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CRUISE REPORT

CAGE 18-1

Marine Geophysical Cruise to Storbanken and Olga Basin in the Barents Sea

R/V Helmer Hanssen 12. May – 20. May 2018

Chief Scientist: Andreia Plaza-Faverola
Captain: John

Centre for Gas Hydrate, Environment and Climate (CAGE)

Department of Geosciences

UiT – The Arctic University of Norway

Report Outline page

1. Scientific objectives

The cruise was part of the Centre of Excellence for Gas Hydrate, Environment and Climate (CAGE) at UiT - The Arctic University of Norway. It was partly supported by The Norwegian Petroleum Directorate (NPD).

The cruise had the following scientific objectives:

- To cover with seismic data of areas with identified seepage related features in Storbanken, for the investigation of mechanisms controlling near-surface migration and seepage.
- To complement the cross-disciplinary data repository by CAGE in this area.
- To identify seafloor seepage regions based on regional structural features (e.g., fault lineaments, glaci-tectonic features)

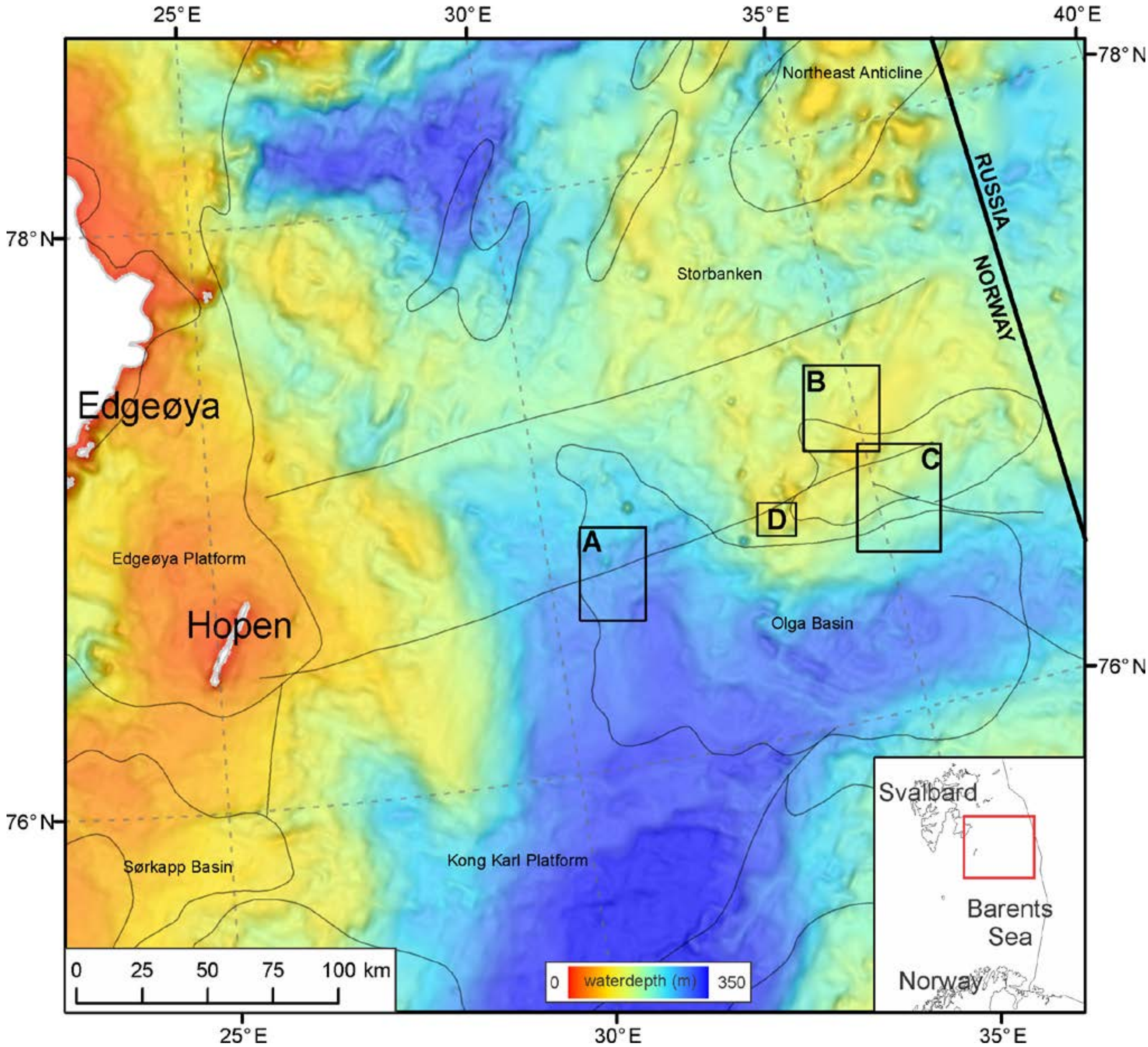


Figure 1. Map showing the overall working areas for cruise CAGE18-1 in the Northern Barents Sea. A: West Olga Basin; B: Storbanken north; C: crater region in Storbanken; D: SW Storbanken.

2. Cruise participants

Andreia Plaza-Faverola	Researcher (Planning, acquisition, seismic processing)
Sunil Vadakkepuliyambatta	Researcher (Planning surveys, bathymetry, maps)
Rune Mattingsdal	NPD (Planning surveys, seismic interpretation)
Malin Waage	PhD (Seismic processing)
Manuel Moser	PhD (Water column analyses and sampling)
Sunny Singhroha	PhD (Seismic acquisition)
Viola Bihler	Intern Erasmus (Various tasks)
Shyam Chand	Researcher (Planning surveys, seismic acquisition)
Steinar Iversen	Engineer
Bjørn Runar Olsen	Engineer
Truls Holm	Engineer

Shift 1: 08:00-14:00;20:00-02:00. Shift 2: 14:00:08:00; 02:00
Bjørn Runar Olsen: 08:00-16:00; 20:00-00:00
Steinar: 08:00-16:00; 20:00-00:00
Truls Holm: 16:00-20:00; 00:00-08:00

Cruise shifts started Sunday 13. May at 08:00, stopped 18. May at 12:00

Departure from Longyearbyen 12.05 kl 00:00, transit to Storbanken: ca 48 hrs.

3. Equipment used

3.1 Subbottom Profiler (Chirp)

A X-STAR Full Spectrum Sonar is a versatile wideband FM sub-bottom profiler that generates cross-sectional images of the seabed and collects digital normal incidence reflection data over many frequency ranges. X-STAR transmits an FM pulse that is linearly swept over a full spectrum frequency range (also called “chirp pulse”).

The chirp system comprises of a hull-mounted 4 x 4 transducer array operated at an energy level of 4 kW and at a shot rate of 1 s. The signal lasts 40 ms, starts at 1.5 kHz and end at 9 kHz. The system can operate in up to 8000 m of water. The penetration depth depends on the sediment type/thickness, it can be up to 80 m in soft clay.

During this cruise, we did not use the chirp at a regular basis. The penetration in the area is poor and the chirp signal introduces undesirable noise to the water column data. However, we recorded a few lines in places where we were looking for sedimentary layers, god target for coring in the future.

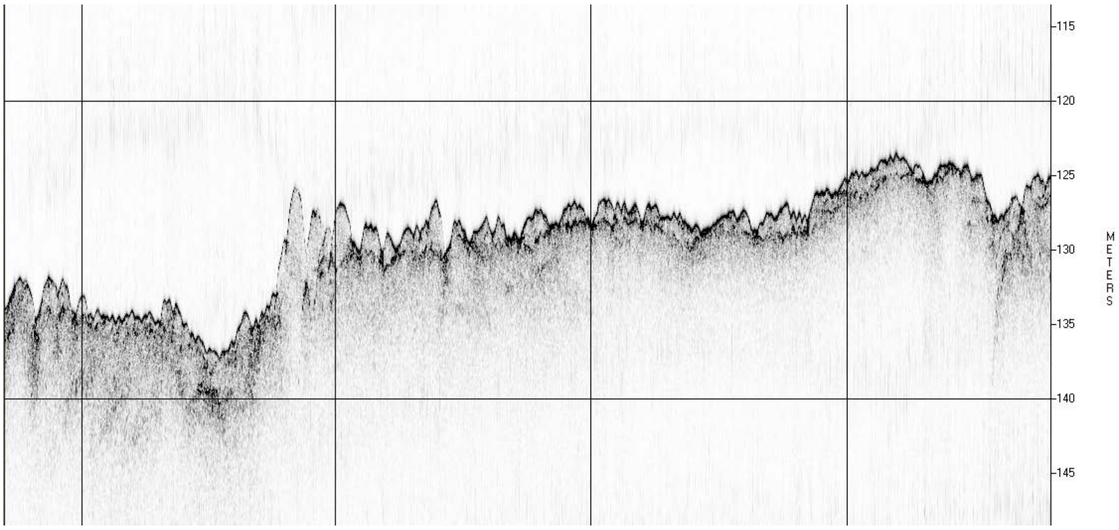


Figure 2. An example of a Chirp profile at Storbanken. We were searching for the presence of a thin (< 3 m layer) of Quaternary sediments on top of the bedrock causing a double pick in our seafloor signal.

3.2 Multibeam Echosounder

R/V Helmer Hansen has a Kongsberg Simrad EM 302 multi-beam echo sounder installed. The multi-beam system measures the two-way travel time that a sound wave initiated by a transmitter needs to reach the sea floor and come back. These waves have a frequency of 30 kHz. At the water depths of the study area (< 300 m) the resulting bathymetry has a resolution of < 2 m. The EM 302 system also provides water column data which we used for detection of acoustic flares indicating seepage from the seafloor. A beam angle of 60/60 was used for the survey with 432 beams on each side sourced two times consecutively (increasing the number of beams to 432). The water velocity for bottom-depth calculation was estimated from CTD sensor measurements.

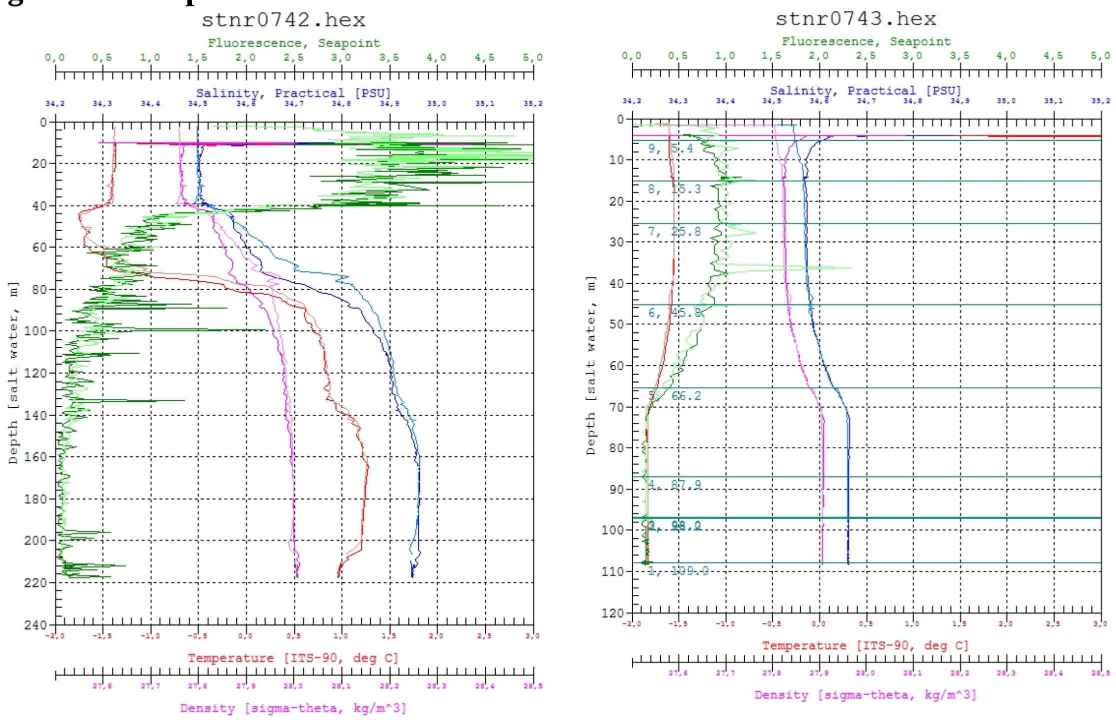
3.3 CTD

CTD (Conductivity, Temperature, Depth) sensors measure the physical properties of seawater. In addition to measuring the conductivity, temperature and pressure (from which depth is calculated), the CTD sensors measure or calculate salinity of seawater, density, sound velocity, turbidity, fluorescence/chlorophyll, and oxygen content. Furthermore, the CTD deck unit can trigger closing of Niskin bottles at discrete depths. Water samples may be taken from the Niskin bottles for further analysis.

R/V Helmer Hanssen uses SBE 911plus CTD for producing vertical profiles of seawater properties. A winch is used to lower the CTD system into the water. The SBE 911plus CTD can measure physical properties of the seawater from up to eight auxiliary sensors, in marine or freshwater environments at depths up to 6000 meters. However, the winch wire length limits CTD measurements to approximately 3200 meters. The CTD sensors record data at a rate of 24 samples per second. The 911plus system uses the modular SBE 3plus temperature sensor, SBE 4C conductivity sensor, SBE 5T submersible pump, and TC duct. The submersible pump pumps water along the sensor to measure the conductivity. The TC duct makes sure that temperature and conductivity are measured on the same parcel of water.

We collected samples from 4 CTD stations (2 stations per location). CTD stations 743 and 744 (figure 3) were taken at an area where acoustic flares extended close to the sea-surface. Water column samples were taken at 8 different depths at each station for gas analysis. Right after bottling the water samples, we injected 1ml of a 5% NaOH solution to each bottle to stop all microorganisms activity. Afterwards we replaced 5ml of the samples by N_2 and stored them in the cooling room.

Figure 3. CTD profiles from sttions 743 and 744.



3.4 2D Reflection Seismic

Source: During 2D seismic acquisition, one GI (Generator-Injector) air gun was used as the seismic source. The air gun generates seismic waves by releasing compressed air into the water. A compressor supplies air at a pressure of 170 bar to the air gun. Shooting rate, sampling rate and other acquisition parameters for each line is listed in the line-log.

Streamer: The streamer used during 2D data acquisition is 100 m long with 32 channels separated by 3.125 m. The streamer is composed of four 25 m long P-Cable Sections.

Operation: The streamer is towed behind the ship at a distance of 68 m from an arm at ~13 m from the centre of the boat. The air gun is towed at a distance of 33 m behind the ship at a depth of approximately 2 mbsl. See Fig. 5 for geometry of the survey.

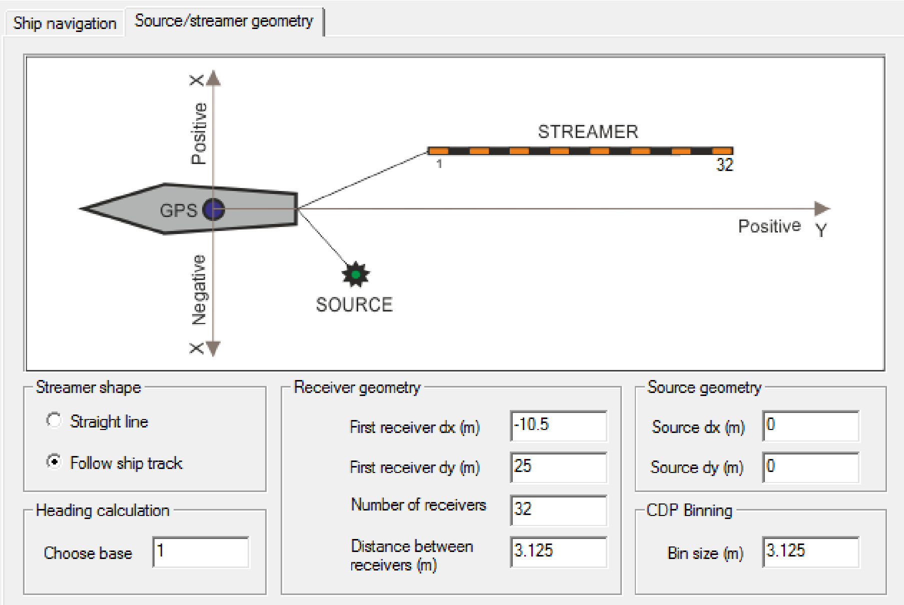


Figure 4. Geometry of the 2D seismic survey. The gun position is used as a reference point for streamer geometry calculation.

3.4.1 Ship-Board Processing

We collected 27 seismic lines in four different areas (figure 1). The lines are named CAGE_18_1_Line1-27. The data was processed onboard using the Radex Pro software. Seg-y files were imported to Petrel for quality control. The project is called “CAGE18_1_2D_Storbanken”. WGS84-N34. NPD received copy of final stack and migrated versions in addition to raw SEGD files and navigation files. On board processing included:

1. *Navigation Files:* Seatrack GPS positioning from the gun raft and stern of the ship is used. These are checked for gaps and interpolated if necessary. The seatrack failed in the beginning. Ship navigation was used in these cases.
2. *Read SegD Files into RadEx Pro*
3. *Geometry assignment*
4. *CDP Binning (3.125 x 3.125 m bin size)*
5. *Filtering: Simple Bandpass filtering (normally 10-25-300-400 Hz) and Spherical divergence*
6. *Wavelet extraction*
7. *Bubble removal*
8. *NMO Correction to water-velocity or using velocity model*
9. *Stacking*
10. *Zero-Offset DeMultiple*
11. *Velocity analysis*
12. *Migration using the Post Stack Kirchhoff Migration algorithm*
13. *Amplitude gain (time-variant and trace equalization) and a second BP filter (20-40-200-300 Hz where necessary)*
14. *Seg-y Output (IBM floating, CDP_X,4R,IBM,181/ CDP_Y,4R,IBM, 185, -10 scalar)*

We generated four segy outputs:

- Cage18_1_LineX_brutestack.segy (1-5 + 8-9)
- Cage_18_1_2D_X (consistent flow with debubble, stacked and migrated using picked velocity and BP 20-40-200-300 Hz).
- Cage18_1_LineX_debub_demult_mig_amplBP.segy (1-13)
- Cage18_LineX_debub_demult_mig.segy (1-12)

Seismic example of processing flow for line 11 is shown in below. Amplitude spectrums are from step 5 (only initial bandpass filter). In general, the penetration of the seismic source used was good enough to image the reflections within the first 200 ms (i.e., at such shallow water depths the first seabed multiple constraints the depth of what we can image using P-Cable data).

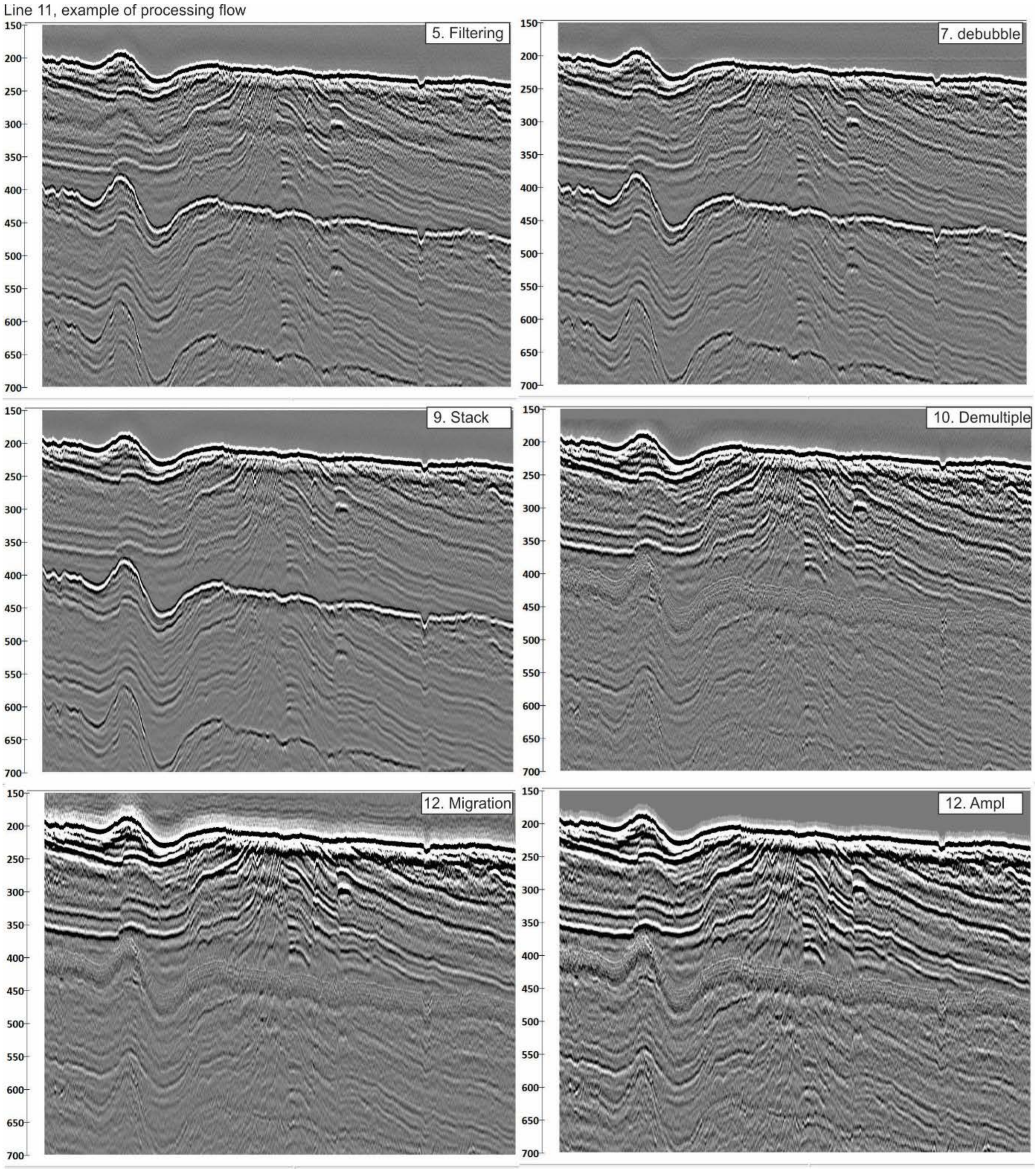


Figure 5. Processing examples of Line 11 (step 5). As seen, there is still a bubble-pulse just beneath the seafloor, which we, unfortunately were unable to correct for onboard. On some lines, this reflector appears less prominent.

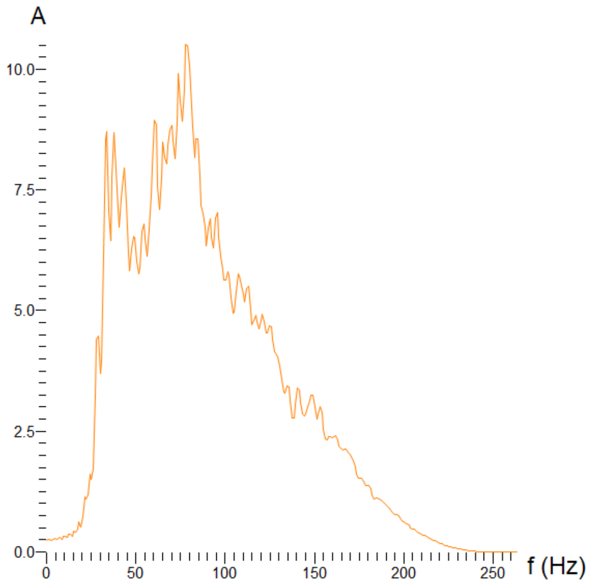


Figure 6. Amplitude spectrum of Line 11 (step 5).

3.5 Single Beam Echo sounder

Single beam echo sounders are common among all types of ships. Their primary purpose is to estimate the depth of the seafloor. In a single beam echo sounder, the transducer projects a sound pulse through water in a controlled direction and the reflected wave is received. The depth is calculated from the travel time of the sound pulse. R/V Helmer Hanssen has a keel-mounted Simrad EK 60 single beam echo sounder with transducers at three different frequencies, 18 KHz, 38 KHz and 120 KHz. The 18 KHz transducer can be used for depths up to 10 km whereas 38 KHz and 120 KHz can only be used for depths up to 2 km and 500m respectively. During the cruise, the single beam echo sounder was used to identify gas seepages in to the water column. Rising gas bubbles appear as high amplitude anomalies within the water column (e.g., Fig.8).

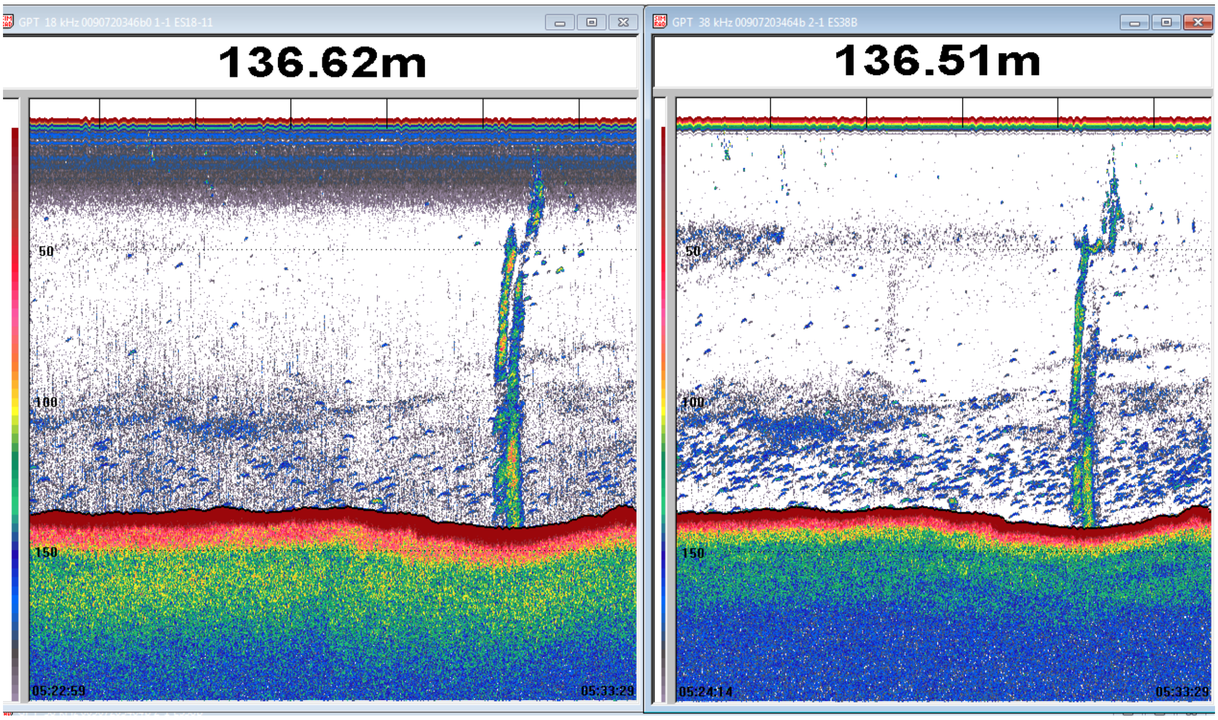


Figure 7. Large gas flare in the Storbanken area where the bubbles emanate from a seafloor depression and reach close to the sea surface. Two CTD stations with water column sampling were collected in this area.

4. Study areas and ship tracks

4.1. NW Olga Basin

Four seismic lines were collected in this area together with one CTD station (lines 1-4), and multibeam for water column inspection. The aim here was to check for seepage associated to a fault where shallow amplitude anomalies have been identified on NPD lines. We did find flares right at the upper projection of the fault plane (figure 8, 9). The base Cretaceous in the area is clearly identified as a strong continuous reflection (Figure 9). Line 1 was overshot over one NPD line.

Figure 10 shows an example of glacial morphology features encountered in the area.

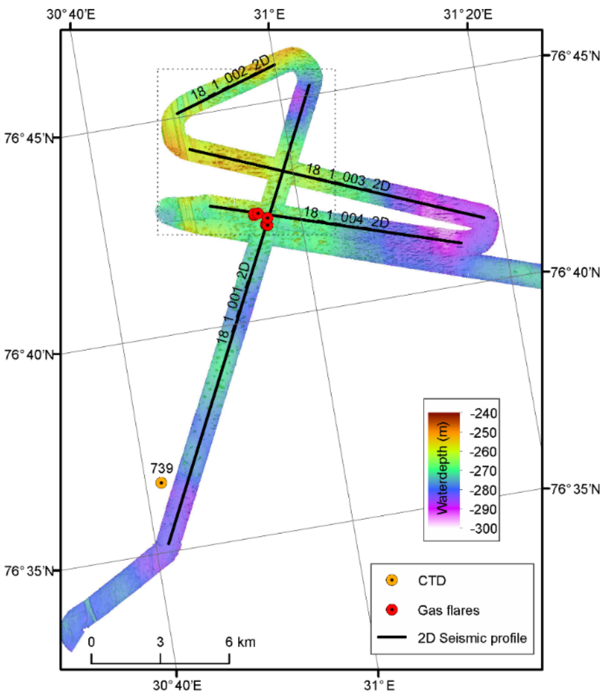


Figure 8. Map showing location of multibeam bathymetry, seismic and CTDs acquired at the NW Olga Basin. Location of gas flares as identified in the multibeam survey in the area is also shown. Location of the area is highlighted in rectangular box A on Fig.1.

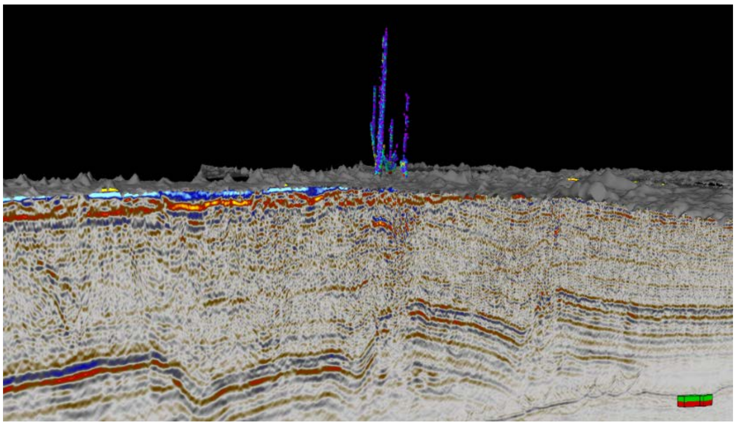
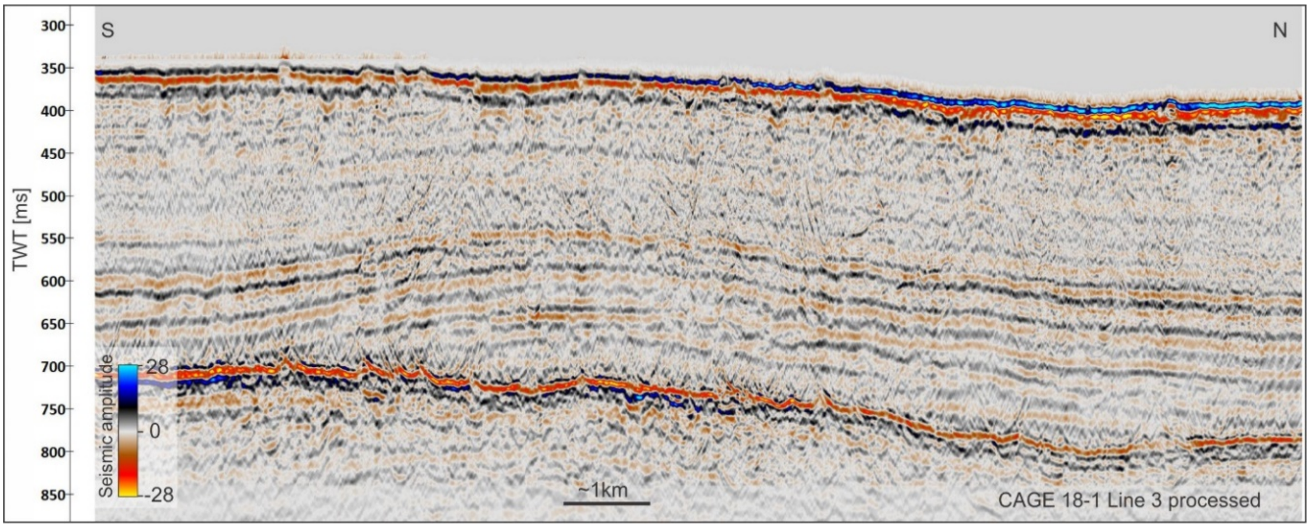


Figure 9 . Top: 3D illustration of gas flares associated with the presence of shallow gas and a faulted graben. The seismic data corresponds to CAGE_18_1_line1. Bottom: Seismic section from profile CAGE 18-1_Line3 on the NW Olga Basin.



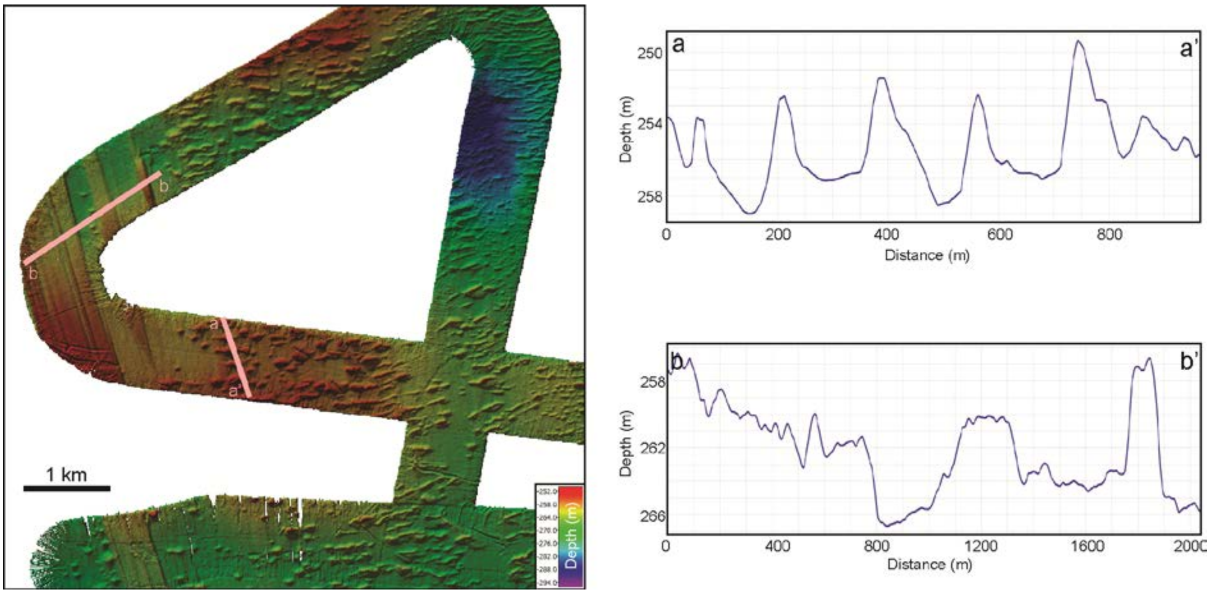


Figure 10: Glacial geomorphology at the NW Olga Basin. Location of the figure shown in dotted rectangle in Fig.8

4.2 North Storbanken

Five seismic lines were collected in this area (Figure 11; 6-7 and 20-22). The investigated north Storbanken area has strong acoustic flares distributed in a zone of erosion and outcrop of the Jurassic sequence (figure 12). Line 5 was shot over one NPD line. The aim here was to image near-surface gas distribution and seepage and correlate with regional deep reaching structures and stratigraphic sequences. In this area we observed acoustic flares that reached near the seafloor in the echosounder profiles. Here we ran two CTD stations (figure 11) with water column sampling at 8 different depths, at two different seepage clusters (after communication with Benedicte Ferré).

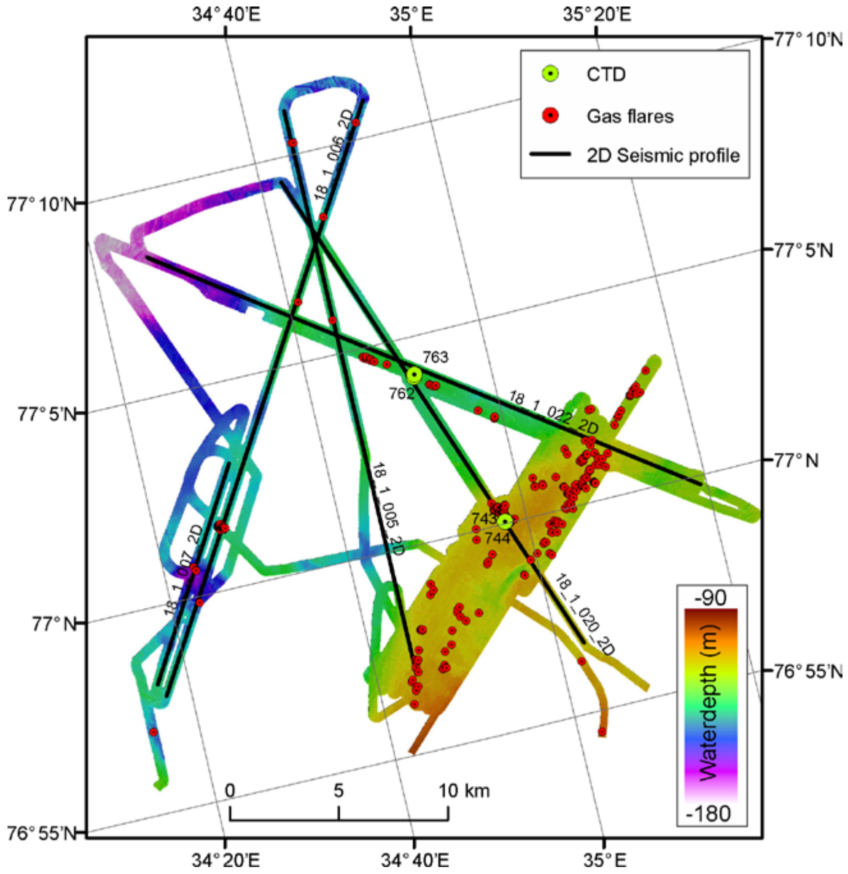


Figure 11: 2D seismic and multibeam data acquired at the N Storbanken area (Area B in fig.1) along with observed gas flares and CTD stations.

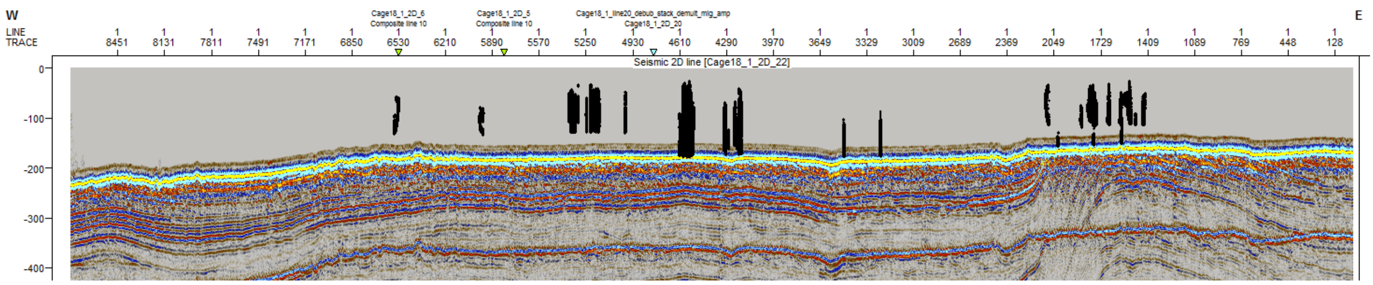


Figure 12: Example of the seismic data collected at the N Storbanken area (Area B in fig. 1). Accoustic flares are proected (black dots).

4.3. Craters on the Storbanken area.

Thirteen seismic lines were collected here (10-19 and 6a, 10a) in addition to multibeam data for water inspection. Line 11 is an overshoot of an NPD line. Two lines cross an available well (NPD report) for stratigraphic constrains (figure 13). Seeping areas identified by Mariano and CAGE cruises were surveyed. Particular focused was given to investigate a mounded feature with seepage associated. This feature was previously suggested to have a similar origin to features interpreted in

Storfjørdenna as pingos (star array; lines 8, 13, 12, 11, 17; figure 13). The mounded feature shows a basal reflector (figure 14).

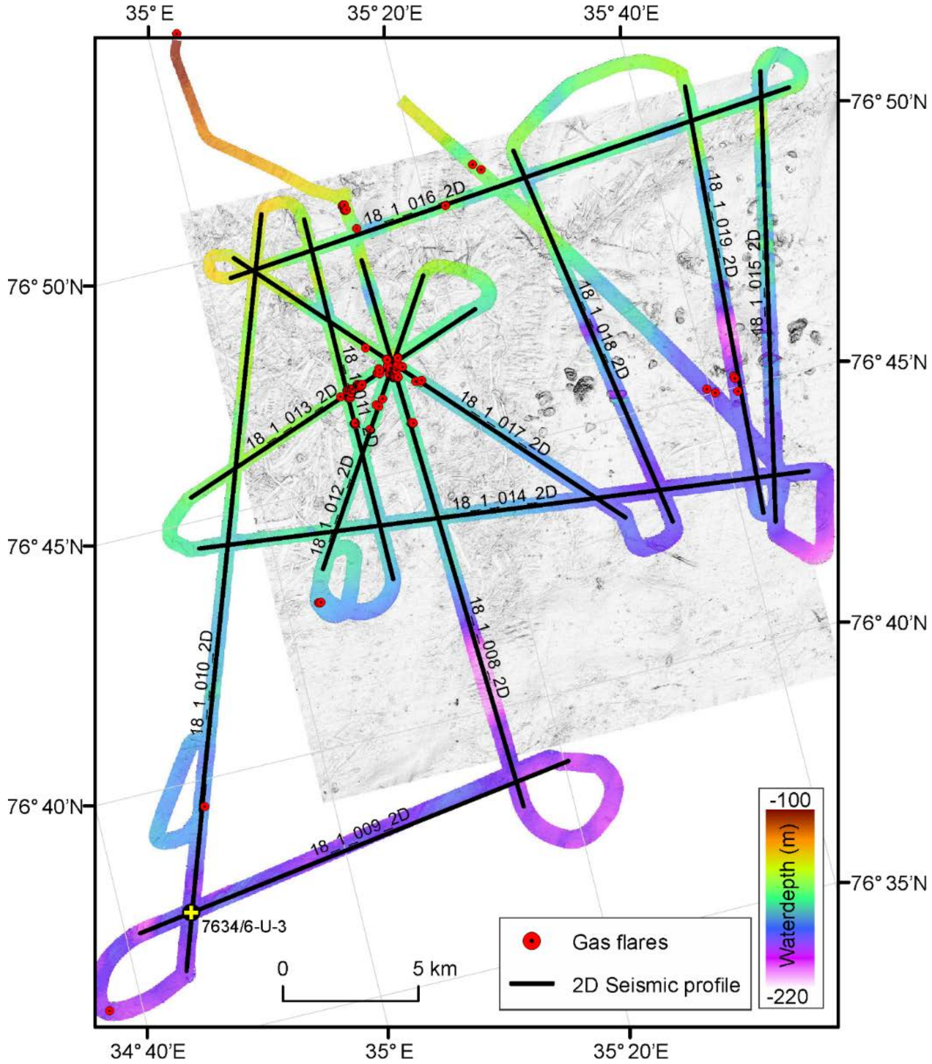


Figure 13: 2D seismic and multibeam data acquired at the crater area in Storbanken (area C in fig.1) along with observed gas flares. The tracks are displayed over a relief map from MAREANO multibeam bathymetry.

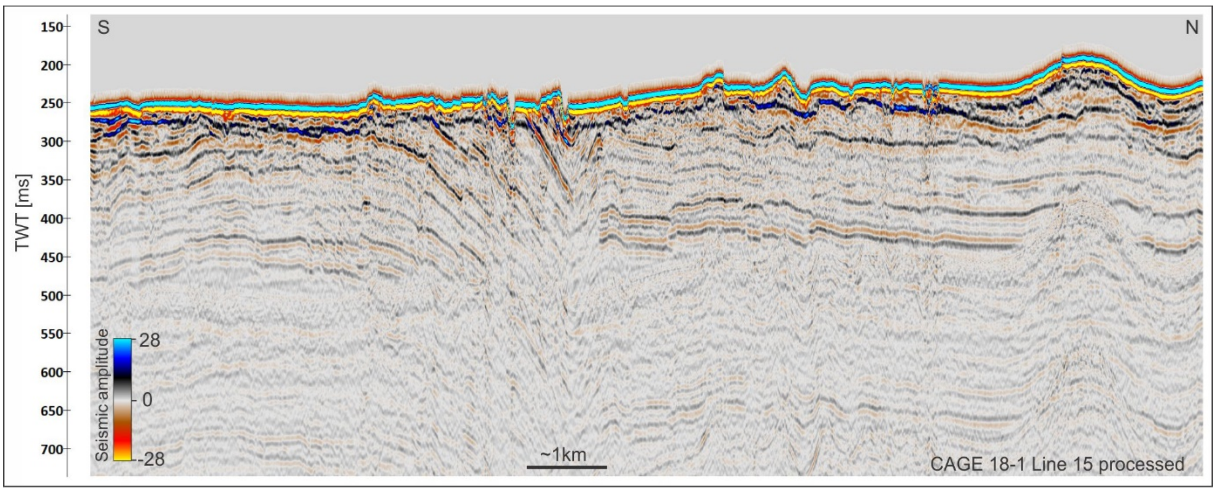


Figure 14. Seismic line Cage18-1-2D Line 15, see Figure 13 for location.

4.3. SW Storbanken

The investigation in this area was focused on a large shallow gas anomaly observed in conventional 2D seismic data (Area D in fig.1). Three 2D seismic profiles were acquired and numerous gas flares were observed at this location (figure 15, 16).

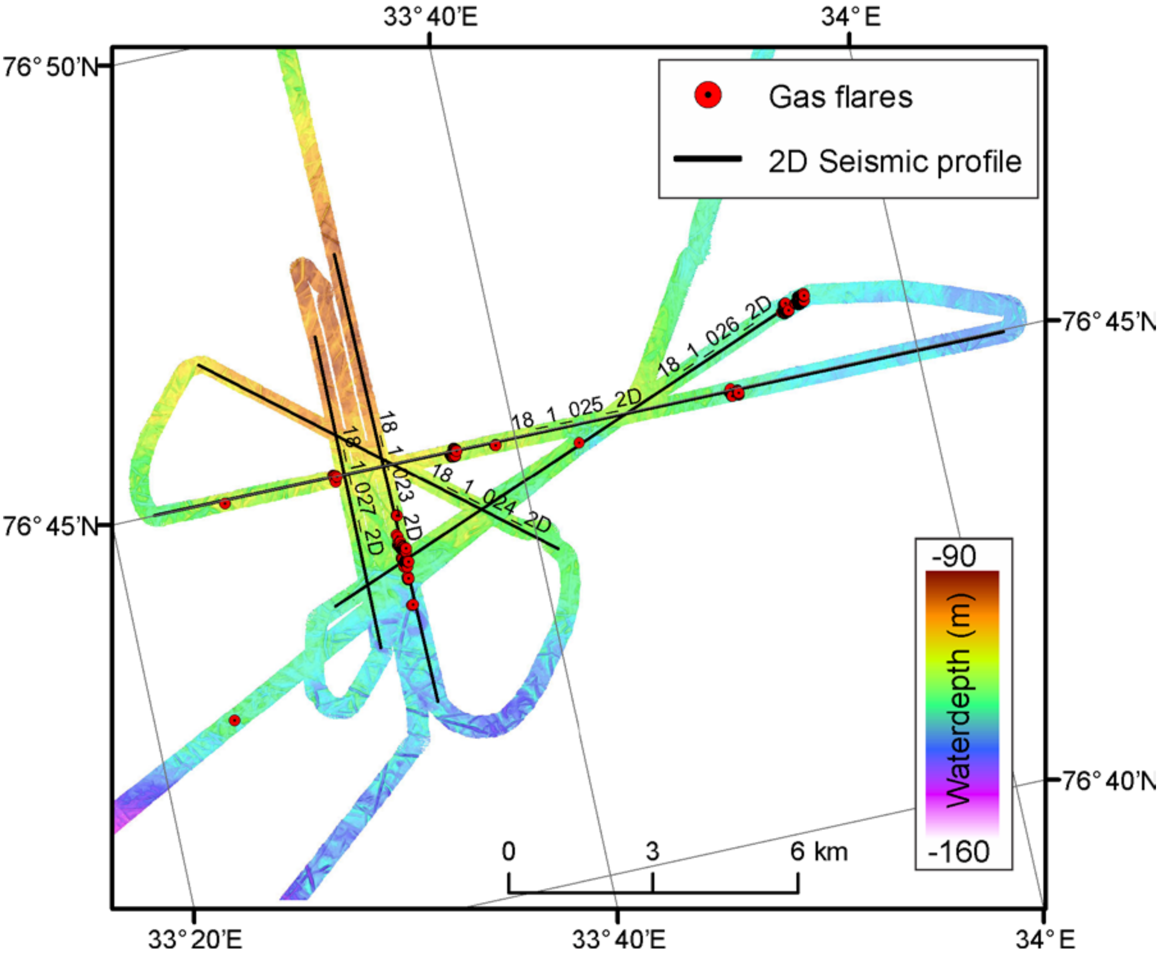


Figure 15: 2D seismic and multibeam data acquired at the SW Storbanken (area C in fig.1) along with observed gas flares.

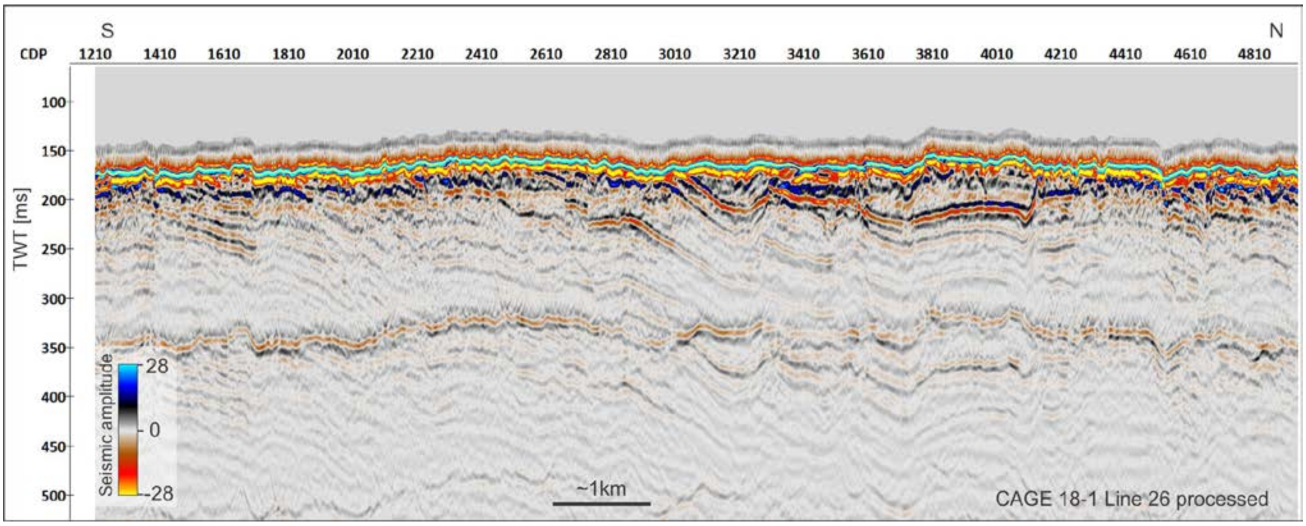


Figure 16. Seismic line Cage18-1-2D Line 26, see Figure 15 for location.

4.5 Observations

- Seepage is widespread in the Barnets Sea. New seepage areas were identified during the cruise associated with faulting, outcropping of permeable layers, erosion of quaternary cover. We did observed accosutic flares in transit lines (figure 17). We believe we should systematically scan water column files during the transists.
- The crater area is less active in terms of seepage. The mound like structure has seepage souranding it. This mound feature shows a basal reflector. Glaci tectonic processes seem to have influenced seabed morphology and leaved inprint on mounds and craters in this area.
- Seepage areas were often identified where shallow gas anomalies exist in the near-surface.
- Not did not observed gas leackage at all the investigated faults. Generally, a combination of faulting and dipping/outcropping permeable stratigraphic sequences (insights by Rune Mattingsdal) characterized the settings were seepage was identified.

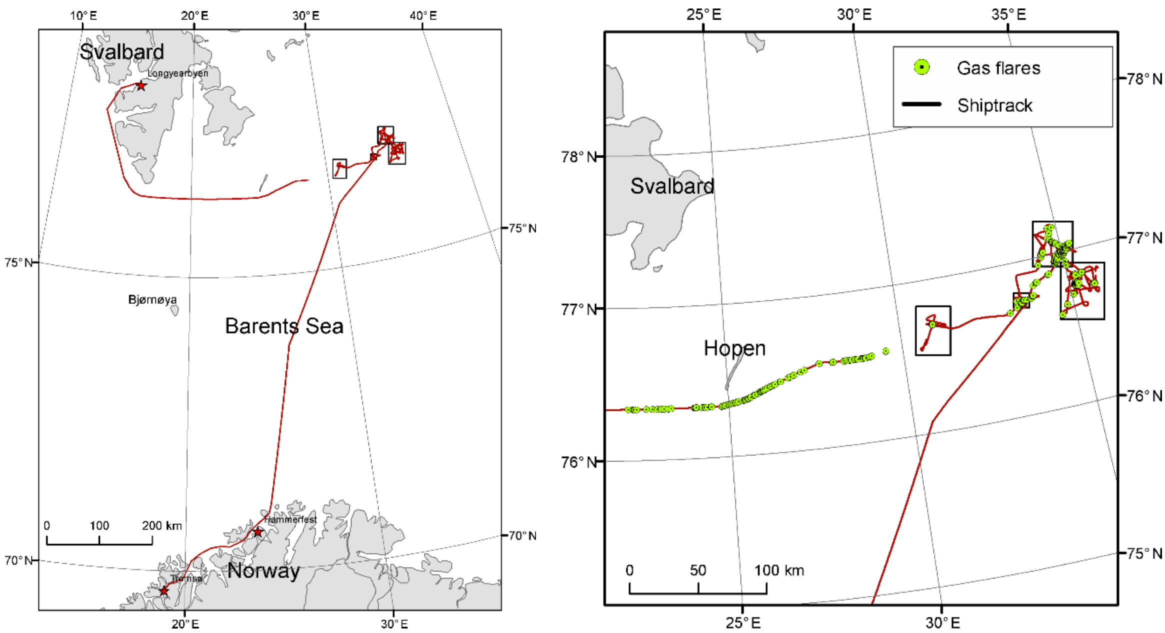


Figure 17. Ship track (left) and ship track with projected picked accoustic flare locations (right).

5. Logs

Event log CAGE_18-1

Date	Time	Event
12/5	01:00	Depart Longyearbyen, heading for the south-east of Hopen. Multibeam
13/5	09:50	First CTD and multibeam line along lineament to search for flares
13/5	15:00	Beginning of seismic survey West Olga Basin
13/5	12:00	Second CTD
13/5	22:30	Streamer on deck
14/5	00:00	Multibeam towards area B; CTD
14/5	18:00	2 CTD stations at high flare (743, 744)
14/5	22:48	Beginning of seismic survey north Storbanken (area B)
15/5	09:00	End seismic survey in area B
15/5	09.30	Multibeam towards area C, craters in Storbanken
15/5	13:00	Begin 2D seismic survey craters Storbanken
16/5	23:40	End seismic survey area C
17/5	00:00	Multibeam towards area B; coverage of a multibeam box not covered yet by MAREANO. Flare hunting.
17/5	04:00	Begin more 2D seismic lines in area B
17/5	14:30	2 CTD stations at high density flare zone in Storbanken
17/5	19:00	End seismic in area B
17/5	20:00	More multibeam coverage and flare hunting in area B
18/5	00:00	Transit towards a zone west of Storbanken; flare hunting
18/5	02:00	Starting 2D seismic southwest of Storbanken
18/5	11:00	End of 2D survey area D
18/5	12:00	Multibeam while transiting to glider location (Biologists instrument to be collected)
18/5	18:00	Favor to the biologists- collection of a damage Glider
18/5	19:00	Transit
20/5	19:00	Arrival in Tromsø

CTD log

Site/Area	Ship Station	Activity	Station Id	Map Id	Date (UTC)	Time (UTC)	Latitude	North/South	Longitude	East/West	Equipment	Water Depth	Bott
Håpen east	738	CTD	CAGE_18_1_HH_738_CTD	18_1_738_CTD	13.05.2018	05:16:46	76,5561	N	27,5948	E	SBE 9 plus CTD	137,28	
Olga Basin	739	CTD	CAGE_18_1_HH_739_CTD	18_1_739_CTD	13.05.2018	09:50:26	76,6108	N	30,6922	E	SBE 9 plus CTD	281,06	
Olga Basin	742	CTD	CAGE_18_1_HH_742_CTD	18_1_742_CTD	14.05.2018	00:05:50	76,6863	N	32,4727	E	SBE 9 plus CTD	223,25	
Storbanken	743	CTD	CAGE_18_1_HH_743_CTD	18_1_743_CTD	14.05.2018	15:54:12	77,0013	N	34,9604	E	SBE 9 plus CTD	112,17	
Storbanken	744	CTD	CAGE_18_1_HH_744_CTD	18_1_744_CTD	14.05.2018	17:04:20	77,0011	N	34,9600	E	SBE 9 plus CTD	111,69	
Storbanken	762	CTD	CAGE_18_1_HH_762_CTD	18_1_762_CTD	17.05.2018	12:22:29	77,0673	N	34,8592	E	SBE 9 plus CTD	129,07	
Storbanken	763	CTD	CAGE_18_1_HH_763_CTD	18_1_763_CTD	17.05.2018	12:50:32	77,0683	N	34,8616	E	SBE 9 plus CTD	128,65	

2D seismic log

Site/Area	Line Name	Activity	Line Id	Mapline Id	Date (UTC)	Time (UTC)	Start Shot	Latitude	Nort	Longitude	Ea	End Time (UTC)	End Shot	Latitude (end)	No	ongitude (end)	Eas	Length	Equipment	Puls	Shot Rate (sec)	Speed (kn)	Notes
Olga Basin west	740	2D	CAGE_18_1_HH_001_2D	18_1_001_2D	13.05.2018	13:12	1128	76.5868	N	30.6878	E	15:58	2791	76.7543	N	31.0514	E	1 GI			6	4	Start of 2D line, 1s record length, 0.125 ms sampling rate, preamp gain 8db gun in 45/45, strong noise in the water column, Profile running SW to NE, water temp 0.5, wind 8.26, wave1 m, seatrack crashed 13:28 UTC, no seatrack for the rest of the line
Olga Basin west		2D	CAGE_18_1_HH_002_2D	18_1_002_2D	13.05.2018	16:22	2792	76.7644	N	30.9996	E	16:55:35	3125	76.7521	N	30.8223	E	1 GI			6	4	Transit line to the beginning of next line. Sample interval changed to 0.250 ms. Seatemp -0.5, wind 13.3 m/s. Seatrack is down
Olga Basin west	741	2D	CAGE_18_1_HH_003_2D	18_1_003_2D	13.05.2018	17:09:47	3126	76.7374	N	30.8333	E	18:46:11	4097	76.6916	N	31.3054	E	1 GI			6	4	Seatrack down. 4.4-4.5 Kn ship speed
Olga Basin west	742	2D	CAGE_18_1_HH_004_2D	18_1_004_2D	13.05.2018	19:02:52	4098	76.6834	N	31.2596	E	20:34:10	5010	76.7143	N	30.8515	E	1 GI			6	4	Seatrack down. 4.4-4.5 Kn ship speed, rough weather (2-2.5 m wave height in the second half of the line)
Storbanken	745	2D	CAGE_18_1_HH_005_2D	18_1_005_2D	14.05.2018	20:48:01	5151	76.9489	N	34.7388	E	00:16:43	7246	77.1850	N	34.7402	E	1 GI			6	4	seatrack showing wrong projection despite being in UTM34. Shot 5345 seatrack good projection again; 5446-5662 test injector genrator for bubble; captain deviated from the planned line due to ice at the start of line;6894- testing pulse parameters
Storbanken	746	2D	CAGE_18_1_HH_006_2D	18_1_006_2D	15.05.2018	00:58:30	7247	77.1817	N	34.8866	E	06:31:54	9752	76.9636	N	34.2871	E	1 GI			6	4	5-7 m/s windspeed 200 deg wind direction, Problem with guns after shot 8748 (03:28 UTC). Recording stopped and guns taken aboard. No physical problems on the guns. Seems like there was a delay between the trigger and the gun fire. 04:08 UTC Turning back to the location from where the problem started and reshoot the line. The reshoot will be called 6a in the geoeel folder. starting shot is 8901. Ship back on track on shot number 8960. Last shot on line 6a is 9752
Storbanken	747	2D	CAGE_18_1_HH_007_2D	18_1_007_2D	15.05.2018	06:44:42	9753	76.9690	N	34.2761	E	08:04:18	10549	77.0503	N	34.4939	E	1 GI			6	4	5.22 m/s wind speed. Ship speed 3.5 Kn
Storbanken Craters	748	2D	CAGE_18_1_HH_008_2D	18_1_008_2D	15.05.2018	11:11:01	10552	76.8211	N	35.2242	E	14:03:42	12279	76.6332	N	35.2617	E	1 GI			6	4	6 m/s wind speed. 1 m waves. Ship speed 3.5 Kn
Storbanken Craters	749	2D	CAGE_18_1_HH_009_2D	18_1_009_2D	15.05.2018	14:57:12	12280	76.6441	N	35.3391	E	17:07:06	13580	76.6223	N	34.6867	E	1 GI			6	4	5 m/s wind speed. 1 m waves. Ship speed 4Kn
Storbanken Craters	750	2D	CAGE_18_1_HH_010_2D	18_1_010_2D	15.05.2018	19:50:00	13581	76.6067	N	34.7393	E	18:58:48	14200	76.6650	N	34.8250	E	1 GI			6	4	6 m/s wind speed. 1 m waves. Ship speed 3.7 Kn; 14146 gun problem. Traces shifted down, gun not synchronized with the trigger. Recording stopped. By 21:51 (real time) we had the guns defrosted and strated shooting again.
Storbanken Craters		2D	CAGE_18_1_HH_010a_2D	18_1_010a_2D	15.05.2018	20:03:00	14201	76.6570	N	34.8120	E	22:53	15901	76.8436	N	35.0983	E	1 GI			6	4	4 m/s windspeed
Storbanken Craters	751	2D	CAGE_18_1_HH_011_2D	18_1_011_2D	15.05.2018	23:10:20	15902	76.8387	N	35.1568	E	01:01:24	17012	76.7164	N	35.1581	E	1 GI			6	4	4 m/s windspeed 150 deg direction, seatemp -1.4 deg airtemp -0.8 deg
Storbanken Craters	752	2D	CAGE_18_1_HH_012_2D	18_1_012_2D	16.05.2018	02:22:30	17048	76.7251	N	35.0633	E	03:53:42	17961	76.8112	N	35.3049	E	1 GI			6	4	2.5 m/s windspeed 43 deg -1.4 deg sea water temp. Gun freezing again. 01:33 UTC recovering gun. Event occurred before the designated start of line. Recording started at 02:22 UTC
Storbanken Craters	753	2D	CAGE_18_1_HH_013_2D	18_1_013_2D	16.05.2018	04:19:20	17962	76.7964	N	35.3666	E	05:59:15	18960	76.7582	N	34.9028	E	1 GI			6	4	2.0 m/s windspeed 73 deg -1.5 deg sea water temp.
Storbanken Craters	754	2D	CAGE_18_1_HH_014_2D	18_1_014_2D	16.05.2018	06:23:24	18961	76.7412	N	34.8974	E	09:28:54	20816	76.7175	N	35.7743	E	1 GI			6	4	3.5 m/s windspeed -1.3 deg sea water temp.
Storbanken Craters	755	2D	CAGE_18_1_HH_015_2D	18_1_015_2D	16.05.2018	10:32:42	20817	76.7041	N	35.7113	E	12:42:54	22119	76.8493	N	35.8512	E	1 GI			6	4	4.5 m/s windspeed -1.3 deg sea water temp.
Storbanken Craters	756	2D	CAGE_18_1_HH_016_2D	18_1_016_2D	16.05.2018	13:04:24	22120	76.8417	N	35.8855	E	15:44:06	23717	76.8256	N	35.0336	E	1 GI			6	4	4 m/s windspeed -1.2 deg sea water temp.
Storbanken Craters	757	2D	CAGE_18_1_HH_017_2D	18_1_017_2D	16.05.2018	16:01:48	23718	76.8317	N	35.0445	E	18:13:00	25029	76.7176	N	35.5031	E	1 GI			6	4	6.01 m/s windspeed -1.4 deg sea wter temperature
Storbanken Craters	758	2D	CAGE_18_1_HH_018_2D	18_1_018_2D	16.05.2018	18:37:24	25030	76.7125	N	35.5681	E	20:34	26195	76.8440	N	35.4755	E	1 GI			6	4	-1.3 deg seawater temp -1.2 air temp
Storbanken Craters	759	2D	CAGE_18_1_HH_019_2D	18_1_019_2D	16.05.2018	21:39:40	26196	76.8506	N	35.7402	E	23:53	27527	76.7078	N	35.6974	E	1 GI			6	4	-1.4 deg seawater temp -1.1 air temp
Storbanken	760	2D	CAGE_18_1_HH_020_2D	18_1_020_2D	17.05.2018	02:14:24	27628	76.9454	N	35.0481	E	05:24:42	29531	77.1570	N	34.7053	E	1 GI			6	4	Preamp gain set to 0 db due to very shallow water. Seatemp -1.3, windspeed 2.3 m/s
Storbanken	761	2D	CAGE_18_1_HH_021_2D	18_1_021_2D	17.05.2018	06:24:42	29532	77.1398	N	34.4326	E	06:34:12	29622	77.1332	N	34.4744	E	1 GI			6	4	4 m/s wind speed, -1.2 seatemp;stop because of waves
Storbanken	764	2D	CAGE_18_1_HH_022_2D	18_1_022_2D	17.05.2018	16:56:42	29659	76 59.794	N	35 19.308	E	20:26:25	31755	77 08.362	N	34 26.106	E	1 GI			6	4	wind 1.5 m/s , seatemp -1.3, Gun energy going up and down. The data seems to be very noisy. Nearoffset has lower amplitude than the far offsets
SW Storbanken	765	2D	CAGE_18_1_HH_023_2D	18_1_023_2D	18.05.2018	00:36:36	31794	76 47.442	N	33 33.267	E	01:50:12	32530	76 42.322	N	33 33.588	E	1 GI			6	4	wind 8 m/s, water temp -1.2