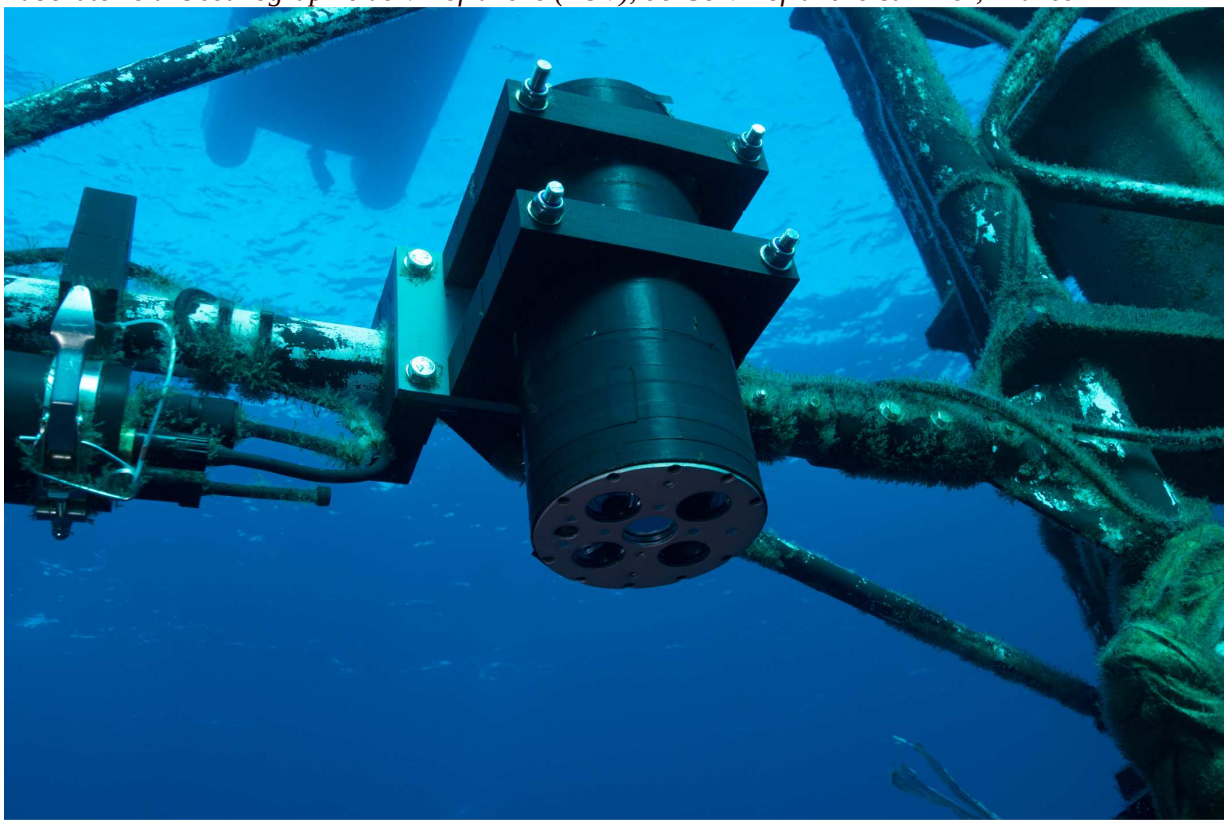
# BOUSSOLE Monthly Cruise Report

## Cruise 190
## December 05-07, 2017

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

Science Personnel: Guillaume De Liège, David Luquet, Melek Golbol, Judicaël Rivier, Eduardo Soto Garcia and Vincenzo Vellucci.

*Laboratoire d'Océanographie de Villefranche (LOV), 06230 Villefranche-sur-Mer, France*



The backscattering meter (*Hobilabs*, HS4) installed on the BOUSSOLE buoy at 9 m depth, measuring $b_{bp}$ at four wavelengths (442, 488, 555, 620 nm).

**BOUSSOLE project**

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

*December 19, 2017*

# 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 (5 m and 10 m) 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

Water samples for cytometry analysis were collected at 10 m depth in the frame of a collaboration with Collin Roesler (Bowdoin College, Maine, USA), about the installation of an ECO 3X1M multi-channel fluorimeter on the BOUSSOLE buoy at 9 m depth.

The DACNet (Data Acquisition and Control Network) was removed from the buoy by the divers because the buoy was not working. It was reinstalled on the buoy after changing the Microdrive. The optode at 10m depth was replaced with a newly calibrated one.

# Cruise Summary

The first day was used to perform diving operations with maintenance of the buoy, for CTD casts with water sampling, for CIMEL measurements, for optical profiles and for a Secchi disk at the BOUSSOLE site. The second day was used for optical profiles, for buoy surface maintenance, for CTD casts with water sampling, and for a Secchi disk at the BOUSSOLE site. The last day, bad weather prevented the departure from the Nice harbour.

## Tuesday 05 December 2017

The sea state was slight with a gentle breeze. The sky was blue and the visibility was excellent. When arrived at the BOUSSOLE site, divers went at sea to remove the DACNet from the buoy for its maintenance on board. The Microdrive was replaced. Then, the DACNet was reinstalled during a second dive. The optode at 10 m depth was replaced with a newly calibrated one. Divers also cleaned the sensors and took pictures of the buoy. Surface sensors, solar panels and ARGOS connector were cleaned on the top of the buoy. Then, 2 CTD casts were performed with water sampling. For the first cast, a cap was put on the Hydroscat-6 for dark measurements and a 0.2 µm filter on the a-Sphere absorption meter for the dissolved mater absorption measurements. Finally, 3 CIMEL measurements, 3 C-OPS profiles and a Secchi disk were performed at the BOUSSOLE site before returning to the Nice harbour.

## Wednesday 06 December 2017

The sea state was slight with a moderate breeze. The sky was overcast and the visibility was good. Firstly, 3 C-OPS profiles were performed. Then, the downloading of buoy data from the surface of the buoy was attempted in order to check the well-functioning of the buoy but failed. Then, 2 CTD cast with water sampling were performed. The second one was performed with 0.2 µm filter on the a-Sphere absorption meter for the dissolved mater absorption measurements. Finally, a Secchi disk was performed before returning to the Nice harbour.

## Thursday 07 December 2017

Bad weather prevented departure from the Nice harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/I1tbOzeRX4y82KU93

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

# Cruise Report

## Tuesday 05 December 2017 (UTC)

People on board: Guillaume De Liège, David Luquet, Melek Golbol, Judicaël Rivier, Eduardo Soto Garcia and Vincenzo Vellucci.

| | |
|---|---|
| 0635 | Departure from the Nice harbour. |
| 0950 | Arrival at the BOUSSOLE site. |
| 1000 | Diving operations: removing and reinstallation of the DACNet, replacement of the optode at 10 m, cleaning sensors, pictures. |
| | Cleaning of surface sensors, ARGOS connector and solar panels. |
| 1100 | Lunch. |
| 1200 | CTD 01, 400 m with water sampling at 10 and 5 m for TSM (with 0.2 µm filter on a-Sphere and cap on HS-6). |
| 1240 | 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 $a_p$. |
| 1235 | CIMEL 01, 02, 03. |
| 1315 | C-OPS 01, 02, 03. |
| 1350 | Secchi 01, 22 m. |
| 1400 | Departure to the Nice harbour. |
| 1700 | Arrival at the BOUSSOLE site. |

## Wednesday 06 December 2017 (UTC)

People on board: Melek Golbol and Eduardo Soto Garcia.

| | |
|---|---|
| 0630 | Departure from the Nice harbour. |
| 0950 | Arrival at the BOUSSOLE site. |

0955 C-OPS 04, 05, 06.
1040 Attempt of downloading data from the top of the buoy: failed.
1130 CTD 03, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, $a_p$ and cytometry.
1200 Lunch, filtrations.
1255 CTD 01, 400 m with water sampling at 10 and 5 m for $O_2$, TA/TC and TSM (with 0.2 µm filter on a-Sphere)
1320 Secchi 01, 18 m.
1325 Departure to the Nice harbour.
1630 Arrival at the BOUSSOLE site.

### Thursday 07 December 2017

Bad weather prevented departure from the Nice harbour.

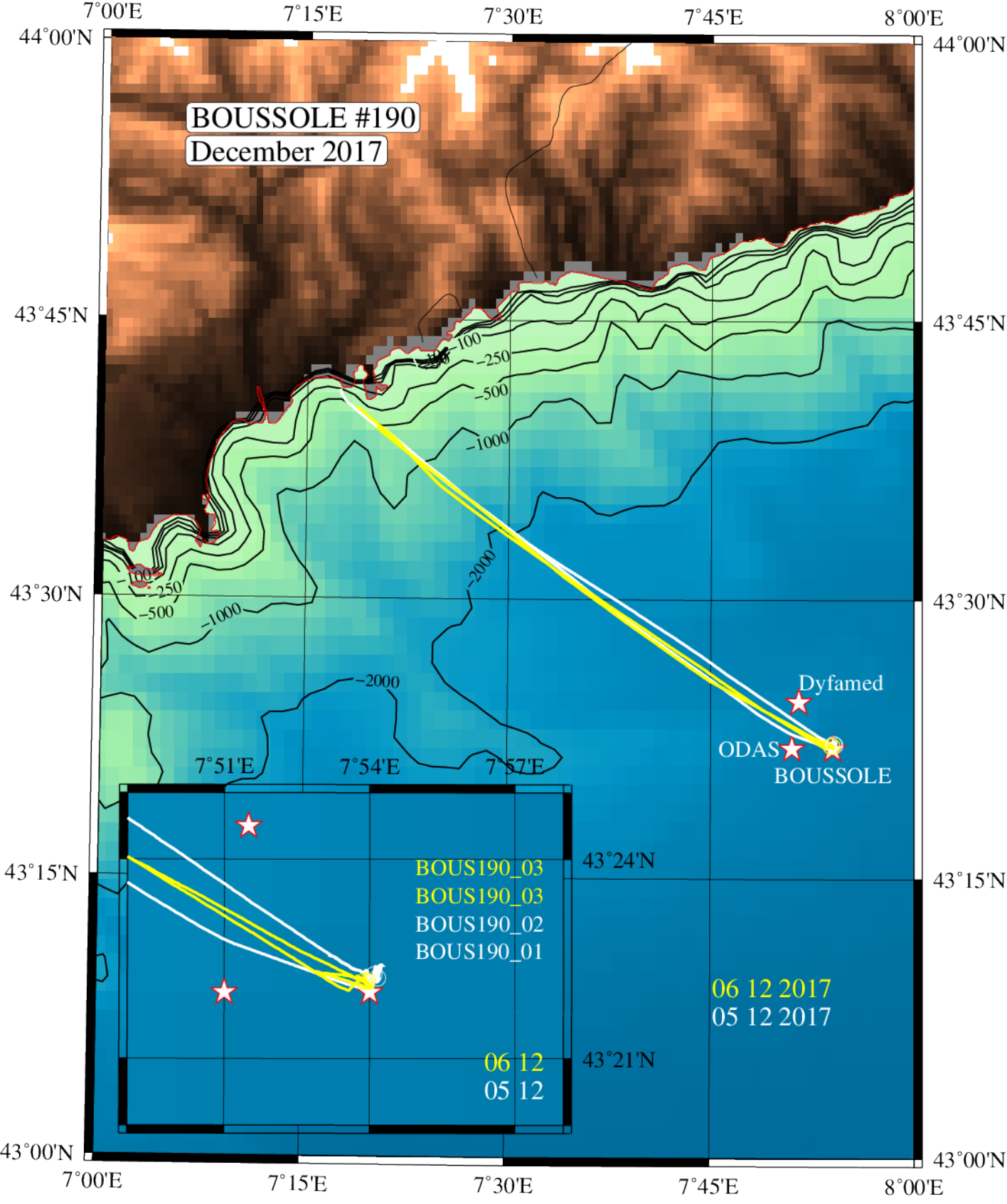
## Problems identified during the cruise

- Buoy data could not be downloaded the second day: it was probably due to the lacking of one of the solar panels. The sky was overcast and maybe the buoy was not functioning because there was not enough energy in the battery. The solar panel could not be replaced during this cruise because for the moment, we had not another one in spare in the lab.

# Appendices

Cruise Summary Table for Boussole 190

| 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 |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 05/12/17 | | | BOUS190_01 | TSM | 12:05 | 19:00 | 400 | 43 | 22.258 | 7 | 54.089 | blue | | 2 | 7 | 200 | 1032.8 | 70 | | 13.1 | 15.00 | calm | | | |
| | | | BOUS190_02 | HPLC & Ap | 12:38 | 26:00 | 400 | 43 | 22.212 | 7 | 54.167 | blue | | 2 | 7 | 216 | 1032.8 | 64 | | 13.3 | 15.08 | calm | | | |
| | | | | CIMEL01 | 12:37 | 3:00 | | 43 | 22 | 7 | 54 | blue | | 0 | | | 1032.7 | | | | | | | | |
| | | | | CIMEL02 | 12:41 | 4:00 | | 43 | 22 | 7 | 54 | blue | | 0 | | | 1032.7 | | | | | | | | |
| | | | | CIMEL03 | 12:45 | 3:00 | | 43 | 22 | 7 | 54 | blue | | 0 | | | 1032.7 | | | | | | | | |
| | | bou_c-ops_171205_1249_001_data.csv | | | 13:15 | 4:34 | 110 | 43 | 22.245 | 7 | 54.008 | blue | None | 0 | 8 | 210 | 1032..5 | 67 | excellent | 13.3 | | calm | 0.7 | | no |
| | | bou_c-ops_171205_1249_002_data.csv | | | 13:26 | 4:56 | 121 | 43 | 22.231 | 7 | 53.756 | blue | None | 0 | 8 | 210 | 1032..5 | 67 | excellent | 13.3 | | calm | 0.7 | | no |
| | | bou_c-ops_171205_1249_003_data.csv | | | 13:36 | 4:45 | 117 | 43 | 22.406 | 7 | 53.535 | blue | None | 0 | 8 | 210 | 1032..5 | 67 | excellent | 13.3 | | calm | 0.7 | | no |
| | | | | Secchi01 | 13:50 | 4:00 | 22 | 43 | 22 | 7 | 54 | blue | | 0 | | | | | excellent | | | calm | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 06/12/17 | | bou_c-ops_171206_0920_001_data.csv | | | 09:59 | 4:01 | 98 | 43 | 22.166 | 7 | 53.909 | overcast | St | 8 | 11 | 225 | 1034.6 | 60 | good | 12.7 | | calm | 0.7 | | no |
| | | bou_c-ops_171206_0920_002_data.csv | | | 10:09 | 4:07 | 103 | 43 | 22.232 | 7 | 53.614 | overcast | St | 8 | 11 | 225 | 1034.6 | 60 | good | 12.7 | | calm | 0.7 | | no |
| | | bou_c-ops_171206_0920_003_data.csv | | | 10:19 | 3:45 | 93 | 43 | 22.265 | 7 | 53.310 | overcast | St | 8 | 11 | 225 | 1034.6 | 60 | good | 12.7 | | calm | 0.7 | | no |
| | | | BOUS190_03 | HPLC, Ap & Cyto | 11:30 | 27:00 | 400 | 43 | 22.164 | 7 | 53.879 | overcast | | 8 | 10 | 203 | 1033.9 | 69 | | 12.7 | 14.77 | calm | | | |
| | | | BOUS190_04 | TA/TC, $O_2$ & TSM | 12:54 | 19:00 | 400 | 43 | 22.156 | 7 | 53.958 | overcast | | 8 | 10 | 210 | 1033.3 | 71 | | 12.6 | 14.70 | calm | | | |
| | | | | Secchi02 | 13:20 | 4:00 | 18 | 43 | 22 | 7 | 54 | overcast | | 8 | | | | | good | | | calm | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 07/12/17 | Bad weather | | | | | | | | | | | | | | | | | | | | | | | | |

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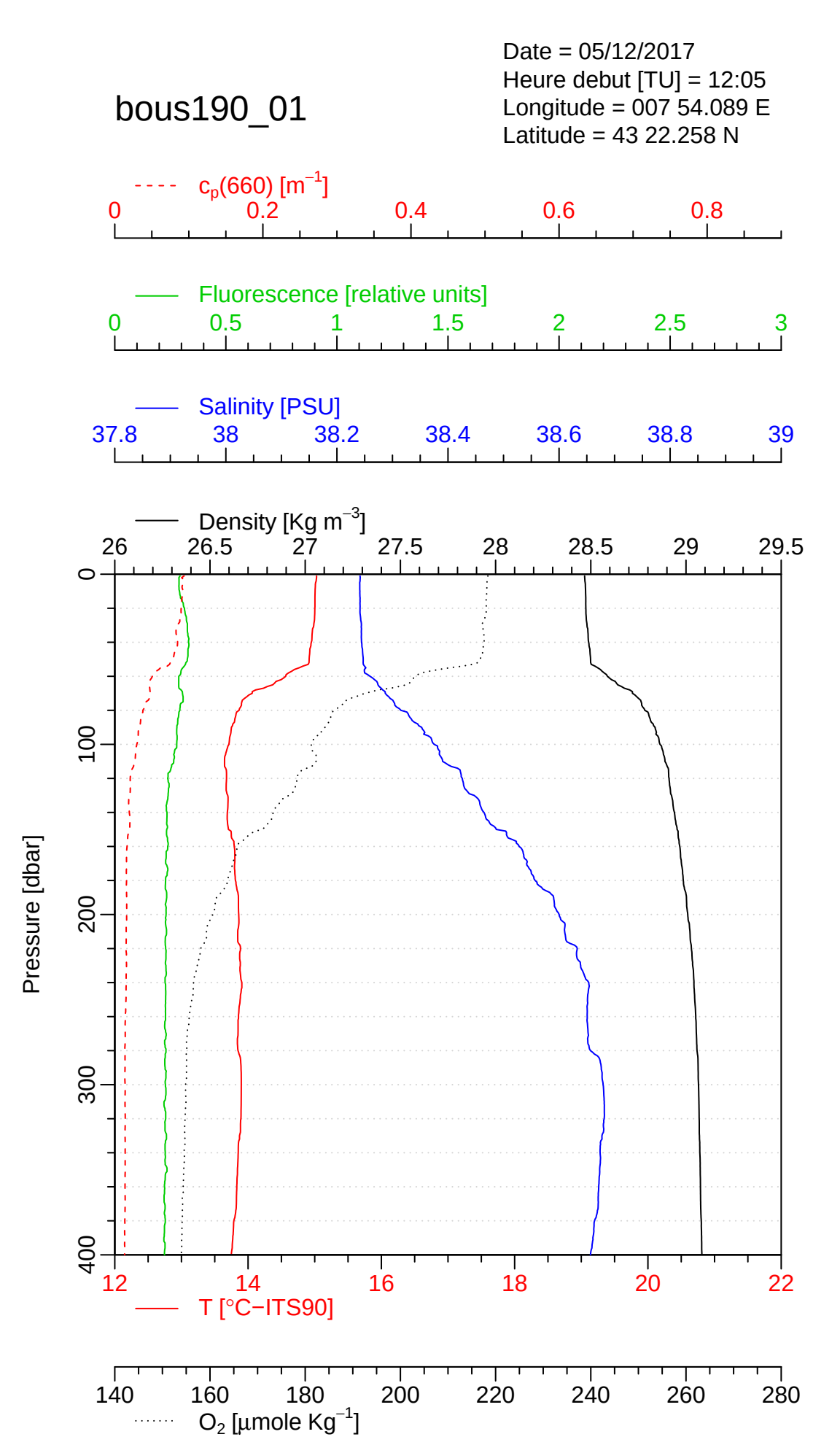
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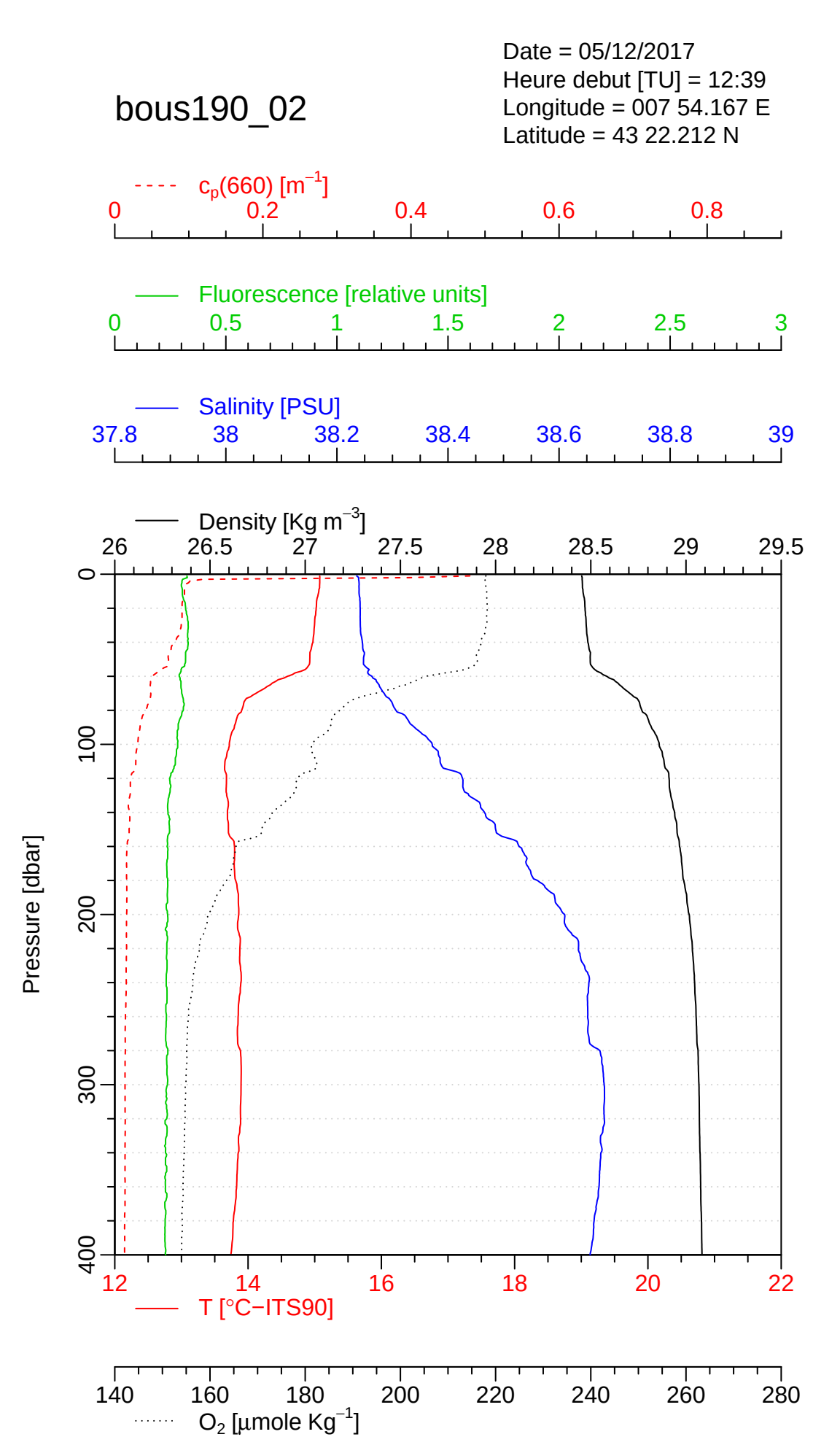
0.2
0.4
0.6
0.8
Fluorescence [relative units]
0
0.5
1
1.5
2
2.5
3
Salinity [PSU]
37.8
38
38.2
38.4
38.6
38.8
39
Density [Kg m−3]
26
26.5
27
27.5
28
28.5
29
29.5
Pressure [dbar]
0
100
200
300
400
12
14
16
18
20
22
T [°C−ITS90]
140
160
180
200
220
240
260
280
O2 [µmole Kg−1]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0.2
0.4
0.6
0.8
Fluorescence [relative units]
0
0.5
1
1.5
2
2.5
3
Salinity [PSU]
37.8
38
38.2
38.4
38.6
38.8
39
Density [Kg m−3]
26
26.5
27
27.5
28
28.5
29
29.5
Pressure [dbar]
0
100
200
300
400
12
14
16
18
20
22
T [°C−ITS90]
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160
180
200
220
240
260
280
O2 [µmole Kg−1]

bous190_03

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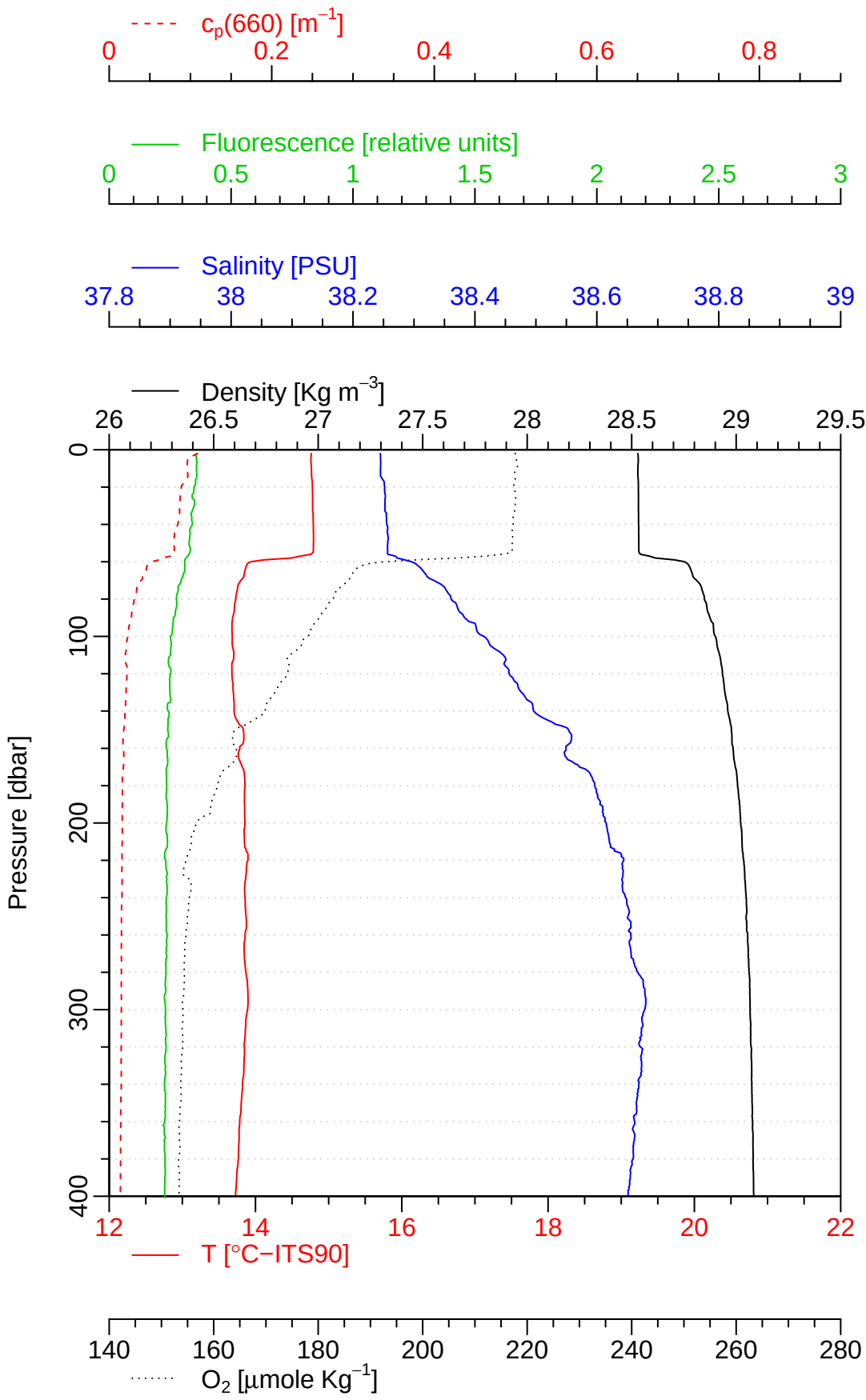

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