# **BOUSSOLE** Monthly Cruise Report

## Cruise 253 April 03-05, 2023

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A view of the R/V L'Europe from the dinghy after diving operations

### **BOUSSOLE** project

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

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## 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







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. 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 for acquiring dark measurements (started in April 2009).

#### Projects-specific operations

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) and pH analysis (from October 2021). The TA/TC samples will be processed by the National service for such analyses (SNAPOCO – LOCEAN in Paris). The DO and pH samples will be analysed in the *Institut de la Mer de Villefranche* by the MOOSE team. The results will allow checking the data collected by the pCO<sub>2</sub> CARIOCA, the DO and pH sensors installed on the buoy at 3 m.

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 "MOOSE DYFAMED" cruise scheduled on 2<sup>nd</sup> April was cancelled because of bad weather forecasts, so their operations were performed the last day of the BOUSSOLE cruise.

Data were downloaded from the SeapHOx sensor installed on the buoy at 3 m depth for the MOOSE program.

#### **Cruise Summary**

The first day was used for CTD casts with water sampling, optical profiles and a Secchi disk at the BOUSSOLE site. The second day was used for diving operations and for MOOSE operations including zooplankton vertical nets, a Manta horizontal net and a deep CTD cast.

#### Monday 3 April 2023

The sea state was slight with a light to gentle breeze. The sky was blue and the visibility was excellent. Firstly, a CTD cast with water sampling and then 3 C-OPS profiles were performed at the BOUSSOLE site. Then a second CTD cast with water sampling was performed with a cap put on the backscattering meter for dark measurements

and a  $0.2\mu m$  filter put on the a-Sphere absorption meter for the dissolved matter absorption measurements. This cast was stopped at 10 depths during the ascent of the CTD. Finally, a Secchi disk was performed before returning to the Nice harbour.

#### Tuesday 4 April 2023

Bad weather prevented departure from the Nice harbour.

#### Wednesday 5 April 2023

The sea state was slight with a gentle breeze. Firstly, we went to the DYFAMED site to perform MOOSE operations. Two vertical zooplankton nets and a Manta horizontal net were performed. Then a deep CTD cast with water sampling was performed before the departure to the BOUSSOLE site. When arrived at BOUSSOLE, divers went at sea to clean the instruments, to take pictures and to put a cap on the backscattering meter for dark measurements. As observed during previous cruises, the buoy was not working: the functioning of the buoy was checked on the top of the buoy, the surface sensor was not heard working and the underwater instruments were not seen working (no opening of the fluorometers shutters during the measurements). The divers switched the battery off and on, to restart the system but it failed. Then the DL3 at surface was switched off and on and the surface sensor was heard working. In the meantime, the DL3 at 4 m and 9 m depths were restarted in the same way and the underwater instruments were seen working. The surface DL3 on the top of the buoy was switched again three times in order to have three series of dark measurements. The files recorded on the surface DL3 and the battery voltage were checked with a WIFI connection. The solar panels and the surface sensor were cleaned.

Pictures taken during this cruise can be found at: <a href="https://photos.app.goo.gl/3RT2BcwQkm8LTjeg6">https://photos.app.goo.gl/3RT2BcwQkm8LTjeg6</a>

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 3 April 2023 (UTC)

People on board: Melek Golbol, Loïc Le Ster, Samuel Martin and Paco Stil.

- 0630 Departure from Nice harbour.
- 1000 Arrival at the BOUSSOLE site.
- 1010 CTD 01, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5 m for HPLC and  $a_p$ .
- 1100 C-OPS 01, 02, 03.
- 1200 CTD 02, 400 m with water sampling at 5 m for TSM, TA/TC, DO and pH (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 m) (with cap on the HS6).
- 1325 Secchi 01, 11 m.
- 1330 Departure to the Nice harbour.
- 1720 Arrival at the Nice harbour.

#### Tuesday 4 April 2023

Bad weather prevented departure from the Nice harbour.

#### Wednesday 5 April 2023

People on board: Cyril Debost, Emilie Diamond-Riquier, Melek Golbol, Sylvie Gestel, Juliette Maury and Paco Stil.

- 0505 Departure from the Nice harbour.
- 0835 Arrival at the DYFAMED site.
- 0840 Zooplankton nets x 2, 100 and 200 m (MOOSE program).

- 0920 Manta horizontal net (MOOSE Program).
- 1015 Deep CTD cast, M230405, 2350 m (MOOSE program).
- 1200 Departure to the BOUSSOLE site.
- 1230 Arrival at the BOUSSOLE site.
- 1245 Diving operations: cleaning, functional checking, dark measurements, pictures.
  Maintenance on the top of the buoy: functional checking, sensor and solar panels cleaning.
  Data downloading from the SeapHOx sensor.
- 1340 End of diving operations.
- 1345 Departure to the Nice harbour.
- 1730 Arrival at the Nice harbour.

#### Problems identified during the cruise

- As observed during previous cruises, during the diving operations, it appeared that the buoy was not functioning and switching off and on the battery was not enough to restart the system. It was necessary to switch off and on each DL3 (surface, 4 and 9 m depths) to restart the buoy system.
- It appeared after the cruise that the cable which connects the Hydroscat-6 (backscattering meter) to the Hydro DAS (data logger of the IOP package) was damaged. It probably happened the first day during the transport of the equipment from the lab to the ship. After checking the data, it appeared that the Hydroscat-6 functioned only during the CTD 01 cast until 225 m depth. It did not work during the CTD 02 cast. Therefore, the dark measurements could not be acquired.

Appendices

#### Cruise Summary Table for Boussole 253

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.mir	) (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
03/04/23			BOUS253_01	HPLC & ap	10:11	0:36:00	400	43	22.054	7	53.947	blue		3	4	309	1010	78.4		15.3	14.1	slight			
		bou_c-ops_230403_1	050_003_data.csv		11:05	0:04:58	125	43	22.47	7	53.897	blue	Cu/Cs	1	6.4	265	1010	77	excellent	15.4		slight	0.7	(	no
		bou_c-ops_230403_1	050_004_data.csv		11:17	0:05:00	125	43	22.599	7	53.836	blue	Cu/Cs	1	6.4	265	1010	77	excellent	15.4		slight	0.7		no
		bou_c-ops_230403_1	050_005_data.csv		11:29	0:04:32	115	43	22.739	7	53.754	blue	Cu/Cs	1	6.4	265	1010	77	excellent	15.4		slight	0.7		no
			BOUS252_02	TSM, TA/TC, DO & pH	12:01	1:27:00	400	43	22.11	7	53.953	blue		2	9	280	1010	77.6		15.9	14.1	slight			
				Secchi 01	13:25	0:04:00	11	43	22	7	54	blue		2					excellent			slight		1	1
04/03/23		Bad weather																							
05/04/23	05/04/23 BOUSSOLE diving and DYFAMED operations																								



GM) 2023 Jun 29 08:53:58



Pressure [dbar]



Pressure [dbar]





