MANAGEMENT UNIT OF THE
NORTH SEA MATHEMATICAL MODELS

REMOTE SENSING AND
ECOSYSTEM MODELLING TEAM

# Cruise summary - Belgica campaign 2010-18 (5-9.7.2010)

BELCOLOUR-2/2/KR/201009/EN/WD

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# 1 Introduction and participants

This report summarises scientific activities of all projects participating in *Belgica* cruise 2010/18. For a more detailed description and/or reports on the data or scientific analysis the reader is advised to contact the scientists concerned. The list of scientists participating in this cruise is given in Table 1.

| NAME | INSTITUTION/TEAM | 5.7 | 6.7 | 7.7 | 8.7 | 9.7 |
|---|---|---|---|---|---|---|
| RUDDICK Kevin[1] | MUMM/BELCOLOUR-2 | X | X | X | X | X |
| NEUKERMANS Griet | MUMM/BELCOLOUR-2 | X | X | X | X | X |
| DOGLIOTTI Ana | IAPE (guest MUMM) | X | X | X | X | X |
| FROUIN Robert | SIO (guest MUMM) | X | X | X | X | X |
| BRETON Solène | ULCO (guest MUMM) | X | X | X | X | X |
| DELILLE Bruno | ULg/BELCOLOUR-2 | X | X | X | X | X |
| DENIS Kevin | UMH/AMORE | X | X | X | X | X |
| FETTWEIS Michael | MUMM/MOMO | X | | X | | X |
| DE BLAUWE Jean-Pierre | MUMM/MOMO | X | | X | | X |
| VAN DEN BRANDEN Reinhilde | MUMM/MOMO | | | X | | |
| VAN LANCKER Vera | MUMM/MOMO | | | X | | |
| DERYCKER Koen | RUG/RCMG | | | X | | |
| TOTAL | | 9 | 7 | 12 | 7 | 9 |

Table 1. List of participants.

# 2 Campaign objectives

## 2.1 BELCOLOUR-2 : MUMM+ ULg+Guests (ULCO, IAPE, SIO)

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 were to make *in situ* measurements simultaneous with satellite overpasses of MERIS (Medium Resolution Imaging Spectrometer) and MODIS (Moderate Resolution Imaging Spectrometer), and measurement of carbon-related parameters (partial pressure of CO2). The participation of a guest from Scripps Institution of Oceanography (SIO) allows the comparison of different protocols and instruments (TriOS, SIMBADA) for abovewater measurement of marine reflectance.

## 2.2 AMORE-3: UMH

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

[1] Team leader

services (atmospheric CO2 absorption) provided by the Belgian coastal zone.
The objective of this cruise for UMONS was to test the FlowCAM, a real-time digital imaging flow cytometry (FlowCAM) 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. Tests were planned to pump sea water directly in the FlowCAM along transects realized between stations.

### 2.3 MUMM-MOMO

MOMO stands for the monitoring and modelling of cohesive sediment transport and the evaluation of the effects on the marine ecosystem due to dredging and dumping operations. The primary objective of the project is the study of the cohesive sediments on the Belgian Continental Shelf (BCS) using numerical models and field measurements. The combination of monitoring and modelling provides information on the transport processes of the fine fraction and is therefore fundamental to answer questions on composition, origin and residence on the BCS, the change in characteristics of this sediment due to dredging and dumping operations, the effects of the natural variability, the impact on the marine ecosystem especially due to alterations of habitats, the estimation of the net input of hazardous substances in the marine environment and the possibilities to reduce these last two items. The objective for this cruise was to recover and redeploy an instrumented Tripod and ADCP to recovery a second ADCP.

## 3 Summary of operations

### 3.1 Planned operations

The cruise plan was designed to allow:

- Daytime optical measurements for the BELCOLOUR-2 projects at a range of stations in Belgian waters, along the "Harwich transect" in UK waters and near the Scheldt estuary mouth in Dutch waters as well as arbitrary places at the time of satellite overpasses. An estimated 22 stations were planned.
- Simultaneous measurements of phytoplankton, including measurements using the FlowCAM, for the AMORE project at a subset of the BELCOLOUR-2 stations.
- One 13-hour cycle night-time session of extra BELCOLOUR-2 measurements for inherent optical properties.
- Two 2 hour sessions of reflectance measurement protocol experiments.
- Recovery of a Tripod and ADCP for the MOMO project (MOW1 location) and redeployment of the Tripod.
- Localisation and/or recovery of an ADCP for the MOMO project (Bligh Bank), including possible use of divers.

### 3.2 Implementation of planned operations

Good weather and efficient working allowed the operations to be implemented as planned for the BELCOLOUR-2 and AMORE project. 22 stations were sampled for the BELCOLOUR-2 project (one of which was repeated), of which measurements were also made for AMORE-3 at 20 stations. Data quality is high for the optical measurements owing to excellent weather conditions (Bf 2-3). An extra measurement was made South of the Wenduine Bank for investigation of dissolved gasses generated by high organic content sediments.

Despite the best efforts of scientists, crew and Navy divers it was not possible to recover or even locate the Tripod and ADCP deployed previously at MOW1. It was concluded that these

instruments have been significantly displaced from their original locations and that their localisation and possible recovery requires actions beyond what is feasible within Belgica cruise 2010-18.

Information was received at the beginning of the cruise that the ADCP at the Bligh Bank could no longer be localised and no communication could be achieved with this instrument. It was concluded that there was no interest to attempt communication with this instrument during this Belgica cruise and this activity was cancelled.

The objectives of the campaign were fulfilled for BELCOLOUR-2 and AMORE-3. Although tripod and ADCP recovery were not successful, every reasonable effort was made during this cruise to achieve recovery and it was possible to conclude that these instruments have been significantly displaced.

# 4 Overview of measurement stations

The cruise log is given in Tables 3-7. An inventory of samples collected is given in Table 2. Figure 1 shows the stations sampled during the campaign.

Table 2. Samples taken on each station. "X" indicates the standard set of measurements. For BELCOLOUR:
FULL=TRIOS+CHL+TSM+Turbidity+ULg(TA+O2+DIC+pH+TEP+$N_2O$+$pCO_2$+$CH_4$)+CTD+LISST+ULCO IOP measurements (BB9, CTD, FluoCHL, FluoCDOM, Transmissometer 650nm, echo-VSF) +ULCO-water (DIC, DOC, CDOM). Exceptions to this full set and suspect measurements are denoted as "ex".

| Date | Time (UTC) | Station | Lat (Deg, Min) | Lon (Deg, Min) | BELCOLOUR | AMORE |
|---|---|---|---|---|---|---|
| 5 Jul 2010 | 10:45 | MOW1 | 51° 21.497 | 3° 05.8719 | X ex ULCO/IOP | X |
| | 16:22 | W05 | 51° 24.590 | 2° 49.5829 | X | X |
| | 18:04 | W07 | 51° 34.960 | 3° 00.6214 | X | X |
| 6 Jul 2010 | 6:46 | BBC | 51° 37.155 | 2° 48.9766 | X | X |
| | 8:08 | W09 | 51° 44.957 | 2° 42.0845 | X | X |
| | 10:10 | W10 | 51° 40.900 | 2° 25.3744 | X | X |
| | 11:54 | MH3 | 51° 44.091 | 2° 06.9484 | X | X |
| | 13:30 | MH4 | 51° 46.797 | 1° 52.6781 | X | X |
| | 15:04 | MH5 | 51° 50.888 | 1° 39.1908 | X | X |
| | 16:30 | MH6 | 51° 52.482 | 1° 28.8510 | X | X |
| | 18:05 | HARE | 51° 55.047 | 1° 26.0938 | X | |
| | 21:30 | WGAB | 51° 58.82′ | 2° 04.97′ | X ex TrIOS | |
| 7 Jul 2010 | 10:41 | 700 | 51° 22.667 | 3° 13.2185 | X | X |
| | 11:38 | 702N | 51° 23.281 | 3° 18.4557 | X | X |
| | 13:10 | S01 | 51° 25.030 | 3° 32.4604 | X | X |
| | 14:44 | W04 | 51° 25.025 | 3° 14.8350 | X | X |
| | 16:00 | MOW | 51° 21.505 | 3° 06.1540 | X+12h + ULg*2 | X |
| 8 Jul 2010 | 7:42 | W02 | 51° 13.563 | 2° 51.7494 | X | X |
| | 8:38 | W03 | 51° 10.295 | 2° 43.1261 | X | X |
| | 10:55 | W06 | 51° 15.990 | 2° 28.4903 | X | X |
| | 13:33 | W08 | 51° 27.444 | 2° 20.9801 | X | X |
| | 17:57 | W01 | 51° 22.523 | 3° 11.5496 | X | X |
| | 19:25 | ULg1, ULg1Top | 51° 19.345 | 3° 49.6380 | Ulg | |
| 9 Jul 2010 | 10:03 | 1018-A | 51° 21.601 | 3° 07.9351 | X | |
| | 10:25 | 1018-B | 51° 21.770 | 3° 07.8863 | Trios+SIMBADA | |

Table 3. Activities on Monday 5th July 2010. All times are in UTC time (UTC = local time – 2 hours)

| Time on 5.7.2010 (UTC=local-2) | Action/status |
|---|---|
| 06:20 | Arrival onboard in Zeebrugge. TriOS already setup from previous cruise. Discussion with captain. Loading and preparing all equipment. Not enough time for FieldCAL. |
| 08:40 | Depart Zeebrugge. Trios levelled to within 1°. CTD/SeaCAT cable found to be broken. |
| 10:30 | ADCP recovery (MOW1). |
| 10:50-11:20 | BELCOLOUR-2/AMORE at MOW1. CTD not transmitting, so logging locally on instrument package. ULCO grappe not recording? |
| 11:20-14:00 | Trying to locate Tripod – unsuccessful, no surface buoy. |
| 15:00 | Disembarkation of MOMO personnel by zodiac. Departing for W05 |
| 16:20 | BELCOLOUR-2/AMORE at W05 |
| 18:00 | BELCOLOUR-2/AMORE at W07 |
| | Delay optical measurements at BBC until tomorrow morning because low sun |

| | |
|---|---|
| 18:15 | Finished BELCOLOUR-2/AMORE sampling for day.<br>Disaggregation optics experiment in Wet Lab.<br>Anchor for night |

Table 4. Activities on Tuesday 6th July 2010. All times are in UTC time (UTC = local time – 2 hours)

| Time on 6.7.2010 (UTC=local-2) | Action/status |
|---|---|
| 05:30 | Up anchor, transit to station BBC |
| 06:46 | BELCOLOUR-2/AMORE at BBC |
| 08:08 | BELCOLOUR-2/AMORE at W09 |
| 10:10 | BELCOLOUR-2/AMORE at W10 |
| 11:54 | BELCOLOUR-2/AMORE at MH3 |
| 13:30 | BELCOLOUR-2/AMORE at MH4 |
| 15:04 | BELCOLOUR-2/AMORE at MH5 |
| 16:30 | BELCOLOUR-2/AMORE at MH6 |
| 18:05 | BELCOLOUR-2 at HARE |
| | Returning towards Belgian waters |
| 21:30 | BELCOLOUR-2 at WGAB |
| | Returning to Belgian coast for night |

Table 5. Activities on Wednesday 7th July 2010. All times are in UTC time (UTC = local time – 2 hours)

| Time on 7.7.2010 (UTC=local-2) | Action/status |
|---|---|
| 06:00 | Arrival at Zeebrugge to embark 4 MOMO scientists for intensive Tripod search (multibeam+side-scan sonar) |
| 06:30 | Depart Zeebrugge. Preparation of multibeam+side-scan sonar |
| 07:30-10:00 | Multibeam+side-scan sonar operations around MOW1 station, searching for Tripod. No immediate identification of Tripod location, but detailed image processing still pending. |
| 10:30 | BELCOLOUR-2/AMORE measurements at 700 |
| 11:10 | Disembarkation of 4 MOMO scientists by zodiac in Zeebrugge, while continuing BELCOLOUR-2/AMORE operations. |
| 11:35 | BELCOLOUR-2/AMORE measurements at 702N |
| 13:10 | BELCOLOUR-2/AMORE measurements at S01 |
| 14:40 | BELCOLOUR-2/AMORE measurements at W04 |
| 16:00 | Arrival at MOW1 for 13-hour BELCOLOUR-2 measurements |
| 16:30 | Anchor at MOW1. BELCOLOUR-2 measurements every hour from 17:00 to 05:00 (ULCO/IOP, surface Niskin for CHL, TSM, Turbidity, PIC/POC). |

Table 6. Activities on Thursday 8th July 2010. All times are in UTC time (UTC = local time – 2 hours)

| Time on 8.7.2010 (UTC=local-2) | Action/status |
|---|---|
| 05:00 | Finish 13 hour measurements at MOW1. Anchor up. |
| 07:40 | BELCOLOUR-2/AMORE measurements at W02 |
| 08:35 | BELCOLOUR-2/AMORE measurements at W03 |
| | Noctiluca visible in streaks. Some jellyfish – photo taken for identification. Very calm sea (Bf 0-1). FLOWCAM underway tests. |
| 10:55 | BELCOLOUR-2/AMORE measurements at W06 (MERIS overpass, but thin clouds) |
| 13:30 | BELCOLOUR-2/AMORE measurements at W08 |
| 17:55 | BELCOLOUR-2/AMORE measurements at W01 |
| 19:25 | Extra ULg measurements South of Wenduine Bank for dissolved gases (station ULg1) |
| | Anchor for night |

Table 6. Activities on Friday 9th July 2010. All times are in UTC time (UTC = local time – 2 hours)

| Time on 9.7.2010 (UTC=local-2) | Action/status |
|---|---|
| | Up anchor, transit to Zeebrugge |
| 05:30 | Arrival at Zeebrugge for embarkation of divers and MOMO scientists. |
| 06:15 | Departure from Zeebrugge. Transit to MOW1 for Tripod recovery. |
| 09:00 | Diving operations at MOW1 |
| 10:00 | BELCOLOUR-2 measurements at 1018A (near MOW1). MERIS matchup. TriOS measurements continued with SIMBADA. |
| 11:15 | Arrival Zeebrugge |
| 13:00 | Disembarkation completed |

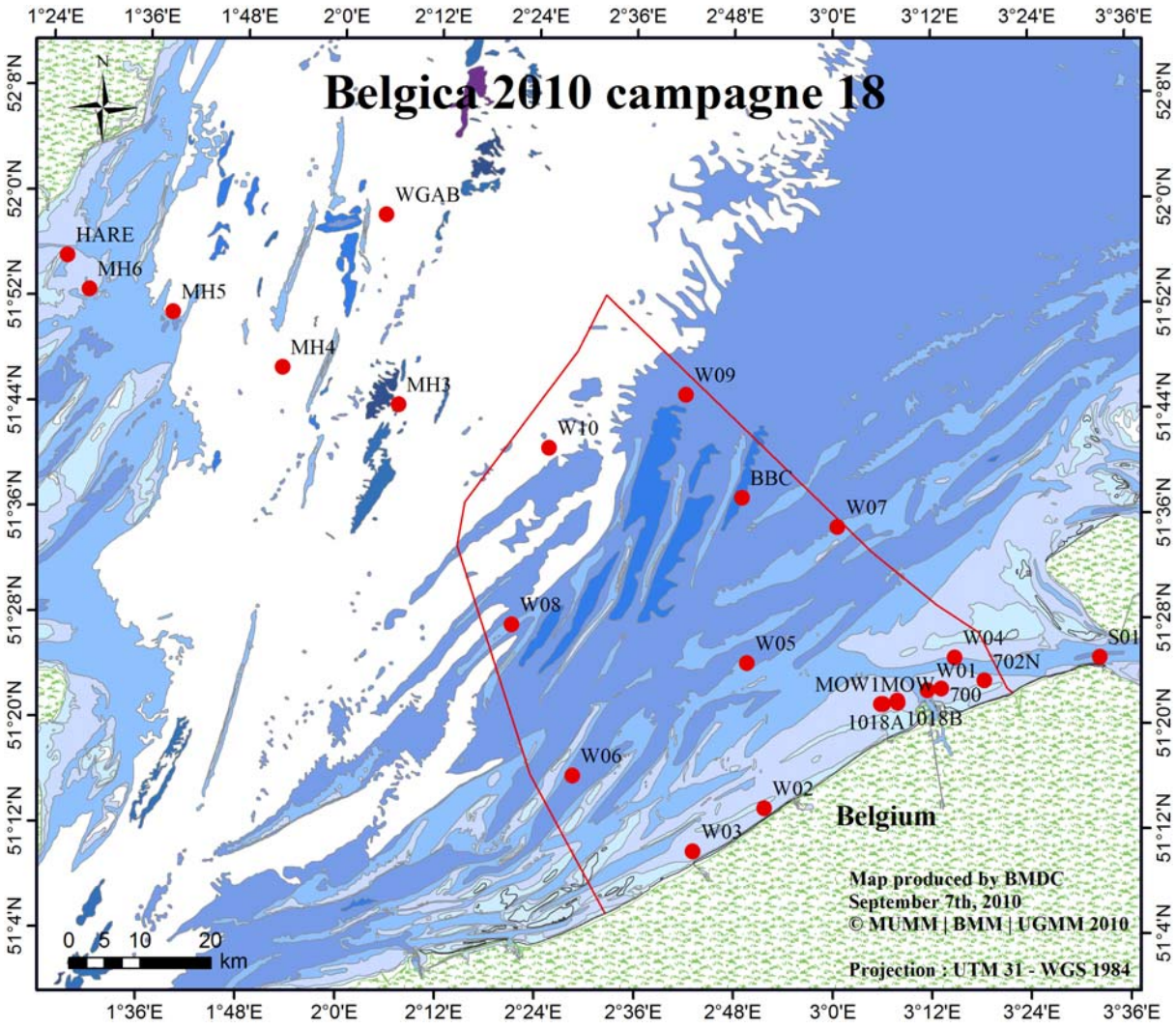


Figure 1. Overview of the stations

## 4.1 BELCOLOUR-2

At 22 stations the following standard set of observations were made for the BELCOLOUR project:

- Above water-leaving radiance, sky radiance and downwelling irradiance were measured continuously during 5 minutes using the MUMM-RAMSES system of spectroradiometers fixed on the bow facing forwards. These measurements are processed to give directional water-leaving radiance reflectance as defined for the MERIS reflectance product. This measurement was not made at one station (WGAB) because the station was sampled at night.
- One water sample (+/- 10l) was taken by Niskin at the surface and filtered using GF/F filters (MERIS validation protocol) for analysis by MUMM of suspended particulate matter and HPLC pigments and for analysis by ULCO of particulate inorganic and organic carbon and Coloured Dissolved Organic matter (CDOM). Filters for HPLC analysis were stored onboard in liquid nitrogen. A subsample was used to measure turbidity at the beginning and end of filtrations.
- One water sample was taken by Niskin near the surface for measurement by ULg of total alkalinity, Transparent Exopolymer particles (TEP), $pCO_2$, $CH_4$ and $N_20$, dissolved oxygen.
- A vertical profile was made with the LISST instrument, attached to a package of optical instruments from ULCO (BB9, CTD, FluoCHL, FluoCDOM, Transmissometer 650nm, echo-VSF).

- Secchi depth was measured and general optical conditions (cloud cover and type, sun visibility, sea surface appearance, photos during measurements, etc.) were noted.

At a limited number of stations (esp. 1018), extra marine reflectance measurements were made with the SIO/SIMBADA instrument.

At one station (MOW1) a 13-hour cycle of measurements was made leaving the IOP instrument package and LISST in the water. Multiple turbidity measurements were also made during these time series.

At one station (ULg1) measurements were made by ULg alone for dissolved gasses.

Partial pressure of CO2 (pCO2) was measured continuously during this cruise.

| Station ID | Date | Time (UTC) | Latitude | Longitude | SunZen (d | Depth (m) | Wind (m/s) | Wind dir. | SeaTemp (°C) | Salinity (PSU) | Fluor. (FSU) | Waves (m) | Clouds (/8) | Sun state |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MOW1 | 5-Jul-2010 | 10:45 | 51° 21.497 | 3° 05.8719 | 31.16 | 9.8 | 6.0 | 290.7 | 19.6 | 30.002 | 3.0 | 0.30 | 6 | Variable |
| W05 | 5-Jul-2010 | 16:22 | 51° 24.590 | 2° 49.5829 | 59.10 | 23.6 | 4.4 | 276.5 | 18.6 | 30.922 | 2.5 | 0.20 | 1 | Clear |
| W07 | 5-Jul-2010 | 18:04 | 51° 34.960 | 3° 00.6214 | 74.84 | 24.3 | 2.2 | 356.0 | 16.8 | 31.599 | 2.8 | 0.10 | 1 | Clear |
| BBC | 6-Jul-2010 | 6:46 | 51° 37.155 | 2° 48.9766 | 63.74 | 39.3 | 4.4 | 339.8 | 16.3 | 32.303 | 2.4 | 0.30 | 6 | Variable |
| W09 | 6-Jul-2010 | 8:08 | 51° 44.957 | 2° 42.0845 | 51.19 | 39.1 | 5.1 | 334.9 | 15.4 | 33.650 | 2.1 | 0.20 | 6 | Variable |
| W10 | 6-Jul-2010 | 10:10 | 51° 40.900 | 2° 25.3744 | 34.96 | 40.3 | 4.7 | 335.3 | 15.4 | 34.057 | 2.3 | 0.30 | 8 | Variable |
| MH3 | 6-Jul-2010 | 11:54 | 51° 44.091 | 2° 06.9484 | 29.18 | 52.2 | 1.5 | 242.5 | 15.5 | 33.992 | 2.0 | 0.00 | 8 | Clouded |
| MH4 | 6-Jul-2010 | 13:30 | 51° 46.797 | 1° 52.6781 | 34.74 | 35.6 | 4.4 | 350.2 | 15.9 | 33.833 | 2.3 | 0.10 | 8 | Clouded |
| MH5 | 6-Jul-2010 | 15:04 | 51° 50.888 | 1° 39.1908 | 46.69 | 20.0 | 4.6 | 172.5 | 15.8 | 33.669 | 2.6 | 0.00 | 5 | Clouded |
| MH6 | 6-Jul-2010 | 16:30 | 51° 52.482 | 1° 28.8510 | 59.59 | 14.8 | 7.4 | 161.5 | 17.6 | 33.564 | 2.9 | 0.20 | 7 | Variable |
| HARE | 6-Jul-2010 | 18:05 | 51° 55.047 | 1° 26.0938 | 74.02 | 18.0 | 8.9 | 155.5 | 16.8 | 33.580 | 4.5 | 0.30 | 7 | Variable |
| WGAB | 6-Jul-2010 | 21:30 | 51° 58.820' | 2° 04.9700' | | | | | | | | | | |
| 700 | 7-Jul-2010 | 10:41 | 51° 22.667 | 3° 13.2185 | 31.63 | 12.3 | 4.1 | 283.0 | 19.3 | 29.756 | 7.5 | 0.00 | 8 | Clouded |
| 702N | 7-Jul-2010 | 11:38 | 51° 23.281 | 3° 18.4557 | 28.98 | 9.4 | 3.3 | 301.7 | 19.2 | 29.731 | 7.4 | 0.00 | 7 | Variable |
| S01 | 7-Jul-2010 | 13:10 | 51° 25.030 | 3° 32.4604 | 33.23 | 26.1 | 4.4 | 320.3 | 19.6 | 28.766 | 7.1 | 0.00 | 5 | Clear |
| W04 | 7-Jul-2010 | 14:44 | 51° 25.025 | 3° 14.8350 | 44.65 | 13.7 | 2.2 | 287.6 | 19.6 | 29.989 | 6.8 | 0.40 | 8 | Variable |
| MOW | 7-Jul-2010 | 16:00 | 51° 21.505 | 3° 06.1540 | 55.98 | 9.7 | 5.4 | 287.1 | 19.4 | 29.768 | 7.5 | 0.00 | 8 | Clouded |
| W02 | 8-Jul-2010 | 7:42 | 51° 13.563 | 2° 51.7494 | 55.14 | 12.1 | 3.5 | 267.3 | 20.0 | 30.434 | 7.2 | 0.10 | 6 | Variable |
| W03 | 8-Jul-2010 | 8:38 | 51° 10.295 | 2° 43.1261 | 46.69 | 10.8 | 4.7 | 266.2 | 19.9 | 31.104 | 6.9 | 0.20 | 5 | Variable |
| W06 | 8-Jul-2010 | 10:55 | 51° 15.990 | 2° 28.4903 | 30.83 | 28.6 | 1.2 | 338.0 | 17.4 | 33.192 | 7.0 | 0.00 | 5 | Variable |
| W08 | 8-Jul-2010 | 13:33 | 51° 27.444 | 2° 20.9801 | 35.20 | 22.9 | 1.8 | 145.7 | 16.8 | 33.394 | 6.7 | 0.00 | 3 | Clear |
| W01 | 8-Jul-2010 | 17:57 | 51° 22.523 | 3° 11.5496 | 74.19 | 14.7 | 3.8 | 35.9 | 19.8 | 29.583 | 8.6 | 0.00 | 1 | Clear |
| 1018-A | 9-Jul-2010 | 10:03 | 51° 21.601 | 3° 07.9351 | 35.45 | 12.3 | 5.5 | 292.0 | 19.8 | 29.870 | 7.0 | 0.00 | 2 | Clear |
| 1018-B | 9-Jul-2010 | 10:25 | 51° 21.770 | 3° 07.8863 | 33.22 | 12.8 | 4.8 | 281.1 | 19.7 | 29.900 | 6.9 | 0.00 | 1 | Clear |

Table 3 Metadata coorespoding to locations where TrIOS reflectance measurements were made. For other locations see ODAS log file.

# 5 Problems and remarks concerning measurements, equipment and operations

Activities progressed smoothly and instruments functioned well with the following exceptions:

- Recovery of the Tripod and ADCP at MOW1 was not possible. Despite the significant efforts put into this activity, including mid-cruise embarkation of specialised scientists for multibeam and side-scan sonar operation, there was no positive locations of these instruments suggesting that they have been significantly displaced from their original location.
- Insufficient walky-talkies were available for scientists during this cruise, leading to occasional poor comunications between scientists and/or between scientists and crew. It is recommended that 3 additional walky-talkies be made available exclusively for scientists and that remaining walky-talkies be dedicated exclusively for crew operations. Crew/scientist sharing of an insufficient number of walky-talkies may be particularly critical in emergency situations (fire, etc.).
- Intermittent problems were encountered with the zodiac engine needed for tripod recovery. This was fixed by the crew during the cruise but complicated recovery operations.
- The SeaCAT CTD cable was found to be damaged at the start of the cruise. This was reported to BMM-Oostende before departure. During the cruise data was recorded internally on the SeaCAT data logger.
- Mattresses are very narrow (76cm). A good day's work is easier after a good night's sleep.

# 6 Auxiliary hydro-meteo parameters

The ODAS auxiliary hydro-meteo data are available online at
http://www.mumm.ac.be/Common/Belgica/Campaigns/Odas/od2010_18.dat

# 7 Team reports

Each team was asked to provide a brief report of the extent to which the cruise objectives of section 2 were fulfilled. These reports are reproduced in the following sub-sections.

## *7.1 BELCOLOUR-2 – MUMM, ULB/ESA, ULCO*

The data collected during this cruise meet most cruise objectives of BELCOLOUR-2 stated in section 2. An overview of the measurements is given by each research team under here.

Excellent weather conditions (sea state generally <3Bf, partially sunny skies) enabled good relfectance measuerments to be made including 1 (station 1018) or potentially 2 MERIS matchups and a few stations with simultaneous TrIOS and SIMBADA measurements. The 13-hour cycle should enable investigation of the relationship between optical properties such as TSM-specific backscatter and particle size.

Instruments, including TriOS, functioned well throughout the cruise with the exception of the FieldCAL.

## *7.2 BELCOLOUR - ULg*

The cruise were carried out on the RV Belgica from 5 to 9/07/2010 in the frame of the BELCOLOUR II project. The person in charge for ULG was Bruno Delille (Bruno.Delille@ulg.ac.be).

All objectives of the BELCOLOUR 2010_18 campaign were reached. Underway pCO2 measurement were carried out from 5/07/2010 12:30 to 9/07/2010 10:50 using the CUBE device (permanent installation on the RV Belgica)

At each BELCOLOUR II station samples were collected for the determination of

- Total Alkalinity (TA)
- dissolved oxygen (DO)
- Transparent Exopolymer Particle (TEP)
- pCO2
- CH4
- N2O

In addition we collected an extra sample (surface and 5 m deep) above organic matter rich sediment at the location denoted ULg (51°19.5550 N 3° 4.9807 E)

Table 4. Stations sampled by ULg

| Station | date | time | Lon (°E) | Lat (°N) |
|---|---|---|---|---|
| MOW1 | 07/05/2010 | 10:59 | 3.0946 | 51.35825 |
| W05 | 07/05/2010 | 16:26 | 2.8267 | 51.4097167 |
| W07 | 07/05/2010 | 18:07 | 3.01233333 | 51.5821 |
| BB C | 07/06/2010 | 06:51 | 2.81533333 | 51.6198 |
| W09 | 07/06/2010 | 08:13 | 2.42105 | 51.7508333 |
| W10 | 07/06/2010 | 10:20 | 2.42105 | 51.6827333 |
| MH3 | 07/06/2010 | 12:00 | 2.11236667 | 51.7344833 |
| MH4 | 07/06/2010 | 13:40 | 1.87713333 | 51.7803667 |
| MH5 | 07/06/2010 | 15:06 | 1.65275 | 51.84795 |

| | | | | |
|---|---|---|---|---|
| MH6 | 07/06/2010 | 16:38 | 1.48045 | 51.8749 |
| HARE | 07/06/2010 | 18:08 | 1.43503333 | 51.9175667 |
| WGAB | 07/06/2010 | 21:16 | 2.08738333 | 51.9856667 |
| 700 | 07/07/2010 | 10:44 | 3.21943333 | 51.3780333 |
| 702N | 07/07/2010 | 11:43 | 3.30698333 | 51.3865133 |
| S01N | 07/07/2010 | 13:14 | 3.54068333 | 51.4170567 |
| W04 | 07/07/2010 | 14:46 | 3.2474 | 51.4168867 |
| MOW1b | 07/07/2010 | 16:09 | 3.1035 | 51.35481 |
| MOW1c | 07/08/2010 | 04:59 | 3.1046 | 51.35345 |
| w02 | 07/08/2010 | 07:45 | 2.86258333 | 51.2223367 |
| w03 | 07/08/2010 | 08:47 | 2.71911667 | 51.1694367 |
| w06 | 07/08/2010 | 11:13 | 2.4756 | 51.2681867 |
| W08 | 07/08/2010 | 13:38 | 2.349 | 51.455 |
| w01 | 07/08/2010 | 18:01 | 3.19241667 | 51.3719267 |
| ULg1 | 07/08/2010 | 19:25 | 3.8273 | 51.3224167 |
| ULg1Top | 07/08/2010 | 19:25 | 3.8273 | 51.3224167 |
| 1018A | 07/09/2010 | 10:05 | 3.13225 | 51.35601 |

Report by Bruno Delille

## *7.3 UMH and ULB/ESA - AMORE*

### 7.3.1 Stations

2010-07-05: MOW1 – ADCP, MOW1 – T1, W05, W07
2010-07-06: BB-C, W09, W10, MH3, MH4, MH5, MH6
2010-07-07: MOW1 (ADCP), 700, 702N, S01, W04, MOW-A, transect between W04 and MOW-A at normal speed (10 – 12 knots)
2010-07-08: W02, transect W02 – W03 (10 knots), W03, transect W03 – W06 (6-7 knots), W06, transect W06-W08 (6-7 knots).
2010-07-09: Transect Zeebrugge – MOW1 (full speed), MOW1

### 7.3.2 Objectives

Three major objectives:
Pump sea water directly in the FlowCAM at normal speed (11 to 12 knots).
Test the new version of Zoo/PhytoImage developed for the automatic recognition of phytoplankton.
Obtain new images to add in the existing training set in order to increase the accuracy of the automatic recognition.

### 7.3.3 Achievements

Pump sea water in the FlowCAM at full speed
Transects at low speed (7 to 8 knots) have been done on wednesday. These transects were successful. At the end of wednesday, pumping sea water at normal speed was possible after changes of the pumping system configuration. On friday, transect at normal speed (10 to 11 knots) were successfully performed between Zeebrugge and MOW1.

Test of the new version of Zoo/PhytoImage
The new version of automatic recognition method is quicker than the previous one and is already functional. Some little bugs must be corrected but these limitations don't disturb the automatic

recognition of digitized particles.

Getting new images of plankton
Images of natural populations have been digitized at each station or during transects and will be used to optimize the automatic recognition of plankton.

### 7.3.4 Limitations and challenges

It is now possible to pump sea water in the FlowCAM at normal speed, but transects at full speed were only performed on friday. New transects at full speed will be done during next cruise (september 2010). It is also possible to pump sea water at each station, this should be useful to analyze quickly sea water composition before sampling.
The last version of automatic recognition method will be tested during next Belgica cruise. This version will use the last training set optimized using the manual classification of new particles. Moreover, bugs detected during this cruise will be fixed.

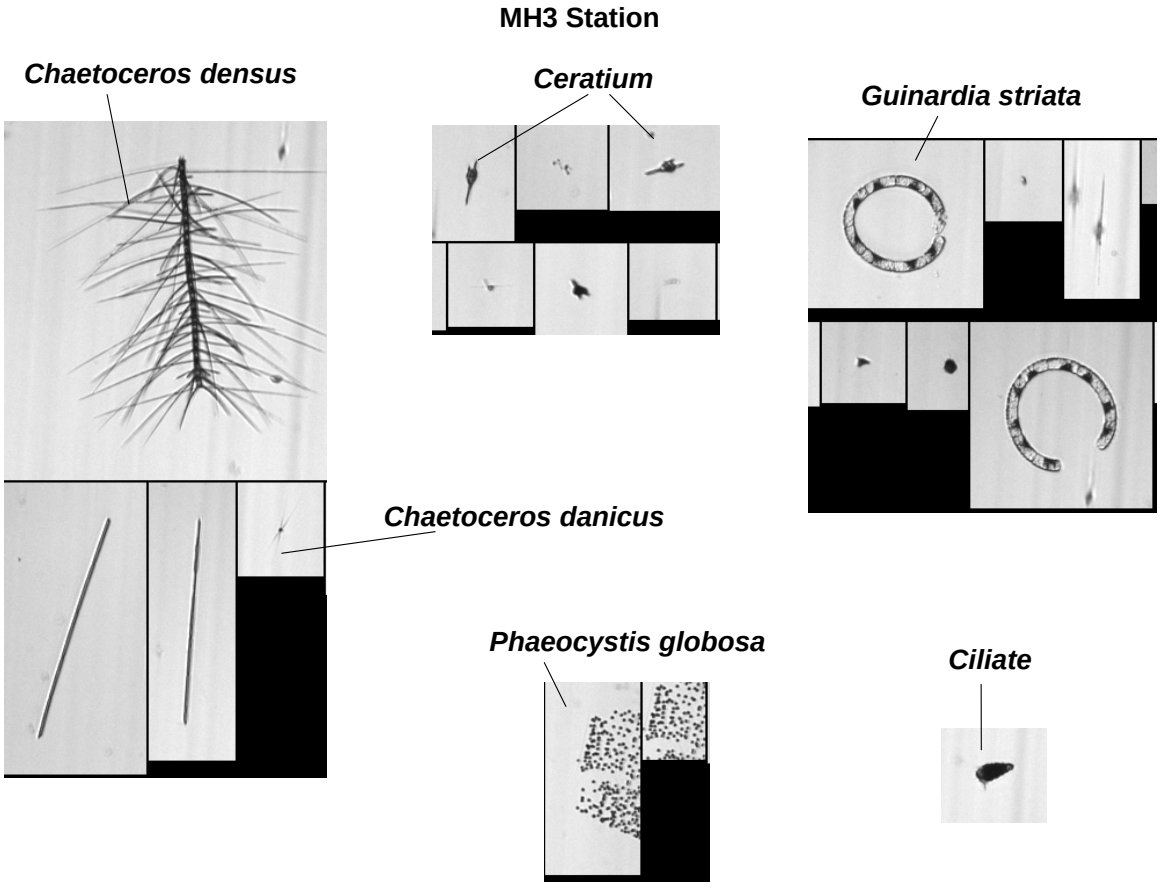


Figure 1 An example of phytoplankton recorded by the FlowCAM at station MH3.

AMORE report by Kevin Denis

## *7.4 MOMO report*

Operations of the MOM team have been incorporated in the main report. Only additional comments are reproduced here.

### 7.4.1 ADCP and TRIPOD recovery

Photo of ADCP recovered at MOW1 and fully covered by biofouling.

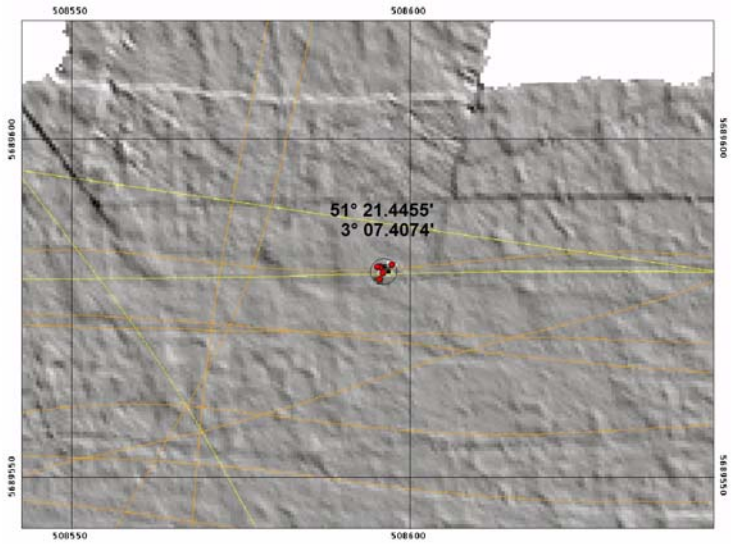


Figure: Tripod detected from multibeam data (N51° 21, 445 E 003° 07,4074) (data processing by FOD-Econ)

### 7.4.2 REMARKS

1) The location of the tripod was identified on multibeam data by FOD-Econ as 51°N 21.445 3°E 07.4074 and was thus displaced about 30 m from the original position.
2) The participation of RCMG (Koen Derycker) and the analysis of multibeam data by FOD-Econ (Koen Degrendele and Marc Roche) was greatly appreciated.

Report by Michael Fettweis

(Additional note by Kevin Ruddick: The Tripod was detected in the multibeam data but was not positively by divers during cruise 2010_18. It was positively identified by divers in a subsequent cruise, Belgica 2010_20, and was recovered with slight damage by another ship).

COLOPHON

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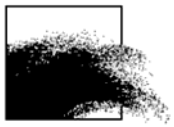
NORTH SEA MATHEMATICAL MODELS

REMOTE SENSING AND ECOSYSTEM
MODELLING TEAM



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