

## RV BELGICA CRUISE 2019/13 - PROGRAM

Subscribers:	Dr. T. Missiaen (chief scientist) & Dr. M. De Clercq (co-chief scientist)
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### Geology: 07/05/2019 - 17/05/2019

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## 1. GENERAL FORM RV BELGICA 2019

1.	Cruise number	2019/13
2.	Date/time Zeebrugge ETD  Zeebrugge ETA	07/05/2019: 09h30* <b>*All scientists present at 08h30</b> 17/05/2019: 14h00–15h00
3.	Chief Scientists Participating institutes	Chief: Tine Missiaen; co-chief: Maikel De Clercq Vlaams Instituut Voor De Zee (VLIZ); Ghent University (UGent); University of Bradford
4.	Geographical area  DIPCLEAR necessary	British and Dutch continental shelf – southern North Sea  YES, approved for the Netherlands dd. 14/12/2018 and approved for the UK dd. 15/04/2019
5.	Scientific personnel	8
6.	Intervention required of: - Marine scuba team - Marine medical assistance - Pilot	NO NO NO
7.	Necessary infrastructure onboard or on the quay to embark or disembark equipment.  Mobilization Zeebrugge, 06/05, 9h30  Demobilization Zeebrugge, 17/05, 15h00	Ship's crane for embarking seismic equipment (sparker and sub- bottom profiler) and video frame.  Ship's crane for disembarkation
8.	Logistic assistance OD Nature for SCTD, AUMS, data acquisition (ODASIII) or other.	Start-up ODASIII, AUMS
9.	Remarks:  - Video frame and seismic installation will stay on board for campaign 15 & 16.	

General remarks c/o OD Nature - Measurement Services Ostend:

i) There are only basic blankets, sheets and a pillow slips available on board, no towels. Every scientist/student can bring his/her bed linen when desired.

ii) All scientists involved in deck operations are to wear appropriate safety clothing such as safety shoes/boots, gloves etc. Only safety helmets are available on board.

iii) Please note that scientists are invited to bring their own GSM. The RV Belgica GSM shall be made available only in exceptional circumstances such as communications related to operational aspects of the ongoing cruise (e.g. calls to OD Nature concerning ODASIII) and in case of an emergency.

iv) All participants are requested to settle their account (daily meal fee, drinks) aboard in Euro (small bills please). Checks are no longer accepted, and neither credit cards nor proton facilities are available.

v) Following governmental regulations, as from January 1st, 2006, smoking inside the ship is entirely prohibited. Please refer to the information posted on the message board inside the ship for the dedicated smoking areas on the outer decks.

**vi) It is prohibited to bring and use any kind of illegal drugs onboard. In case of violation, criminal prosecution will be initiated and any further access to the ship will be denied.**

**vii) It is not allowed to bring your own alcoholic drinks onboard. There is a possibility to purchase limited amounts of alcoholic drinks onboard. It is also not allowed to bring your own food onboard unless agreed upon by the CO and crew (cfr. special dietary requirements).**

**viii) It is no longer allowed to park on the quays of the Naval Base in Zeebrugge. Any violation will lead to a fine of 120 €. Please use the dedicated parking lots on the base. The crew and the guards can give information on the correct locations. For long stays (> 3 days/3 nights) a document needs to be filled in and needs to be left visible in the car and the car keys need to be given to the guards of the base (see document sent with this program).**

ix) Each scientist has an email account aboard. This should mainly be used for work related to the campaign.

x) The AUMS screen in the wet lab can only be used for visualization of the AUMS parameters and can't be used for any other purpose! Please report abuse to Coordinator RV Belgica.

xi) All participants embarking on RV Belgica should be in good health allowing them to perform their activities at sea without being an extra safety risk and/or possibly causing a loss of ship time. When in doubt of a participant's medical situation the Chief Scientist or person in question should contact the Coordinator RV Belgica prior to the cruise. The Coordinator RV Belgica will consult and decide with the CO RV Belgica if the person in question can embark on the RV Belgica cruise.

For approval OD Nature: 30/04/2019

L. NAUDTS, Dr.-Adviseur  
OD Nature Coordinator RV BELGICA

## 2. LIST OF PARTICIPANTS

Institute	NAME	Gender	07/05 - 17/05/19
VLIZ	Tine MISSIAEN	F	X
	Wim VERSTEEG	M	X
UGent	Maikel DE CLERCQ	M	X
	Koen DE RYCKER	M	X
	Axel BATEN <sup>1</sup>	M	X
	Lore VANHOOREN <sup>1</sup>	F	X
Bradford U.	Simon FITCH <sup>1</sup>	M	X
	Andy FRASER <sup>1</sup>	M	X
<i>Total participants:</i>			8

<sup>1</sup>Permission for embarkation on RV BELGICA is requested for these persons.  
Assignment of the cabins by the Chief-Scientist at the start of the campaign.

## 3. SCIENTIFIC OBJECTIVES

### **VLIZ-UGent–Bradford U.**

In April 2018, a seismic reconnaissance survey (RV Belgica 2018/09) was carried out in the southern North Sea (larger Brown Bank area). The objectives of that campaign were: (1) to investigate the drainage pattern of the palaeo-fluvial systems that traversed the SNS during the Last Glacial Age (including the presence/absence of large proglacial lake/s), and (2) to model the late Quaternary palaeolandscape of the SNS in the span Late Pleistocene – early Holocene and its possible impact on the human occupation of this area. The 2018 survey generated a unique dataset of unprecedented quality, but, due to the vastness of the study area, further seismic/geophysical data are necessary to characterize it. The main aims of the follow-up survey of 2019 are to (1) fill up data gaps for geomorphologic/palaeogeographic study, (2) investigate the further link with the drowned ‘Doggerland’, and (3) perform detailed seismic investigations in well-chosen sub-areas for archaeological studies.

### **OD Nature-LN (ICOS)**

The AUMS (Autonomous Underway Measurement System) system is inspired by the success of similar systems deployed on various ships of opportunity in the framework of the European Union FerryBox project ([www.ferrybox.org](http://www.ferrybox.org)). The instrumentation will greatly enhance the continuous oceanographic measurements made by RV Belgica by taking advantage of the significant technological improvements since the design of the existing (salinity, temperature, fluorescence) systems (cfr. ICOS Standards). In particular, many new parameters can now be measured continuously including important ecosystem parameters such as nitrate, ammonia, silicate, dissolved oxygen and CO<sub>2</sub>, turbidity, alkalinity and phytoplankton pigments. In addition, the new equipment allows automatic acquisition and preservation of water samples, rendering RV Belgica operations significantly more efficient by reducing onboard human resources. Data will be available in near real-time via OD Nature’s public website (<http://odnature.naturalsciences.be/belgica/en/odas>) and following quality control, from the Belgian Marine Data Centre. Since 2015, the AUMS data are also delivered to the EC ESFRI project ICOS.

## 4. RESEARCH AREA - SAMPLING STATIONS

### 4.1. UGENT–VLIZ–BRADFORD U.

The study area is located in the southern North Sea (British–Dutch continental shelf), within latitudes 53°15.5'N – 51°40.2'N and longitudes 1°11.8'E – 3°43.9'E.

The various geophysical survey lines planned for the RV Belgica 2019/13 campaign are indicated in Figure 1 and Table 1. The study area is rather large, we therefore understand that it may not be possible to collect all planned lines. If survey time is not enough or bad weather conditions prevent continuous acquisition, we will communicate to the RV Belgica crew the survey lines that have priority in order to collect the minimum necessary to fulfill our objectives. The survey has four target areas: (1) a large area in between the Brown Bank and East Anglia, (2) smaller areas located in the Brown Bank, (3) a minor palaeovalley (Southern River) located in the northwestern corner of the study area, and (4) an area just off the BCS.

**Note:** The length, number and/or position/orientation of some of the proposed survey lines may be modified during the campaign depending on the incoming data. Changes, if any, will be communicated clearly and well in advance to the RV Belgica crew during the survey.

If times allows, we would like to collect sedimentary grabs (van Veen) and video footage (video frame) from selected locations at Brown Bank and the Southern River palaeovalley. An overview of preliminary grab locations is given in Table 2.

**Note:** The definite location of these sites will also depend on the newly acquired data. Hence, sampling locations will be selected on board during seismic data acquisition based on the preliminary analysis of these data. Final coordinates of sampling sites will be transferred to the captain as soon as they are validated by the chief scientists and colleagues.

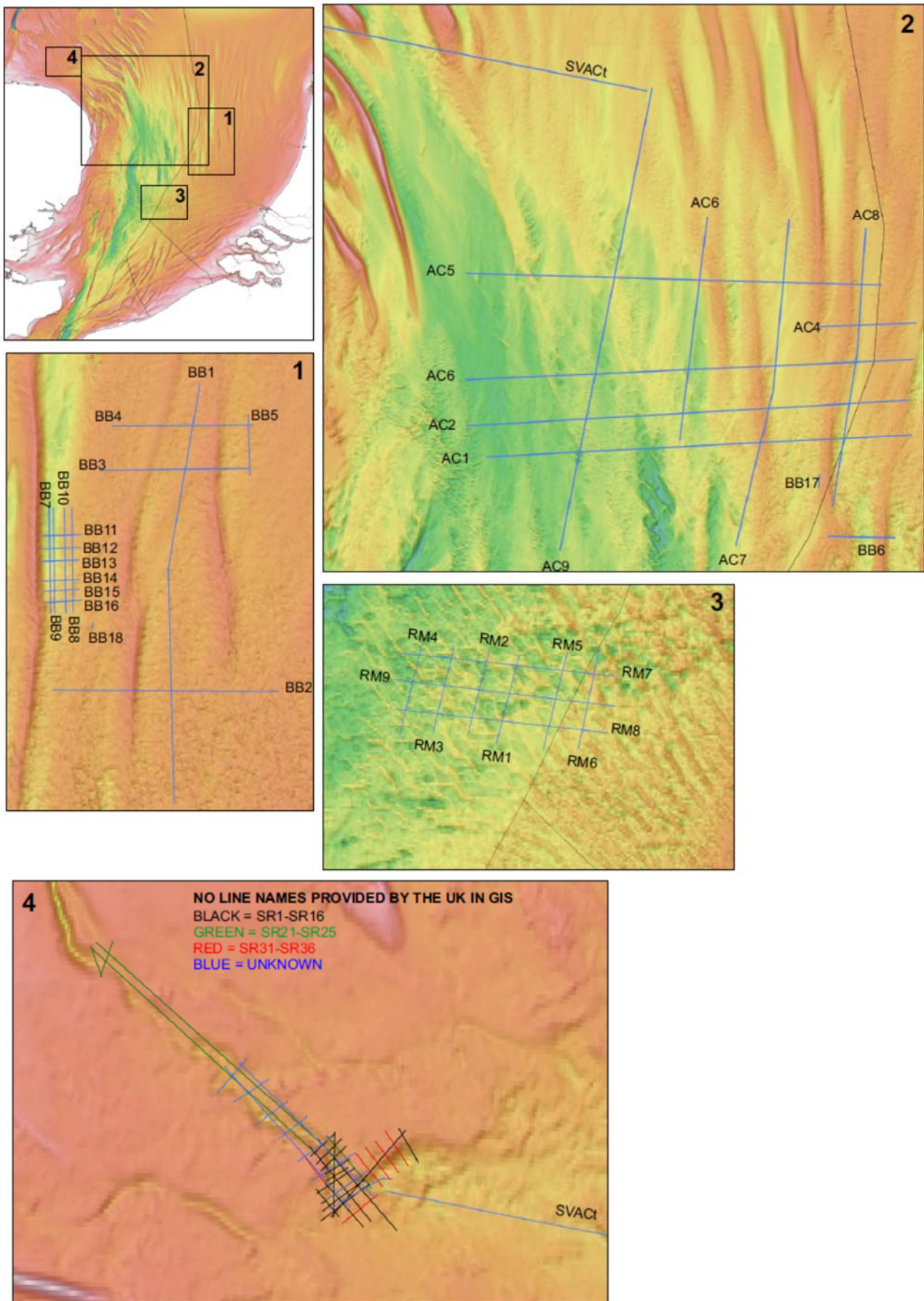


Figure1: Proposed seismic survey lines plotted on top of bathymetric DTM (see Table).

**Table 1: List of coordinates (Lat/long WGS-84) of start and end points of the proposed seismic survey lines. Points marking changes in orientation are indicated as 'Middle X / Middle Y'. Green = high priority, yellow = medium priority, orange = low priority.**

Line						
	Start X	Start Y	Middle X	Middle Y	End X	End Y
RM1	51° 54,827'	2° 30,284'			51° 58,891'	2° 31,945'
RM2	51° 59,173'	2° 29,728'			51° 55,153'	2° 28,106'
RM3	51° 59,340'	2° 27,076'			51° 55,253'	2° 25,494'
RM4	51° 59,508'	2° 24,678'			51° 55,196'	2° 23,030'
RM5	51° 59,106'	2° 35,573'			51° 54,549'	2° 33,803'
RM6	51° 59,248'	2° 37,968'			51° 54,626'	2° 36,448'
RM7	51° 59,006'	2° 22,942'			51° 57,952'	2° 39,285'
RM8	51° 56,382'	2° 22,651'			51° 55,350'	2° 38,653'
RM9	51° 57,749'	2° 22,596'			51° 56,584'	2° 39,187'
BB1	52° 44,449'	3° 32,956'	52° 34,990'	3° 30,178'	52° 22,995'	3° 30,541'
BB2	52° 28,808'	3° 20,427'			52° 28,639'	3° 39,293'
BB3	52° 40,046'	3° 24,496'			52° 40,081'	3° 37,030'
BB4	52° 42,328'	3° 25,550'			52° 42,321'	3° 37,357'
BB5	52° 42,860'	3° 36,996'			52° 39,722'	3° 37,099'
BB6	52° 24,915'	3° 5,661'			52° 24,810'	3° 13,438'
AC1	52° 32,176'	3° 15,439'			52° 30,512'	2° 25,743'
AC2	52° 34,665'	3° 15,091'			52° 32,764'	2° 23,409'
AC3	52° 37,561'	3° 15,625'			52° 36,042'	2° 23,235'
AC4	52° 40,175'	3° 15,952'			52° 39,907'	3° 4,864'
AC5	52° 42,859'	3° 11,975'			52° 43,614'	2° 23,258'
AC6	52° 47,683'	2° 51,474'			52° 31,774'	2° 48,272'
AC7	52° 47,499'	3° 1,086'	52° 35,342'	2° 59,219'	52° 24,286'	2° 54,897'
BB7	52° 38,148'	3° 20,210'			52° 32,762'	3° 20,298'
BB8	52° 38,127'	3° 22,152'			52° 32,819'	3° 22,210'
BB9	52° 38,137'	3° 20,599'			52° 32,775'	3° 20,647'
BB10	52° 38,095'	3° 21,517'			52° 32,788'	3° 21,590'
BB11	52° 36,712'	3° 19,614'			52° 36,765'	3° 22,848'
BB12	52° 36,047'	3° 19,619'			52° 36,116'	3° 22,852'
BB13	52° 35,411'	3° 19,601'			52° 35,46'	3° 22,731'
BB14	52° 34,400'	3° 19,548'			52° 34,485'	3° 22,780'
BB15	52° 33,880'	3° 19,751'			52° 33,981'	3° 22,698'
BB16	52° 33,313'	3° 19,876'			52° 33,414'	3° 22,926'
AC8	52° 46,876'	3° 10,110'	52° 37,807'	3° 9,040'	52° 27,102'	3° 6,220'
SVAct	53° 5,285'	1° 27,477'			52° 56,728'	2° 44,267'
AC8	52° 56,886'	2° 44,912'			52° 23,912'	2° 34,380'
BB17	52° 29,304'	3° 4,650'			52° 28,445'	3° 4,532'
BB18	52° 32,250'	3° 23,816'			52° 32,013'	3° 23,798'
SR1	53° 4,215'	1° 28,073'			53° 6,643'	1° 24,393'
SR2	53° 6,450'	1° 24,010'			53° 4,450'	1° 26,886'
SR3	53° 5,462'	1° 24,764'			53° 4,296'	1° 26,539'
SR4	53° 4,555'	1° 25,429'			53° 5,279'	1° 24,367'
SR5	53° 4,438'	1° 24,609'			53° 5,462'	1° 26,768'

SR6	53° 5,579'	1° 26,548'			53° 4,716'	1° 24,696'
SR7	53° 4,903'	1° 24,614'			53° 5,691'	1° 26,379'
SR8	53° 5,181'	1° 24,396'			53° 5,89'	1° 26,088'
SR9	53° 5,521'	1° 24,802'			53° 5,897'	1° 25,777'
SR10	53° 5,710'	1° 24,741'			53° 6,118'	1° 25,825'
SR11	53° 5,797'	1° 24,557'			53° 6,476'	1° 25,683'
SR12	53° 5,979'	1° 24,350'			53° 6,671'	1° 25,458'
SR13	53° 6,174'	1° 24,071'			53° 6,824'	1° 25,156'
SR14	53° 6,851'	1° 25,142'			53° 4,534'	1° 25,167'
SR15	53° 4,552'	1° 25,074'			53° 6,946'	1° 28,375'
SR16	53° 6,083'	1° 28,972'			53° 6,987'	1° 28,065'
SR21	53° 11,902'	1° 14,076'			53° 6,476'	1° 24,655'
SR22	53° 10,981'	1° 14,298'			53° 11,936'	1° 14,827'
SR23	53° 10,978'	1° 14,351'			53° 11,780'	1° 13,838'
SR24	53° 11,761'	1° 13,823'			53° 6,269'	1° 24,288'
SR25	53° 6,751'	1° 24,786'			53° 5,359'	1° 26,864'
SR31	53° 5,472'	1° 24,751'			53° 6,260'	1° 23,668'
SR32	53° 6,288'	1° 26,121'			53° 5,422'	1° 27,354'
SR33	53° 6,452'	1° 26,560'			53° 5,605'	1° 27,710'
SR34	53° 6,632'	1° 26,998'			53° 5,798'	1° 28,098'
SR35	53° 6,910'	1° 27,449'			53° 5,992'	1° 28,519'
SR36	53° 5,175'	1° 27,158'			53° 4,369'	1° 25,559'

**Table 2: List of coordinates (Lat/long WGS-84) of grab sample locations. This excludes possible repeats or extra grabs due to good results.**

Location	x	y
Brown Bank Location 1	52° 32,16323'	3° 23,57993'
Brown Bank Location 1	52° 32,16271'	3° 23,60112'
Brown Bank Location 1	52° 32,16249'	3° 23,62077'
Brown Bank Location 1	52° 32,16205'	3° 23,63585'
Brown Bank Location 2	52° 28,91247'	3° 4,44518'
Brown Bank Location 2	52° 28,90936'	3° 4,51473'
Brown Bank Location 2	52° 28,91616'	3° 4,43444'
Brown Bank Location 2	52° 28,91944'	3° 4,24408'
Brown Bank Location 3	52° 32,83424'	3° 24,42668'
Brown Bank Location 3	52° 32,92071'	3° 24,44704'
Brown Bank Location 3	52° 32,93376'	3° 24,45019'
Brown Bank Location 3	52° 32,95467'	3° 24,45513'
Southern River	53° 5,65372'	1° 25,14136'
Southern River	53° 5,65460'	1° 25,18345'
Southern River	53° 5,15098'	1° 25,17421'
Southern River	53° 5,14980'	1° 25,08466'



## 5. OPERATIONAL COURSE

All times are given in local time. All coordinates in WGS84. Tentative program; priority or observations may change according to tidal and weather conditions and/or technical constraints. Throughout the campaign, measurements are performed with the AUMS system.

### Tuesday 07/05/2019

08h00-09h30: Embarkation of personnel. **Scientists should be aboard the latest at 08h30.**

09h00: Transit to the Brown Bank survey area. During transit, we will finalize the installation of the various survey equipment, meet with the RV Belgica crew to discuss the plan, etc.

Late afternoon: Arrival to starting point of first survey line. The following days will be dedicated to acquiring 2D seismic-reflection data using a sparker source, very high-resolution sub-bottom profiles by means of a SES-Quattro echosounder, and multibeam bathymetric swaths using the multibeam echosounder installed on the RV Belgica. All these data will be collected simultaneously. Electrical propulsion and an average speed of 4 knots are requested during data acquisition.

Areas of interest for video survey and grab sampling will be selected during seismic survey. The moment of collection of these data will depend on the weather conditions and the survey progress. However, note that if a major discovery is made during seismic data acquisition, we may interrupt the geophysical survey at any moment to collect video and/or grab samples.

### Friday 17/05/2019

15h00 Arrival at Zeebrugge

End of campaign

## 6. OCCUPATION OF LABORATORIES

Bridge:	seismic equipment, general control of operations
Wet lab:	AUMS visualization
Microbiology Lab:	
Chemistry Lab:	
Fish Lab:	high-voltage seismic equipment
Biology Lab:	AUMS
Rear Deck:	seismic equipment, video frame, grab

(\*) Necessary alterations specified on board.

## 7. USE OF INFRASTRUCTURE AND INSTRUMENTATION

### Equipment RV BELGICA:

#### Ship's crane

#### RHIB

#### ODASIII data acquisition and presentation system

#### Seabed sampling

- Van Veen grab sampler

#### Laboratory equipment

- Freezer and refrigerator for sample preservation (in wet lab and fish lab)

#### Underway measurements

- Sea-Bird SBE21 thermosalinograph.
- AUMS (Autonomous Underway Measurement System)
- Sub-surface seawater pump

#### Navigation/Meteorology

- Standard meteorological instruments (wind, atmospheric pressure, PAR, air temperature)
- Septentrio AsteRx2eH RTK – EGNOS DGPS system
- Furuno GP-170 EGNOS DGPS system
- Ship heading and speed
- Kongsberg EA400 echosounder with 33, 38 and 210 kHz transducer

#### Multibeam data acquisition

- Side winch
- Sound velocity profiler or SeaCat
- Kongsberg Simrad EM3002D multibeam echosounder –

#### Additional equipment

- Centipede Sparker and single channel streamer (RCMG, UGent)
- GSO multitype sparker (GSO)
- Video frame (VLIZ)
- SES-2000 Quattro echosounder (VLIZ)
- Gilson dredge (VLIZ)
- NMEA-string at the bridge for Delphin

## 8. SAMPLING - ON BOARD ANALYSIS

- Seismic reflection profiles will be subjected to preliminary processing on board in the survey room. No especial equipment is required for this analysis.
- We will collect bathymetric data continuously and simultaneously with the seismic reflection lines. Salinity and temperature measurements, and sound velocity profiles will be performed regularly for calibration.
- If sedimentary samples are taken from the seafloor, they will be photographed on the rear deck, sealed in plastic bags and stored in the freezer and/or refrigerator.

## 9. AUTOMATIC DATA ACQUISITION: ODASIII continuous measurements

Instrument	ODASnr	Parameter	Data acquisition rate				
			ID	ODASIII standard		extra	
				10 sec.	10 min.	1 sec.	0.5 sec.
SEPTENTRIO AsteRx2eH RTK EGNOS receiver	573	Sept LAT.N/S	X	X		X	
	574	Sept LON.E/W	X	X		X	
	575	Sept CA TAW	X	X		X	
	576	Sept UTCTIME	X	X		X	
	577	Sept SPEED	X	X		X	
	578	Sept COURSE	X	X		X	
	579	Sept QUALITY	X	X		X	
	580	Sept DSTA	X	X		X	
	581	Sept DRMS	X	X		X	
	582	Sept HEADING	X	X		X	
FURUNO GP-170 EGNOS DGPS receiver	560	Fur LAT.N/S	X	X		X	
	561	Fur LON.E/W	X	X		X	
	562	Fur HG MSL	X	X		X	
	563	Fur UTCTIME	X	X		X	
	564	Fur SPEED	X	X		X	
	565	Fur COURSE	X	X		X	
	566	Fur QUALITY	X	X		X	
	567	Fur DSTA	X	X		X	
	568	Fur DRMS	X	X		X	
ANSHUTZ GYRO STD20 compass	36	SHIP HEADING	X	X		X	
CONSILIUM SAL 860T doppler log	387	PT/ST SPEED	X	X			
	388	DEPTH SAL860	X	X			
	389	FO/AF SPEED	X	X			
Kongsberg EA400 echosounder	465	EA DEPTH_38	X	X		X	
	466	EA DEPTH_210	X	X		X	
	467	EA DEPTH_33	X	X		X	
FRIEDRICHS meteostation	243	R. WINDDIR SB	X	X			
	244	R. WINDSPD SB	X	X			
	245	ATM PRESSURE	X	X			
	246	AIRTEMP. DRY	X	X			
	247	AIRTEMP. WET	X	X			
	266	SOL RAD	X	X			
	375	R. WINDSPPB	X	X			
	376	R. WINDDIR PB	X	X			
	487	SOL RAD	X	X			
	488	ATM PRESSURE 2	X	x			
SEA-BIRD SBE21 thermosalinograph	191	SBE21 TEMP.	X	X		X	
	192	SBE21 SALIN.	X	X		X	
	193	SBE21 SIGTH.	X	X			
	194	SBE21 S.VEL.	X	X			
	216	SBE21 I-TEMP	X	X			
	217	SBE21 COND	X	X			
	570	SBE21 FREQ 0	X	X			
	571	SBE21 FREQ 1	X	X			
	572	SBE21 FREQ 2	X	X			
SEA-BIRD SBE38 temperature	242	SBE38 TEMP.	X	X			
VALEPORT HM SVP	559	VALEPORT SV	X	X			
VALEPORT 106 CM currentmeter	382	CURR. I-VEL					
	383	CURR. I-DIR					
	384	CM DEPTH					
MARELEC small A-frame	206	LENGTH_W1	X	X			
	207	SPEED_W1					
	208	MEANTRAC_W1	X	X			
	209	PEAKTRAC_W2					
MARELEC oceanographic winch	210	LENGTH_W2	X	X			
	211	SPEED_W2					
	212	MEANTRAC_W2	X	X			
	213	PEAKTRAC_W2					
pump status	377	SEAWATERPUMP	X	X			
	378	SEWAGE PUMP	X	X			
	489	SW PUMP VOL.	X	X			
	569	SW PUMP FLOW	X	X			

<b>AUMS OceanPack</b>						
Endress+Hauser	506	EH TURBIDITY L	X	X		
	508	EH TURBIDITY H	X	X		
Campbell Scientific OBS3+	510	OBS LOW	X	X		
	511	OBS HIGH	X	X		
SEA-BIRD SBE45	500	SBE45 SALINITY	X	X		
Trios Microflu	512	CHLOROPHYLL	X	X		
	513	BLUE ALGAE	X	X		
	514	CDOM	X	X		
Aanderaa optode	501	OPTODE O2	X	X		
Meinsberg	504	pH	X	X		
Turner Designs	515	FLUORESCENCE	X	X		
OceanPack MK2	518	pCO2	X	X		
Li-Cor LI-190SA	530	PAR	X	X		
<b>Calculated parameters</b>						
F: Absolute wind	120	IN-WIND DIR.	X	X		
	121	IN-WINDSPD.	X	X		
	122	IN-WINDSP.BF	X	X		
	379	IN-WINDIR PB	X	X		
	380	IN-WINDSP PB	X	X		
	381	IN-WINDBF PB	X	X		
F:Humidity	182	HUMIDITY DW	X	X		
F: Improved position	479	LAT_AFRAME	X	X		
	480	LON_AFRAME	X	X		
	481	LAT_BENTHOS	X	X		
	482	LON_BENTHOS	X	X		
	483	LAT_VV_FRAME	X	X		
	484	LON_VV_FRAME	X	X		
	485	LAT_OCEANO	X	X		
	486	LON_OCEANO	X	X		

## 10. CHEMICALS

N/A