

The BOUSSOLE project technical reports; report # 10-210, issue 1.

# BOUSSOLE Monthly Cruise Report

**Cruise 227**

**February 15-18, 2021**

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

Vessel: R/V Téthys II

(Captain: Dany Deneuve)

Science Personnel: Melek Golbol, Flavien Petit, Emilie Riquier-Diamond and Eduardo Soto Garcia.

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

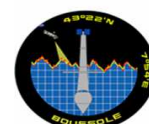


The R/V *Téthys II* with its new white livery, pictured in the vicinity of the Météo-France meteorological buoy in the DYFAMED area.

**BOUSSOLE project**

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

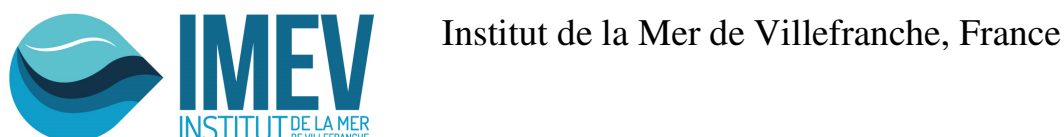
*February 26, 2021*



## 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



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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  $\mu\text{m}$  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 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). 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<sub>2</sub> 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 (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](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, three 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, an Eco 3X1M sensor that measures multispectral fluorescence (excitation at 440, 470 et 532 nm, emission at 695 nm) and an ECO V2 B206 sensor that measures chlorophyll fluorescence at 470 and 440 nm, CDOM fluorescence and backscattering at 700 nm.

The last day, during the way to BOUSSOLE, we stopped at the Météo-France buoy to take some pictures of the buoy in order to provide a visual check of the buoy as requested by the Météo-France engineers' team.

## Cruise Summary

BOUSSOLE additional operations including sampling in the frame of the OBOO project were performed on February 15<sup>th</sup> during the DYFAMED cruise day for logistical reasons. The two first days of the BOUSSOLE cruise were cancelled because of bad weather. The last day was used for optical profiles, CTD casts with water sampling and a Secchi disk. We stopped also at the Météo-France buoy site during the way to BOUSSOLE site to take some picture of the external structure of the buoy.

### Monday 15 February 2021 (DYFAMED cruise)

Water sampling and measurements in the frame of the OBOO project were performed during the DYFAMED cruise day for logistical reasons. The sea state was smooth with a gentle breeze. The sky was blue. Firstly, a CTD cast with water sampling was performed at the BOUSSOLE site and then a Secchi disk before departure to the DYFAMED site for MOOSE operations (zooplankton nets and deep CTD cast with water sampling).

### Tuesday 16 February 2021

Bad weather prevented departure from the Nice harbour.

### Wednesday 17 February 2021

Bad weather prevented departure from the Nice harbour.

### Tuesday 18 February 2021

The sea state was slight with a moderate breeze. The sky was cloudy to overcast yet the visibility was good. During the way to BOUSSOLE, we stopped at the Météo-France buoy to take some pictures of the buoy. When arrived to the BOUSSOLE site, two CTD casts with water sampling and a Secchi disk were performed. For the first cast (CTD 02), a cap was put on the backscattering meter for dark measurements and a 0.2 $\mu$ m 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. Then, C-OPS balance tests were performed in order to adjust it during the descent phase of the profiles before finishing the operations of the day with three optical profiles.

Pictures taken during this cruise can be found at:

<https://photos.app.goo.gl/3qBxyeSKJhyQXCyk9>

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

### Monday 15 February 2021 (UTC) (DYFAMED cruise)

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

0630 Departure from the Nice harbour.  
0940 Arrival at the BOUSSOLE site.  
0945 CTD 01, 200 m with water sampling at 80, 45 and 5m for TA/TC, O<sub>2</sub>, TSM and phytoplankton microscopy, cytometry, PIC, POC, HPLC (OBOO project).  
1000 Secchi disk, 22 m.  
1035 Departure to the DYFAMED site.  
1055 Manta horizontal net.  
1140 Arrival at DYFAMED site.  
1145 Zooplankton nets, 100 and 200 m.  
1245 Deep CTD cast, MOOSE 148, 2350 m.  
1435 Departure to the Nice harbour.  
1715 Arrival to the Nice harbour.

## Tuesday 16 February 2021

Bad weather prevented departure from the Nice harbour.

## Wednesday 17 February 2021

Bad weather prevented departure from the Nice harbour.

## Tuesday 18 February 2021 (UTC)

People on board: Melek Golbol, Flavien Petit and Eduardo Soto Garcia.

0615 Departure from the Nice harbour.  
0910 Arrival at the Météo-France buoy site: pictures.  
0920 Departure to the BOUSSOLE site.  
0935 Arrival at the BOUSSOLE site.  
0950 CTD 02, 400 m with water sampling at 60, 30, 15 and 5 m for TSM and metagenomic, cytometry, nutrients analyses (EFFICACY project) (with cap on the HS6, a 0.2  $\mu\text{m}$  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).  
1210 CTD 03, 400 m with water sampling at 400, 200, 150, 80, 70, 60, 50, 40, 30, 20, 10 and 5m for HPLC and  $a_p$ .  
1210 Secchi disk 02, 15 m.  
1305 C-OPS balance tests.  
1345 C-OPS 01, 02, 03.  
1430 Departure to the Nice harbour.  
1725 Arrival to the Nice harbour.

## Problems identified during the cruise

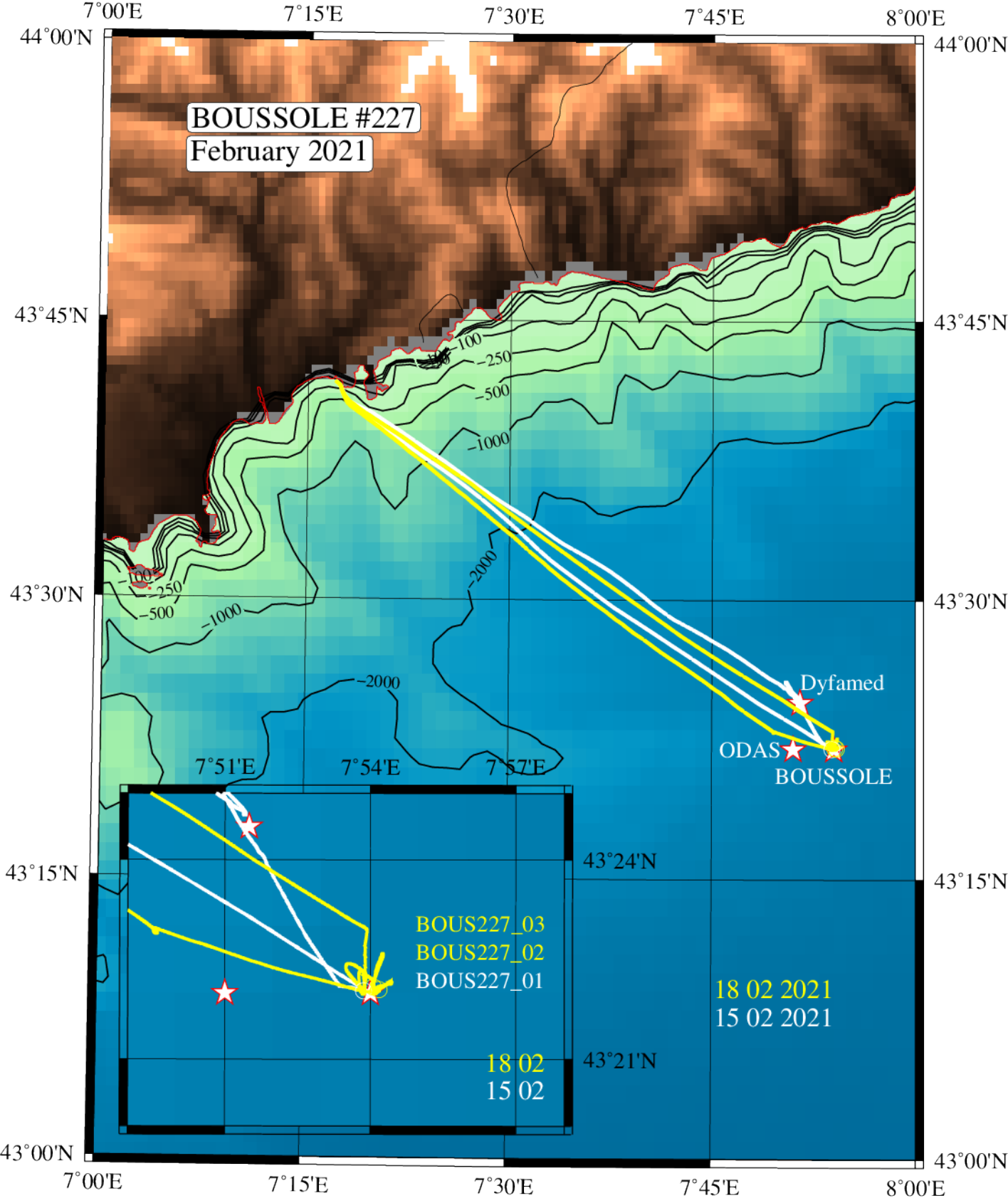
- Diving and maintenance operations of the buoy were not carried out because the buoy currently does not function.
- CTD 01 cast: the alarm of the deck unit sounded very stealthily four to five times during the cast, similarly to what happened during the previous cruise.
- COPS 02: the profile was stopped at 10 m depth because the instrument was too much tilted.
- The CTD of the IOP package could not be installed on the package with the other instruments because it was still under calibrations at SeaBird. Therefore, the IOP data will have to be synchronized in time with the main CTD for the data processing.

# **Appendices**

Cruise Summary Table for Boussole 227

Date	Black names (file ext: ".raw")	Profile names (file extension: ".raw")	CTD notées	Other sensors	Start Time	Duration	Depth max	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)	(meter)	(Degree)	(Minute)	(Degree)	(Minute)				Wind sp. (kn)	Wind dir.						Sea	Swell H (m)			
15/02/2021 (DYFAMED cruise)			BOUS227_01	HPLC, ap & Phytofloat (HPLC, PIC, POC, Cyto, phyto)	9:51	0:39:00	400	43	22.034	7	53.86	blue		2	7	120	1038.4	32		9.3	13.35	smooth				
				Secchi 01	10:00	0:04:00	22	43	22	7	54	blue											smooth			
16/02/21																										
Bad weather																										
17/02/21																										
Bad weather																										
18/02/21			BOUS227_02	Metagenomics, Cyto, Nutrients & TSM & filtre a-Sphere & dark HS6	9:47	1:31:00	400	43	22.085	7	54.062	cloudy		6	13	210	1022.8	78		13.3	13.512	slight				
			BOUS227_03	HPLC, ap & TSM	12:08	0:35:00	400	43	22.051	7	54.181	overcast		8	11.3	220	1022.5	77		13.5	13.64	slight				
				Secchi 02	12:10	0:04:00	15	43	22	7	54	overcast											slight			
			bou_c-ops_210218_1343_001_data.csv		13:47	0:04:27	115	43	22.237	7	53.906	cloudy	Cc	6	10	225	1022	74.8	good	13.4		slight	0.7		few	
			bou_c-ops_210218_1343_002_data.csv		14:01	0:00:33	11	43	22.506	7	53.892	cloudy	Cc	6	10	225	1022	74.8	good	14.4		slight	1.7		few	
		bou_c-ops_210218_1343_003_data.csv		14:08	0:04:15	109	43	22.633	7	53.894	cloudy	Cc	6	10	225	1022	74.8	good	15.4		slight	2.7		few		





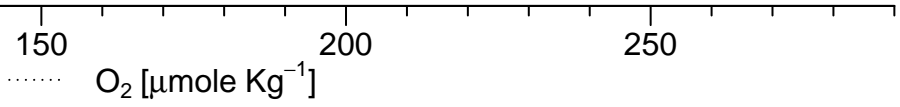
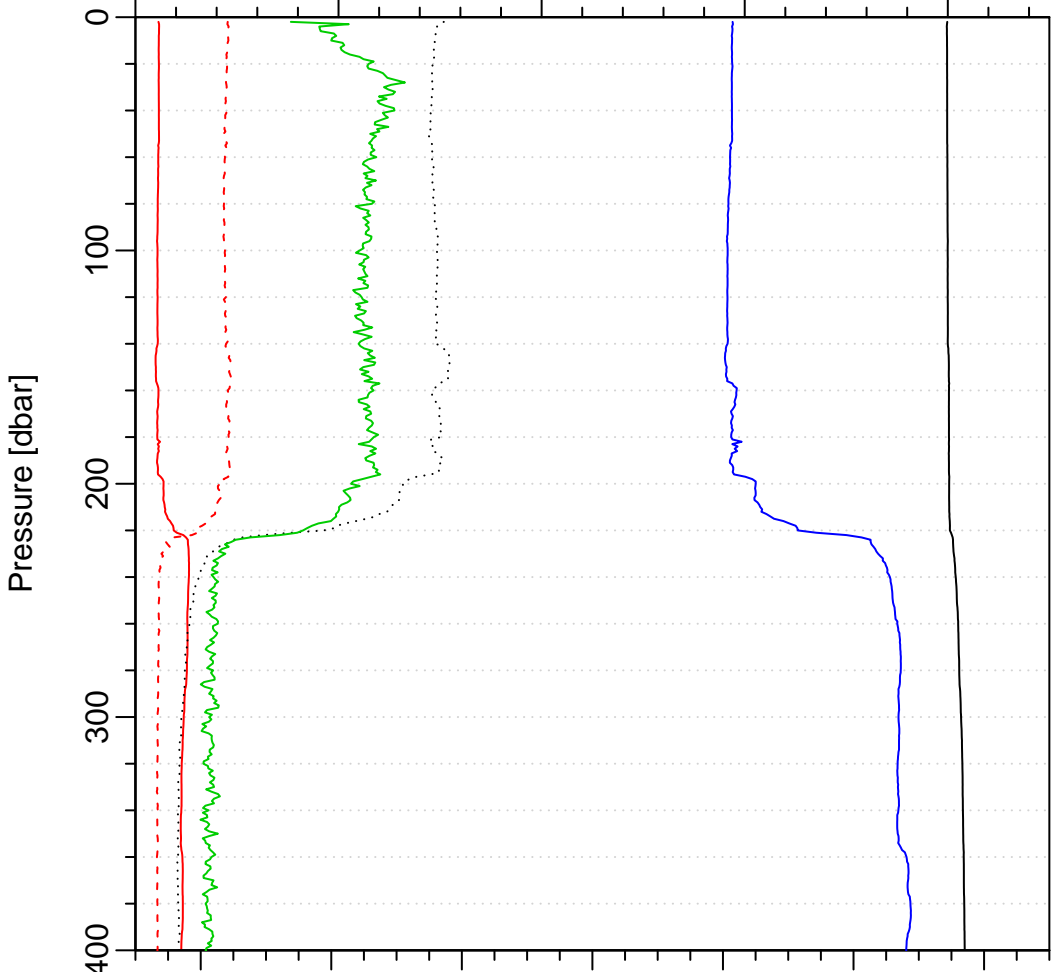
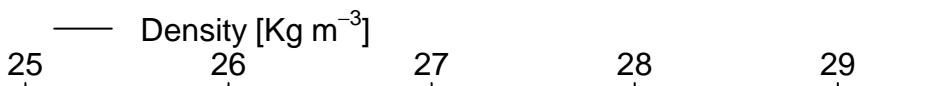
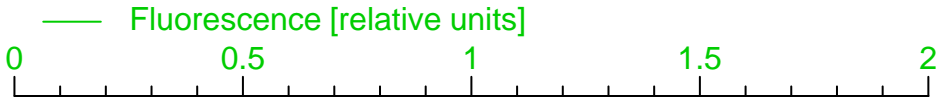
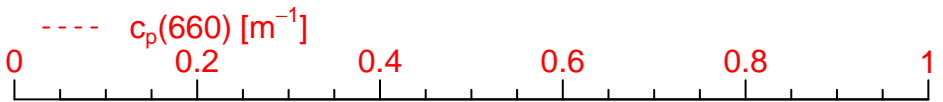
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Latitude = 43 22.034 N



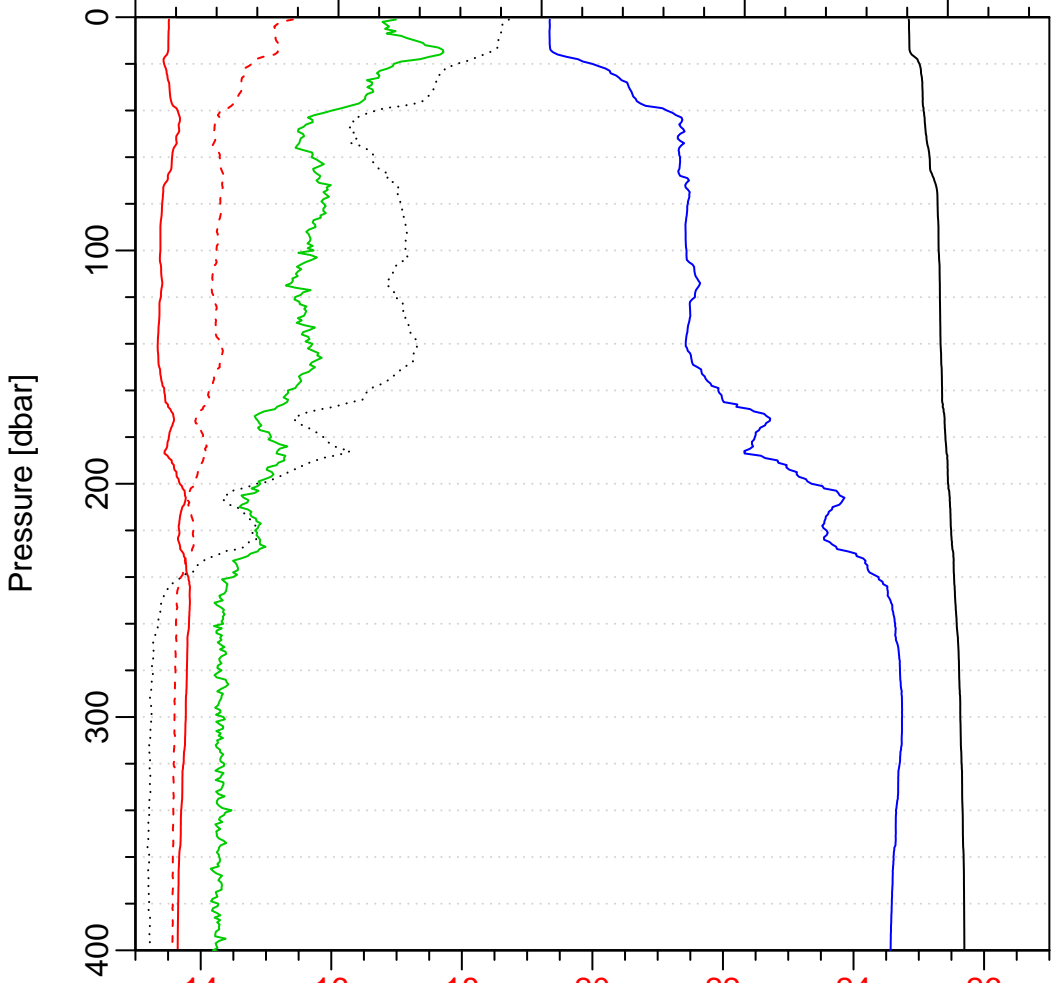
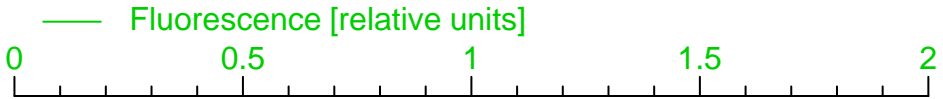
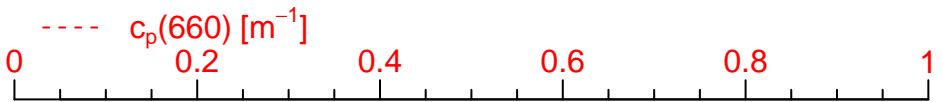
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Date = 18/02/2021

Heure debut [TU] = 09:47

Longitude = 007 54.062 E

Latitude = 43 22.085 N



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.....  $\text{O}_2$  [ $\mu\text{mole Kg}^{-1}$ ]

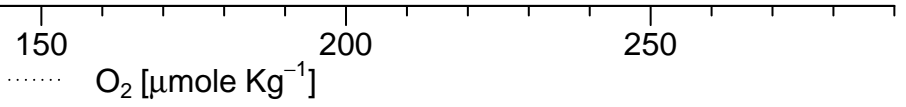
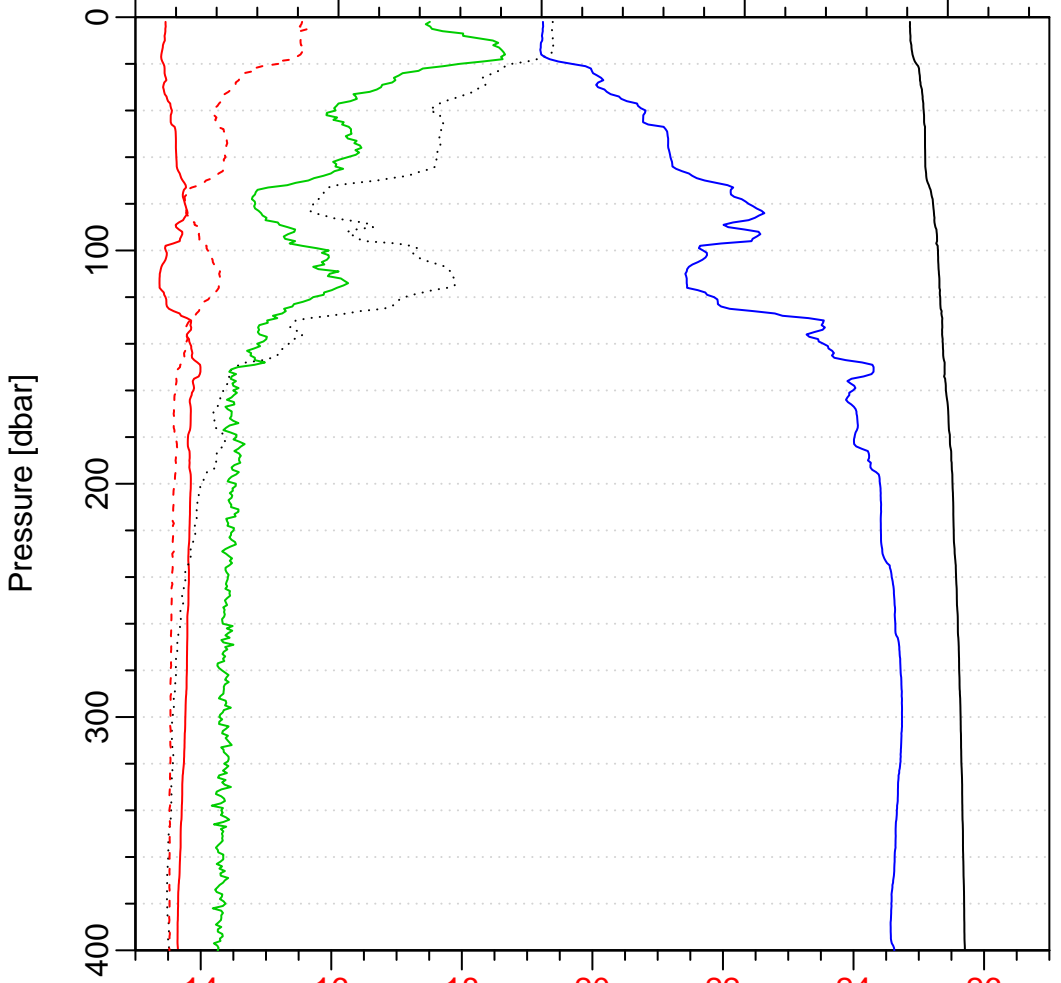
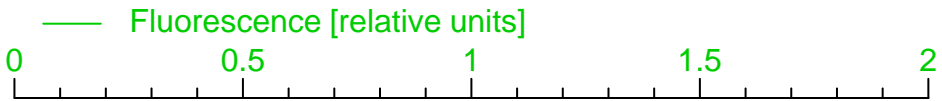
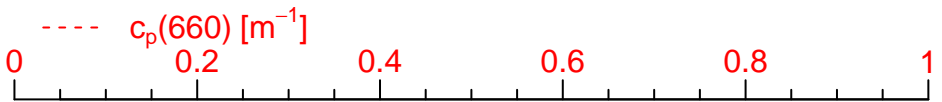
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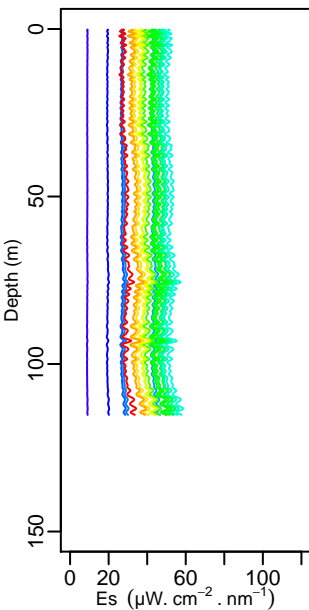
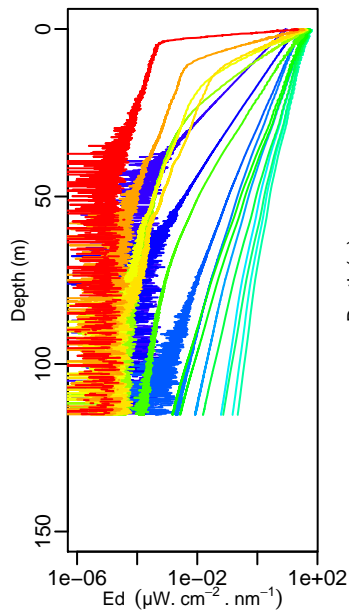
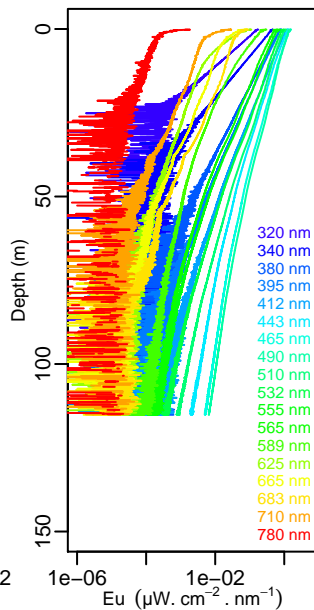
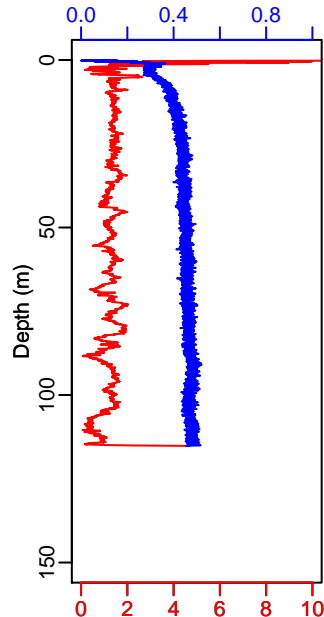
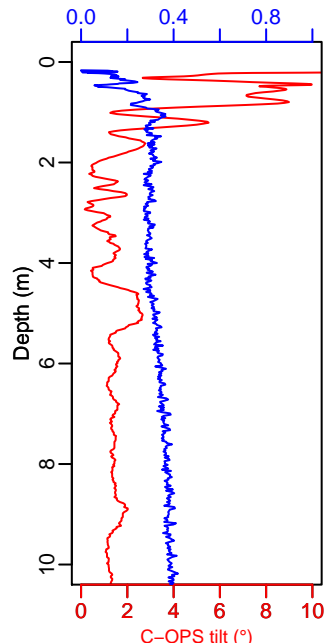
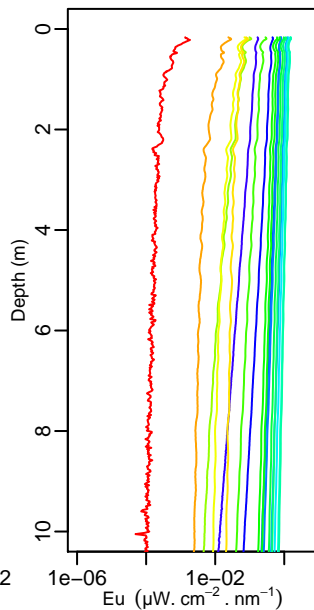
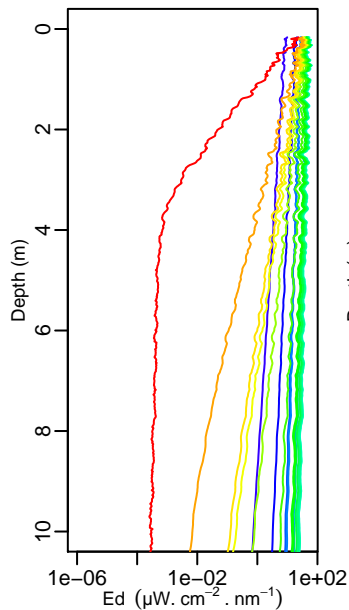
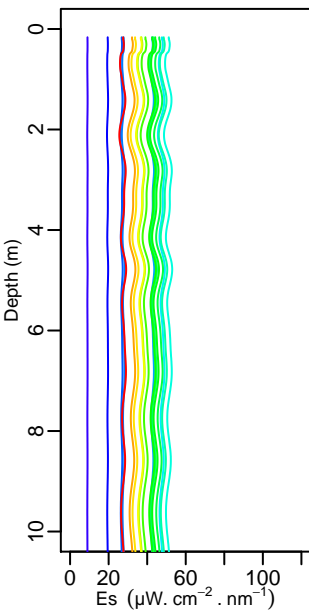
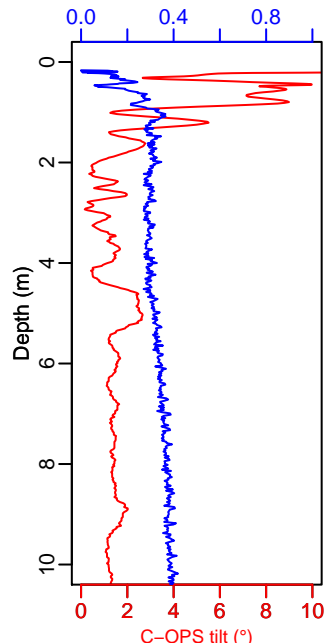
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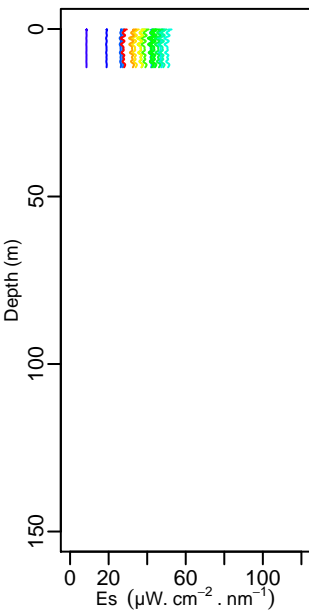
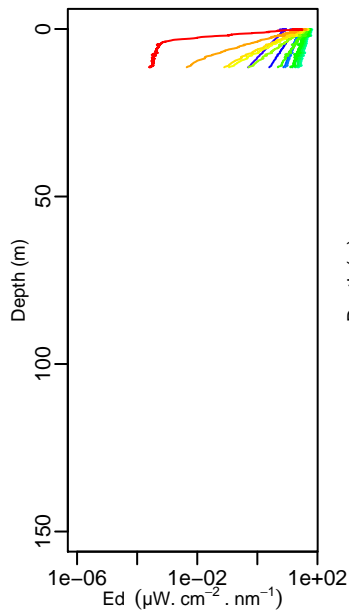
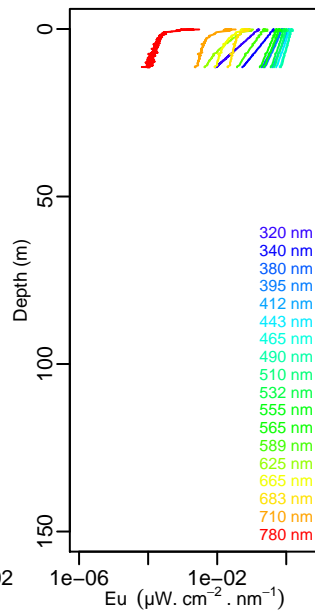
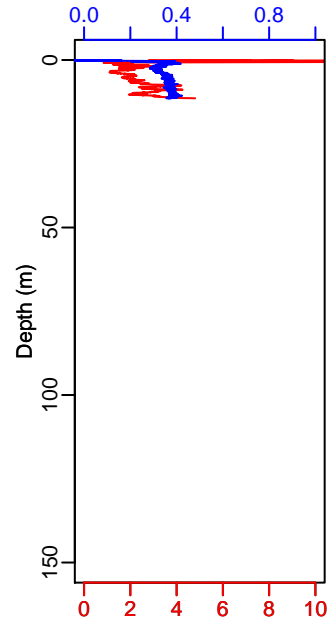
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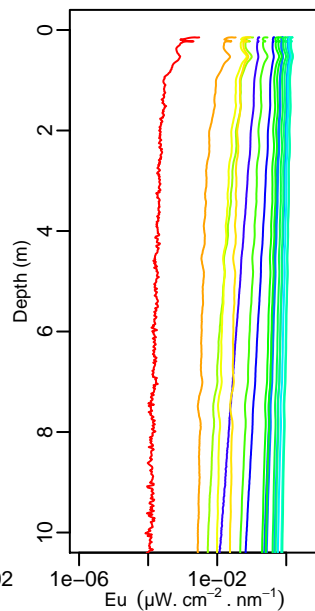
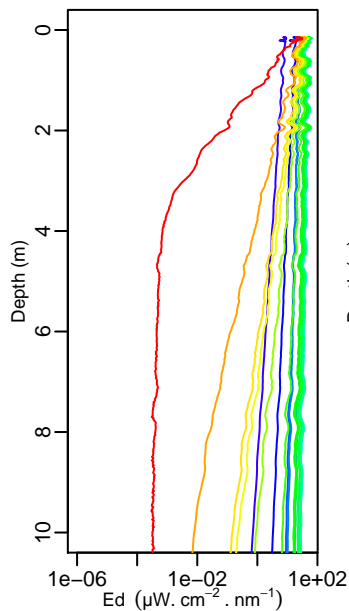
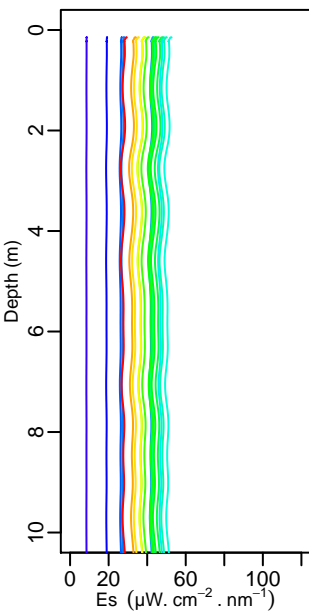
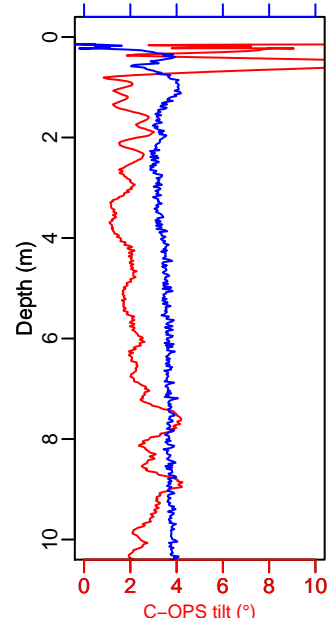
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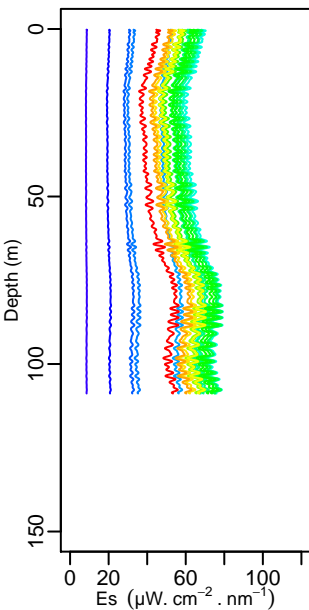
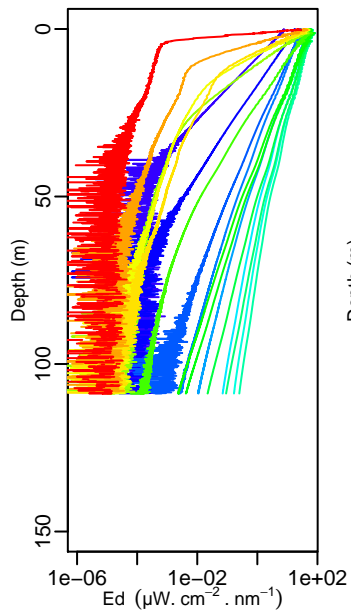
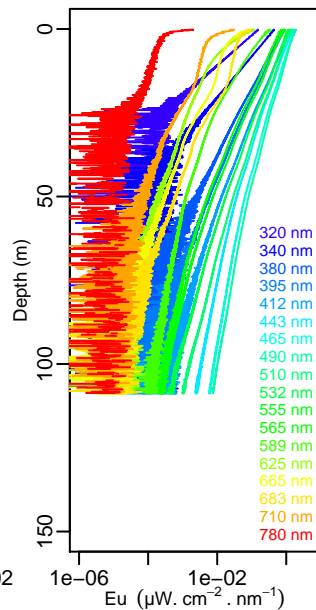
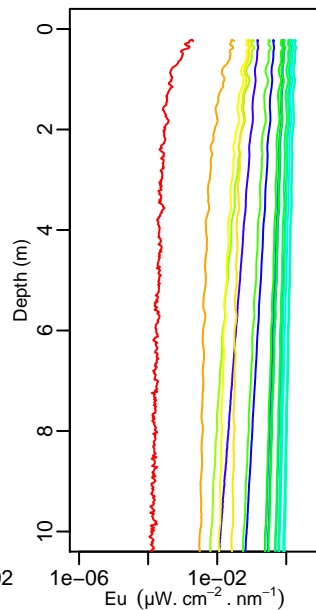
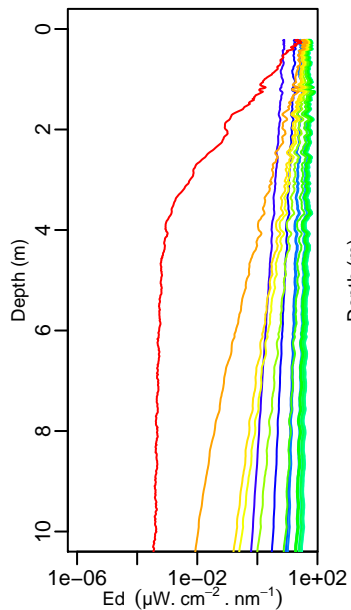
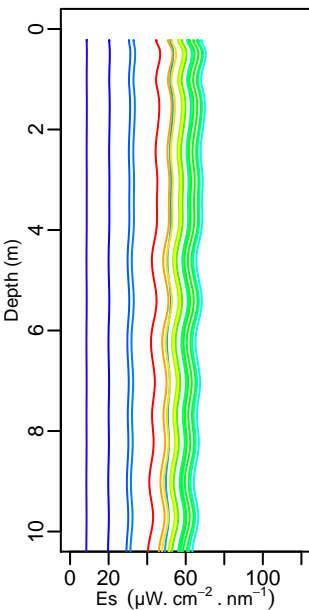
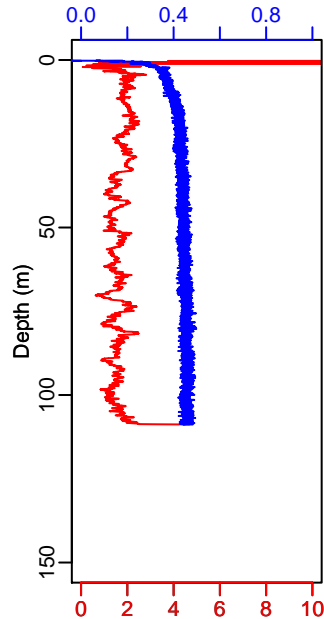


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**Boussole\_227****bou\_c-ops\_210218\_1343\_002\_data****14:01 UTC****C-OPS speed (m. s<sup>-1</sup>)**

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

**C-OPS tilt (°)****C-OPS speed (m. s<sup>-1</sup>)****C-OPS tilt (°)****C-OPS tilt (°)**

**Boussole\_227****bou\_c-ops\_210218\_1343\_003\_data****14:08 UTC****C-OPS speed ( $\text{m} \cdot \text{s}^{-1}$ )****C-OPS tilt ( $^\circ$ )****C-OPS speed ( $\text{m} \cdot \text{s}^{-1}$ )**