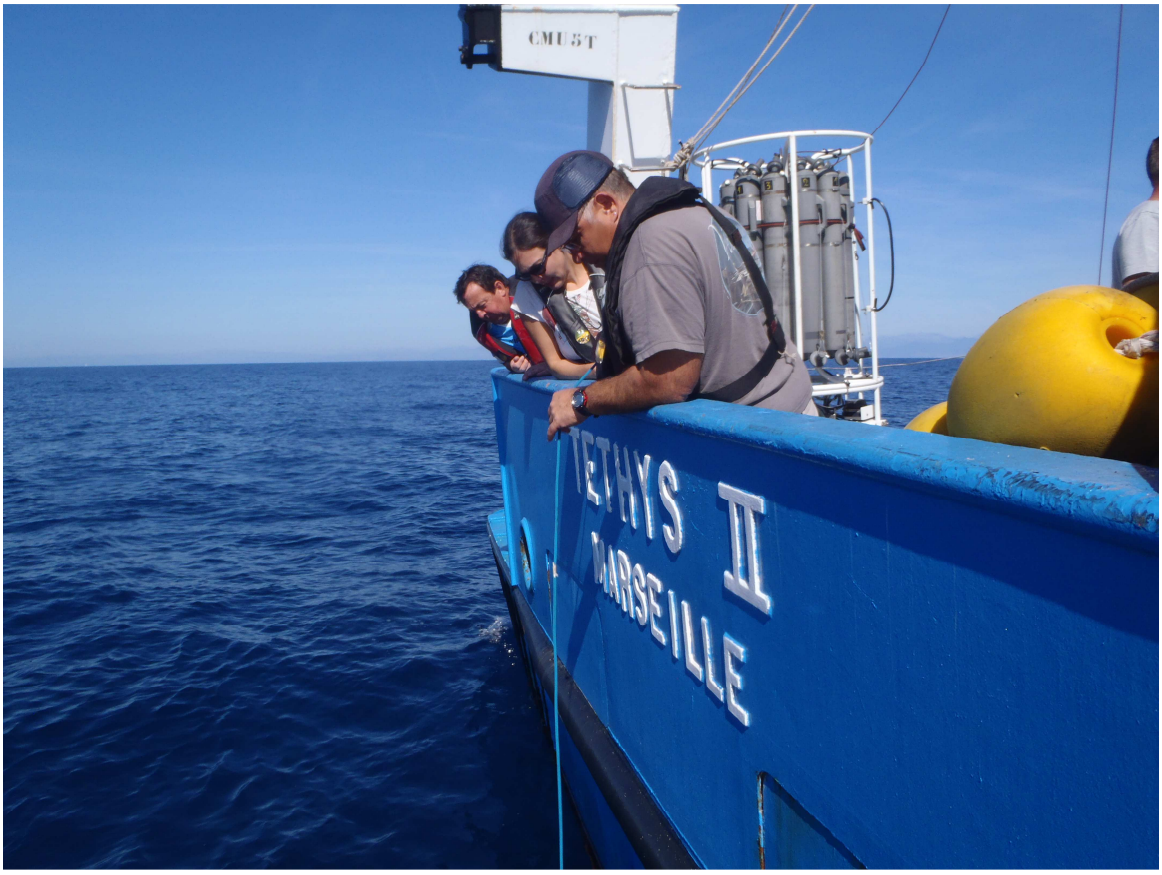
BOUSSOLE Monthly Cruise Report

Cruise 163
September 21–24, 2015

Duty Chief: Melek Golbol
Vessel: R/V Téthys II
(Captain: Dany Deneuve)

Science Personnel: Sophie Collet, Guillaume De Liège, Emilie Diamond, Melek Golbol, Didier Robin, Collin Roesler and Vincenzo Vellucci.

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



Measurement of the water transparency with the Secchi disk at the BOUSSOLE site from the deck of the R/V *Téthys II*.

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

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). 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

The first day, a deep CTD cast at the DYFAMED site was performed for the MOOSE DYFAMED program.

Cruise Summary

The first day was used for the usual diving operations and maintenance on the BOUSSOLE buoy. This day was also used to download data from the buoy and to perform a CTD cast with water sampling, optical profiles, Secchi disk and CIMEL measurements. Then, we went to the DYFAMED site in order to perform a deep CTD cast. The second day, the transect was completed from the Nice harbour to the BOUSSOLE site. When arrived at BOUSSOLE, 1 CTD cast with water sampling and 1 Secchi disk were performed. The optical profiles could not be performed this day because the nebulosity conditions were not optimal (overcast sky). The third day was cancelled because of bad weather forecasts.
The last day programmed for the MOOSE DYFAMED program was also used for the BOUSSOLE operations. Optical profiles, CIMEL measurements and a Secchi disk were performed at the BOUSSOLE site. The CTD cast could not be performed because of bad weather conditions (heavy swell).

Monday 21 September 2015

The sea state was slight 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 take pictures and to perform dark measurements of the transmissiometers and the backscattering meters. Buoy data were downloaded directly using the cable available on top of the buoy. Only pCO2 data at 10m were downloaded using the telemetry cable affixed on the top of the buoy. Sensors, solar panels and ARGOS and CISCO connectors were cleaned. In the meantime, a Secchi disk was performed. Then, a CTD cast with water sampling, 3 C-OPS profiles and 3 CIMEL measurements were performed at the BOUSSOLE site. After the work at BOUSSOLE was completed, we went to the DYFAMED station to perform a deep CTD cast with water sampling.

Tuesday 22 September 2015

The sea state was calm with a light breeze on the morning and a gentle breeze on the afternoon. The sky was overcast and the visibility was good. It was decided to perform the CTD transect from the Nice harbour to the BOUSSOLE site because the weather forecast indicated bad conditions in the afternoon. At station 05, an IOP cast with a cap installed on the backscattering meter for dark measurements was performed before the CTD cast acquisition. When arrived at BOUSSOLE, a CTD cast with water sampling and a Secchi disk were performed.

Wednesday 23 September 2015

Bad weather prevented departure from the Nice harbour.

Thursday 24 September 2015

This day was programmed for MOOSE DYFAMED operations but we used this day to perform also operations for the BOUSSOLE program. The sea state was moderate with a light breeze. The sky was blue and the visibility was excellent. The buoy was completely underwater because of strong currents. 3 C-OPS profiles, 3 CIMEL measurements and a Secchi disk were performed at the BOUSSOLE site. A deployment of the CTD was attempted but cancelled because there was too much swell and it would have been dangerous to deploy the instrument.

Pictures taken during this cruise can be found at:
https://plus.google.com/photos/114686870380724925974/albums/6209912705172610113?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 21 September 2015 (UTC)

People on board: Sophie Collet, Guillaume De Liège, Emilie Diamond, Melek Golbol, Didier Robin, Collin Roesler and Vincenzo Vellucci.

0550 Departure from the Nice harbour.
0915 Arrival at the BOUSSOLE site.

0930 Diving on the BOUSSOLE buoy: cleaning of the sensors, performing dark measurements, taking pictures.
0950 Secchi 01, 24 m.
1000 Direct connection with the buoy and data retrieval. Downloading of pCO2 data at 10m depth. Cleaning of solar panels and surface sensors.
1120 CTD 01, 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, TA/TC, O_2 and TSM.
1135 CIMEL 01, 02, 03.
1205 C-OPS 01, 02, 03.
1300 Departure to the DYFAMED site.
1325 Arrival at the DYFAMED site.
1330 Deep CTD cast, 2300m for MOOSE program.
1510 Departure to the Nice harbour.
1800 Arrival at the Nice harbour.

Tuesday 22 September 2015 (UTC)

People on board: Melek Golbol and Collin Roesler.

0430 Departure from the Nice harbour.
0505 Arrival at the sixth station transect.
0510 CTD 02, 400 m, station 06 (43°39'N 07°21'E).
0600 Dark Hydroscat-6, 50 m, station 05 (43°37'N 07°25'E).
0610 CTD 03, 400 m, station 05.
0710 CTD 04, 400 m, station 04 (43°34'N 07°31'E).
0810 CTD 05, 400 m, station 03 (43°31'N 07°37'E).
0905 CTD 06, 400 m, station 02 (43°28'N 07°42'E).
1000 CTD 07, 400 m, station 01 (43°25'N 07°48'E).
1105 CTD 08, 400 m with water sampling at 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, a_p and TSM.
1145 Secchi 02, 19 m.
1200 Departure to the Nice harbour.
1600 Arrival at the Nice harbour.

Wednesday 23 September 2015 (UTC)

Bad weather prevented departure from the Nice harbour.

Thursday 24 September 2015 (UTC)

People on board: Emilie Diamond and Melek Golbol.

0715 Departure from the Nice harbour.
1045 Arrival at the BOUSSOLE site.
1110 C-OPS, 07, 08, 09.
1210 Attempt of CTD deployment: cancelled.
1225 Secchi 03, 19 m.
1230 CIMEL 04, 05, 06.
1300 Departure to the Nice harbour.
1630 Arrival at the Nice harbour.

Problems identified during the cruise

- The second day, the CTD transect was performed starting from Nice because the weather was expected to worsen on the afternoon.

- Only pCO2 data at 10 m were downloaded during this cruise because the pCO2 CARIOCA sensor at 3 m depth was not functioning. So we have sampled the TA/TC parameters only at 10 m depth.

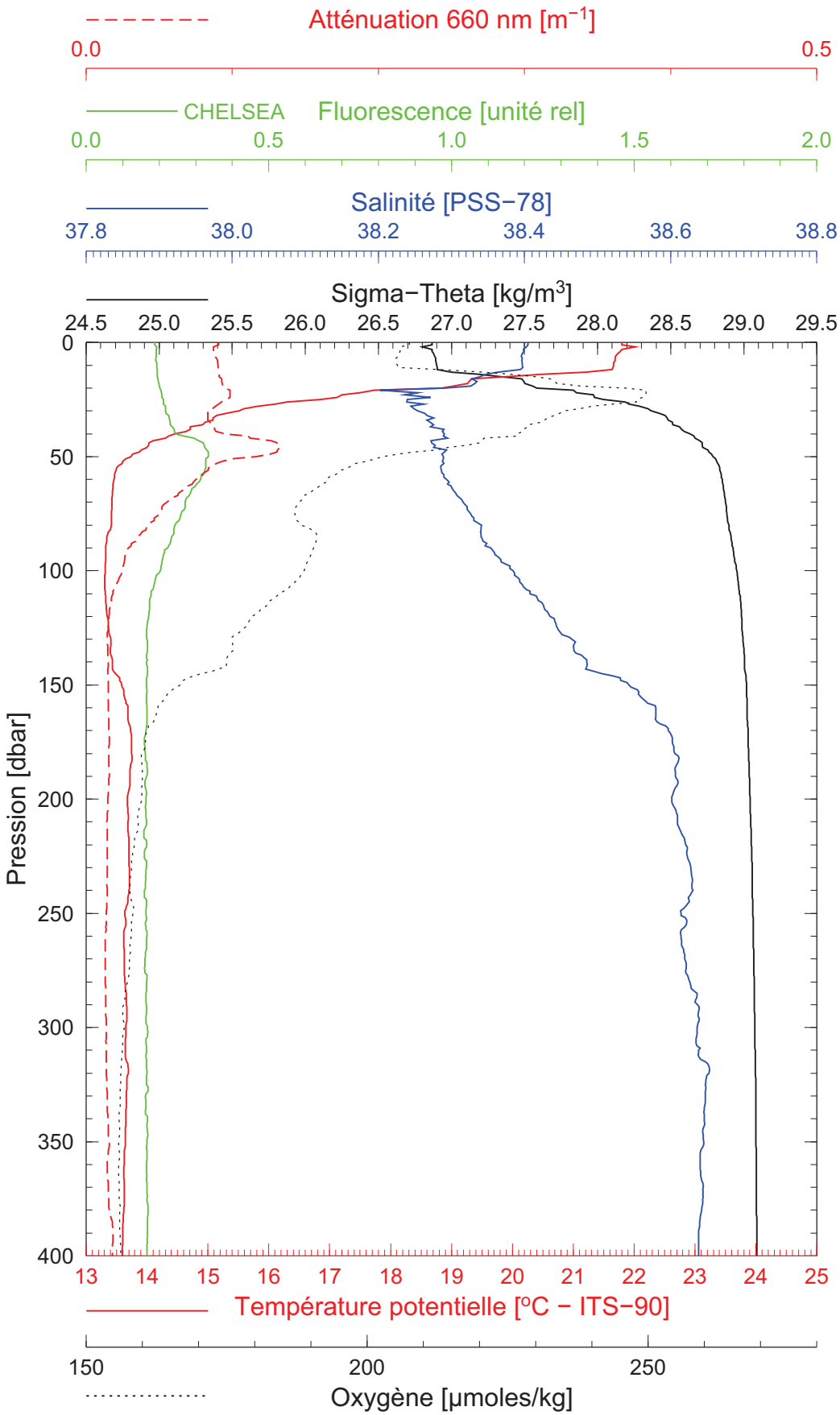
Appendices

Cruise Summary Table for Boussole 163

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
21/09/15				Secchi01	09:50	4:00	24	43	22	7	54	blue		1	5	217	1015.4	81	excellent	21.3	22.50	calm	0.5		
			CTDBOUS001	HPLC, Ap, CDOM, TA/TC, O2 & TSM	11:19	37:00	400	43	21.931	7	53.885	blue		0	6	97	1014.9	80		21.1	21.69	calm			
				CIMEL01	11:32	5:00		43	21.915	7	53.817	blue		0			1014.7								
				CIMEL02	11:40	4:00		43	21.915	7	53.817	blue		0			1014.6								
				CIMEL03	11:47	3:00		43	21.915	7	53.817	blue		0			1014.6								
		bou_c-ops_150921_1103_001_data.csv			12:09	3:42	95	43	22.180	7	53.736	blue	none	0	7	199	1014.4	73	excellent	22.6		calm	0.6		no
		bou_c-ops_150921_1103_002_data.csv			12:21	3:29	88	43	22.401	7	53.413	blue	none	0	7	199	1014.4	73	excellent	22.6		calm	0.6		no
		bou_c-ops_150921_1103_003_data.csv			12:31	3:28	88	43	22.580	7	53.109	blue	none	0	7	199	1014.4	73	excellent	22.6		calm	0.6		no
22/09/15			CTDBOUS002		05:10	26:00	400	43	38.984	7	21.057	blue		3	2	49	1010.9	77		19.5	22.95	calm			
			CTDBOUS003		06:09	20:00	400	43	36.973	7	24.828	cloudy		4	3	42	1010.9	71		20.4	22.96	calm			
			CTDBOUS004		07:08	20:00	400	43	33.968	7	30.870	blue		3	2	37	1011.0	73		20.3	22.96	calm			
			CTDBOUS005		08:08	19:00	400	43	30.966	7	36.954	cloudy		4	2	314	1010.9	71		20.9	22.83	calm			
			CTDBOUS006		09:03	20:00	400	43	28.009	7	41.940	overcast		6	4	259	1011.0	74		20.4	22.21	calm			
			CTDBOUS007		10:03	19:00	400	43	25.039	7	47.978	overcast		7	6	251	1010.8	73		20.9	22.05	calm			
			CTDBOUS008	HPLC, Ap & TSM	11:14	30:00	400	43	22.236	7	54.065	overcast		7	9	232	1010.3	74		20.7	22.16	calm			
				Secchi02	11:45	4:00	19	43	22	7	54	overcast		7								calm			
23/09/15	Bad weather																								
24/09/15		bou_c-ops_150924_1040_001_data.csv			11:08	3:52	98	43	22.791	7	53.454	blue	none	0	4	258	1013.3	51	excellent	21.2		moved	1.2		no
		bou_c-ops_150924_1040_003_data.csv			11:20	3:51	99	43	22.069	7	53.193	blue	none	0	4	258	1013.3	51	excellent	21.2		moved	1.2		no
		bou_c-ops_150924_1040_004_data.csv			11:32	3:34	93	43	22.354	7	52.951	blue	none	0	4	258	1013.3	51	excellent	21.2		moved	1.2		no
				Secchi03	12:25	4:00	19	43	22	7	54	blue		0								moved			
				CIMEL04	12:30	5:00		43	22.539	7	53.632	blue		0			1013.5								
				CIMEL05	12:37	4:00		43	21.915	7	53.817	blue		0			1013.4								
				CIMEL06	12:43	4:00		43	21.915	7	53.817	blue		0			1013.5								

BOUSSOLE 163 **21/09/2015** **BOUS150921_01**

BOUS001

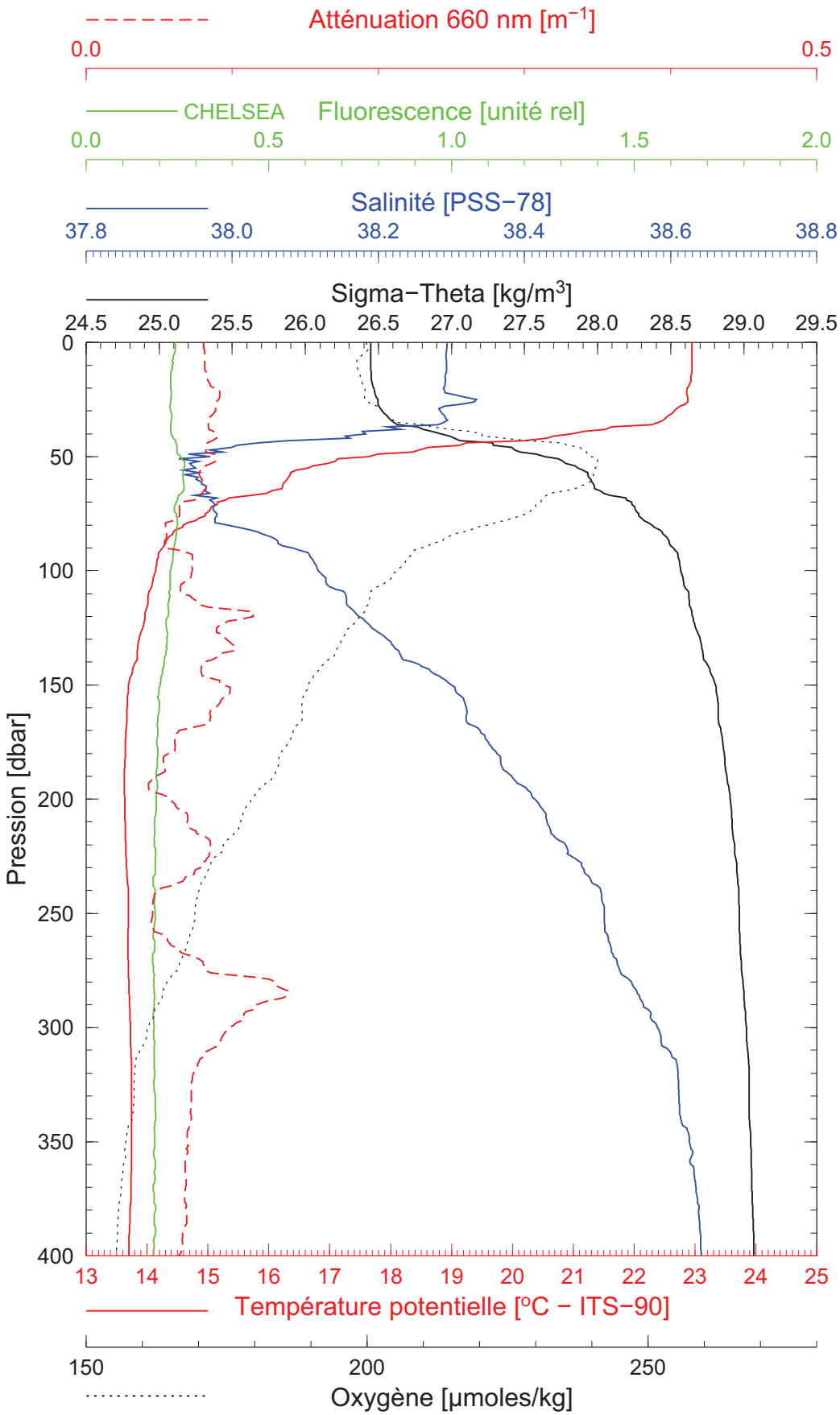


Date *21/09/2015* *Latitude* *43°21.931 N*

Heure déb *11h 19min [TU]* *Longitude* *07°53.885 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_01**

BOUS002

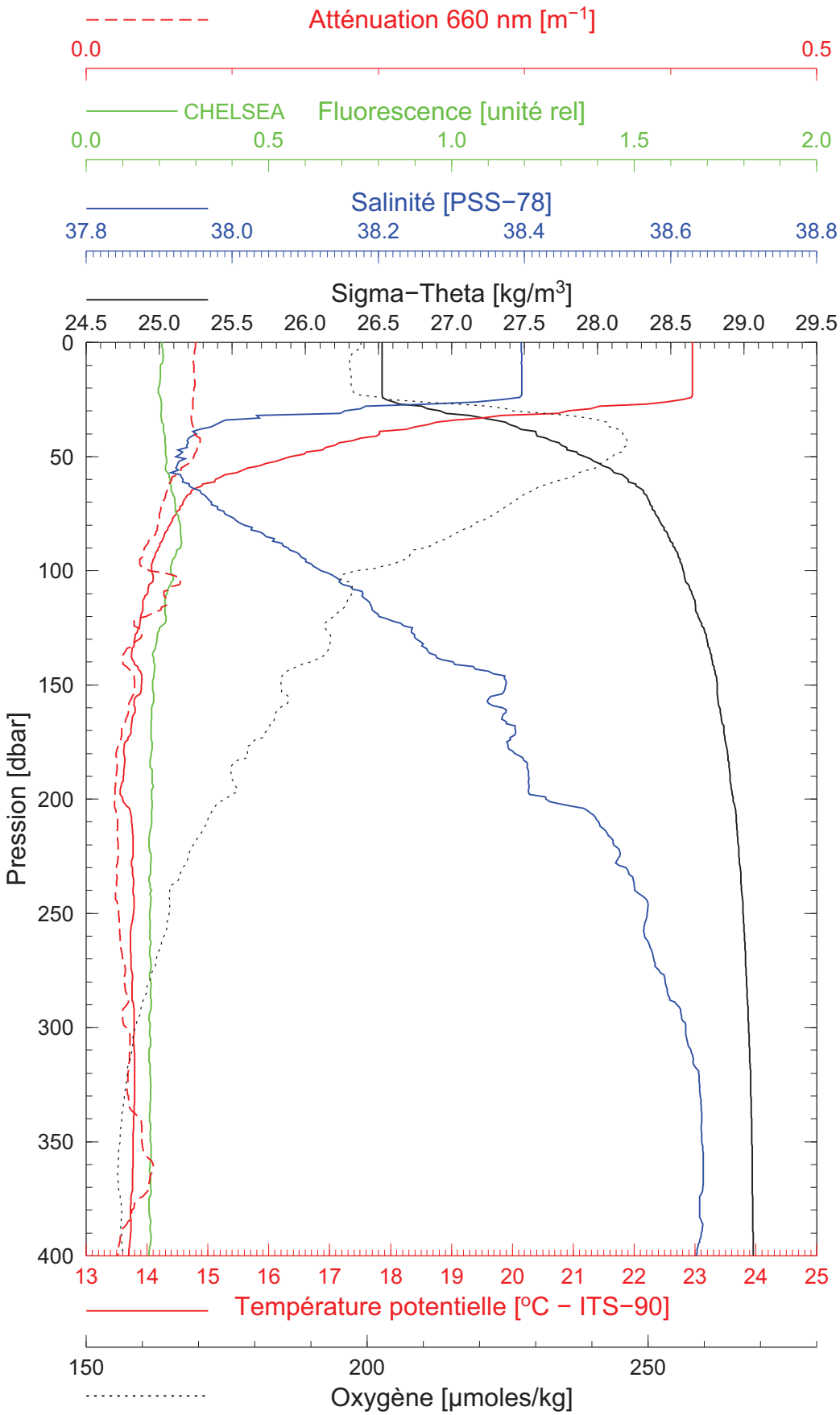


Date *22/09/2015* *Latitude* *43°38.984 N*

Heure déb *05h 10min [TU]* *Longitude* *07°21.057 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_02**

BOUS003

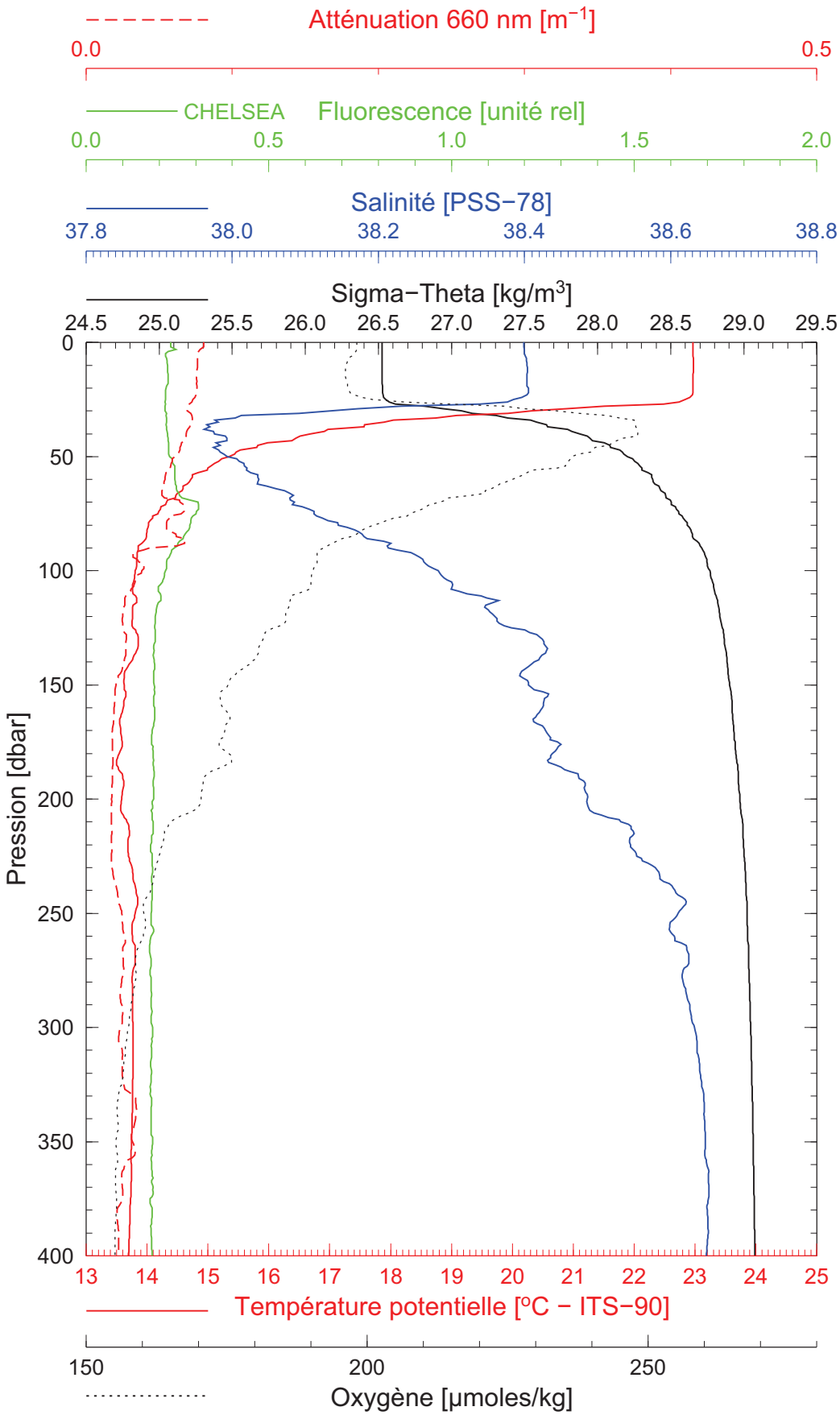


Date *22/09/2015* *Latitude* *43°36.973 N*

Heure déb *06h 09min [TU]* *Longitude* *07°24.828 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_03**

BOUS004

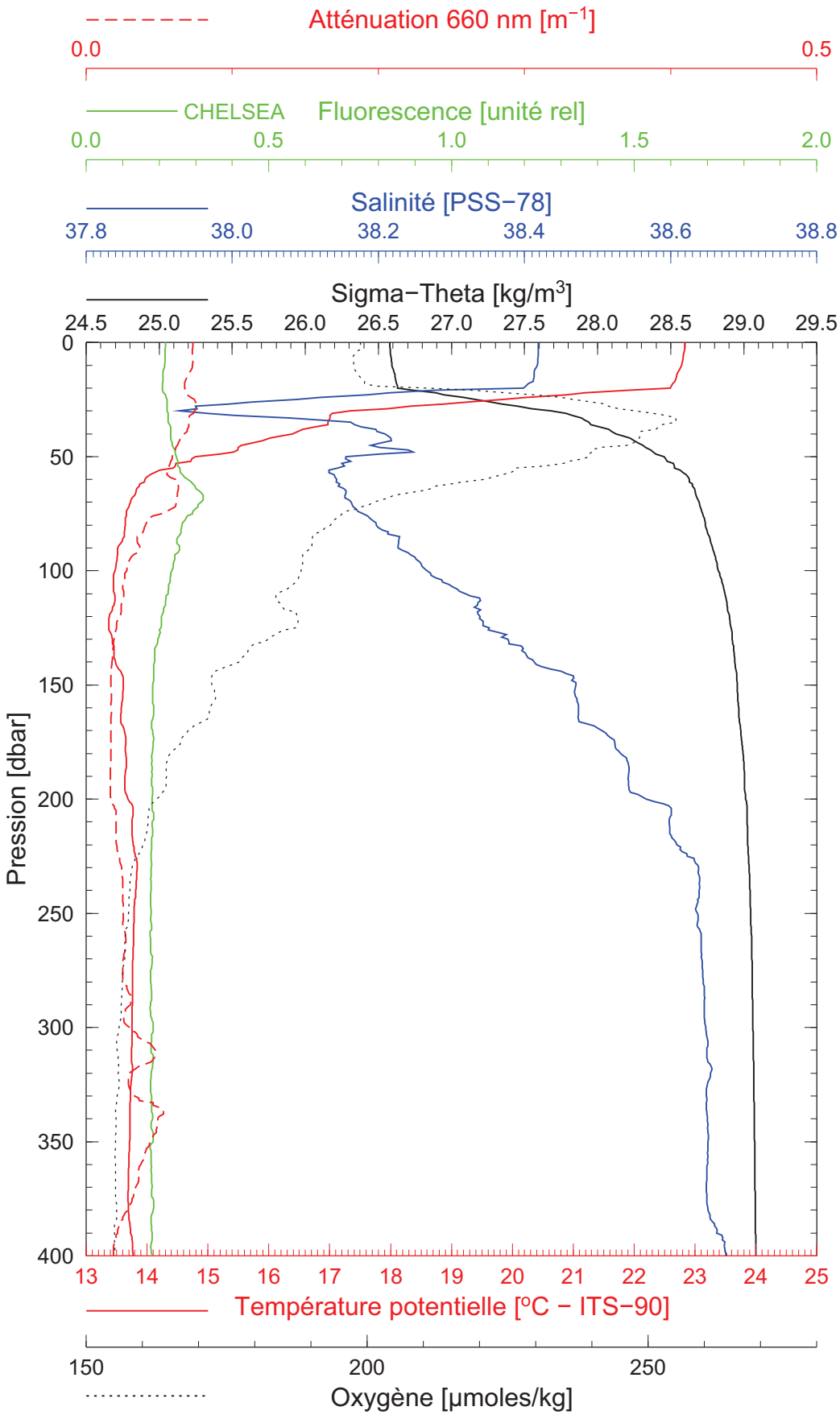


Date *22/09/2015* *Latitude* *43°33.968 N*

Heure déb *07h 08min [TU]* *Longitude* *07°30.870 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_04**

BOUS005

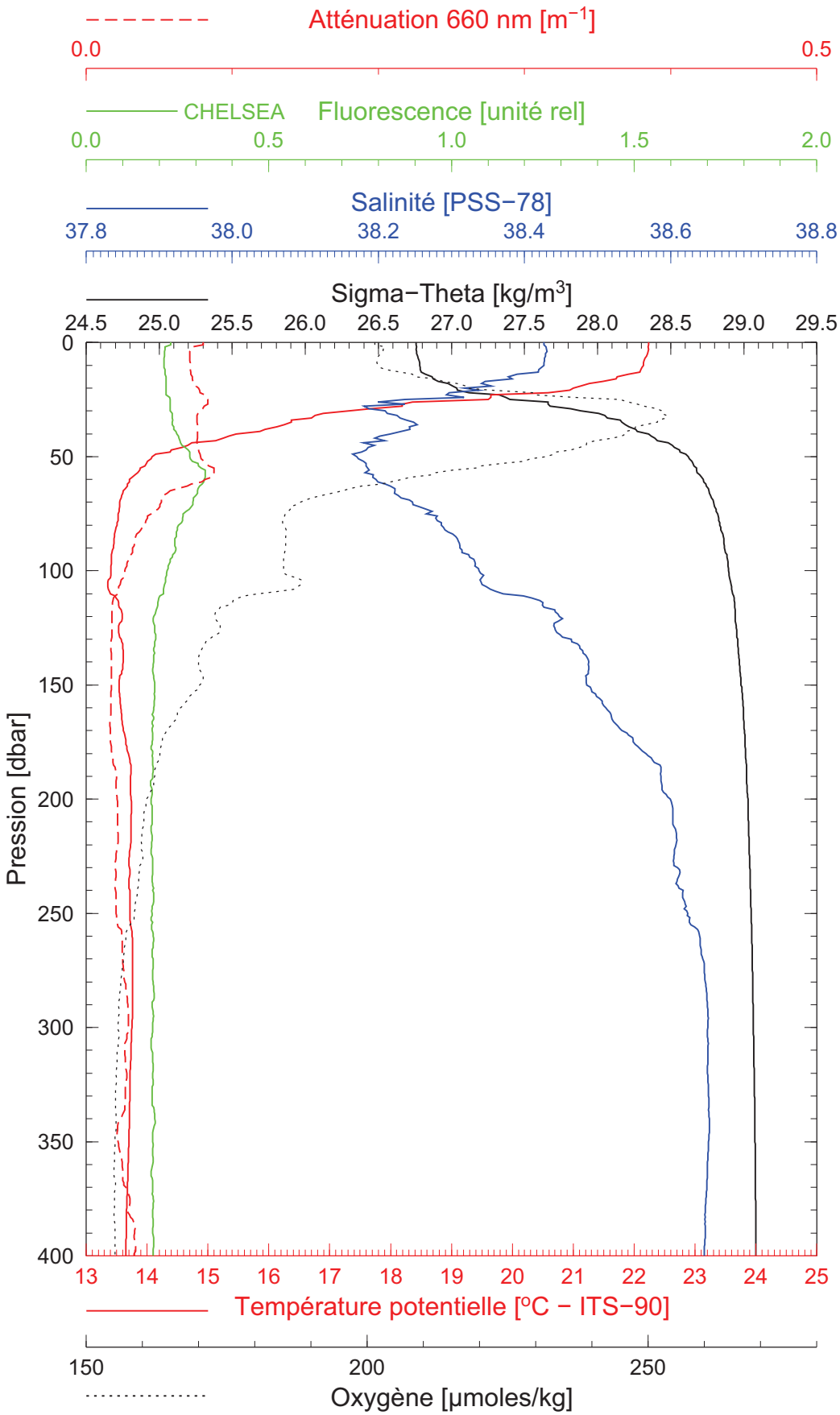


Date *22/09/2015* *Latitude* *43°30.966 N*

Heure déb *08h 08min [TU]* *Longitude* *07°36.954 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_05**

BOUS006

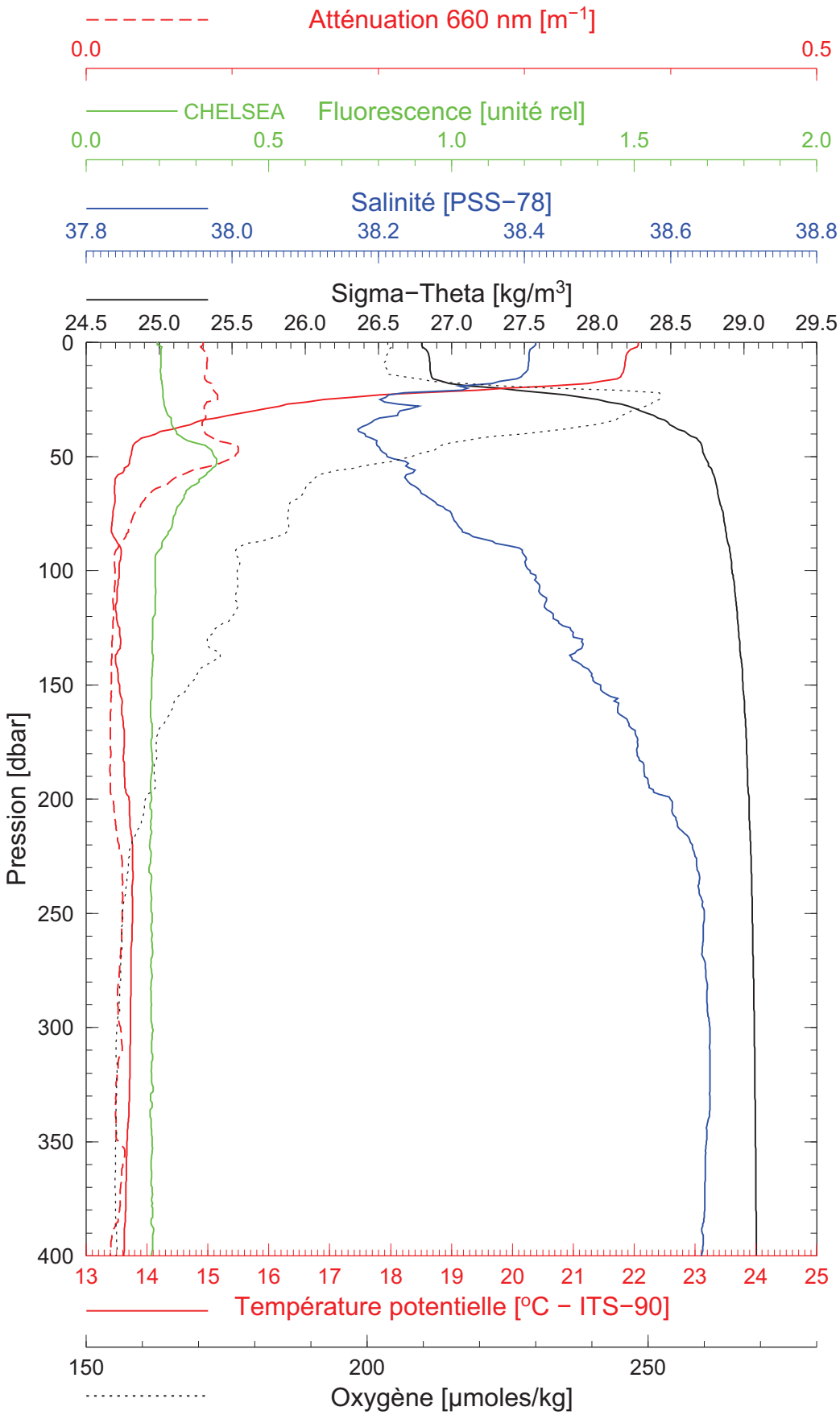


Date *22/09/2015* *Latitude* *43°28.009 N*

Heure déb *09h 03min [TU]* *Longitude* *07°41.940 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_06**

BOUS007

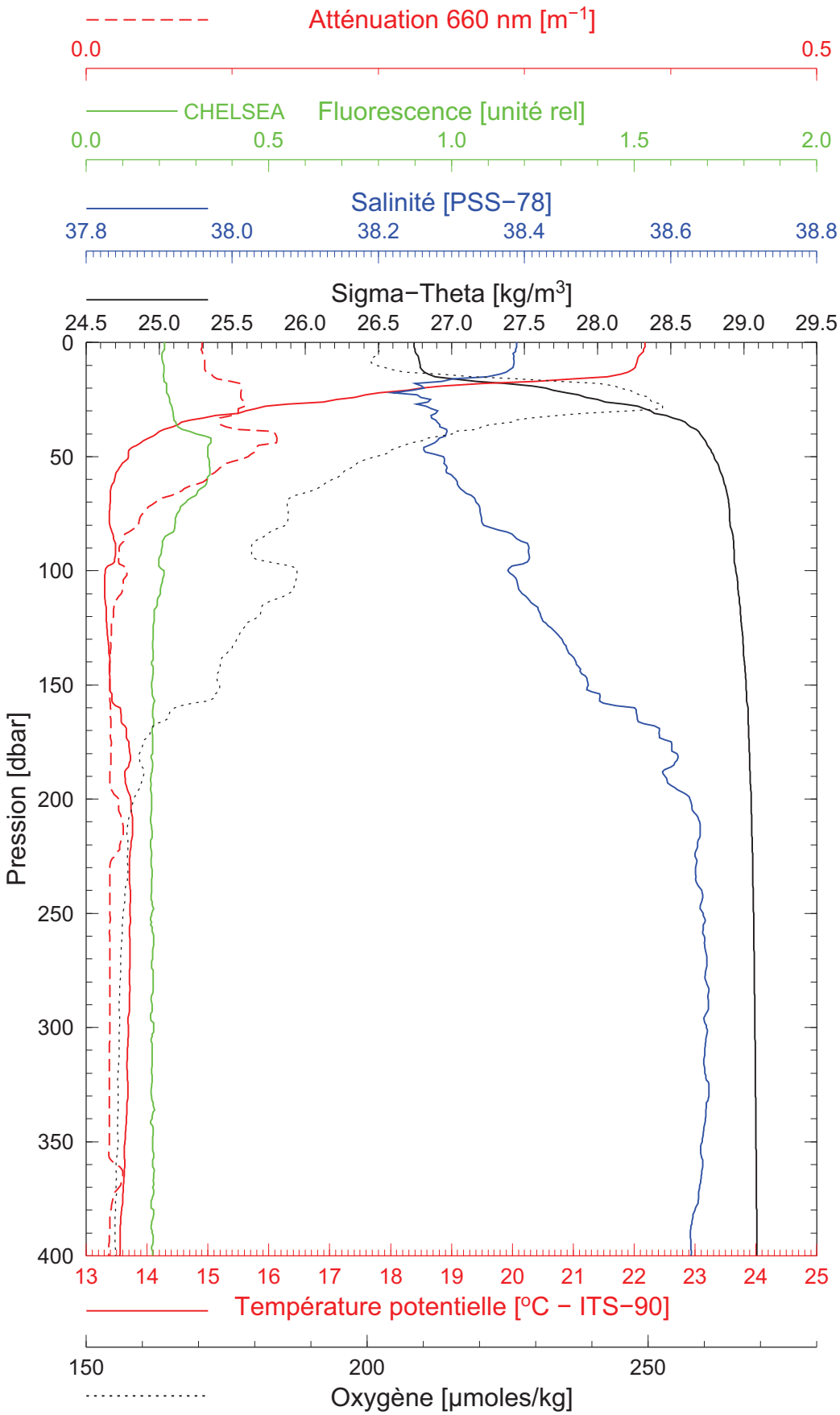


Date *22/09/2015* *Latitude* *43°25.039 N*

Heure déb *10h 03min [TU]* *Longitude* *07°47.978 E*

BOUSSOLE 163 **22/09/2015** **BOUS150922_07**

BOUS008



Date *22/09/2015* *Latitude* *43°22.238 N*

Heure déb *11h 14min [TU]* *Longitude* *07°54.065 E*