# BOUSSOLE Monthly Cruise Report

## Cruise 233
## August 17-18, 2021

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

Science Personnel: Ewen Ancel, Melek Golbol, Flavien Petit and Ruben Tournier Broer.

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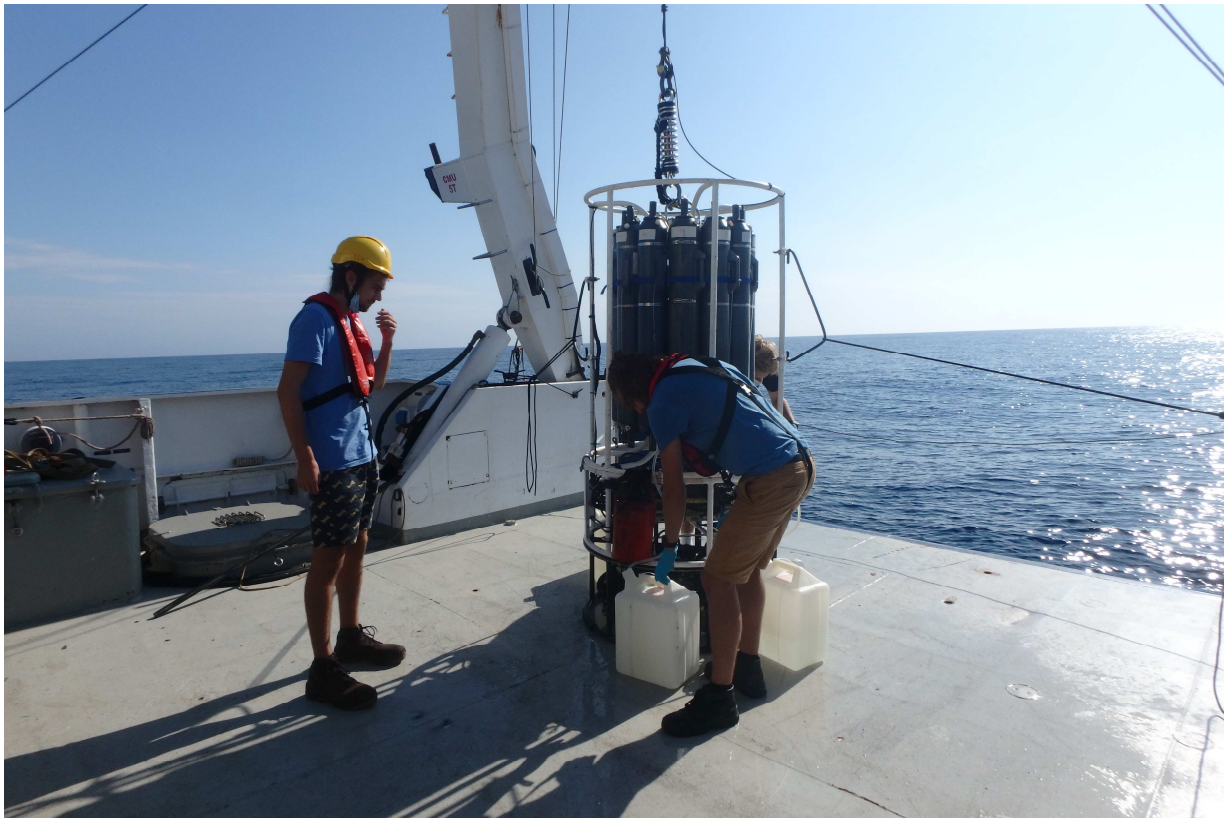

Seawater sampling from the CTD Rosette at the BOUSSOLE site for the metagenomic analyses (EFFICACY ANR project).

**BOUSSOLE project**

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

*August 30, 2021*

# 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


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Sorbonne Université, France


Institut de la Mer de Villefranche, 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), handheld CIMEL sun photometer measurements are to be performed consecutively where possible with C-OPS profiles. If sea conditions are poor but sky is good, handheld 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). A CTD cast including a 0.2 µm filter installed on the inlet tube of the a-Sphere is to be performed once per cruise at the BOUSSOLE site for the dissolved matter absorption measurements. This cast will be stopped at ten depths during 2 or 7 min depending on the depths in order to ensure that the integrating cavity of the a-Sphere be completely filled at each of these depths during the ascent of the CTD.

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 replicate 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 5 m depth for dissolved oxygen (DO), total alkalinity (TA) and total inorganic carbon (TC) analysis (from March 2014). 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 and the two optodes installed on the buoy at 3 m.
Water samples are to be collected at four depths for metagenomic analyses of different types of Synechococcus, cytometry and nutrients (from March 2020). This operation is part of the EFFICACY ANR project in collaboration with the *Roscoff Biological Station.* The aim is to study the distribution of different types of Synechococcus populations characterized by distinct pigmentation and adaptation to the colour of light. It includes two years of cytometry and metagenomic sampling at the BOUSSOLE site.

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

Seawater is to be sampled at 3 depths for micro-, nano- and pico-phytoplankton analysis by microscopy and cytometry. This operation is part of the OBOO (*From Optics to Biodiversity in the world Open Oceans: application to BGC-Argo floats*) LEFE-CYBER (*Les Enveloppes Fluides et l'Environnement – CYcles Biogéochimiques, Environnement et Ressources*) project of the *Marine optics and remote sensing group* of the *Laboratoire d'Océanographie de Villefranche (LOV).* In addition, two sensors were added to the Rosette CTD from September 2020 in the frame of this project: an Eco FLBB2 sensor that measures fluorescence (excitation at 470 nm, emission at 695 nm) and backscattering at 700 nm and an Eco 3X1M sensor that measures multispectral fluorescence (excitation at 440, 470 et 532 nm, emission at 695 nm).

A detection of the DYFAMED mooring with the sounder of the R/V *Téthys II* was attempted during this cruise for the MOOSE program.

# Cruise Summary

Only the second day was used for BOUSSOLE operations due to bad weather the first day. It was used for CTD casts with water sampling, for sun photometer measurements (CIMEL CE317), for optical profiles (C-OPS), for a Secchi disk at the BOUSSOLE site and for the detection of the DYFAMED mooring.

## Tuesday 17 August 2021

Bad weather prevented departure from the Nice harbour.

## Wednesday 18 August 2021

The sea state was slight with a light breeze in the morning and a gentle breeze in the afternoon. The sky was blue, the visibility was good. Firstly, a CTD cast with water sampling was performed at the BOUSSOLE site. A 0.2µm filter was put on the a-Sphere absorption meter for the dissolved matter absorption measurements. The cast was stopped at 10 depths during the ascent of the CTD. In the meantime, three CIMEL measurements were performed. Then two CTD casts with water sampling and three C-OPS profiles were performed at the BOUSSOLE site. Finally, a Secchi disk was performed before the departure to DYFAMED site for the detection of the sub-surface DYFAMED mooring (MOOSE program). This operation failed and we had to return to the Nice harbour because we did not have enough time to continue the detection.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/E66zP9GFQuuB4vSJA

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 17 August 2021

Bad weather prevented departure from the Nice harbour.

## Wednesday 18 August 2021 (UTC)

People on board: Ewen Ancel (student), Melek Golbol, Flavien Petit and Ruben Tournier Broer (student).

0300 Departure to the BOUSSOLE site.
0615 Arrival at the BOUSSOLE site.
0910 CTD 01, 400 m with water sampling at 50, 40, 20 and 5 m for metagenomic, cytometry and nutrients analyses (with a 0.2 µm filter on a-Sphere and with 2 minutes stop at 400, 150 m and 7 minutes stop at 80, 60, 50, 40, 30, 20, 10 and 5 m).
0710 CIMEL 01, 02, 03.
0840 CTD 02, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC, $a_{p,}$ $O_2$ and TA/TC.
1030 CTD 03, 300 m with water sampling at 50, 40 and 5 m for TSM, and phytoplankton microscopy, cytometry, PIC, POC, HPLC (with cap on the HS6).
1115 C-OPS 01, 02, 03.
1200 Secchi 01, 20 m.
1205 Departure to the DYFAMED site.
1235 Arrival to the DYFAMED site.
1240 Start of the mooring detection.
1305 End of the mooring detection.
Departure to the Nice harbour.
1605 Arrival to the Nice harbour.

## Problems identified during the cruise

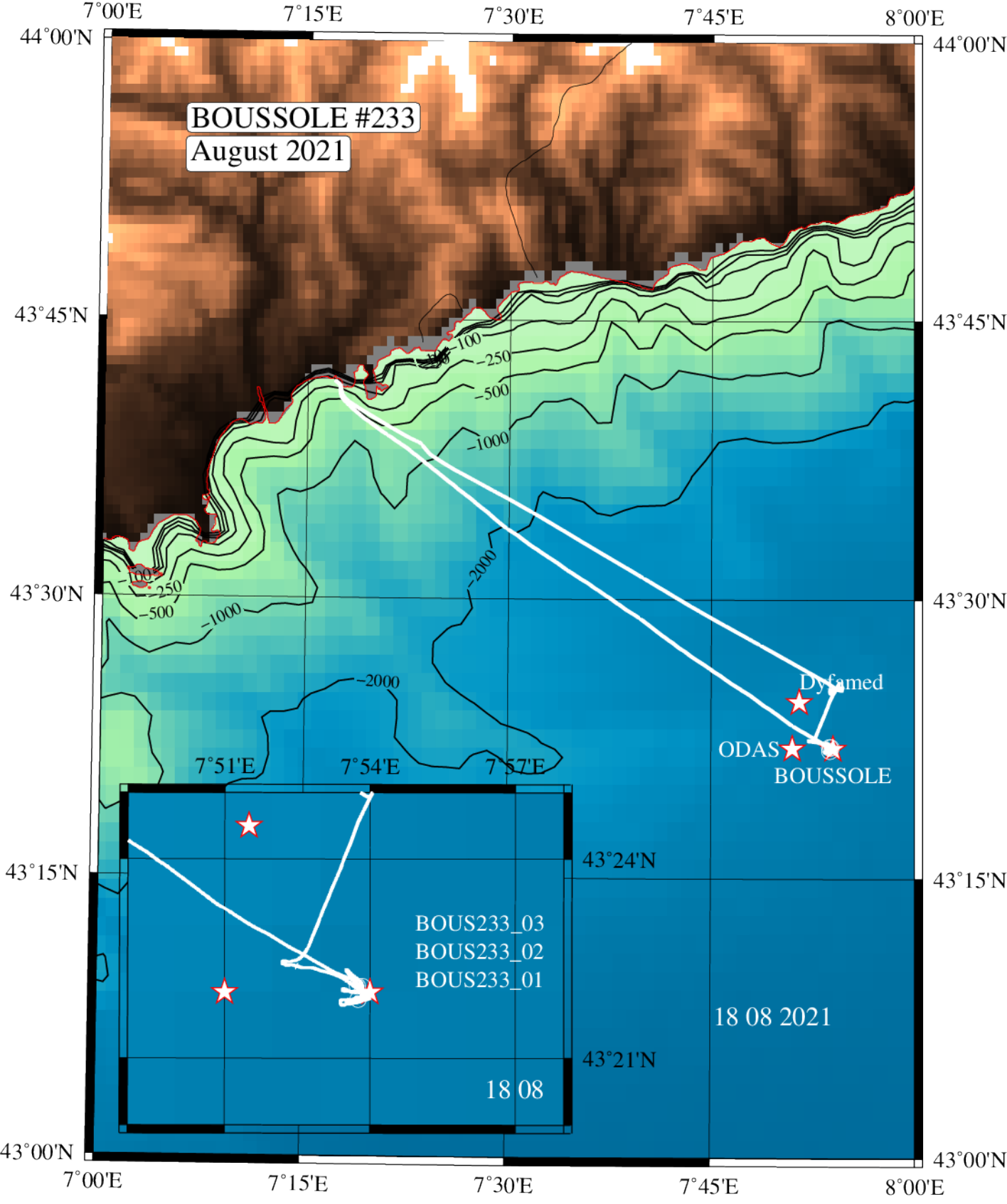
- It appeared after the cruise that the battery of the backscattering meter in the IOP package was discharged, the sensor was not functioning, so there is no backscattering data for this cruise.

- Diving and maintenance operations of the buoy were not carried out because the buoy currently does not function.

# Appendices

Cruise Summary Table for Boussole 233

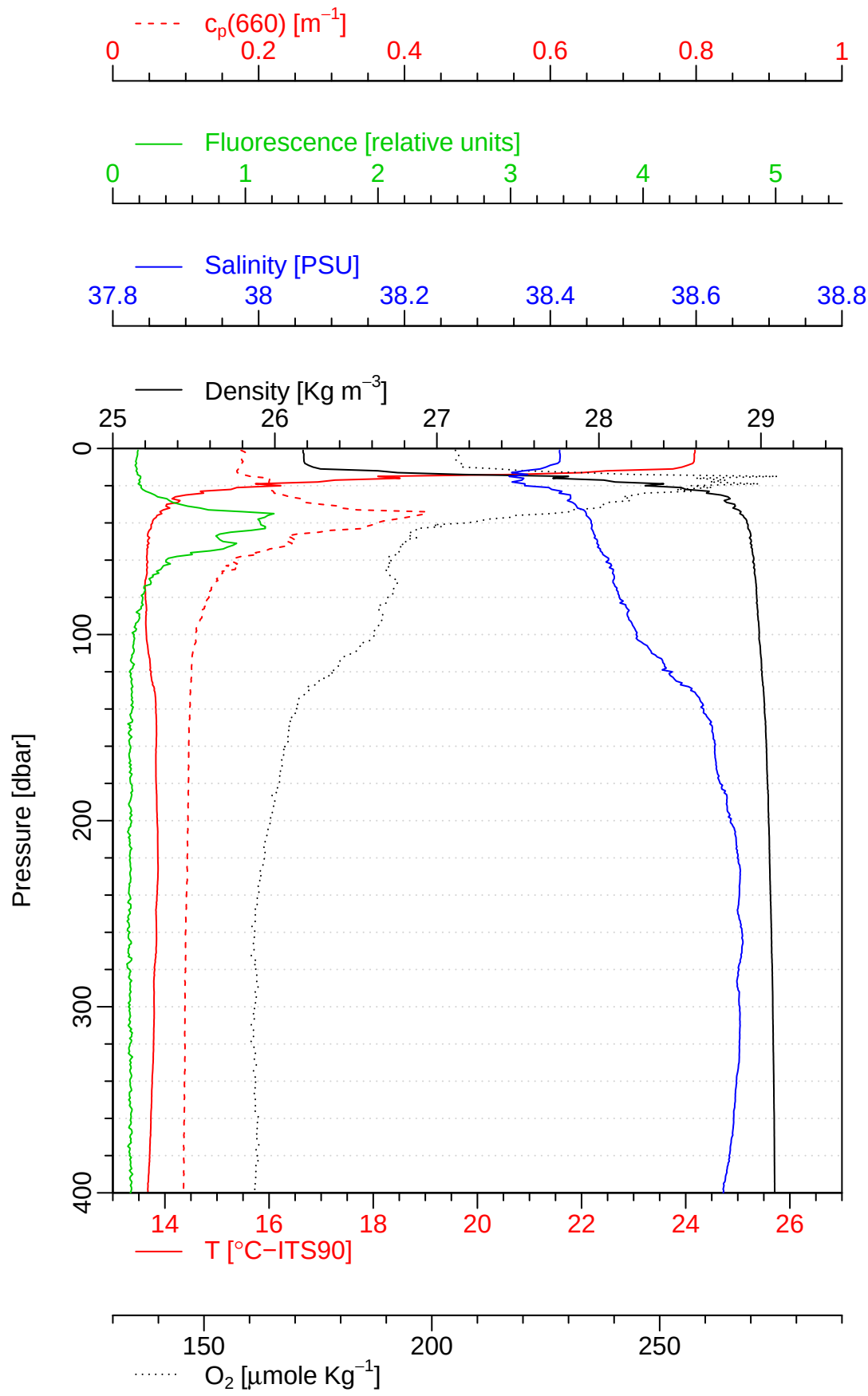
| Date | Black names | Profile names | CTD notées | Other sensors | Start Time | Duration | Depth max | Latitude (N) | | longitude | | | | | Weather | | | | | | | Sea | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (file ext: ".raw") | (file extension: ".raw") | | | GMT (hour.min) | (hour.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 |
| 17/08/21 | Bad weather | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18/08/21 | | | BOUS233_01 | Metagenomics, Cyto & Nutrients | 6:30 | 1:29:00 | 400 | 43 | 22.082 | 7 | 53.846 | blue | | 0 | 3.5 | 170 | 1011.3 | 73 | | 24 | 24.18 | slight | | | |
| | | | | CIMEL01 | 7:10 | 0:05:00 | | 43 | 21.972 | 7 | 53.834 | blue | | 0 | | | 1011.5 | | | | | | | | |
| | | | | CIMEL02 | 7:15 | 0:04:00 | | 43 | 21.972 | 7 | 53.834 | blue | | 0 | | | 1011.5 | | | | | | | | |
| | | | | CIMEL03 | 7:20 | 0:06:00 | | 43 | 21.972 | 7 | 53.834 | blue | | 0 | | | 1011.5 | | | | | | | | |
| | | | BOUS233_02 | HPLC, ap, $O_2$ & TA/TC | 8:40 | 0:24:00 | 400 | 43 | 21.89 | 7 | 53.759 | blue | | 0 | 7.1 | 127 | 1012.3 | 76 | | 24.7 | 24.23 | slight | | | |
| | | | BOUS233_03 | TSM & Phytofloat (PIC, POC, Cyto, phyto) | 10:31 | 0:20:00 | 300 | 43 | 22.087 | 7 | 53.744 | blue | | 1 | 8 | 120 | 1012.5 | 78.5 | | 24.6 | 24.43 | slight | | | |
| | | bou_c-ops_210818_1102_001_data.csv | | | 11:13 | 0:03:58 | 99 | 43 | 22.117 | 7 | 53.614 | blue | None | 0 | 7.1 | 130 | 1012.3 | 76.9 | good | 24.8 | | slight | 0.9 | | few |
| | | bou_c-ops_210818_1102_002_data.csv | | | 11:25 | 0:03:33 | 87 | 43 | 22.292 | 7 | 53.142 | blue | None | 0 | 7.1 | 130 | 1012.3 | 76.9 | good | 24.8 | | slight | 0.9 | | few |
| | | bou_c-ops_210818_1102_003_data.csv | | | 11:38 | 0:03:59 | 102 | 43 | 22.361 | 7 | 52.785 | blue | None | 0 | 7.1 | 130 | 1012.3 | 76.9 | good | 24.8 | | slight | 0.9 | | few |
| | | | | Secchi 01 | 12:00 | 0:04:00 | 20 | 43 | 22 | 7 | 54 | blue | | 0 | | | | | good | | | slight | | | |




GMT 2021 Sep 24 09:40:00

# bous233_01

Date = 18/08/2021
Heure debut [TU] = 06:30
Longitude = 007 53.846 E
Latitude = 43 22.082 N



# bous233_02

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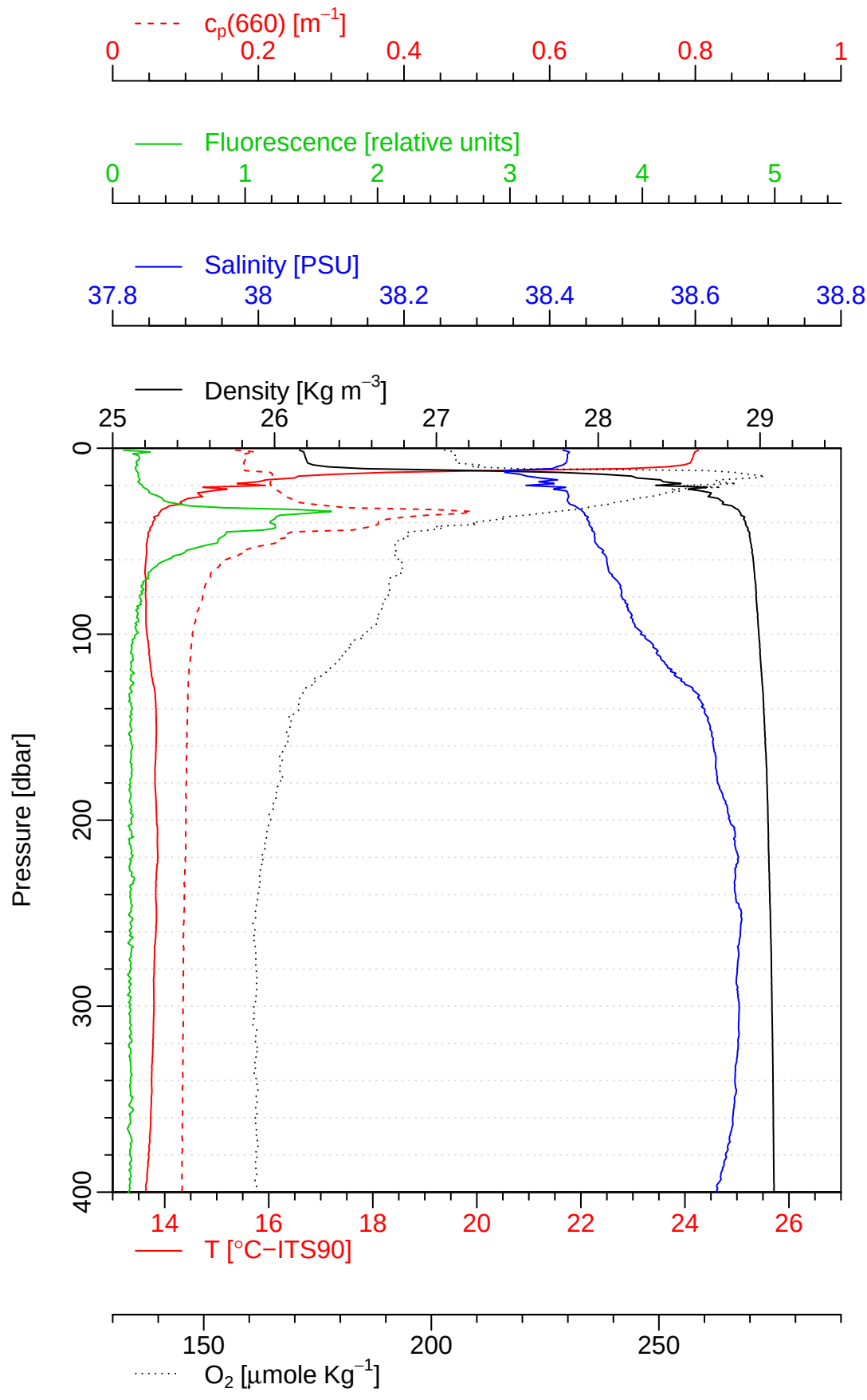
Longitude = 007 53.759 E
Latitude = 43 21.890 N



# bous233_03

Date = 18/08/2021
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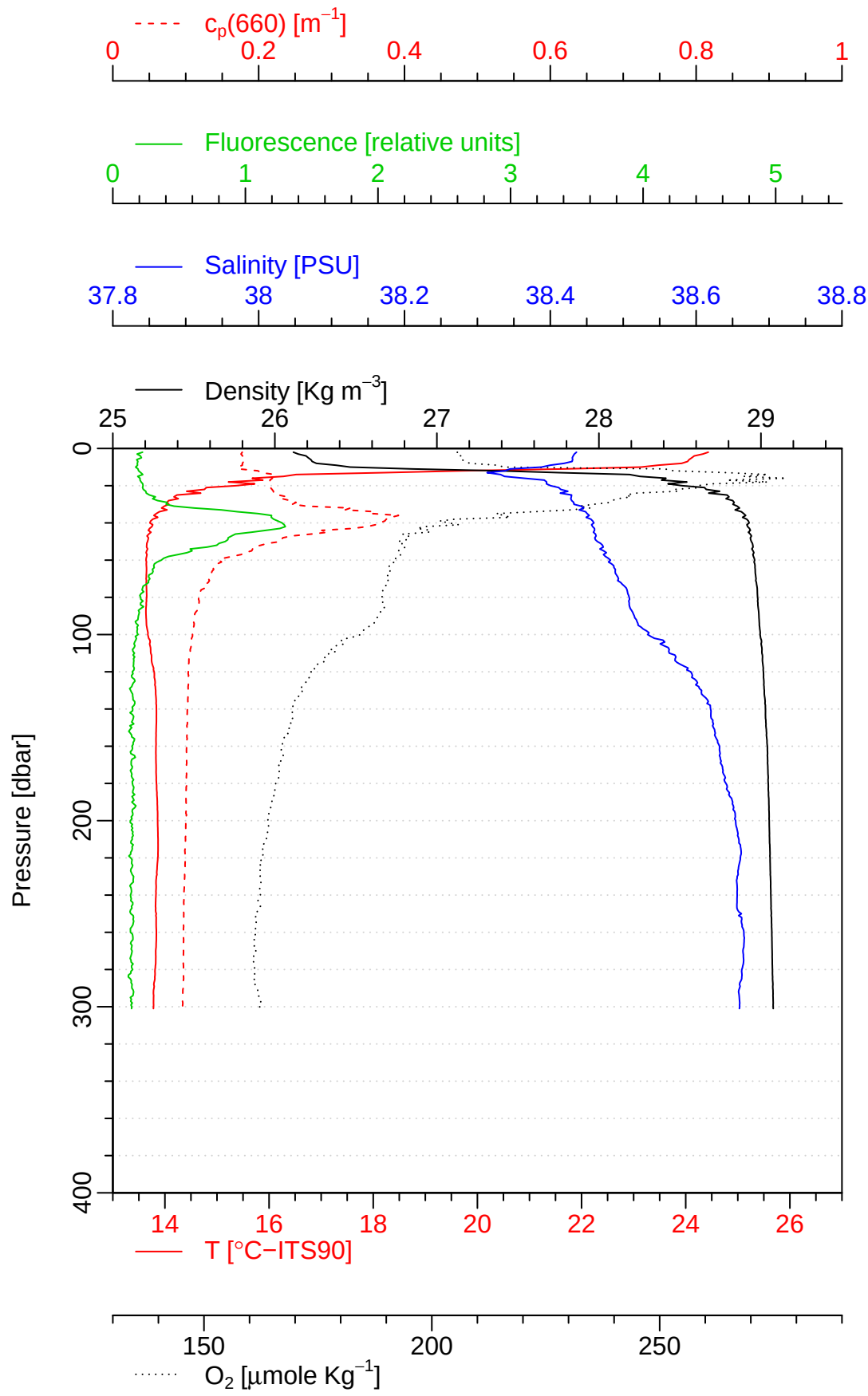
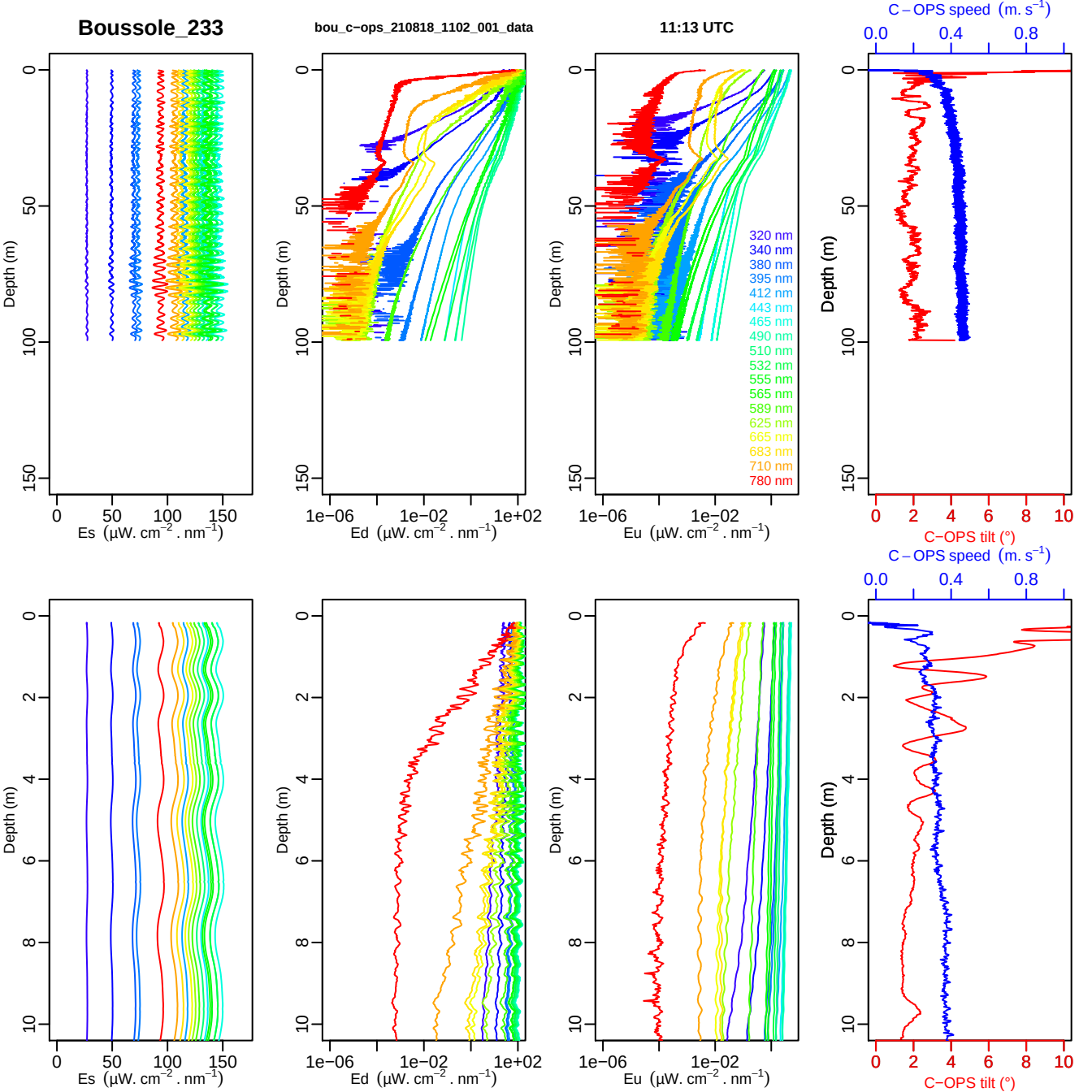
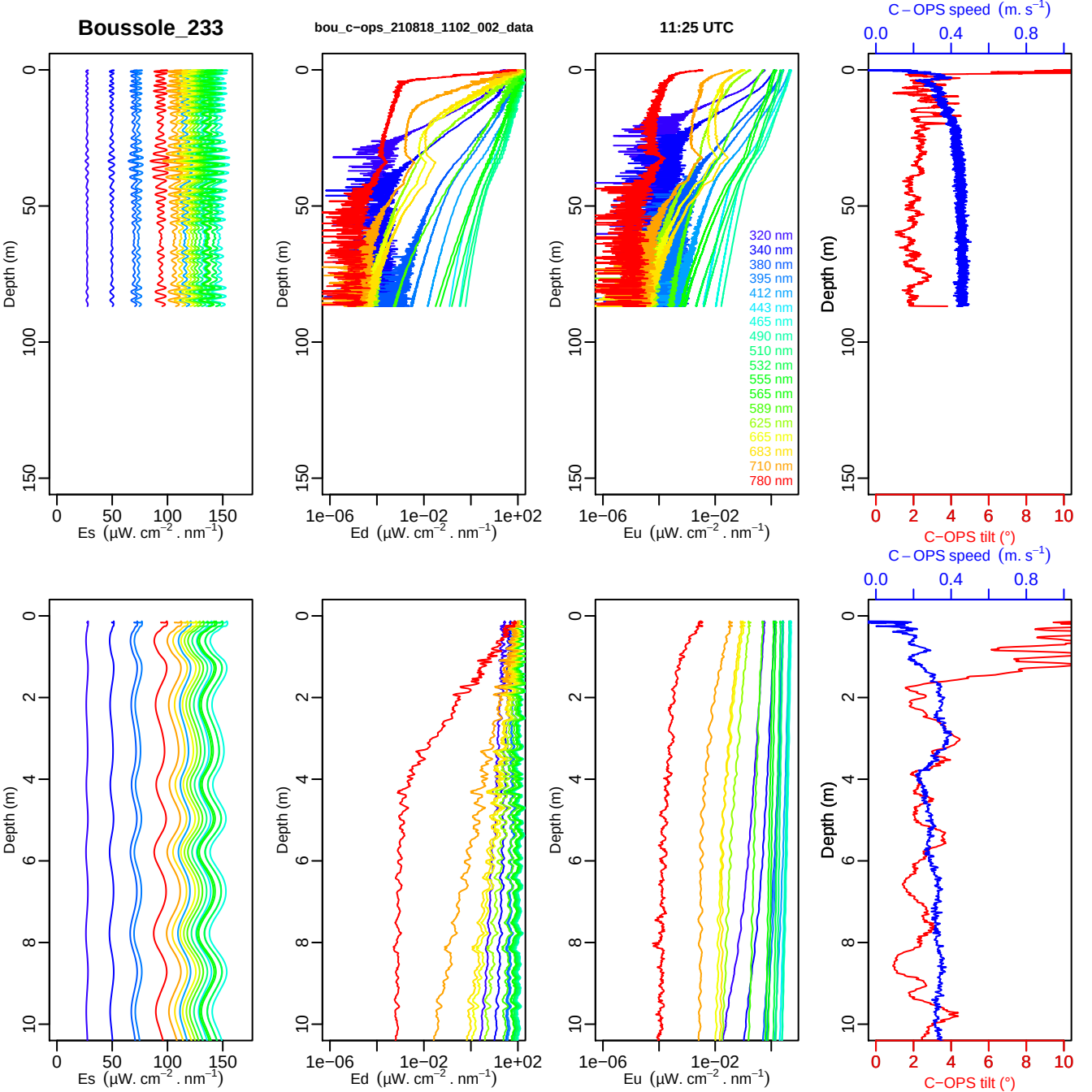
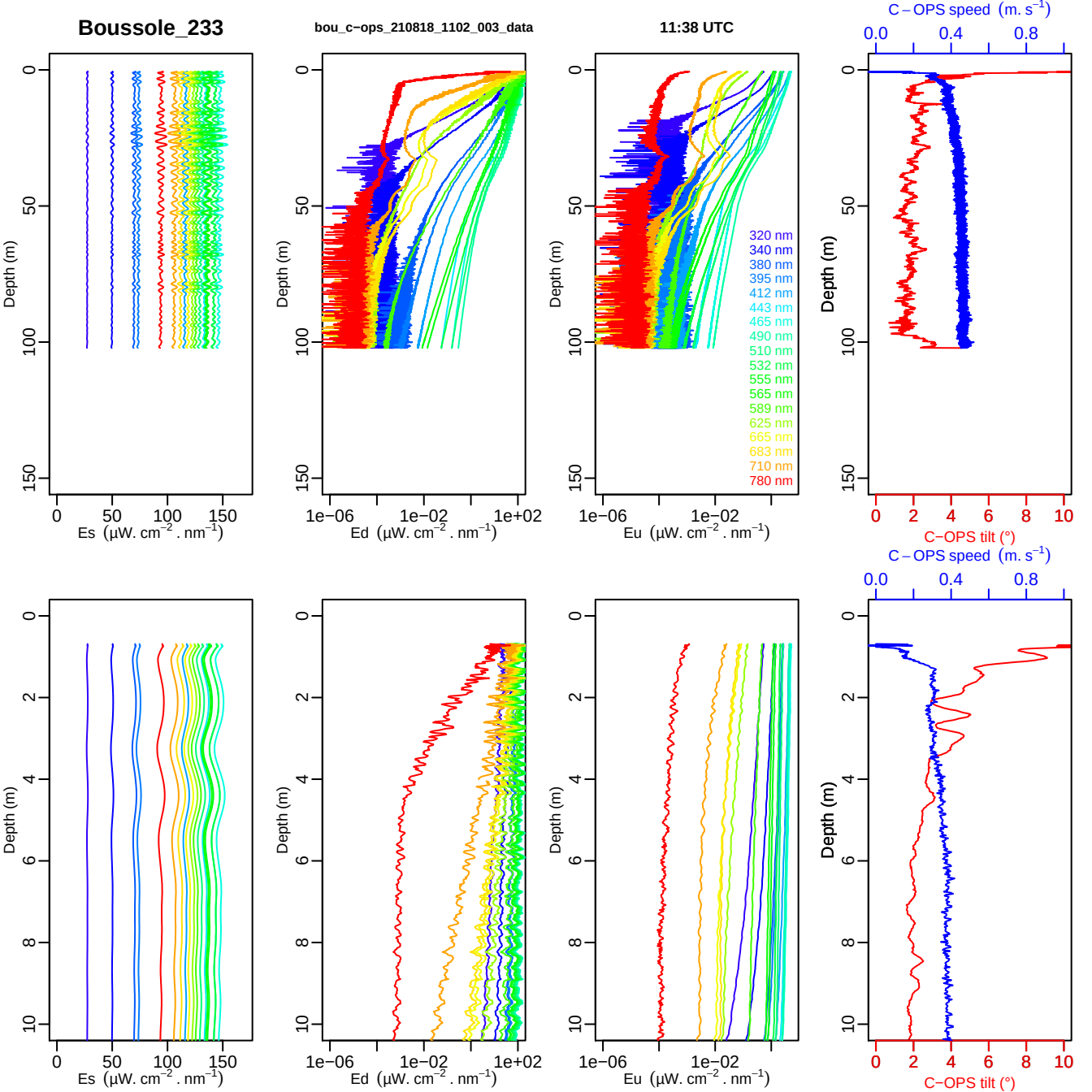
Longitude = 007 53.744 E
Latitude = 43 22.087 N




Boussole_233
bou_c-ops_210818_1102_001_data
11:13 UTC
Depth (m)
Es (µW. cm⁻². nm⁻¹)
Ed (µW. cm⁻². nm⁻¹)
Eu (µW. cm⁻². nm⁻¹)
C-OPS speed (m. s⁻¹)
C-OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm


Boussole_233
bou_c−ops_210818_1102_002_data
11:25 UTC
C − OPS speed (m. s−1)
0.0
0.4
0.8
Depth (m)
0
50
100
150
0
50
100
150
Es (µW. cm−2 . nm−1)
1e−06
1e−02
1e+02
Ed (µW. cm−2 . nm−1)
Eu (µW. cm−2 . nm−1)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm
0
2
4
6
8
10
C−OPS tilt (°)


Boussole_233
bou_c−ops_210818_1102_003_data
11:38 UTC
Depth (m)
Es (µW. cm−2 . nm−1)
Ed (µW. cm−2 . nm−1)
Eu (µW. cm−2 . nm−1)
C − OPS speed (m. s−1)
C−OPS tilt (°)
320 nm
340 nm
380 nm
395 nm
412 nm
443 nm
465 nm
490 nm
510 nm
532 nm
555 nm
565 nm
589 nm
625 nm
665 nm
683 nm
710 nm
780 nm