCO_2 data from the sensors at 3m and 10m were downloaded using the telemetry cable fixed on the top of the buoy. 2 C-OPS profiles, 1 Secchi disk and 3 CTD casts with water sampling were performed at the BOUSSOLE site. One of the CTD cast was performed at 10m depth because there were problems with some of the Niskin bottles: the bottles did not close, therefore there was not enough water for sampling of surface parameters.

Wednesday 22 July 2015

The sea state was smooth with a light breeze. The sky was blue and the visibility was excellent. When arrived at the BOUSSOLE site, divers went at sea to clean the sensors, to perform dark measurements of the transmissometers and backscattering meter and to take pictures. They also replaced the CTD at 3m with another one. 3 C-OPS profiles, 1 CTD cast with water sampling and 1 Secchi disk were performed at the BOUSSOLE site. During the way back to the Nice harbour, we stopped at the METEO-FRANCE buoy and divers went a sea to take pictures and to check the mooring in order to prepare the next installation of the ISUS V3 sensor at 45m for DYFAMED program.

Pictures taken during this cruise can be found at:
https://plus.google.com/photos/114686870380724925974/albums/6192537429300341729?banner=pwa

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 20 July 2015 (UTC)

People on board: Céline Dimier, Melek Golbol and Vincent Taillandier.

0550 Departure from the Nice harbour.
0915 Arrival at the BOUSSOLE site.
0930 CTD 01, 400 m with water sampling at 200, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p and TSM.
1015 C-OPS 01, 02, 03.
1050 Secchi 01, 17 m.
1100 Departure to the first transect station.
1150 CTD 02, 400 m, station 01 (43°25'N 07°48'E).
1250 CTD 03, 400 m, station 02 (43°28'N 07°42'E).
1345 CTD 04, 400 m, station 03 (43°31'N 07°37'E).

1440 CTD 05, 400 m, station 04 (43°34'N 07°31'E).
1535 CTD 06, 400 m, station 05 (43°37'N 07°25'E).
1620 Dark Hydroscat-6, 50m, station 06 (43°39'N 07°21'E).
1630 CTD 07, 400 m, station 06.
1650 Departure to the Nice harbour.
1730 Arrival at the Nice harbour.

Tuesday 21 July 2015 (UTC)

People on board: Melek Golbol, Stefani Novoa and Vincent Taillandier.

0500 Departure from the Nice harbour.
0830 Arrival at the BOUSSOLE site.
0845 Cleaning of solar panels and surface sensors.
0900 Direct connection with the buoy and data retrieval. Downloading of pCO2 data at 3m and 9m depth.
1000 C-OPS 04, 05.
1045 Secchi 02, 23m
1100 CTD 08, 400 m with water sampling at 200, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC and $a_{p.}$
1215 CTD 09, 10 m with water sampling at 10m and 5 m for TA/TC, O_2 and TSM.
1310 CTD10, 400 m with water sampling at 200, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC and $a_{p.}$
1340 Departure to the Nice harbour.
1700 Arrival at the Nice harbour.

Wednesday 22 July 2015 (UTC)

People on board: Guillaume De Liège, Jean-Pierre Gattuso, Melek Golbol, David Luquet, Antoine Poteau and Vincent Taillandier.

0555 Departure from the Nice harbour.
0830 Arrival at the BOUSSOLE site.
0915 Diving on the BOUSSOLE buoy: replacement of the CTD at 3m, cleaning of the sensors, performing dark measurements and taking pictures.
1000 Lunch.
1105 C-OPS 06, 07, 08.
1155 CTD 11, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, $a_{p,}$ CDOM and TSM.
1240 Secchi 01, 24 m.
1250 Departure to the METEO-FRANCE buoy.
1320 Arrival at the METEO-FRANCE buoy.
1330 Diving on the METEO-FRANCE buoy for checking and taking pictures.
1400 Departure to the Nice harbour.
1700 Arrival at the Nice harbour.

Problems identified during the cruise

- The Niskin bottles #2 and #6 did not close. The mechanical pieces of the carrousel that allow the closing of the bottles were broken. They were repaired the last day during the way up to BOUSSOLE.

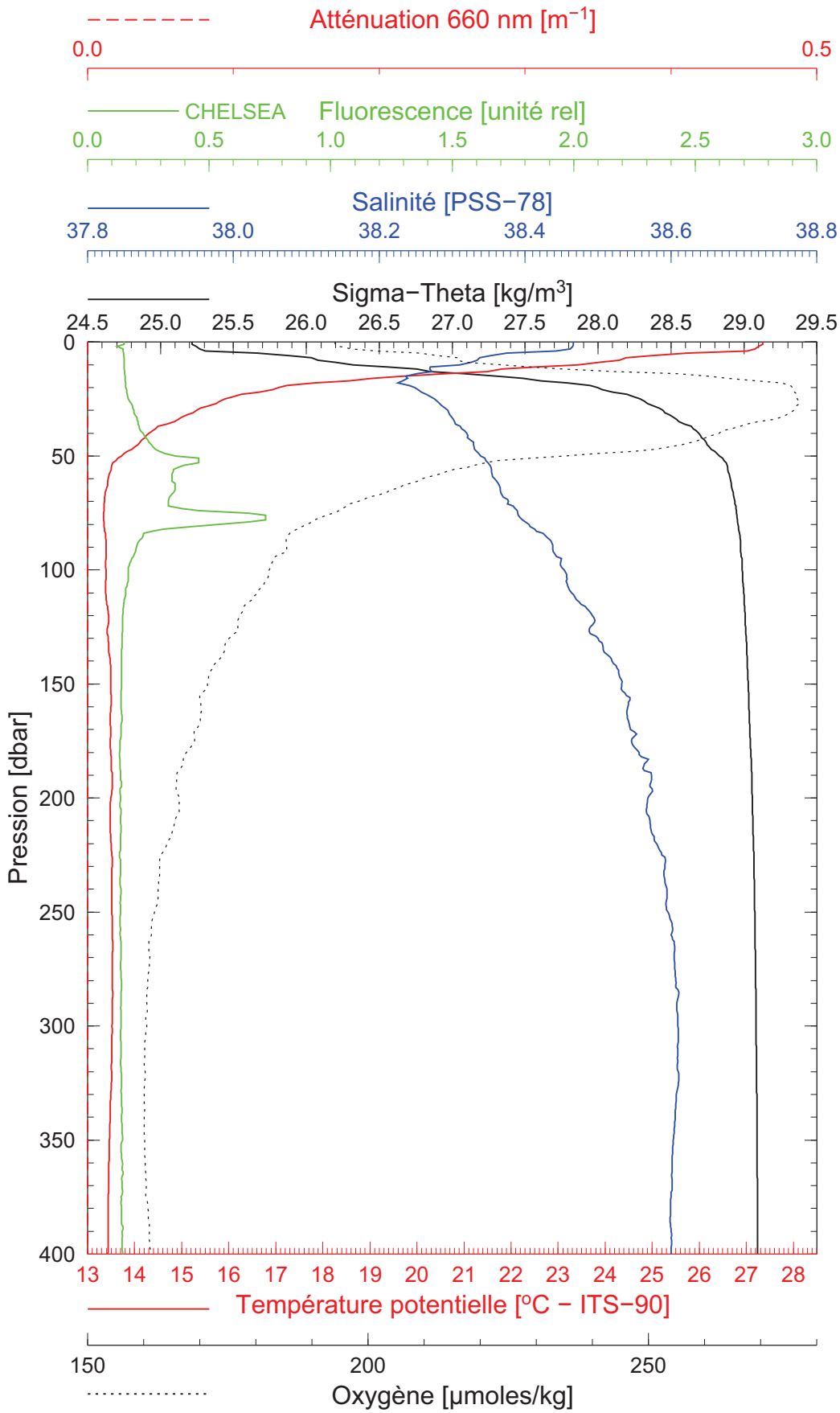
Appendices

Cruise Summary Table for Boussole 161

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
20/07/15			CTDBOUS001	HPLC, Ap & TSM	09:28	30:00	400	43	22.236	7	53.827	blue		3	5	146	1013.0	77		28.0	27.40	calm			
		bou_c-ops_150720_0957_001_data.csv			10:15	4:08	104	43	22.139	7	53.863	blue	Cu,Cs	2	6	125	1013.1	80	good	27.0		calm	0.6		no
		bou_c-ops_150720_0957_002_data.csv			10:27	4:37	117	43	22.018	7	53.637	blue	Cu,Cs	2	6	125	1013.1	80	good	27.0		calm	0.6		no
		bou_c-ops_150720_0957_004_data.csv			10:40	4:56	128	43	21.818	7	53.518	blue	Cu,Cs	2	6	125	1013.1	80	good	27.0		calm	0.6		no
				Secchi01	10:50	4:00	17	43	22	7	54	blue		2					good			calm	0.6		
			CTDBOUS002		11:51	22:00	400	43	24.930	7	47.950	cloudy		5	7	111	1010.3	80		26.9	27.70	calm			
			CTDBOUS003		12:50	22:00	400	43	28.292	7	42.197	overcast		7	8	97	1012.8	65		31.0	27.90	calm			
			CTDBOUS004		13:44	22:00	400	43	31.148	7	36.965	cloudy		4	7	91	1012.6	78		27.2	27.90	calm			
			CTDBOUS005		14:40	22:00	400	43	33.971	7	30.780	cloudy		5	6	106	1012.7	76		27.9	28.20	calm			
			CTDBOUS006		15:36	22:00	400	43	36.941	7	24.908	cloudy		4	6	99	1012.7	77		27.5	27.80	calm			
			CTDBOUS007		16:28	21:00	400	43	38.972	7	20.948	overcast		6	4	63	1012.5	77		27.5	27.60	calm			
21/07/15		bou_c-ops_150721_0815_001_data.csv			09:59	4:12	107	43	22.178	7	53.667	blue	Ci, Cu	2	7	84	1014.7	74	good	29.6		calm	0.4		no
		bou_c-ops_150721_0815_002_data.csv			10:10	3:04	78	43	22.064	7	53.461	blue	Ci, Cu	2	7	84	1014.7	74	good	29.6		calm	0.4		no
				Secchi02	10:45	4:00	23	43	22	7	54	blue		2								calm	0.4		
			CTDBOUS008	HPLC & Ap	11:00	45:00	400	43	22.129	7	53.900	blue		3	6	137	1014.8	77		27.7	28.00	calm			
			CTDBOUS009	TSM, TA/TC & 02	12:15	5:00	10	43	22.180	7	53.960	overcast		6	6	132	1014.5	76		27.8	28.00	calm			
			CTDBOUS010	HPLC & Ap	13:10	34:00	400	43	22.300	7	53.900	cloudy		5	6	146	1014.3	76		27.6	28.10	calm			
22/07/15		bou_c-ops_150722_1048_002_data.csv			11:06	4:51	128	43	22.157	7	53.775	blue	none	0	4	172	1014.2	77	excellent	27.6		calm	0.3		no
		bou_c-ops_150722_1048_003_data.csv			11:17	4:08	108	43	22.036	7	53.643	blue	none	0	4	172	1014.2	77	excellent	27.6		calm	0.3		no
		bou_c-ops_150722_1048_004_data.csv			11:27	4:14	111	43	21.872	7	53.617	blue	none	0	4	172	1014.2	77	excellent	27.6		calm	0.3		no
			CTDBOUS0011	HPLC, Ap, TSM & CDOM	11:54	43:00	400	43	21.980	7	53.910	blue		2	5	171	1013.7	74		27.9	28.00	calm			
				Secchi03	12:40	4:00	24	43	22	7	54	blue		5					excellent			calm	0.3		

BOUSSOLE 161 **20/07/2015** **BOUS150720_01**

BOUS001

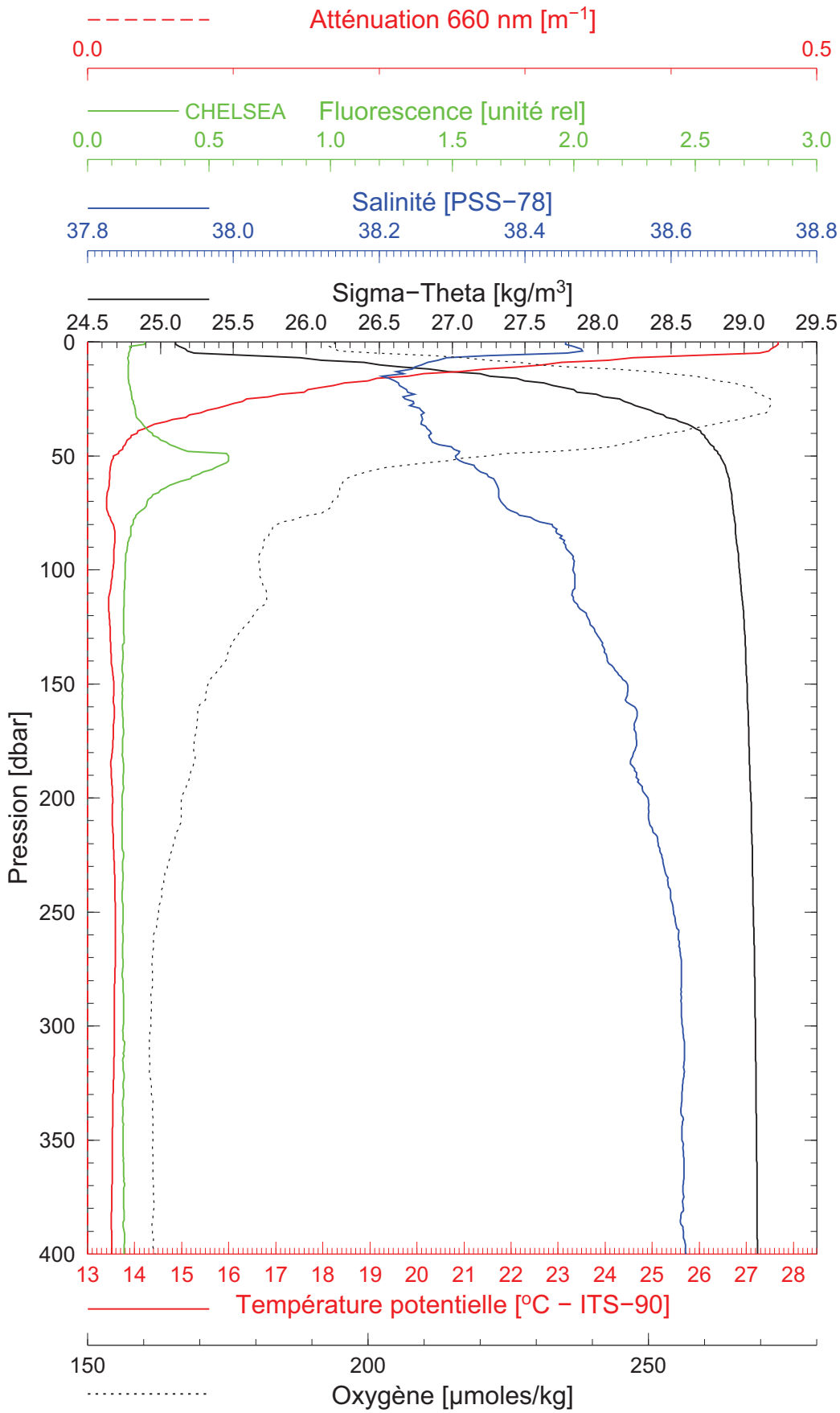


Date *20/07/2015* *Latitude* *43°22.236 N*

Heure déb *09h 28min [TU]* *Longitude* *07°53.827 E*

BOUSSOLE 161 **20/07/2015** **BOUS150720_02**

BOUS002

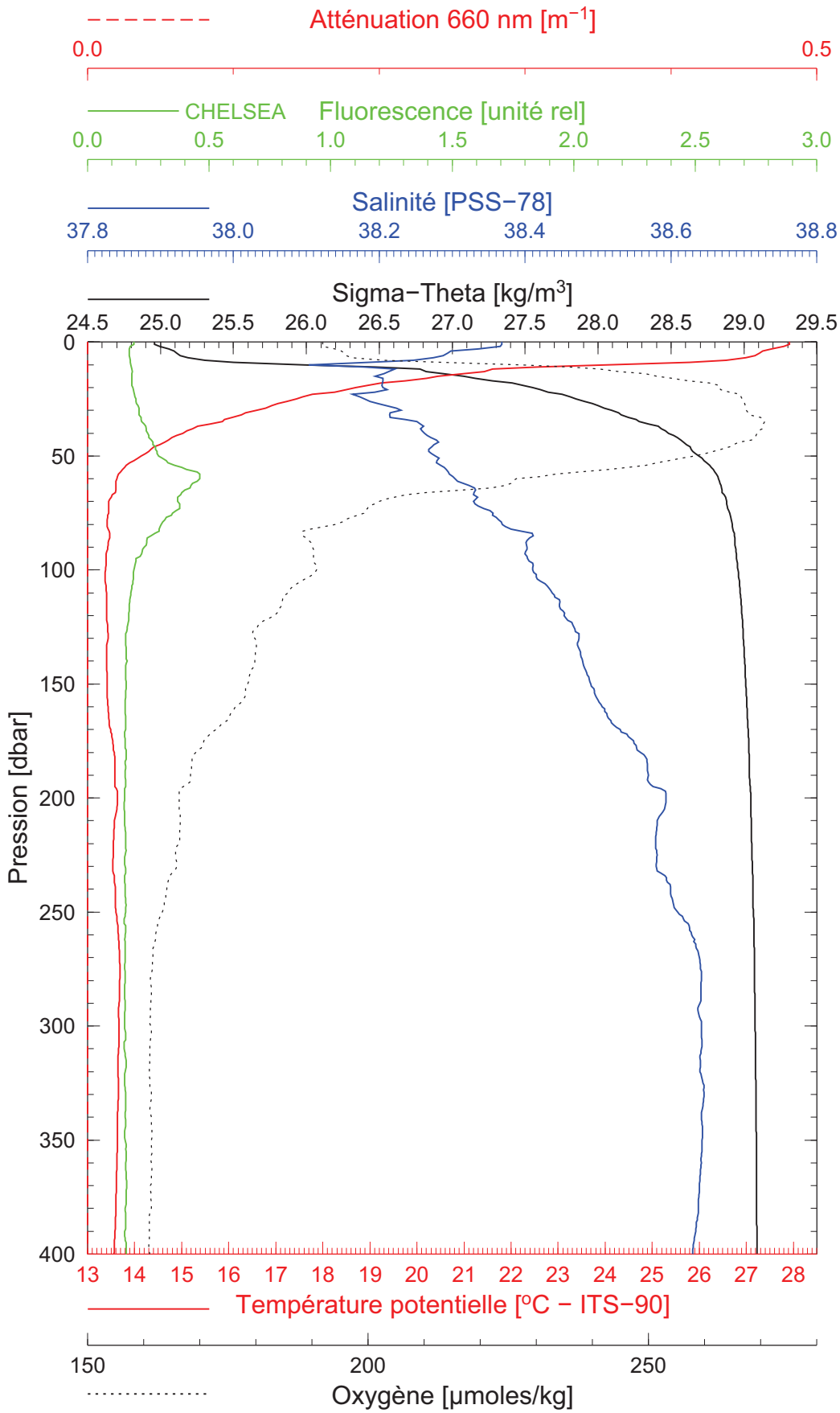


Date *20/07/2015* *Latitude* *43°24.930 N*

Heure déb *11h 51min [TU]* *Longitude* *07°47.950 E*

BOUSSOLE 161 **20/07/2015** **BOUS150720_03**

BOUS003

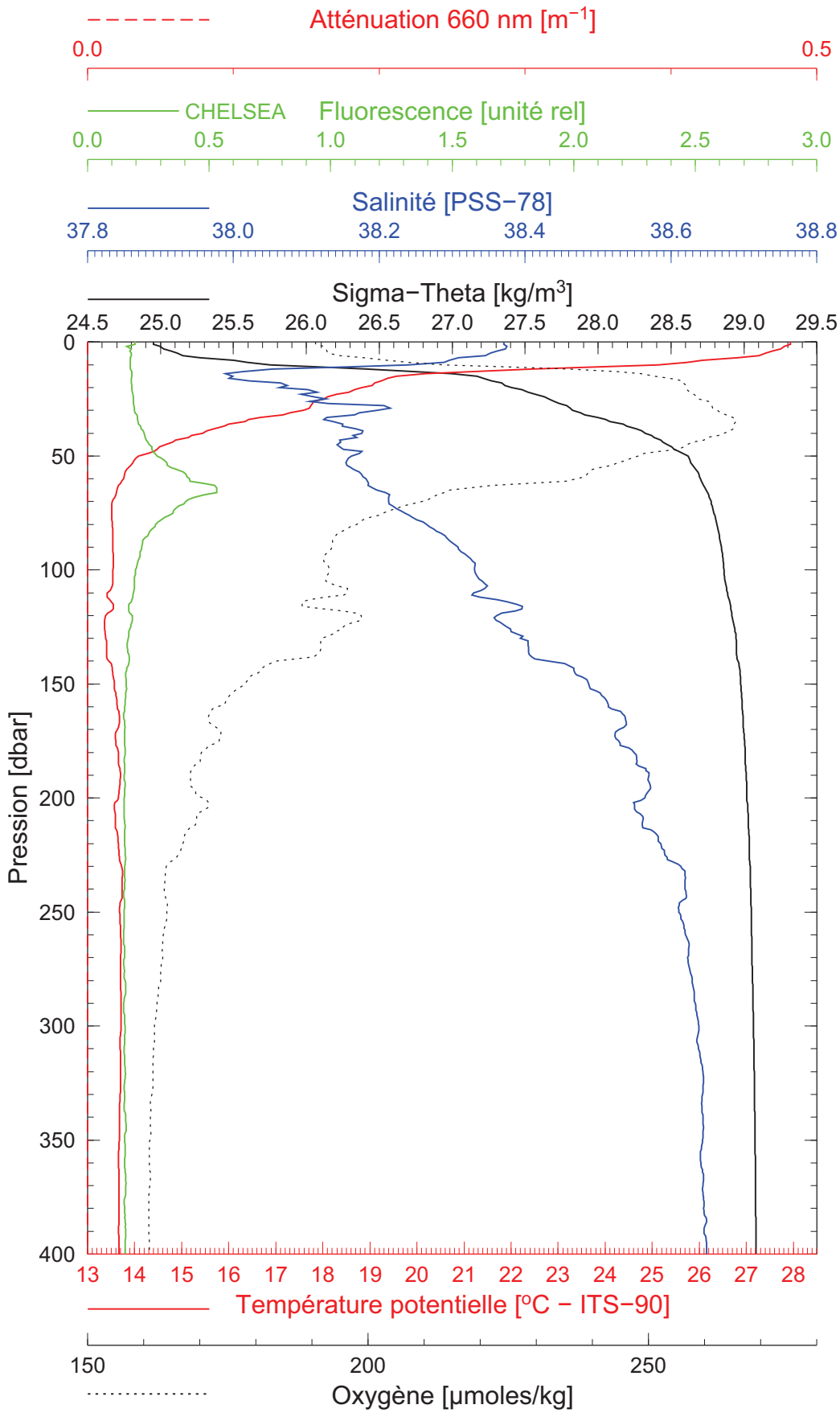


Date *20/07/2015* *Latitude* *43°28.292 N*

Heure déb *12h 50min [TU]* *Longitude* *07°42.197 E*

BOUSSOLE 161 **20/07/2015** **BOUS150720_04**

BOUS004

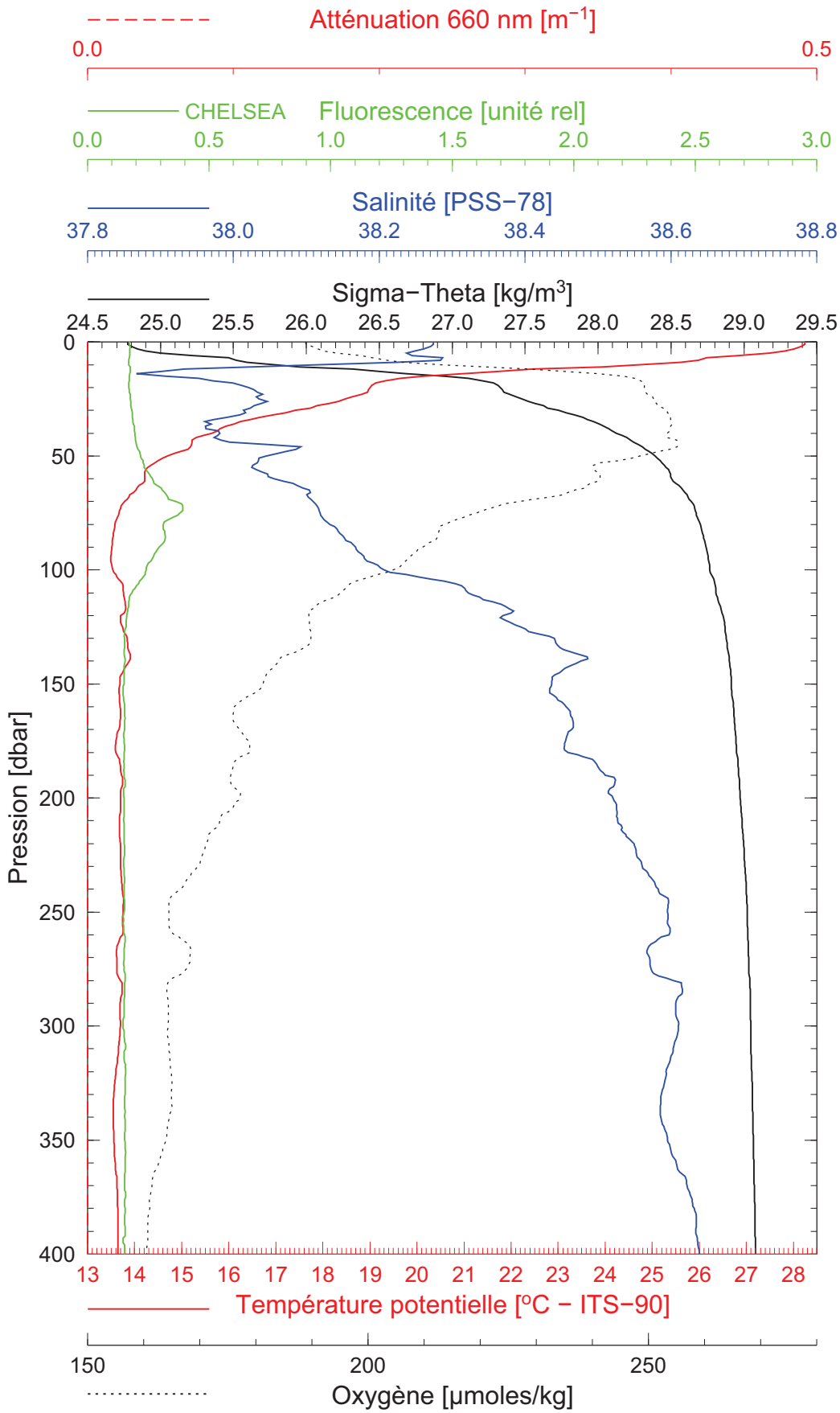


Date *20/07/2015* *Latitude* *43°31.148 N*

Heure déb *13h 44min [TU]* *Longitude* *07°36.965 E*

BOUSSOLE 161 **20/07/2015** **BOUS150720_05**

BOUS005

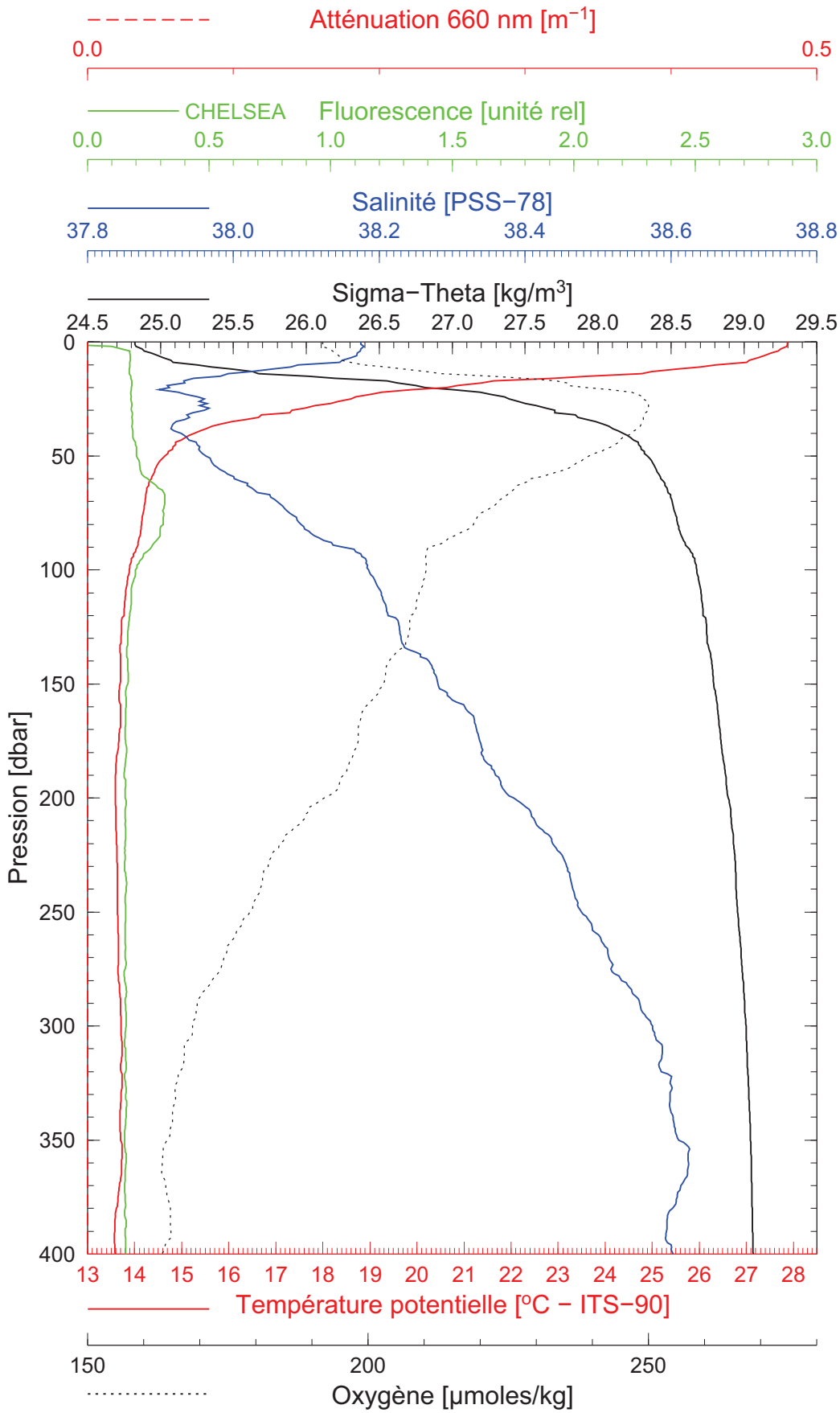


Date *20/07/2015* *Latitude* *43°33.971 N*

Heure déb *14h 40min [TU]* *Longitude* *07°30.780 E*

BOUSSOLE 161 **20/07/2015** **BOUS150720_06**

BOUS006



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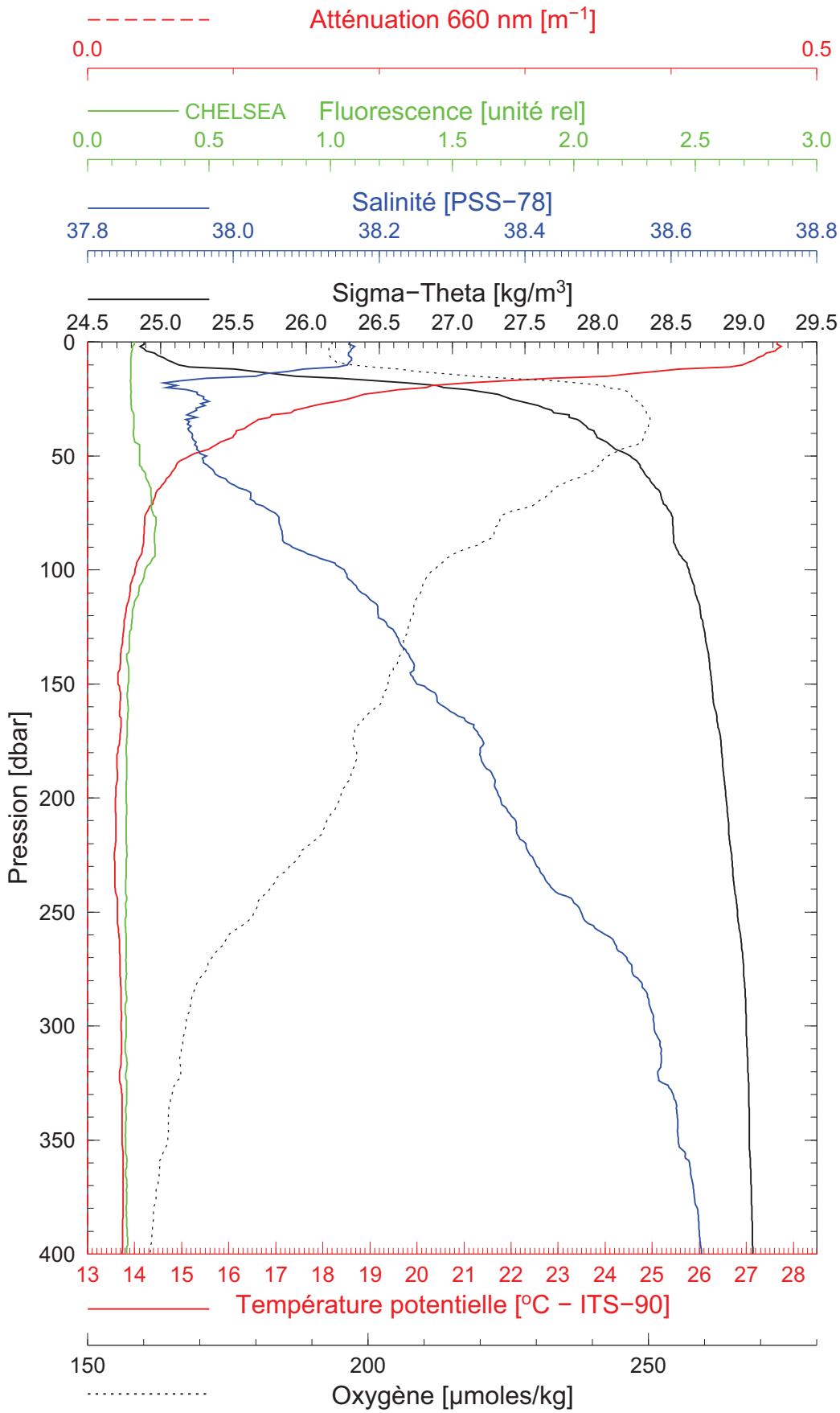
Heure déb *15h 36min [TU]* *Longitude* *07°24.908 E*

BOUSSOLE 161 **20/07/2015** **BOUS150720_07**

BOUS007



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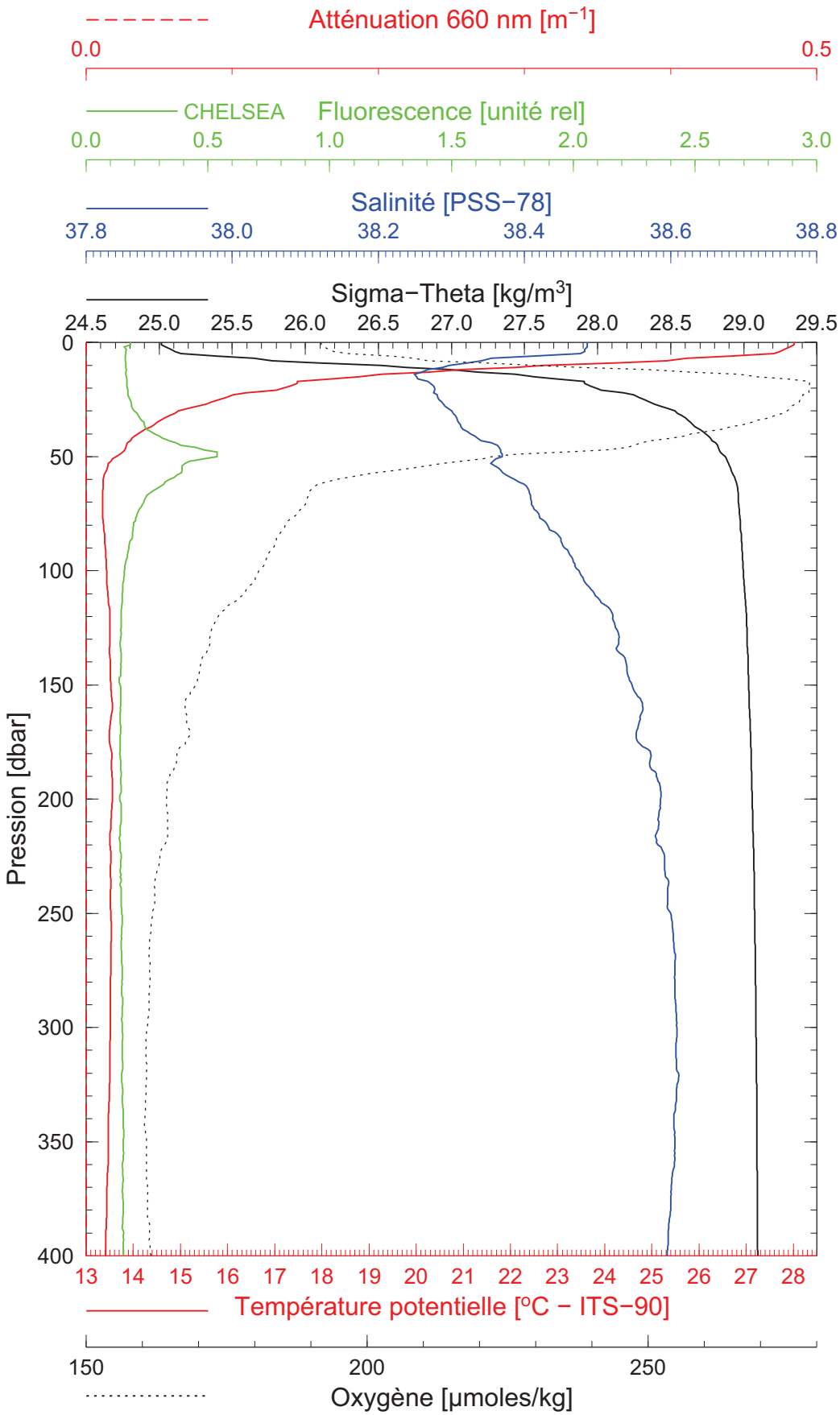
BOUSSOLE 161 **21/07/2015** **BOUS150721_01**

BOUS008

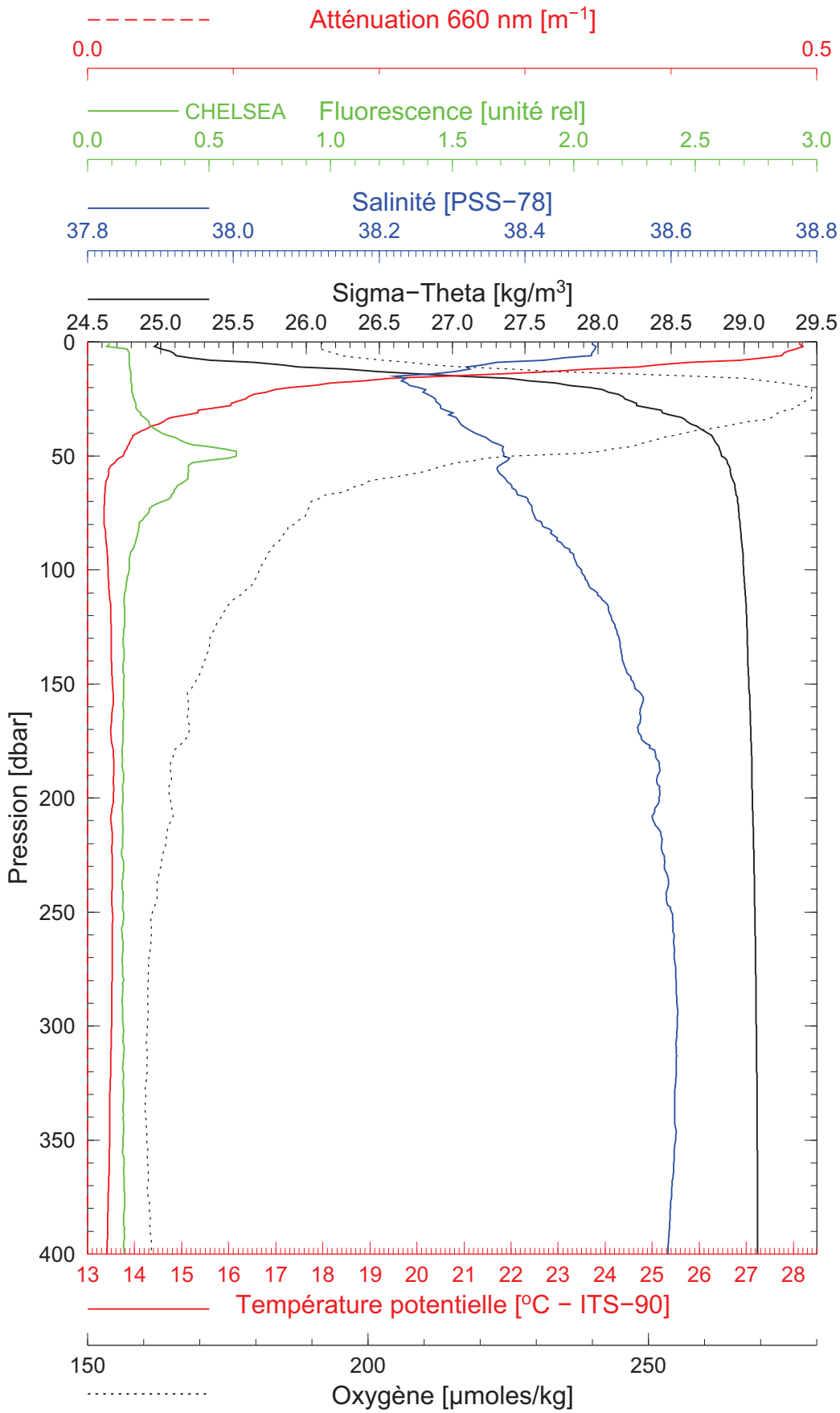


Date *21/07/2015* *Latitude* *43°22.129 N*

Heure déb *11h 00min [TU]* *Longitude* *07°53.900 E*

BOUSSOLE 161 **21/07/2015** **BOUS150721_02**

BOUS010



Date *21/07/2015* *Latitude* *43°22.300 N*

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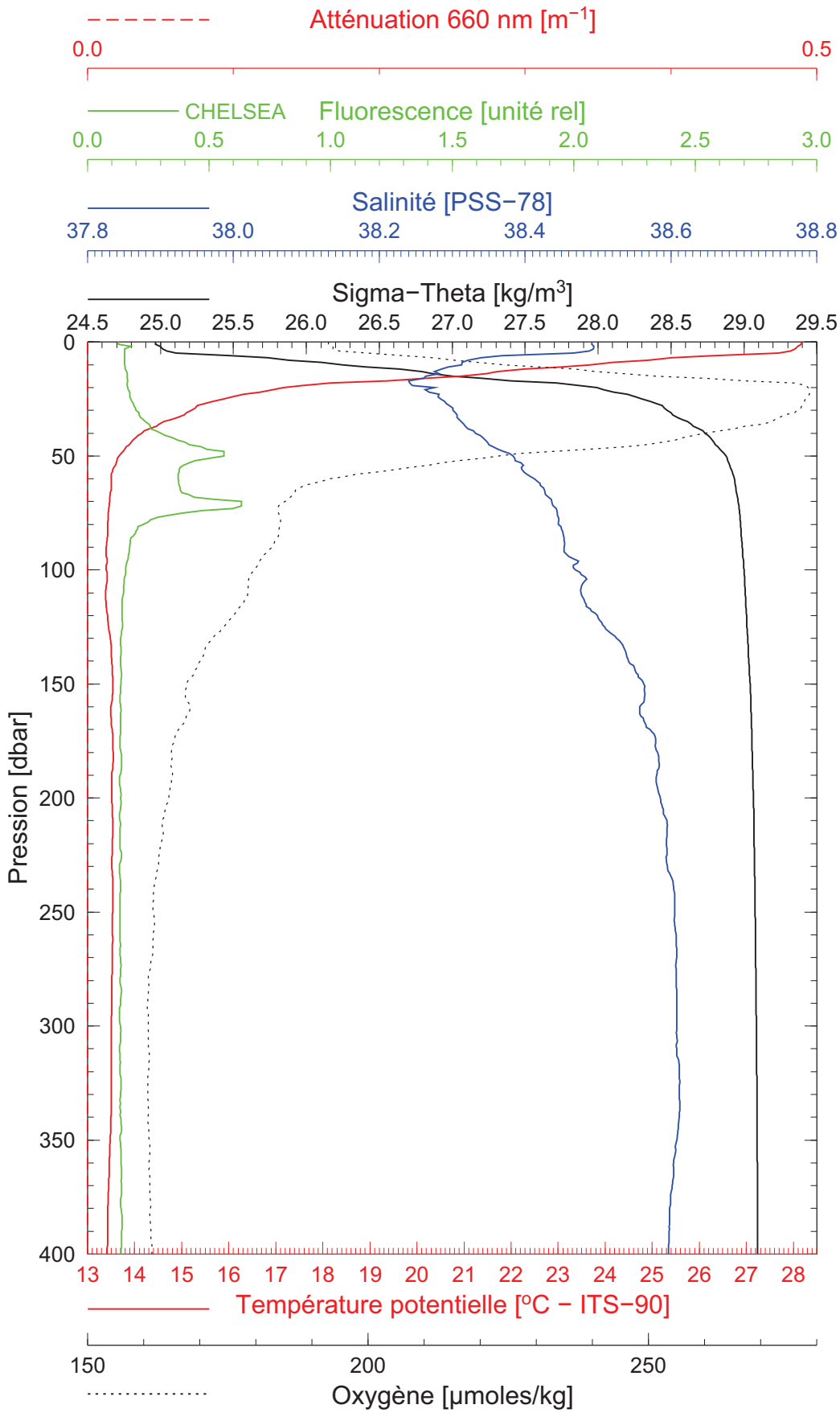
BOUSSOLE 161 **22/07/2015** **BOUS150722_01**

BOUS011



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Heure déb *11h 54min [TU]* *Longitude* *07°53.910 E*