

The BOUSSOLE project technical reports; report # 10-235, issue 1.

# BOUSSOLE Monthly Cruise Report

**Cruise 252**

**March 5-8 & 12-13, 2023**

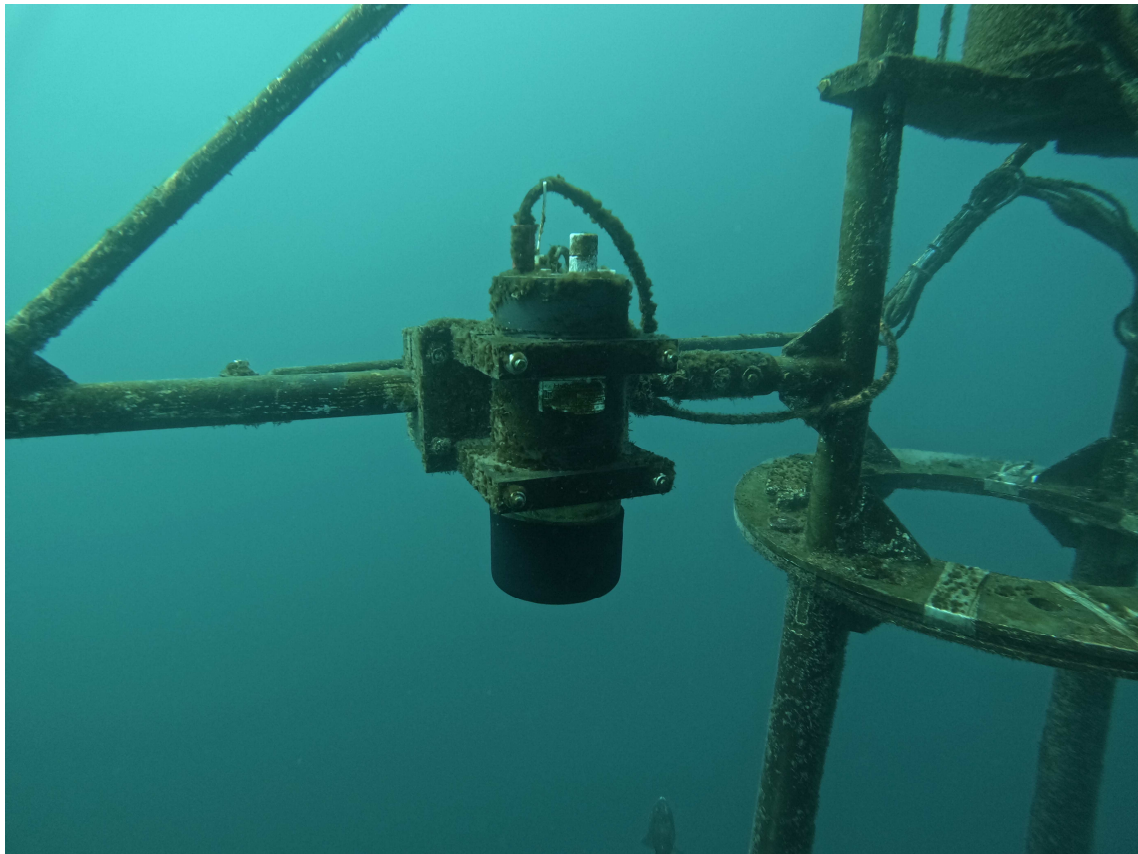
Duty Chief: Melek Golbol ([melek.golbol@imev-mer.fr](mailto:melek.golbol@imev-mer.fr))

Vessel: R/V L'EUROPE

(Captain: Vincent Rousselot)

**Science Personnel:** Emilie Diamond-Riquier, Cyril Debost, Céline Dimier, Beat Gasser, Melek Golbol and Paco Stil

*Institut de la Mer de Villefranche (IMEV), 06230 Villefranche-sur-Mer, France*



Backscattering meter located at 9 m depth on the BOUSSOLE buoy. A cap was put on the sensor for dark measurements.

**BOUSSOLE project**

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

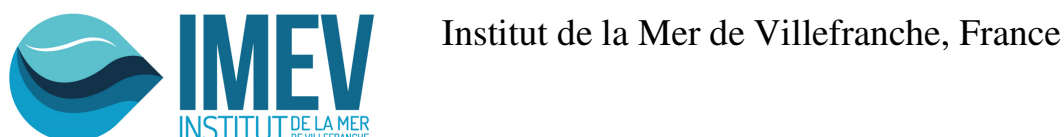
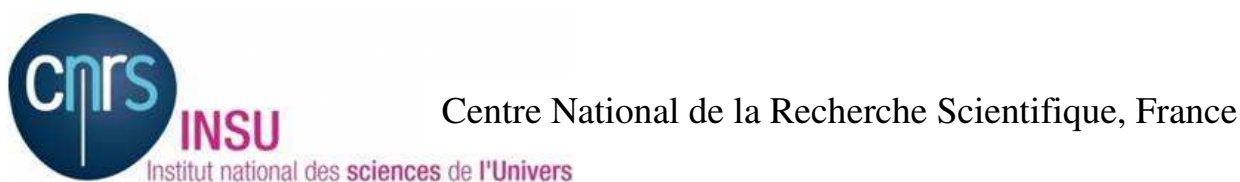
*March 20, 2023*



## 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



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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  $\mu\text{m}$  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](http://www.obs-vlfr.fr/Boussole/html/publications/pubs/BOUSSOLE_TM_214147.pdf)

### Additional operations

The PCO<sub>2</sub> CARIOCA sensor located at 3 m depth was replaced with a newly calibrated one.

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

All of BOUSSOLE operations were performed during the days initially planned for the SEAMER cruise (*Laboratoire d'Océanographie de Villefranche*) because of bad weather during the days allocated to BOUSSOLE. The SEAMER cruise was cancelled but two CTD casts (at 1250 m and 100 m depths) with water sampling for the *International Atomic Energy Agency (IAEA)* of Monaco, initially planned during the SEAMER cruise had to be performed the last day. Beat Gasser from IAEA was onboard to perform these operations.

## Cruise Summary

The bad weather did not allow to work during the dates planned for BOUSSOLE cruises (March, 6-8). Nevertheless, HPLC and  $a_p$  parameters were sampled on the deep CTD cast of the DYFAMED program in order to avoid a lack of data because of the bad weather forecast for the next days. Indeed, the bad weather did not allow to work during the days allocated to BOUSSOLE. Nevertheless, the operations were postponed a few days after

during the SEAMER cruise which took on March, 11-13. The SEAMER drifting mooring line was not deployed due to the bad weather conditions, so it was possible to perform the BOUSSOLE operations during two days (March, 12-13<sup>th</sup>). The first day was used for optical profiles, CTD casts with water sampling and a Secchi disk at the BOUSSOLE site. The second day was used for diving operations and for CTD casts with water sampling for the IAEA of Monaco.

## Sunday 5 March 2023

This day was allocated for MOOSE DYFAMED program. The sea state was slight with a moderate breeze. The sky was blue. Firstly, two vertical zooplankton nets were performed at the DYFAMED site for MOOSE operations. Then a deep CTD cast was performed but a problem appeared on the conductivity sensors. The CTD was deployed again with water sampling after the cleaning of the connectors of conductivity sensors cables. The problem was resolved for one of the two conductivity sensors installed on the CTD. The second sensor was again faulty. This deep CTD cast was performed with water sampling for MOOSE biogeochemical parameters but also for HPLC and  $a_p$  parameters at 6 depths for BOUSSOLE program. Finally, a Secchi disk was performed at the DYFAMED site before returning to the Nice harbour.

## Monday 6 March 2023

Bad weather prevented operations at the BOUSSOLE site. We tried to go to the BOUSSOLE site but we had to turn back on the way because of the bad weather conditions.

## Tuesday 7 March 2023

Bad weather prevented departure from the Nice harbour.

## Wednesday 8 March 2023

Bad weather prevented departure from the Nice harbour.

## Sunday 12 March 2023

The sea state was slight with a light to gentle breeze. The sky was blue and the visibility was excellent. Firstly, a C-OPS profile was attempted but failed probably due to a computer bug. The C-OPS was brought onboard, the software was restarted. Then, three C-OPS profiles, a CTD cast with water sampling and a Secchi disk were performed at the BOUSSOLE site. Finally, a CTD cast with water sampling and with a cap put on the backscattering meter for dark measurements was performed before returning to the Nice harbour.

## Monday 13 March 2023

The sea state was slight with a gentle breeze. Firstly, divers went at sea to replace the pCO<sub>2</sub> CAROCA sensor, to clean the instruments, to take pictures and to put a cap on the backscattering meter for dark measurements. It appeared that 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 appeared that the buoy was not working even after repeating this operation two other times. Then the DL3 at surface was switched off and on and the surface sensor was heard working. Then 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.

Finally, we went at the sampling site for IAEA operations (43°21.351'N & 7°40.039'E) and two CTD casts with water sampling were performed before returning to the Nice harbour.

Pictures taken during this cruise can be found at:

<https://photos.app.goo.gl/px66xFx9uHyymjuJ7>

Data from the BOUSSOLE cruises and buoy are available at:

[http://www.obs-vlfr.fr/Boussole/html/boussole\\_data/login\\_form.php](http://www.obs-vlfr.fr/Boussole/html/boussole_data/login_form.php)

## Cruise Report

### Sunday 5 March 2023 (UTC) (DYFAMED cruise)

People on board: Emilie Diamond-Riquier and Paco Stil.

0605 Departure from the Nice harbour.  
0925 Arrival at the DYFAMED site.  
0935 Vertical zooplankton nets x 2 at 100 and 200m (MOOSE operations).  
1015 Deep CTD cast M230305a, 2350 m (MOOSE operation).  
1220 Deep CTD cast M230305, 2350 m (MOOSE operations) with water sampling for HPLC and ap (renamed CTD 01 for BOUSSOLE program).  
1415 Secchi 01, 12 m.  
1420 Departure to the Nice harbour.  
1745 Arrival at the Nice harbour.

### Monday 6 March 2023

People on board: Melek Golbol and Paco Stil.

0700 Departure from Nice harbour.  
0900 Tun back to the Nice harbour.  
1030 Arrival to the Nice harbour.

### Tuesday 7 March 2023

Bad weather prevented departure from the Nice harbour.

### Wednesday 8 March 2023

Bad weather prevented departure from the Nice harbour.

### Sunday 12 March 2023 (UTC)

People on board: Melek Golbol.

0815 Departure from the Nice harbour.  
1230 Arrival at the BOUSSOLE site.  
1250 C-OPS attempt: failed.  
1210 C-OPS 01, 02, 03.  
1310 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  $a_p$ .  
1515 Secchi 01, 11 m.  
1545 CTD 03, 50 m with water sampling at 5 m for TSM, TA/TC, DO and pH (with cap on HS6).  
1600 Departure to the Nice harbour.  
1930 Arrival at the Nice harbour.

### Monday 13 March 2023 (UTC)

People on board: Cyril Debost, Céline Dimier, Beat Gasser, Melek Golbol and Paco Stil.

0600 Departure from the Nice harbour.  
1000 Arrival at the BOUSSOLE site.  
1025 Diving operations: replacement of the  $pCO_2$  CARIOCA sensor, 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.  
1145 End of diving operations.  
1155 Departure to the IAEA sampling site.  
1305 Arrival to the IAEA sampling site.  
1320 CTD AIEA\_20230313\_01, 1250 m.  
1520 CTD AIEA\_20230313\_02, 100 m.

1530 Departure to the Nice harbour.  
1830 Arrival at the Nice harbour.

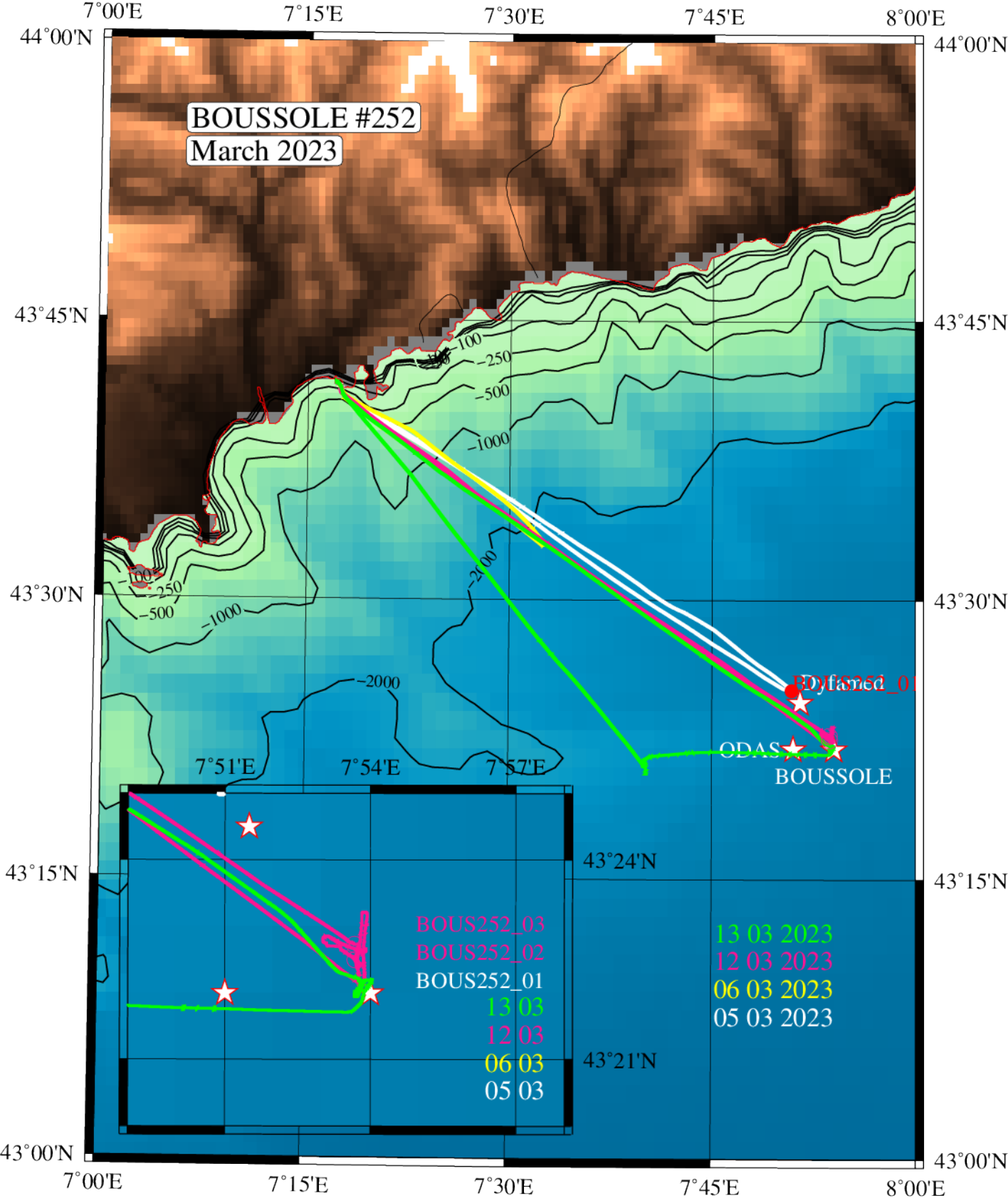
## **Problems identified during the cruise**

- During the DYFAMED cruise, problems appeared on the two conductivity sensors of the CTD. The CTD was deployed again after cleaning the conductivity sensors cables on the CTD: one of the two sensors worked correctly, the other was always faulty.
- The first attempt of the C-OPS failed: the signal on the computer was lost. The connectors and cables of the C-OPS were cleaned but it seems that the problem provide from a computer bug. The software was restarted and the C-OPS worked correctly.
- The last day, it appeared that there was no more nitrogen in the nitrogen container: it had completely evaporated. Nevertheless, all the samples inside the container were still cold. They were put in the onboard freezer at  $-40^{\circ}\text{C}$ , then they were transferred in the freezer at  $-80^{\circ}\text{C}$  when we returned to the lab.
- As last cruise, 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 was not possible to perform the CTD cast including a  $0.2\ \mu\text{m}$  filter installed on the inlet tube of the a-Sphere for the dissolved matter absorption measurements because of the lack of time due to the bad weather.

# **Appendices**

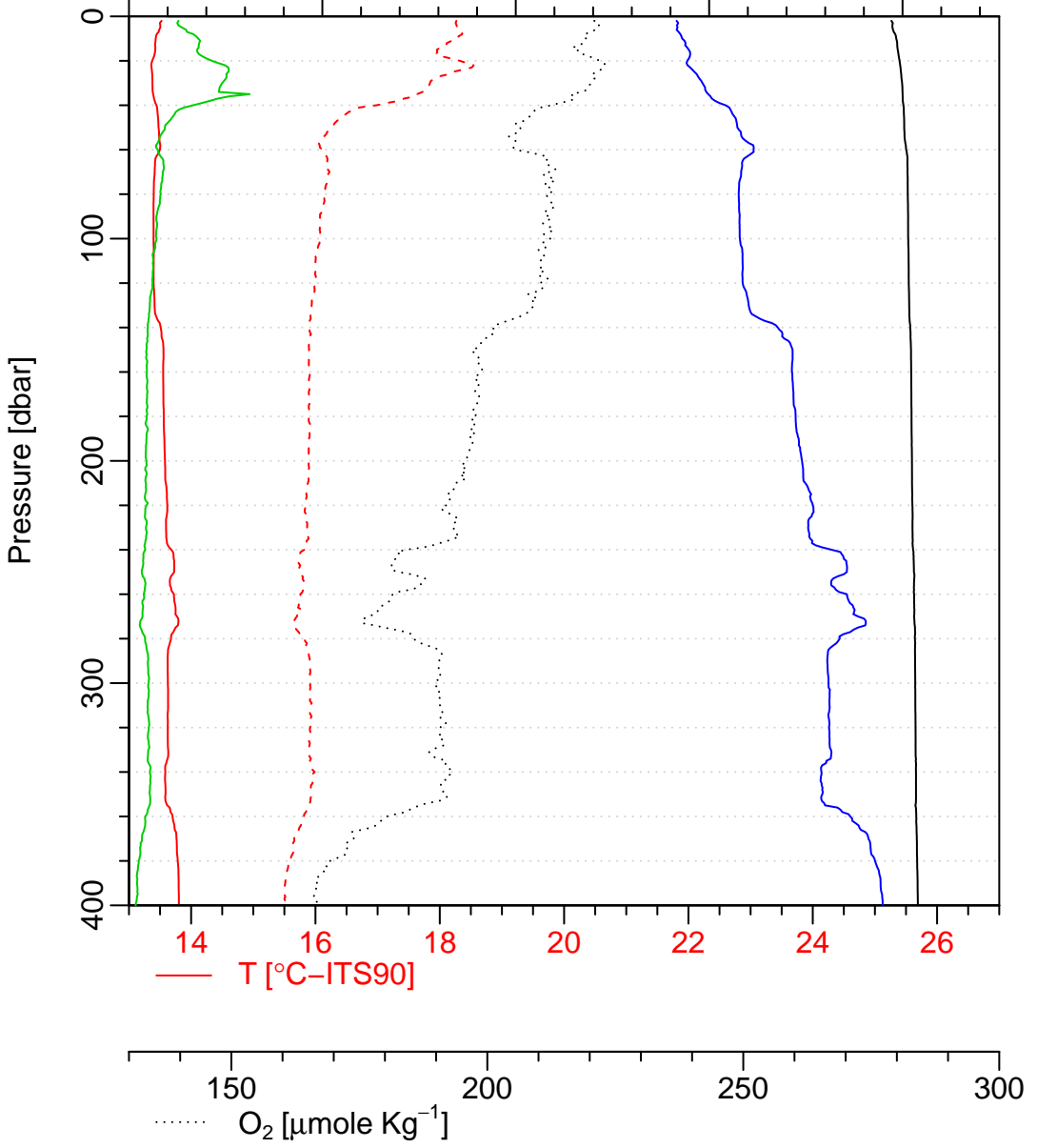
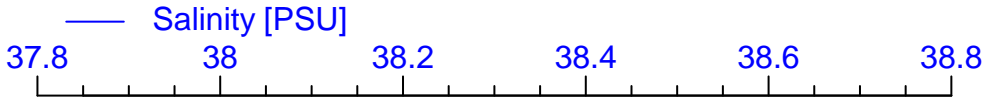
Cruise Summary Table for Boussole 252

Date	Black names (file ext: ".raw")	Profile names (file extension: ".raw")	CTD notes	Other sensors	Start Time		Depth max (meter)	Latitude (N)			Longitude			Sky	Clouds	Quantity (#/8)	Weather		Atm. Pressure (hPa)	Humidity (%)	Visibility	T air	T water	Sea		Swell dir.	Whitecaps			
					GMT (hour.min)	(hour.min.sec)		(Degree)	(Minute)	(Degree)	(Minute)	Wind sp. (kn)	Wind dir.				Sea	Swell H (m)												
05/03/23			BOUS252_01	HPLC & ap	12:24	1:49:00	400	43	25.15	7	50.881	blue			1	11	224	1010	76		12.2	13.5	slight							
				Secchi 01	14:15	0:04:00	12	43	22	7	54	blue			1									slight						
06/03/23																														
Bad weather																														
07/03/23																														
Bad weather																														
08/03/23																														
Bad weather																														
12/03/23		bou_c-ops_230312_1259_001_data.csv			13:07	0:05:16	132	43	22.402	7	53.869	blue	Cs	1	6.6	109	1011	88.5	excellent	16.1		slight	1					no		
		bou_c-ops_230312_1259_002_data.csv			13:22	0:05:02	118	43	22.722	7	53.868	blue	Cs	1	6.6	109	1011	88.5	excellent	16.1		slight	1						no	
		bou_c-ops_230312_1259_003_data.csv			13:34	0:04:53	121	43	22.947	7	53.891	blue	Cs	1	6.6	109	1011	88.5	excellent	16.1		slight	1							no
			BOUS252_02			14:08	0:36:00	400	43	22.5	7	53.893	blue			1	8.5	128	1011	88.4		16	13.6	slight						
						15:15	0:04:00	11	43	22	7	54	blue			1						excellent			slight					
		BOUS252_03		TSM, TA/TC, O <sub>2</sub> & pH	15:43	0:07:00	50	43	22.726	7	53.669	blue			2	7.9	118	1012	92		15.6	13.8	slight							



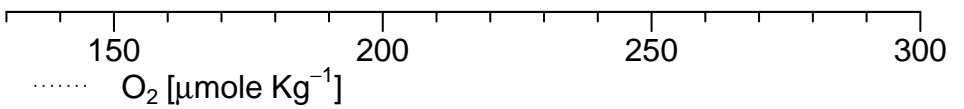
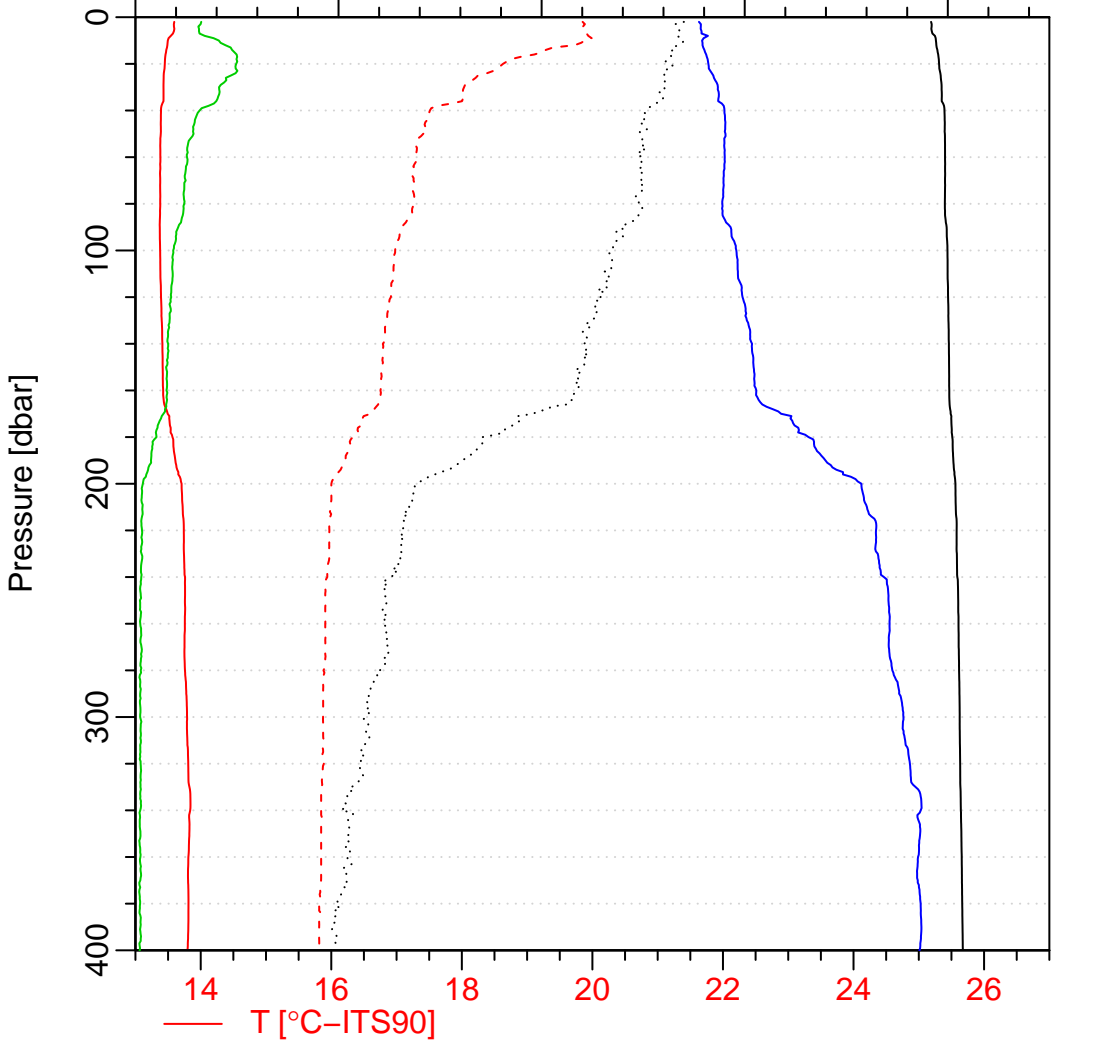
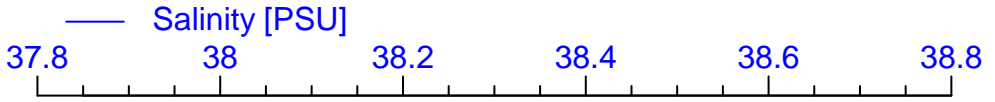
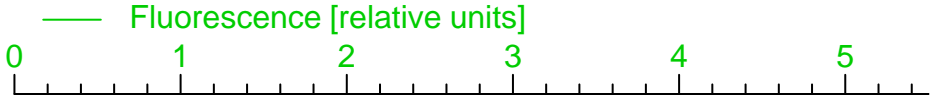
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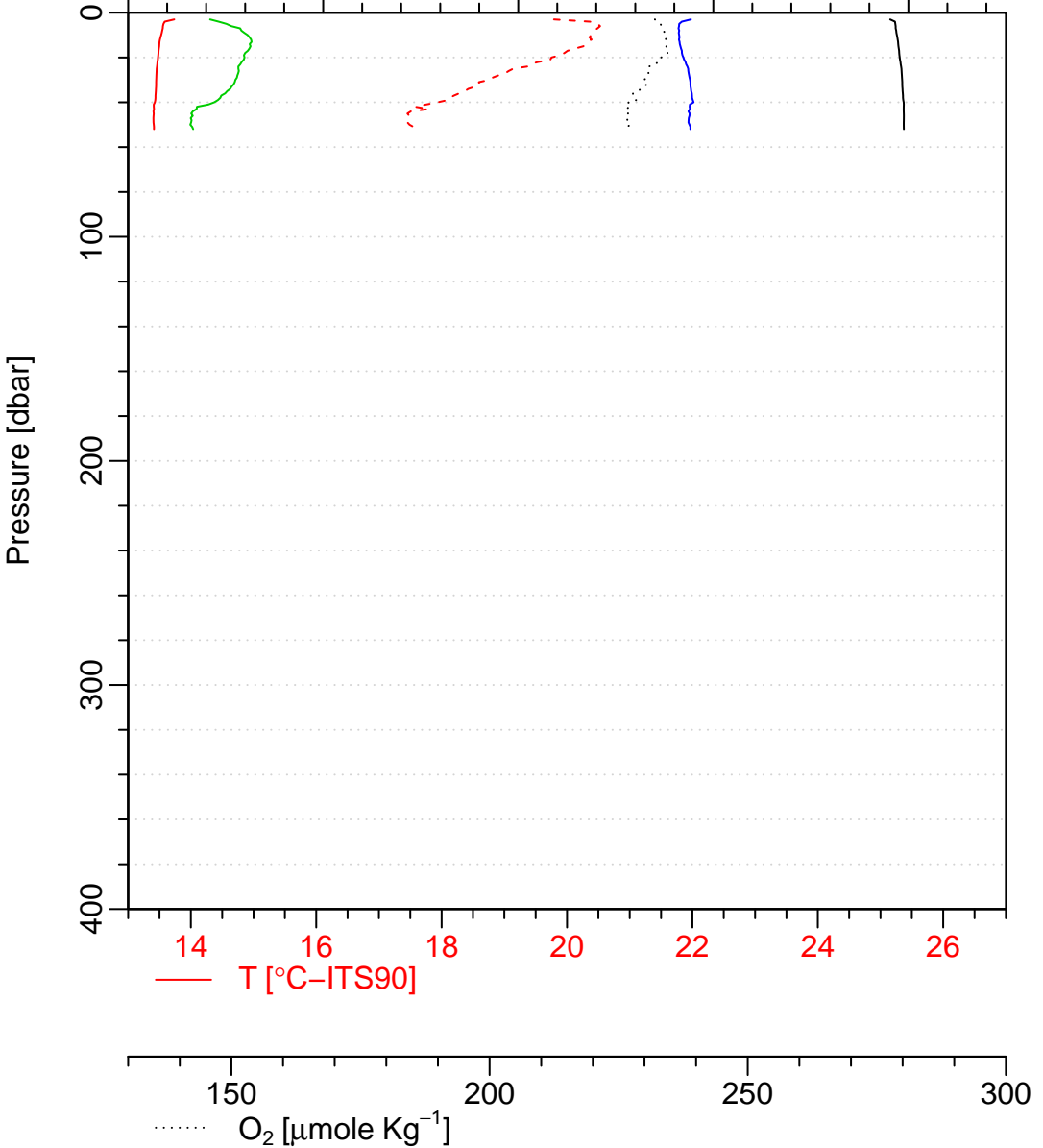
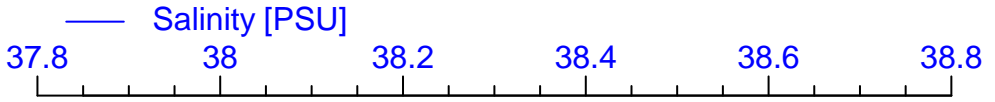
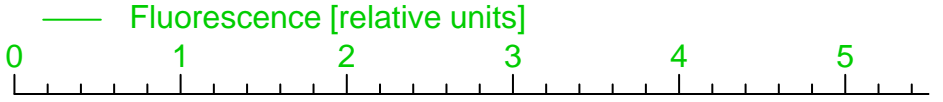
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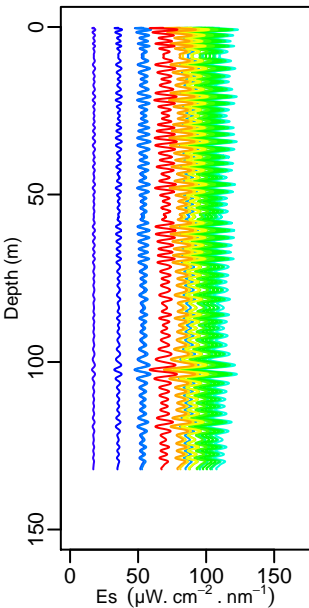
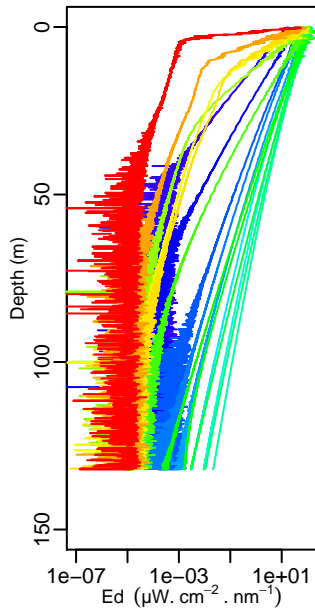
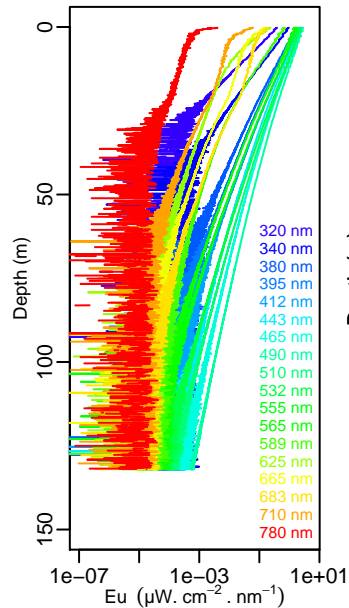
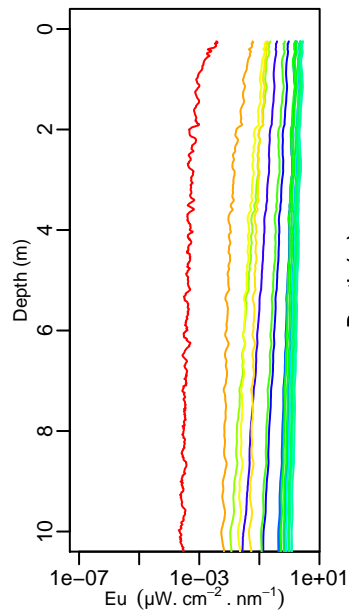
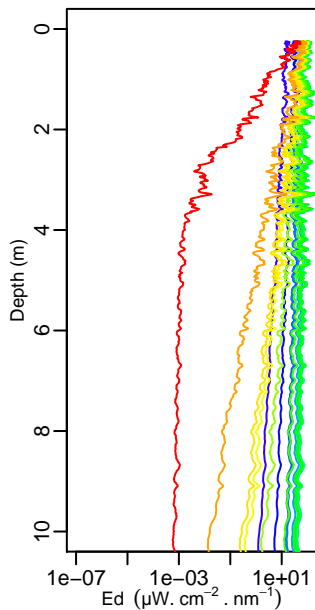
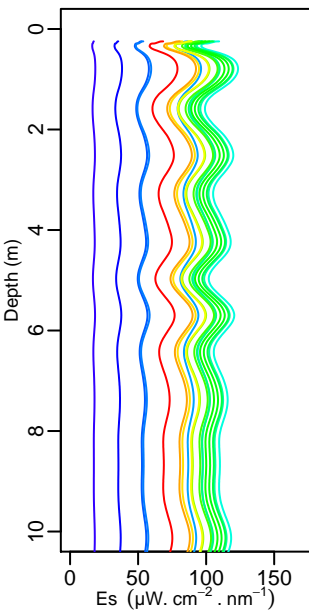
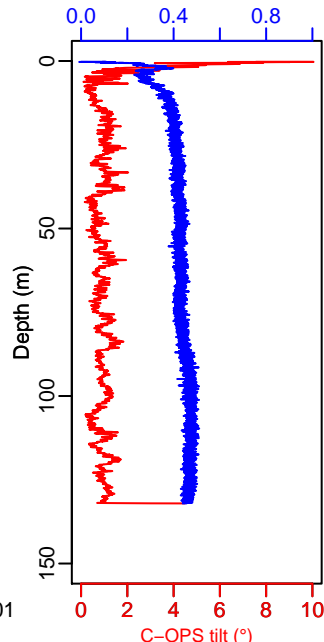
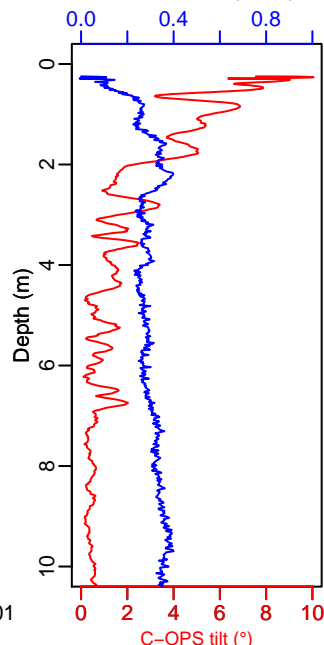
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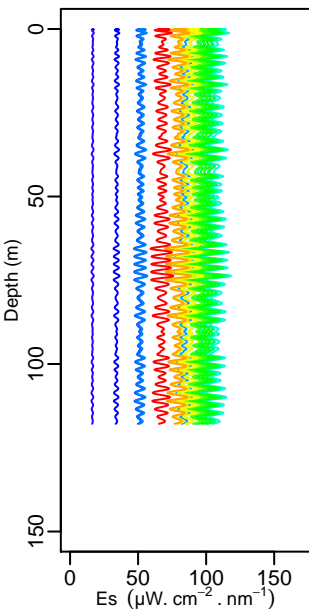
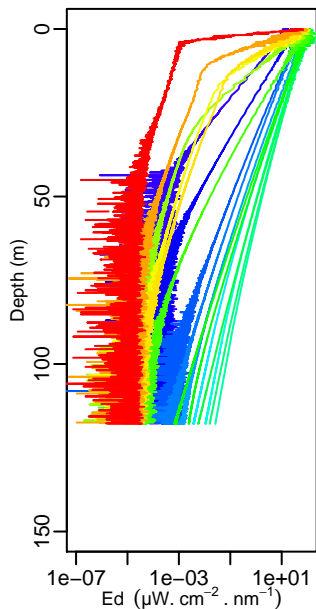
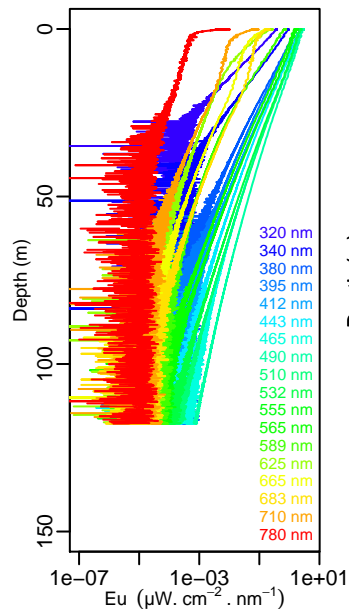
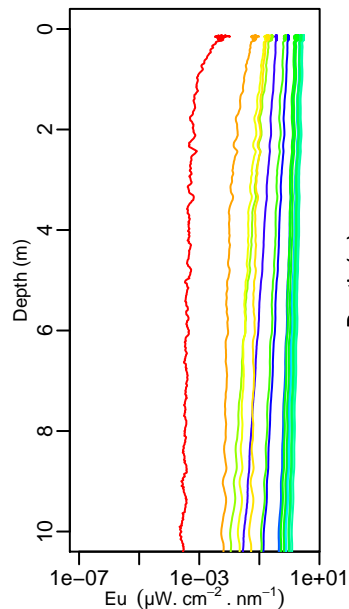
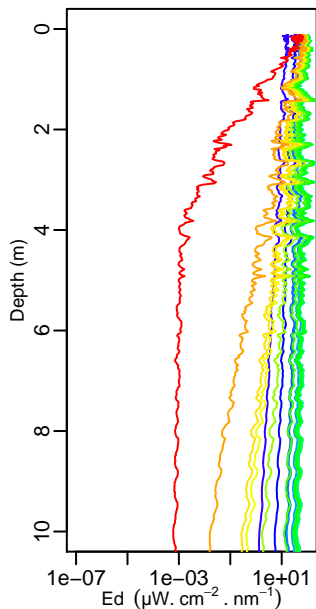
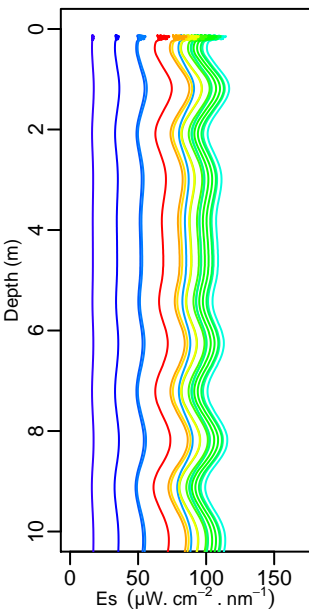
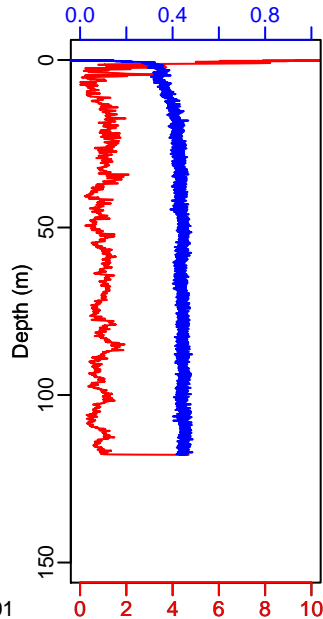
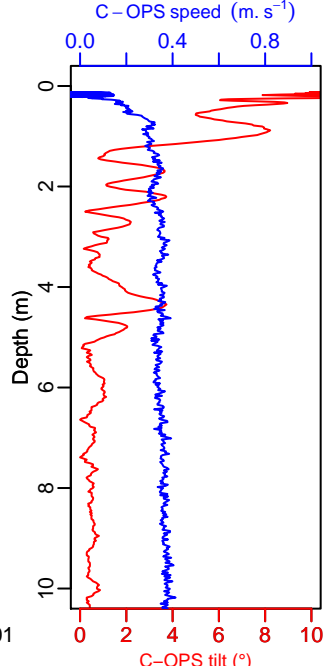


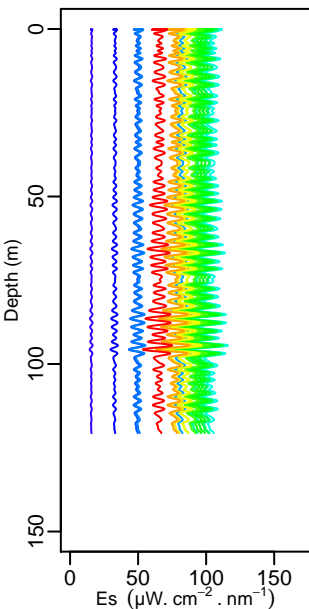
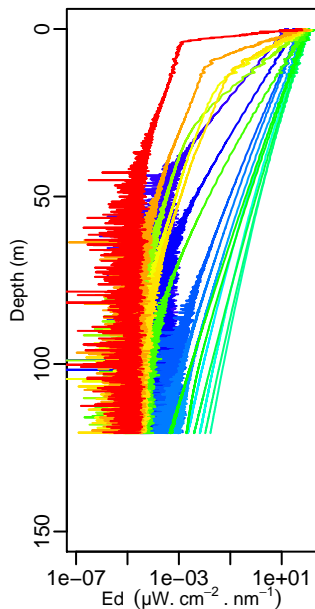
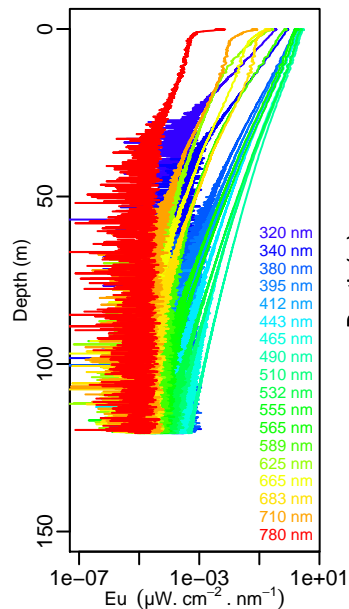
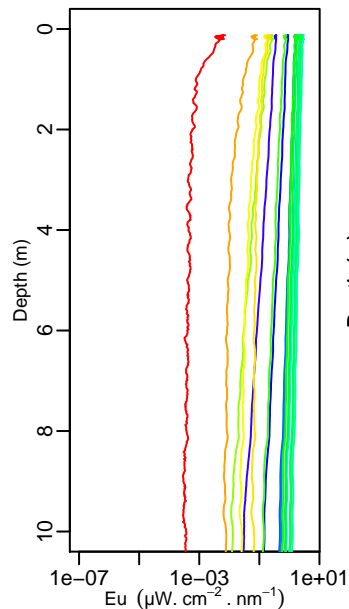
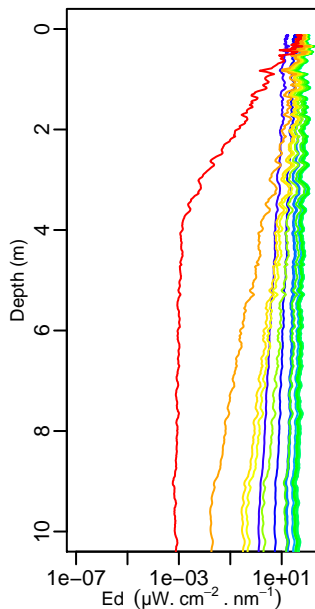
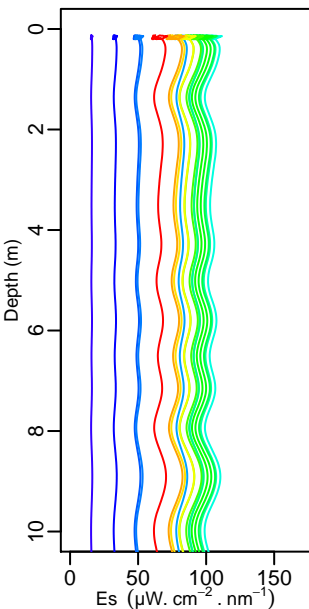
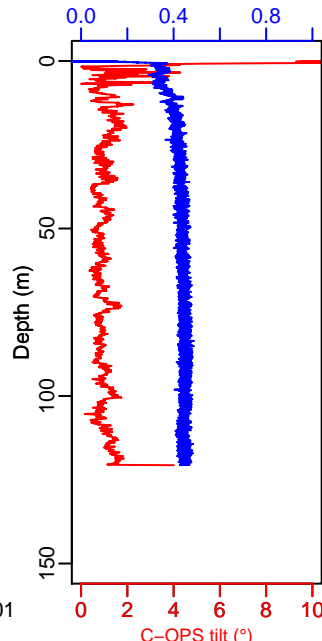
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