



Belgica cruise 98/15 - Scientific report

OMEX II cruise (Leg C, Vigo - La Coruña)

1. Participants

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ULB	Lei Chou Kinh Trang Dotansi Michèle Loijens
ULg	Alberto Borges Claire Daemers Michel Frankignoulle
VUB	Natacha Brion Marc Elskens
BODC	Zeljko Loncar
GEOMAR	Robin Keir
IIM	Jose Anton Alvarez-Salgado
PML-RSDAS	Tim Smyth
UAL	Pedro André Jesus Mendez

2. Measured parameters & processes

2.1 Underway measurements (sailing)

MUMM: Salinity, temperature, fluorescence, ship track, meteo.

ULg: pH, dissolved oxygen & pCO₂ (each minute), chlorophyll and total alkalinity (discrete sampling).

2.2 Vertical profiles (stations)

MUMM: CTD (conductivity, temperature, backscatterance & dissolved oxygene), light penetration (Seacat).

ULB: Primary production (¹⁴C & ³²P), chlorophyll, nutrients, *in situ* pumping.

ULg: pH, total alkalinity, dissolved oxygen

VUB: Uptake rate of NO₃, NH₄ & urea using ¹⁵N tracer technique.

BODC: Plankton net, data management, CTD

GEOMAR: Stables isotopes (¹⁸O₂, ¹³C)

IIM: Nutrients, phytoplankton

PML-RSDAS: Radiometry, plankton

UAL: Bacteriology



3. Work overview

During the cruise, the following work has been carried out:

- CTD Casts (SBE09): 51 profiles
- Seacat (SBE19): 21 profiles
- Parameters: 236 samples
- Primary production: 9 stations
- Radiometer: 17 profiles
- Plankton net: 9 profiles
- Purifier: 8 stations
- Sap: 19 samples



4. Detailed sequence of operations

- Time is expressed in GMT
- Stations details are provided in a joint **Appendix 1**

27th June:

- Departure from Vigo at 13h25, sailing to station 8, underway measurements.

- **Station 8 (N422004, W090004)**

- Arrival at 14h50
- Depth: 95m
- Surface salinity & temp: 35.80, 15.89°C
- **CTD 981508A** (no sampling) from 14h55 to 15h50 (-> 87m)
Salinometer check at 87m
- Radiometer from 15h10 to 15h18 (-> 60m)
- departure at 15h20, sailing to station 9, underway measurements.

- **Station 9 (N422060, W091205)**

- Arrival at 16h15
- Depth: 157m
- Surface salinity & temp: 35.71, 15.79°C
- **CTD 981509A** (no sampling) from 16h22 to 16h35 (-> 147m)
Salinometer check at 147m
- departure at 16h36, sailing to station 13, underway measurements.

- **Station 13 (N421952, W095952)**

- Arrival at 19h40
- Depth: 2600m (from map)
- Surface salinity & temp: 35.77, 18.41°C
- **CTD 981513A** (no sampling) from 19h47 to 21h01 (-> 1750m)
Salinometer check at 1750m
- departure at 21h08, sailing to station 1, underway measurements.

28th June:

- **Station 1 (N420858, W085727)**

- Arrival 03h29
- Depth: 92m
- Surface salinity & temp: 35.60, 15.60°C
- **CTD 981501A** (parameters) from 03h39 to 03h48 (-> 80m)
Salinometer check at 10 & 80 m
- departure at 04h18, sailing to station 2, underway measurements.

**- Station 2 (N420901, W090817)**

- Arrival 05h05
- Depth: 146m
- Surface salinity & temp: 35.73, 16.75°C
- **CTD 981502A** (primary production) from 05h16 to 05h25 (-> 80m)
 - Salinometer check at 10 & 80 m
 - Parameters: pH, O₂, Plankton
 - Few material, rust (?!?!?)
- **Seacat** (first light profile), from 05h40 to 05h45 (->100m)
- **SAP (1st)** from 06h01 to 07h07 (60 & 10 m, 1/2 hour pumping)
- **CTD 981502B** (parameters) from 07h40 to 07h53 (-> 125m)
- **Plankton net**, from 07h59 to 08h09 (-> 140m)
 - Few material
- **Radiometer**, from 08h29 to 08h35 (-> 60m)
- **Seacat** (second light profile), from 08h41 to 08h47 (100m)
- **SAP (2nd)** from 09h20 to 10h30 (100 & 20 m, 1/2 hour pumping)
- departure at 10h30, sailing to station 3, underway measurements.

- Station 3 (N420856, W091856)

- Arrival 11h52
- Depth: 216m
- Surface salinity & temp: 35.82, 17.21°C
- **CTD 981503A** (parameters) from 11h58 to 12h12 (-> 200m)
 - Salinometer check at 10 & 200 m
- departure at 12h53, sailing to station 4, underway measurements.

- Station 4 (N420859, W093135)

- Arrival 14h12
- Depth: > 1300m
- Surface salinity & temp: 35.84, 17.77°C
- **CTD 981504A** (surface parameters) from 14h19 to 14h30 (-> 100m)
 - Salinometer check at 10 & 100
- **Purifier** from 14h20 to 05h02 (28th June) (5065 liters)
- **Plankton net** from 15h11 to 13h27 (-> 200m)
- **SAP (1st)** from 15h40 to 17h10 (60 & 20 m, 1 hour pumping)
- **CTD 981504B** (deep parameters) from 17h24 to 18h22 (1250m)
 - Salinometer check at 150 & 1250 m
- **SAP (2nd)** from 20h00 to 21h30 (80 & 40 m, 1 hour pumping)

**29th June:**

- **CTD 981504C** (Primary production) from 05h03 to 05h13 (80m)
 - Salinometer check at 10 & 35 m
 - Parameters: pH, O₂, Plankton
- **Seacat** (first light profile), from 05h24 to 05h28 (80m)
- departure at 05h46, sailing to station 5, underway measurements, underway measurements.

- **Station 5 (N420827, W094403)**
 - Arrival 08h32
 - Depth: >2000m
 - Surface salinity & temp: 35.88, 17.71°C
 - **CTD 981505A** (parameters) from 08h42 to 09h14 (-> 450m)
 - Salinometer check at 40 & 400 m
 - rem: sea too rough, no deep cast; bottle 10m & 20m empty
 - **Seacat** (light profile), from 09h22 to 09h27 (80m)
 - departure at 09h35, sailing to station 15, underway measurements.
 - rem: underway pump stopped from 14h04 to 15h06

- **Station 15 (N423035, W091857)**
 - Arrival at 20h49
 - Depth: 152m
 - Surface salinity & temp: 35.73, 15.27°C
 - **CTD 981515A** (no sampling) from 20h54 to 21h02 (-> 135m)
 - Salinometer check at 135m
 - departure at 21h09, sailing to station 14, underway measurements.

- **Station 14 (N422953, W091056)**
 - Arrival at 21h46
 - Depth: 88m
 - Surface salinity & temp: 35.67, 14.33°C
 - **CTD 981514A** (no sampling) from 21h48 to 21h52 (-> 75m)
 - Salinometer check at 75m
 - departure at 22h01, sailing to station 20, underway measurements.



30th June:

Sewage pump not working

- Station 20 (N424010, W092158)

- Arrival 03h30
- Depth: 132m
- Surface salinity & temp: 35.70, 14.77°C
- Sewage pump from 03h30 to 03h46
- **CTD 981520A** (primary production) from 03h55 to 04h04 (-> 80m)
 - Salinometer check at 10 & 40 m
 - Parameters: pH, O₂, Plankton
- **Purifier** from 04h04 to 09h20 (20611)
- **CTD 981520B** (parameters) from 4h38 to 04h48 (->120m)
- **SAP (1st)** from 05h30 to 06h30 (40m, 30 min & 10 m, 36 min)
- Sewage pump from 06h30 to 07h00
- **Seacat** (first light profile), from 07h14 to 07h20 (->100m)
- **Plankton net**, from 07h25 to 07h34 (-> 200m)
- **SAP (2nd)** from 08h03 to 09h05 (80m, 36 min & 20 m, 36 min)
- **Seacat** (second light profile), from 09h14 to 09h20 (->100m)
- **Radiometer** from 09h26 to 09h34 (-> 60m)
- departure at 09h34, sailing to station 19, underway measurements.

- Station 19 (N424006, W091241)

- Arrival 11h10
- Depth: 102m
- Surface salinity & temp: 35.55, 15.80°C
- **CTD 981519A** (parameters) from 11h15 to 11h23 (-> 90m)
 - Salinometer check at 10 & 90 m
- **Seacat** (light profile) from 11h28 to 11h32 (->80m)
- **Radiometer** from 11h43 to 11h58 (-> 60m)
- departure at 12h00, sailing to station 21, underway measurements.



- Station 21 (N423957, W092959)

- Arrival 13h46
- Depth: 210m
- Surface salinity & temp: 35.74, 15.47°C
- **CTD 981521A** (parameters) from 13h52 to 14h05 (-> 180m)
Salinometer check at 10 & 200 m
- departure at 02h40, sailing to station 22, underway measurements.

- Station 22 (N423957, W093625)

- Arrival 15h16
- Depth: 993m
- Surface salinity & temp: 35.73, 16.02°C
- **CTD 981522A** (parameters) from 03h23 to 04h03 (-> 900m)
Salinometer check at 10 & 900 m
- departure at 04h45, sailing to station 17, underway measurements.

- Station 17 (N423000, W093941)

- Arrival 18h00
- Depth: >2000m
- Surface salinity & temp: 35.82, 16.66°C
- **CTD 981517A** (CTD only) from 18h06 to 19h22 (-> 1750m)
Salinometer check at 1750 m
- departure at 19h30, sailing to station 16, underway measurements.

- Station 16 (N422956, W092621)

- Arrival 20h38
- Depth: 890m
- Surface salinity & temp: 35.71, 15.01°C
- **CTD 981516A** (CTD only) from 20h42 to 21h20 (-> 800m)
Salinometer check at 800 m
- departure at 21h30, sailing to station 23, underway measurements.

**1st July:****- Station 23 (N424001, W094242)**

- Arrival 02h58
- Depth: 1659m
- Surface salinity & temp: 35.79, 17.18°C
- **Purifier** from 02h42 to 13h29 (4360 l)
- **SAP (1st)** from 03h12 to 04h15 (40m, 36 min, & 20 m, 36 min)
- **CTD 981523A** (primary production) from 04h44 to 04h52 (-> 100m)
Salinometer check at 10 & 60 m
Parameters: pH, O₂, Plankton
- **CTD 981523B** (surface parameters) from 05h44 to 6h00 (-> 100m)
Salinometer check at 10 & 100 m
- **Seacat** (first light profile), from 06h10 to 06h13 (->100m)
- **SAP (2nd)** from 06h20 to 07h30 (100m, 42 min & 20 m, 42 min)
- Sewage pump from 07h33 to 07h57
- **CTD 981523C** (deep parameters) from 08h10 to 09h38 (-> 1600m)
Salinometer check at 150 & 1600 m
- **SAP (3rd)** from 10h15 to 13h00 (500m, 90 min & 200 m, 90 min)
- **Radiometer** from 12h45 to 15h00 (-> 100m)
- **Seacat** (second light profile) from 13h03 to 13h10 (80m)
- **Plankton net** from 13h27 to 13h40 (-> 200m)
- departure at 13h45, sailing to station 24, underway measurements.

- Station 24 (N423940, W095012)

- Arrival 19h56
- Depth: ~1500m
- Surface salinity & temp: 35.57, 17.56°C
- **CTD 981524A** (deep parameters) from 15h15 to 16h43 (-> 1720m)
Salinometer check at 150 & 1720 m
- **CTD 981524B** (surface parameters) from 17h32 to 17h42 (-> 100m)
Salinometer check at 10 & 100 m
- departure at 06h05, sailing to station 30, underway measurements.

Arrival at Station 30 at 20h00, sea too rough, sailing to station 29

Arrival at Station 29 at 20h45, sea too rough, sailing to station 28

- Station 28 (N425006, W092814)

- Arrival at 21h31
- Depth: 165m
- Surface salinity & temp: 35.69, 15.86°C
- **CTD 981528A** (no sampling) from 21h40 to 22h01 (-> 150m)
Salinometer check at 150m
- departure at 21h53, sailing to station 33, underway measurements.

**2nd July:****- Station 33 (N425947, W092409)**

- Arrival 02h20
- Depth: 118m
- Surface salinity & temp: 35.67, 14.91°C
- **Purifier** from 02h24 to 08h32 (2511 l)
- **SAP (1st)** from (40m, 36 min & 20 m, 36 min)
- **CTD 981535A** (primary production) from 04h59 to 05h05 (-> 80m)
Salinometer check at 10 & 40 m
Parameters: pH, O₂, Plankton
- **CTD 981535B** (parameters) from 06h04 to 06h17 (-> 134m)
Salinometer check at 10 & 120 m
- Sewage pump from 06h18 to 06h43
- **Seacat** (first light profile), from 06h48 to 06h53 (->80m)
- **SAP (2nd)** from 08h15 to 10h20 (80m, 42 min & 60m, 42 min)
- **Seacat** (second light profile) from 08h26 to 08h31 (80m)
- departure at 08h34, sailing to station 27, underway measurements.

- Station 27 (N425000, W091914)

- Arrival 10h55
- Depth: 128m
- Surface salinity & temp: 35.67, 13.57°C
- **CTD 981527A** (parameters) from 11h16 to 11h26 (-> 110m)
Salinometer check at 10 & 110 m
- **Seacat** (light profile), from 11h30 to 11h34 (->80m)
- **Radiometer** from 11h37 to 11h47 (-> 60m)
- departure at 11h53, sailing along the coast, into Ria de Muros, into Ria de Arosa and to station 35, underway measurements.

- Station 35 (N425955, W093918)

- Arrival 22h48
- Depth: 1587m
- Surface salinity & temp: 35.69, 16.33°C
- **Purifier** from 23h40 to 13h59 (3rd/7) (5680 l)
- **SAP (1st)** from 23h22 to 02h40 (3rd/7) (500m, 48 min & 200 m, 48 min)

**3rd July:**

- **CTD 981535A** (primary production) from 04h40 to 04h48 (-> 80m)
Salinometer check at 10 & 60 m
Parameters: pH, O₂, Plankton
- **CTD 981533B** (Deep parameters) from 05h24 to 07h03 (-> 1500m)
Salinometer check at 100 & 1500 m
- Sewage pump from 07h05 to 07h34
- **Seacat** (first light profile), from 07h35 to 07h53 (->80m)
- **CTD 981535C** (Surface parameters) from 07h43 to 07h53 (-> 80m)
Salinometer check at 10 & 80m
- **SAP (2nd)** from 08h00 to 09h10 (100m, 36 min & 60m, 36 min)
- **Radiometer** from 08h24 to 08h37 (-> 60m)
- **Seacat** (second light profile) from 09h16 to 09h20 (-> 80m)
- **Radiometer** from 09h24 to 09h37 (-> 80m)
- **Plankton net** from 09h45 to 10h01 (-> 200m)
- Sewage pump from 10h01 to 10h40
- **SAP (3rd)** from 10h56 to 11h36 (40m, 30 min & 10m, 30 min)
- **SAP (4th)** from 13h00 to 14h00 (80m, 36 min & 20m, 36 min)
- departure at 14h10, sailing to station 34, underway measurements.

- Sewage from 14h15 to 14h45

- Station 34 (N425943, W093053)

- Arrival 15h39
- Depth: 210m
- Surface salinity & temp: 35.64, 16.54°C
- **CTD 981534A** (parameters) from 15h17 to 15h33 (-> 200m)
Salinometer check at 10 & 200 m
- **Seacat** (light profile), from 15h46 to 15h53 (->100m)
- **Radiometer** from 15h58 to 16h13 (-> 100m)
- departure at 16h15, sailing to station 36, underway measurements.



- Station 36 (N425941, W094821)

- Arrival 17h59
- Depth: 1900m
- Surface salinity & temp: 35.75, 16.81°C
- **CTD 981536A** (Deep parameters) from 18h05 to 19h55 (-> 1750m)
Salinometer check at 150 & 1750 m
- **Plankton net** from 20h01 to 20h16 (-> 200m)
- Sewage pump from 20h17 to 20h30

- **CAST 981536B** (surface parameters) from 20h32 to 20h41 (-> 100m)
Salinometer check at 10 & 100m
- departure at 21h03, sailing to station 38, underway measurements.

- Station 38 (N430010, W101836)

- Arrival 23h30
- Depth: > 2000m
- **Purifier** from 23h45 to 12h48 (4th/7) (4634l)
- **SAP (1st)** from 23h40 to 02h30 (4th/7) (500m, 108 min & 80 m, 108 min)

**4th July:**

- **CTD 981538A** (primary production) from 04h39 to 04h44 (-> 80m)
 - Salinometer check at 10 & 60 m
 - Parameters: pH, O₂, Plankton
 - **CTD 981538B** (Deep parameters) from 05h22 to 06h53 (-> 1750m)
 - Salinometer check at 100 & 1750 m
 - Sewage pump from 0655 to 07h09
 - **Seacat** (first light profile), from 07h11 to 07h17 (->80m)
 - **Radiometer** from 07h24 to 07h34 (-> 60m)
 - **CTD 981535C** (Surface parameters) from 07h39 to 07h45 (-> 80m)
 - Salinometer check at 10 & 80m
 - **SAP (2nd)** from 08h00 to 10h15 (100m, 36 min & 60m, 36 min)
 - **Plankton net** from 09h22 to 09h38 (-> 200m)
 - **Seacat** (second light profile) from 09h42 to 09h49 (-> 100m)
 - **Radiometer** from 09h51 to 10h01 (-> 60m)
 - Sewage pump from 10h02 to 10h45
 - **SAP (3rd)** from 11h05 to 12h15 (40m, 36 min & 20m, 36 min)
 - **Seacat** (third light profile) from 12h17 to 12h25 (-> 100m)
 - **Radiometer** from 12h28 to 12h41 (-> 80m)
 - departure at 12h55, sailing to station 37, underway measurements.
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- **Station 37 (N430004, W100105)**
 - Arrival 15h00
 - Depth: > 2000m
 - Surface salinity & temp: 34.87(?), 17.60
 - **CAST 981537A** (surface parameters) from 15h07 to 15h16
 - Salinometer check at 10 & 100 m
 - **Seacat** from 15h20 to 15h26 (-> 100m)
 - **CAST 981537B** (deep parameters) from 16h39 to 17h39
 - Salinometer check at 1000 & 150 m (sea too rough, stop at 1000m)
 - departure at 20h20, sailing to station 29, underway measurements.
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- **Station 29 (N424941, W093800)**
 - Arrival at 20h28
 - Depth: 990m
 - Surface salinity & temp: 35.47, 16.50°C
 - **CTD 981529A** (no sampling) from 20h36 to 21h15 (-> 800m)
 - Salinometer check at 800m
 - Radiometer from 15h10 to 15h18 (-> 60m)
 - departure at 21h28, sailing to station 26, underway measurements.

**5th July:****- Station 26 (N423833, W101726)**

- Arrival 00h10
- Depth: > 2000m
- **Purifier** from 00h32 to 09h37 (2411l)
- **SAP (1st)** from 00h15 to 01h15 (80m, 36 min & 40 m, 36 min)
- **SAP (2nd)** from 02h40 to 04h00 (60m, 36 min & 20m, 36 min)
- **CTD 981526A** (primary production) from 05h15 to 05h23 (-> 80m)
 - Salinometer check at 10 & 60 m
 - Parameters: pH, O₂, Plankton
- **CTD 981526B** (Deep parameters) from 06h05 to 07h39 (-> 1750m)
 - Salinometer check at 100 & 1750 m
- **Seacat** (first light profile), from 07h45 to 07h51 (->100m)
- **Radiometer** from 07h55 to 08h06 (-> 80m)
- Sewage pump from 08h06 to 08h33

Sea too rough for any further SAP

- **CTD 981526C** (Surface parameters) from 08h45 to 08h53 (-> 80m)
 - Salinometer check at 10 & 80m
- **Plankton net** from 09h03 to 09h20 (-> 200m)
- **Seacat** (second light profile) from 09h25 to 09h36 (-> 100m)
- departure at 09h40, sailing to station 25, underway measurements.

- Station 25 (N423956, W100004)

- Arrival at 13h00
- Depth: >2000m
- Surface salinity & temp: 35.81, 17.20°C
- **CTD 981525A** (Deep parameters) from 13h10 to 14h56 (-> 1750m)
 - Salinometer check at 100 & 1750m
- Sewage from 15h10 to 15h25
- **CTD 981525B** (Surface parameters) from 15h10 to 15h48 (-> 80m)
 - Salinometer check at 10 & 80m
- departure at 16h06, sailing to station 30, underway measurements.

- Station 30 (N424944, W094608)

- Arrival at 14h50
- Depth: >2000m
- Surface salinity & temp: 35.71, 16.50°C
- **CTD 981530A** (no sampling) from 19h35 to 20h40 (-> 1750m)
 - Salinometer check at 1750m
- departure at 21h00, sailing to station 9, underway measurements.

**6th July:****- Station 33bis (N425959, W092350)**

- Arrival at 07h00
- Depth: 124m
- Surface salinity & temp: 35.70, 13.41°C
- **CTD 981533BA** (Primary production) from 07h05 to 07h21 (-> 115m)
 - Salinometer check at 10 & 40m
- **Seacat** from 07h34 to 07h39 (-> 80m)
- **Radiometer** from 07h42 to 07h54 (-> 60m)
- **CTD 981533BB** (parameters) from 07h58 to 08h10 (-> 120m)
 - Salinometer check at 10 & 120m
- departure at 08h48, sailing to station 35, underway measurements with zigzagging trough transect O2N (5 miles North and South)

- Station 35bis (N430004, W093855)

- Arrival at 11h30
- Depth: 1500m
- Surface salinity & temp: 35.70, 14.98°C
- Plankton net from 11h41 to 11h50 (> 200m)
- **CTD 981535BA** (no sample) from 11h54 to 15h09 (-> 1467m)
 - Salinometer check at 1467m
- **Seacat** from 13h12 to 13h18 (-> 80m)
- **Radiometer** from 13h24 to 13h33 (->60m)
- Departure at 13h35, sailing to station 34, underway measurements

- Station 34bis (N425958, W093855)

- Arrival at 14h14
- Depth: 216m
- Surface salinity & temp: 35.67, 14.93°C
- Plankton net from 11h41 to 11h50 (> 200m)
- **CTD 981534BA** (no sample) from 14h19 to 14h32 (-> 200m)
 - Salinometer check at 200m
- **Seacat** from 14h37 to 14h45 (-> 80m)
- **Radiometer** from 14h46 to 14h56 (->60m)
- Departure at 15h00, sailing to station anchoring station, underway measurements

6th July:

Sailing to La Coruña via the filament off Finistere cape, underway measurements;



5. Specific remarks

Many thanks to both *Belgica* crew and MUMM for the help provided at work

Done in Liège, 10th July 1998

Michel Frankignoulle