BELGICA Cruise Report B10-10

19- 23 April 2010

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Content

1 Participants

Name	Institution-Team	On board 19-23/4
NEUKERMANS Griet	MUMM	X
LACROIX Geneviève	MUMM	X
MERIAUX Xavier	ULCO (guest MUMM)	X
ASTORECA Rosa	ULB/ESA	X
ROUSSEAU Véronique	ULB/ESA	X
CABRITA Ines	ULB/ESA	X
PARENT Jean-Yves	ULB/ESA	X
JANSSENS Julie**	ULB/ESA (student)	X
MOLLE Xavier**	ULB/ESA (student)	X
DENIS Kevin	UMons	X
HARLAY Jérôme	ULg	X
COULIER Gijs	MUMM	X (19-22)
SAUDEMONT Daniël	MUMM	X (19-22)
TOTAL aboard		**13**

2 Scientific objectives

2.1 BELCOLOUR-2

The general objective of the BELSPO-funded BELCOLOUR-2 project is to improve the quality of existing optical remote sensing products for marine, coastal and inland waters based on new scientific knowledge and to develop new products (including partial pressure of CO2 and primary production) for key applications such as aquaculture and air-sea CO2 flux quantification. In addition to algorithm work and image processing BELCOLOUR-2 participates in seaborne cruises for the purposes of calibration of algorithms and for validation of the end products. The primary objectives of this campaign are making in-situ measurements simultaneous with satellite overpasses of MERIS (Medium Resolution Imaging Spectrometer) and MODIS (Moderate Resolution Imaging Spectrometer), measurements of a very detailed set of apparent and inherent optical properties (optical closure, characterisation of specific inherent optical properties for use in algorithm calibration/evaluation) and measurement of carbon-related parameters (partial pressure of CO2, primary production).

The *Université Littoral Côte d'Opal* will participate in this cruise through an *ad hoc* collaboration in optical property measurements and POC/PIC. BELCOLOUR-ULCO will carry out a lab experiment to investigate the influence of particle aggregation on IOPs.

Teams involved in the project: MUMM+ULB/ESA+ULg +ULCO

2.2 AMORE-3

The research project AMORE-3 seeks to contribute to the development of Sustainability Science for the management of coastal zones. In particular AMORE-3 address the dual control of changing human activity and climate on eutrophication processes in the Belgian coastal zone and the feedback effect of eutrophication on goods (newly-deployed offshore mussel farming) and services (atmospheric CO_2 absorption) provided by the Belgian coastal zone.

ULB-ESA objectives of the cruise are the study of phytoplankton ecophysiology and more particularly photoadaptation properties.
UMONS will test the FlowCAM, a real-time digital imaging flow cytometry in field conditions, and more particularly the possibility for continuous measurements and real time analysis of natural phytoplankton communities present in spring in the Southern Bight of the North Sea.

Teams involved in the project: ULB-ESA+UMons

2.3 MUMM-MONIT

Monitoring en evaluatie van de kwaliteit van het mariene milieu in de zone van het BCP en het Schelde-estuarium in het kader van internationale (het 'Joint Assessment en Monitoring Programme' (JAMP), nationale verplichtingen voor de kaderrichtlijn water (KRW) en andere (monitoring van het milieu i.v.m. diverse impacten o.a. zand- en grindexploitaties en baggeractiviteiten).

Dit programma behelst de bepaling van organische contaminanten, nutriënten, zoutgehalte, temperatuur, gesuspendeerde stoffen, opgeloste zuurstof, TOC en POC, chlorofyl a, faeofytine, en optische parameters in de waterkolom (bijlagen 1-2), evenals de bepaling van de biomassa en soortensamenstelling van fytoplankton en benthische organismen. Voor het sediment betreft het organische contaminanten, zware metalen en ondersteunende parameters. Voor biota wordt naar de programma's van het ILVO-visserij verwezen.

3 Operational course

3.1 Planned operations

The cruise plan was designed to allow:

- Daytime (8:00 – 19:00) optical measurements for the BELCOLOUR-2 project at a range of stations in Belgian waters, along the "Harwich transect" in UK waters and at arbitrary places at the time of satellite overpasses. An estimated 22 stations were planned.
- Measurements of phytoplankton primary production and community, including measurements using the FlowCAM, for the AMORE project at a subset of the BELCOLOUR-2 stations in clearer waters.
- Day and night time sampling at WFD monitoring stations (W01-W10).
- Two tidal cycle continuous measurements of optical properties of suspended matter and concentration (which can be done during day and night).
- Particle disaggregation lab experiment by MUMM-ULCO

For further details on the operational planning, we refer to the cruise plan.

3.2 Implementation of planned operations

Efficient working and optimal weather conditions allowed the operations to be maximally implemented:

- 20 out of 22 planned stations were sampled for all teams
- Due to cloudfree, sunny skies, 5 satellite match-ups were achieved (3 for MERIS and 2 for MODIS Aqua) at 5 additional stations.
- two tidal cycle measurements were conducted at stations BWS1 (10h) and MH5 (9h)
- a disaggregation experiment was successfully conducted on board to demonstrate the effect of aggregation on the optical properties of marine particles. The experiment was successfully repeated on another water sample of very different particle composition

- due to sunny conditions the phytoplankton incubation experiments were successfully conducted

The objectives of the campaign were fulfilled for all teams onboard.

3.3 Operational course

All times are given in local time (=UTC + 2 hours)

Monday 19th April 2010

08:00 -10:30 Embarkation Zeebrugge

11:00 Departure Zeebrugge and transit to station W01. Station measurement for MONIT+ULg. Set-up of LISST by BELCOLOUR.

12:15 Transit to station B&W S1. FlowCAM continuous pumping system tested in transit.

13:10 Arrival at B&W S1, on anchor.

13:30-24:00 BELCOLOUR-2 measurements at station B&WS1, continuous tidal cycle measurements. Niskin samples at the surface every hour (14:00-24:00).

21:00 (?) TriOS mounting frame was picked up by Zodiac in Zeebrugge.

22:00 Calibration of Stereomicroscope (equipped with camera) using the scale cross for all possible magnifications

24:00 End of sampling at B&W S1, transit to W05.
24:00 Calibration of TriOS sensors.

Tuesday 20th April 2010

07:00 Installation of TriOS sensors on Belgica

08:30-20:10 BELCOLOUR-2/AMORE/MONIT measurements at stations W05 (08:30), W07 (10:30), W10 (15:45), W08 (18:10), W06 (20:10). The FlowCAM continuous pumping was tested between stations.

MERIS match-up at 12:38 at station MER-A

MODIS match-up at 14:09 at station MOD-A

Wednesday 21st April 2010

08:10-11:20 BELCOLOUR-2/AMORE measurements at stations MH2 (08:18), MH3 (±09:56), MH4 (±11:24). The FlowCAM continuous pumping system was tested between stations.

MERIS match-up at 14:07 at station MER-B. If cloud free and not on a station at this time, additional stop for making MERIS match-up measurement.

15:00-24:00 BELCOLOUR-2 measurements at station MH5, continuous tidal cycle measurements. Niskin samples at the surface every hour.

24:00 End of tidal cycle measurements at station MH5. Transit to W03.

Thursday 22nd April 2010

07:30-14:00 BELCOLOUR-2/AMORE/MONIT measurement at stations W03 (08:00) and W02 (09:00).

11:30 Transit of Daniël Saudemont and Gijs Coulier from W02 to Oostende harbour by Zodiac.

MERIS match-up at 13:15 at station MER-C.

MODIS match-up at 13:57 at station MOD-B.

15:00-17:00 Disaggregation experiment carried out in the lab, using the LISST and optical instruments.

19:00-21:00 Repetition of disaggregation experiment.

Friday 23rd April 2010

09:00-11:15 BELCOLOUR-2/AMORE measurements at station 250 (08:50), W04 (09:45, also MONIT) and 700 (11:01).

11:40 Arrival Zeebrugge

12:30-15:00 Disembarkation of equipment

4 Sampling stations and operations

4.1 BELCOLOUR-2

4.1.1 MUMM, ULCO AND ULG

BELCOLOUR and AMORE sampled simultaneously at 20 stations. Due to cloudfree, sunny skies, 5 satellite match-ups were achieved (3 for MERIS and 2 for MODIS Aqua). A list of stations and parameters measured by MUMM and ULCO is given in Table 1.

At these 20 stations, ULg has determined total alkalinity (TA), oxygen saturation (O2%), concentrations in transparent exopolymer particles (TEP) and methane (CH4) in surface waters, in addition to the continuous pCO2 record. The TEP and CH4 remain to be analysed in the ULg lab. Total alkalinity exhibited an overall conservative relationship with respect to salinity and the signature of the Thames (St. W06) and the Scheldt (St. 250 and W04) waters could be observed. The surface waters were oversaturated with respect to O2 with saturation (in %) ranging between 101.0 (St. W02) and 137.5 (St. W05_MERIS_C). ULg also sampled at station W01 on April 19th, simultaneously with MONIT.

Marine reflectance was not recorded on Monday 19th due to the absence of the TriOs mounting frame (due to illness of a MUMM colleague). Everything was put to work to get the frame from Brussels on board the Belgica as soon as possible. By Tuesday morning the sensors were calibrated, installed and up and running for the rest of the campaign. Marine reflectance was recorded at all stations since Tuesday, except during the tidal cycle measurements (not possible to rotate the ship when anchored), and for sampling at low sun zenith angles.

Two tidal cycle measurements were conducted at stations BWS1 (during 10h) and MH5 (during 9h), on April 19 and 21, respectively. Every hour, a surface water sample was taken with a Niskin and treated on board for turbidity, chlorophyll a, suspended matter concentration and particulate organic carbon. ULCO's optical instruments remained in the water during the tidal cycle and continuously recorded the optical properties of suspended particles (absorption and scattering), while a LISST (fixed together with the other optical instruments) recorded particle size distribution. Every hour a vertical profile was done to record the optical properties and size distribution of particles along the water column. This brings the total number of stations sampled by MUMM and ULCO to 40.

On Thursday 22nd, a disaggregation experiment was successfully conducted on board to demonstrate the effect of particle aggregation on the optical properties of marine particles. Particles were desaggregated with a huge kitchen mixer. Before and after the disaggregation, a small subsample was analysed with the FlowCAM. The experiment was successfully repeated on another water sample of very different particle composition.

Table 1. Sampling stations and parameters measured by MUMM and ULCO during campaign B10-10. Stations in bold correspond to satellite match-ups.

Station	Date	Time (UTC)	Lat (°N)	Lon(°E)	Turb	TSM	Chl a	POC/ PIC	LISST	marine refl	ULCO-optics
BWS1-A	19/4/2010	11:30	51.421667	3.049182	x	x	x	x	x		x
BWS1-B	19/4/2010	12:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-C	19/4/2010	13:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-D	19/4/2010	14:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-E	19/4/2010	15:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-F	19/4/2010	16:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-G	19/4/2010	17:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-H	19/4/2010	18:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-I	19/4/2010	19:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-J	19/4/2010	20:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-K	19/4/2010	21:00	51.421667	3.049182	x	x	x	x	x		x
BWS1-L	19/4/2010	22:00	51.421667	3.049182	x	x	x	x	x		x
W05	20/4/2010	6:50	51.416417	2.809538	x	x	x	x	x	x	x
W07	20/4/2010	8:34	51.583633	3.007272	x	x	x	x	x	x	x
MER-A	**20/4/2010**	**10:39**	**51.743550**	**2.746322**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
MOD-A	**20/4/2010**	**12:05**	**51.721000**	**2.667932**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
W10	20/4/2010	13:45	51.684733	2.419080	x	x	x	x	x	x	x
W08	20/4/2010	16:12	51.458083	2.354648	x	x	x	x	x	x	x
W06	20/4/2010	18:07	51.257317	2.432127	x	x	x	x	x	x	x
MH2	21/4/2010	6:18	51.677067	2.364705	x	x	x	x	x	x	x
MH3	21/4/2010	7:56	51.718767	2.111232	x	x	x	x	x	x	x
MH4	21/4/2010	9:24	51.790667	1.896198	x	x	x	x	x	x	x
MER-B	**21/4/2010**	**10:06**	**51.785867**	**1.894530**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
MH5-A	21/4/2010	13:00	51.883833	1.671030	x	x	x	x	x		x
MH5-B	21/4/2010	14:00	51.883833	1.671030	x	x	x	x	x		x
MH5-c	21/4/2010	15:00	51.883833	1.671030	x	x	x	x	x		x
MH5-D	21/4/2010	16:00	51.883833	1.671030	x	x	x	x	x		x
MH5-E	21/4/2010	17:00	51.883833	1.671030	x	x	x	x	x		x
MH5-F	21/4/2010	18:00	51.883833	1.671030	x	x	x	x	x		x
MH5-G	21/4/2010	19:00	51.883833	1.671030	x	x	x	x	x		x
MH5-H	21/4/2010	20:00	51.883833	1.671030	x	x	x	x	x		x
MH5-I	21/4/2010	21:00	51.883833	1.671030	x	x	x	x	x		x
MH5-J	21/4/2010	22:00	51.883833	1.671030	x	x	x	x	x		x
W03	22/4/2010	5:57	51.174450	2.708405	x	x	x	x	x	x	x
W02	22/4/2010	7:05	51.223717	2.857825	x	x	x	x	x	x	x
MER-C	**22/4/2010**	**11:10**	**51.414417**	**2.808927**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
MOD-B	**22/4/2010**	**11:53**	**51.448800**	**2.810095**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
250	23/4/2010	6:52	51.516667	3.314998	x	x	x	x	x	x	x
W04	23/4/2010	7:48	51.451050	3.239407	x	x	x	x	x	x	x
700	23/4/2010	9:01	51.376967	3.211290	x	x	x	x	x	x	x

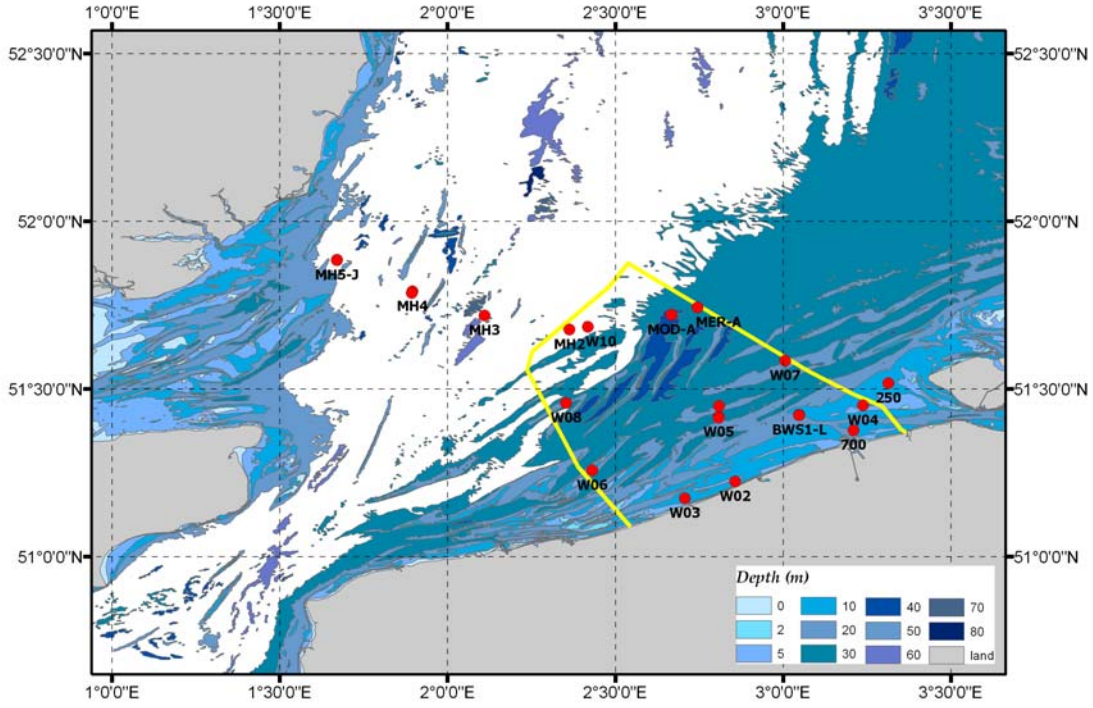

Figure 1. BELCOLOUR-2/AMORE-3 sampling stations during campaign B10-10. Tidal cycle stations which were continuously sampled for 9-10h are MH5 and BWS1.

4.1.2 ULB-ESA

At each of the 20 BELCOLOUR stations, ULB-ESA sampled seawater for IOP's determination (absorption (CDOM, NAP, pigments), suspended matter, HPLC pigments, ac-9 attenuation). At 7 stations (Table 2), deck incubations were performed during photoperiod for photosynthetic parameters determination using radiotracer methodology. Incubations with a photosynthetron and PAM (Pulse Amplitude Modulated fluorimeter) were run in parallel in the lab container.

Table 2. Sampling stations and parameters measured by ULB-ESA for the BELCOLOUR-2 project during campaign B10-10. Time in UTC.

Station	Date	Time	Lat	Lon	ODAS	OURS	CTD	Chla	SM	Phyto	CDOM	Chla HPLC	Absorpt	AC9	PE exp
W01	19/04/2010	9:52	51 22.4900	3 11.2118	X	X	X	X	X	X	X	X	X	X	
B&WS1A	19/04/2010	11:19	51 25.3000	3 2.9509	X	X	X	X	X	X	X	X	X	X	X
B&WS1B	19/04/2010	12:07	51 25.2980	3 2.9502	X	X	X							X	
B&WS1C	19/04/2010	13:06	51 25.2980	3 2.9509	X	X	X	X	X	X	X			X	
B&WS1D	19/04/2010	14:06	51 25.2980	3 2.9509	X	X	X	X	X					X	
B&WS1E	19/04/2010	15:04	51 25.3800	3 3.0172	X	X	X				X			X	
B&WS1F	19/04/2010	16:05	51 25.3830	3 3.0084	X	X	X							X	
B&WS1G	19/04/2010	17:02	51 25.3240	3 3.0519	X	X	X	X	X					X	
B&WS1H	19/04/2010	18:01	51 25.3630	3 3.0494	X	X	X	X	X					X	
B&WS1I	19/04/2010	19:00	51 25.3760	3 3.0149	X	X	X				X			X	
W05	20/04/2010	6:30	51 24.9850	2 48.5693	X	X	X	X	X	X	X	X	X	X	
W07	20/04/2010	8:32	51 35.0380	3 0.4866	X	X	X	X	X	X	X	X	X	X	X
MERIS A	20/04/2010	10:38	51 44.5690	2 44.7693	X	X	X	X	X	X	X	X	X	X	X
MODIS A	20/04/2010	12:07	51 43.2870	2 40.1449	X	X	X	X	X	X	X	X	X	X	X
W10	20/04/2010	13:47	51 41.0820	2 25.1352	X	X	X	X	X	X	X	X	X	X	
W08	20/04/2010	16:14	51 27.4950	2 21.4495	X	X	X	X	X	X	X	X	X	X	
W06	20/04/2010	18:08	51 15.4320	2 25.9786	X	X	X	X	X	X	X	X	X	X	
MH2	21/04/2010	6:21	51 40.6230	2 21.8738	X	X	X	X	X	X	X	X	X	X	
MH3	21/04/2010	7:52	51 43.1540	2 6.6125	X	X	X	X	X	X	X	X	X	X	
MERIS B	21/04/2010	10:07	51 47.1010	1 53.6711	X	X	X	X	X	X	X	X	X	X	X
DWSUNK	21/04/2010	13:03	51 53.0300	1 40.2618	X	X	X	X	X	X	X	X	X	X	
W02	22/04/2010	7:06	51 13.4200	2 51.4703	X	X	X	X	X	X	X	X	X	X	
MERIS C	22/04/2010	11:11	51 24.8680	2 48.5371	X	X	X	X	X	X	X	X	X	X	X
MODIS B	22/04/2010	11:57	51 26.9710	2 48.6761	X	X	X	X	X	X	X	X	X	X	X
250	23/04/2010	6:54	51 31.0070	3 18.8991	X	X	X	X	X	X	X	X	X	X	
W04	23/04/2010	7:46	51 27.0470	3 14.3623	X	X	X	X	X	X	X	X	X	X	

4.1.3 CONCLUSION

This was a very successful campaign for BELCOLOUR-2:

- Due to cloudfree, sunny skies, 5 satellite match-ups were achieved (3 for MERIS and 2 for MODIS Aqua)
- two tidal cycle measurements were successfully conducted at stations BWS1 (10h) and MH5 (9h)
- a disaggregation experiment was successfully conducted on board to demonstrate the effect of aggregation on the optical properties of marine particles. The experiment was successfully repeated on another water sample of very different particle composition
- due to sunny conditions the phytoplankton incubation experiments were successfully conducted

4.2 AMORE-3

4.2.1 ULB-ESA

Some 20 stations were sampled during this cruise. At each station, ULB-ESA sampled seawater with Niskin bottles for Chla, Suspended matter content, phytoplankton community composition while CTD and ODAS (coordinates, time, salinity, temperature, depth) parameters were collected (Table 1). At 7 stations subsamples were taken for nutrient (nitrate+nitrite, ammonium, silicate and phosphate) determinations. Incident PAR was recorded continuously on the upper deck.

A significant Phaeocystis bloom was observed in the coastal waters, in particular close to the BCZ coast. Colonies were correctly detected with the FlowCAM.

Table 3. Sampling stations and parameters measured by ULB-ESA/UMH for the AMORE-3 project during campaign B10-10. Time in UTC.

Station	Date	Time	Lat	Lon	ODAS	OURS	CTD	Nutrients	Chla	SM	Phyto
W01	19/04/2010	9:52	51 22.4900	3 11.2118	X	X	X		X	X	X
B&WS1A	19/04/2010	11:19	51 25.3000	3 2.9509	X	X	X	X	X	X	X
W05	20/04/2010	6:30	51 24.9850	2 48.5693	X	X	X		X	X	X
W07	20/04/2010	8:32	51 35.0380	3 0.4866	X	X	X	X	X	X	X
MERIS A	20/04/2010	10:38	51 44.5690	2 44.7693	X	X	X	X	X	X	X
W09	20/04/2010	11:32	51 44.9100	2 41.9822	X	X	X				X
MODIS A	20/04/2010	12:07	51 43.2870	2 40.1449	X	X	X	X	X	X	X
W10	20/04/2010	13:47	51 41.0820	2 25.1352	X	X	X		X	X	X
W08	20/04/2010	16:14	51 27.4950	2 21.4495	X	X	X		X	X	X
W06	20/04/2010	18:08	51 15.4320	2 25.9786	X	X	X		X	X	X
MH2	21/04/2010	6:21	51 40.6230	2 21.8738	X	X	X		X	X	X
MH3	21/04/2010	7:52	51 43.1540	2 6.6125	X	X	X		X	X	X
MERIS B	21/04/2010	10:07	51 47.1010	1 53.6711	X	X	X	X	X	X	X
DWSUNK	21/04/2010	13:03	51 53.0300	1 40.2618	X	X	X		X	X	
W02	22/04/2010	7:06	51 13.4200	2 51.4703	X	X	X		X	X	X
MERIS C	22/04/2010	11:11	51 24.8680	2 48.5371	X	X	X	X	X	X	X
MODIS B	22/04/2010	11:57	51 26.9710	2 48.6761	X	X	X	X	X	X	X
250	23/04/2010	6:54	51 31.0070	3 18.8991	X	X	X		X	X	X
W04	23/04/2010	7:46	51 27.0470	3 14.3623	X	X	X		X	X	X
700	23/04/2010	9:03	51 22.6700	3 12.6938	X	X	X		X	X	X

4.2.2 UMONS

UMons sampled at the following statios: W01, BWS1a, BWS1c, BWS1d, W05, W07, W09, W10, W06, MH2, MH3, MERISB, DWSUNK, W02, W05, 250, W04.

Goals

Test the analysis of phytoplankton communities along transects between stations by pumping sea water directly in the FlowCAM.
Digitize samples from contrasted stations in order to optimize the automatic recognition of phytoplankton.

Experiments

Transect between stations were performed but because of the high power of sea flow, the system was broken during the transect between W07 and W09 (second day of cruise). Because of that, only discrete samples were analyzed in the FlowCAM.
At each station, samples was taken with a bucket. 100mL were preserved in lugol for manual counting, the rest was analyzed with the FlowCAM.

Conclusions and limitations

The fist goal was not achieved: the pumping system was broken on the second day of cruise. It was thus not possible to pump sea water directly in the FlowCAM.
Anyway, the second goal was fully achieved and new images of phytoplankton were collected to complete the data base used for the automatic recognition.

4.2.3 CONCLUSION

AMORE-3's scientific objectives were achieved during the cruise 2010/10. In paricular the number of satellite matchups (5) was highly satisfying as they were required for primary production algorithm validation. All instruments functioned correctly. Both ULB-ESA and UMH made very interesting observations and experiments at a high number of stations.

4.3 MUMM-MONIT

4.3.1 OPERATIONIONAL COURSE

Op elk punt werden staalname's uitgevoerd met Niskin, Van Veen grijper en werd een CTD-profiel genomen.

19/04/10: 9u00 inschepen labomateriaal.
09u40 vertrek naar W01
09u54 staalnames op W01

20/04/10: 08u50 staalname op W07
11U33 staalname op W09
13u58 staalname op S10
16u26 staalname op S08
18u26 staalname op W06

22/04/10: 07u01 staalname op W02
03u03 staalname op W10

23/04/10 07u54 staalname op W04

4.3.2 UITGEVOERDE STAALNAMES:

STATION	ODAS	In situ metingen		WATER NISKIN (5 l)	WATER NISKIN (10 l)		WATER GO FLO (10 l)
		CTD Seacat	D.O.YSI 52	Saliniteit en pH	POC / DOC materie in suspentie	Nutrienten en Chlorofyl	Analysis Endocrine Disruptors
W01	X	X	X	X	X	X nut + chloro	X
W02	X	X	X	X	X	X nut + chloro	
W03	X	X	X	X	X	X nut + chloro	
W04	X	X	X	X	X	X nut + chloro	
W05	X	X	X	X	X	X nut + chloro	X
W06	X	X	X	X	X	X nut + chloro	x
W07	X	X	X	X	X	X nut + chloro	
W08	X	X	X	X	X	X nut + chloro	
W09	X	X	X	X	X	X nut + chloro	
W10	X	X	X	X	X	X nut + chloro	
S01	X	X	X	X	X	X nut + chloro	
S03	X	X	X	X	X	X nut + chloro	

4.3.3 ODAS-DATA

Station	Dat.	tijd	Windsp. m/s	latitude	longitude	Turner Fluo (ug/l)	Depth (m)	Sal (psu)	Air temp (°C)	Water temp
W01	1904	09u54	4.6	51°22.5090	3°11.2727	2.2	13.7	29.8824	8.7	9.123
W02	22/04	01u10	2.4	51°13.4450	2°51.4774	2.2	12.1	29.9087	6.3	9.8152
W03										
W04	23/04	07u54	3.1	51°27.1600	3°14.3288	2.2	10.0	31.5439	8.2	8.737
W05										
W06	20/04	18.26	8.4	51°15.5800	2°26.5133	2.2	15.1	33.7448	9.6	8.498
W07	20/04	08u51	9.2	51°34.9150	3°0.2706	2.2	24.3	32.7799	9.8	8.073
W08	20/04	16u28	5.5	51°27.6730	2°22.0917	2.2	27.14	34.7432	9.5	8.271

W09	20/04	11u34	10.8	51°44.9060	2°41.9787	2.2	41.6	34.6081	8.7	7.844
W10	20/04	13u59	5.0	51°41.0730	2°25.2397	2.2	42.89	34.9500	09.8	7.932

4.3.4 SEACAT DATA

Tabel : Sampling Depth, Sea Temperature, Salinity, Turbidity, Oxygen and Density are measured
In situ with the Seabird SCTD-model SBE19 (Seacat) (S: suspected data) (B: no data)
Stations W01,W02 & W03 were sampled by Ugent as well *

Bottom

n	Depth	Temperature	Salinity	Oxygen	Oxygen Sat
	(m)	(°C)	(ppt)	(mg/L)	(ml/L)
W01	6.341	8.9981	30.0239	7.548	6.669
W02	9.447	9.8387	30.0947	6.939	6.542
W03	6.819	9.7178	30.5878	7.860	6.539
W04	7.017	8.7107	31.5715	8.640	6.646
W05					
W06	13.177	8.4928	33.7551	8.181	6.586
W07	23.277	8.0420	32.7915	8.709	6.696
W08	21.695	8.2236	34.7523	7.216	6.584
W09	36.920	7.7810	34.6115	7.710	6.657
W10	36.204	7.9112	34.9671	7.649	6.622

Sample depth

Station	Depth	Temperature	Salinity	Oxygen	Oxygen Sat
	(m)	(°C)	(ppt)	(ml/L)	(ml/L)
W01	4.375	9.0429	29.9241	7.571	6.667
W02	4.821	9.8308	30.0406	6.862	6.545
W03	5.827	9.7194	30.5870	7.834	6.538
W04	4.903	8.7108	31.5730	8.745	6.646
W05					
W06	5.316	8.4908	33.7522	8.276	6.587
W07	5.675	8.0647	32.7918	8.855	6.692
W08	5.784	8.2643	34.7577	7.413	6.578
W09	4.339	7.7999	34.6194	7.862	6.654
W10	4.110	7.9317	34.9630	7.716	6.619

4.3.5 ROSCOP DATA

H71-Surface measurements underway
H09- Water bottle stations: 2 x 10
H10-CTD stations: 12
H21-Oxygen: 12
H22-Phosphates: 12
H24-Nitrates: 12
H25-Nitrites: 12

H76-Ammonia: 12
H26-Silicates: 12
H28-pH: 12

P01-Suspended matter: 3 x 12

B02- Phytoplancton Pigments:12
B71- Particulate organic matter: 12
B06- Dissolved organic matter: 12

4.3.6 OPMERKINGEN

Staalnames zijn goed verlopen.

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