BOUSSOLE Monthly Cruise Report

Cruise 220
July 17, 2020

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Vessel : R/V Sagitta III
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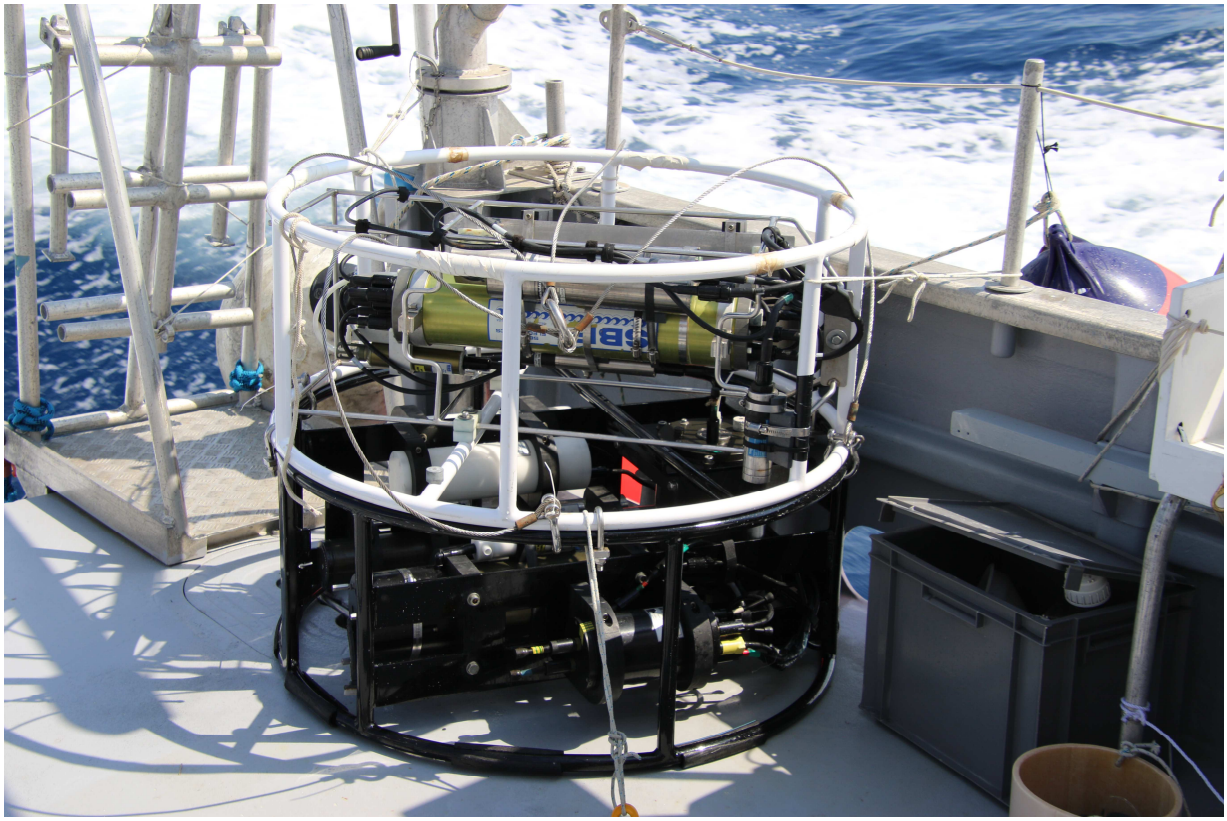

The CTD (in the white frame) and the IOP package (in the black frame) on the deck of the R/V *Sagitta III* before their deployment at the DYFAMED site.

BOUSSOLE project

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

July 31, 2020

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

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), 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). 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 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 and the two optodes installed on the buoy at 3 m and 10 m.
Water samples are to be collected at four depths for metagenomic analyses of different types of Synechococcus, cytometry and nutrients. 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

Monthly servicing cruises could not be carried out as normal on the R/V *Téthys*-II from April to May 2020 because of the restrictions due to the Covid-19 pandemic (all activities on the R/V *Téthys II* were cancelled until September). We were allowed to use the R/V *Sagitta III* instead, for joint operations of the BOUSSOLE and MOOSE programs during 2 days per month from June. The first day was dedicated to BOUSSOLE and DYFAMED operations and the second day to BOUSSOLE and its current adjunct operations (OBOO and EFFICACY project).

Cruise Summary

The operations were performed on a single day and only at the DYFAMED site because it was not possible to reach the BOUSOLE site due to the short time at our disposal. The overheating engine problem, which appeared in June, was indeed not solved and the ship had to navigate at slow speed. CTD casts all failed (see below). The IOP package was deployed down to 500 m depth. Seawater was sampled with Niskin bottles.

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The sea state was slight with a light breeze. Firstly, a CTD cast was attempted at the DYFAMED site but failed. There were spikes on the temperature, salinity and oxygen sensors from 10 m depth. Then 3 CTD casts were attempted after cleaning the connections and after replacing the cable between the temperature sensor and the CTD, but all casts failed. The IOP package was deployed alone down to 500 m depth. Then, TSM was sampled with a bucket at surface. Seawater was sampled at 4 depths (500, 80, 40 and 10 m) for HPLC, a_p, O_2 and TA/TC analysis, pH, nutrients and cytometry for BOUSSOLE and MOOSE programs before returning to the Villefranche-sur-mer harbour.

Pictures taken during this cruise can be found at:
https://photos.app.goo.gl/ZZczeFMxuYpaEFWZ8

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

Cruise Report

Friday 17 July 2020 (UTC)

People on board: Emilie Diamond Riquier and Eduardo Soto Garcia.

0605	Departure from the Villefranche-sur-Mer harbour.
0910	Arrival at the DYFAMED site.
0915	Several CTD profiles, failed.
1035	IOP cast, 500m.
1100	Surface bucket for TSM.
1125	Niskin water sampling at 500, 80, 40 and 10 m for HPLC, ap, O_2 and TA/TC.
1200	Departure to the Villefranche-sur-Mer harbour.
1500	Arrival to the Villefranche sur Mer harbour.

Problems identified during the cruise

- The problem of the engine overheating of the Sagitta III was not solved so that a low ship's speed had to be maintained, reducing the available work time on site. Therefore, it was decided to perform only one CTD and seawater sampling with Niskin bottles at the DYFAMED site. C-OPS profiles and sampling for the EFFICACY and OBOO projects was not performed.

- Because it is not possible to use the main BOUSSOLE Rosette on the deck of the *Sagitta III*, the water sampling was performed with Niskin bottles and messengers at four depths.

- It was not possible to perform the IOP cast including a 0.2 µm filter installed on the inlet tube of the a-Sphere for the dissolved matter absorption measurements because of the lack of time.

- CTD casts were not performed: there were spikes on T, S and DO sensors during the first attempt. Three other CTD casts were attempted after cleaning the connections and after replacing the cable between the T sensor and the CTD with new cables. Unfortunately, all three casts failed: there were "bip" errors on

the deck unit. We do not know whether the problem originates from the CTD or from the electro carrier cable. However, the IOP package includes also a CTD which can be used for data analysis.

Appendices

Cruise Summary Table for Boussole 220

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
17/07/20			IOP_BOUS220_01		10:39	29:00	500	43	24.992	7	51.957	blue		1	6	120	1012.8	78		23.5	24.34	slight			
				Bucket TSM	11:00	4:00	1	43	22.000	7	54.000	blue										slight			
				Niskins: HPLC, a_p, TA/TC & O_2	11:25	30:00	500	43	22.000	7	54.000	blue										slight			