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R/V Helmer Hanssen

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Tromsø – Tromsø

CAGE-21-3 Cruise Report

Ocean bottom seismics and acoustic surveys on the West-Svalbard margin – a study of local seismicity and its effect on methane seepage

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Capt. R/V: Hansen, Hans R.

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OBJECTIVES

Cruise CAGE21-3 with UiT's research vessel R/V Helmer Hanssen was carried out to address the following objectives within the SEAMSTRESS project (*Tectonic stress effects on Arctic methane seepage*):

1- Recovery of 10 Ocean Bottom Seismometers (OBS) deployed last year north of the Knipovich Ridge-Molloy Transform Fault corner (see report CAGE20-5).
2- Conduction of an active source OBS experiment for the study of shear waves propagation in relation to local stress field and focused fluid flow.
3- Acquisition of seismic lines for completing a side survey for the FRAME-IODP proposal.

In 2020, 10 ocean-bottom seismometers (OBS) were deployed at the northern termination of the Knipovich Ridge to monitor seismic activity. The aim is to detect regional and local earthquakes. If local earthquakes are captured we will investigate the stress field in the region and how faults and fluids react to such stress (Figure 1). From the 10 instruments 8 are from Awi and 2 from UiT.

IODP proposal 985 *Eastern Fram Strait Palaeo-archive* (FRAME) proposed to drill five sites on the western Svalbard margin in order to study chronostratigraphy, palaeoceanography, the palaeoclimatic evolution, and the forcing mechanisms responsible for main climatic transitions and the dynamics of the Svalbard Barents Sea Ice Sheet complex. This cruise acquired additional site survey seismic data for proposed primary and alternate drill sites.

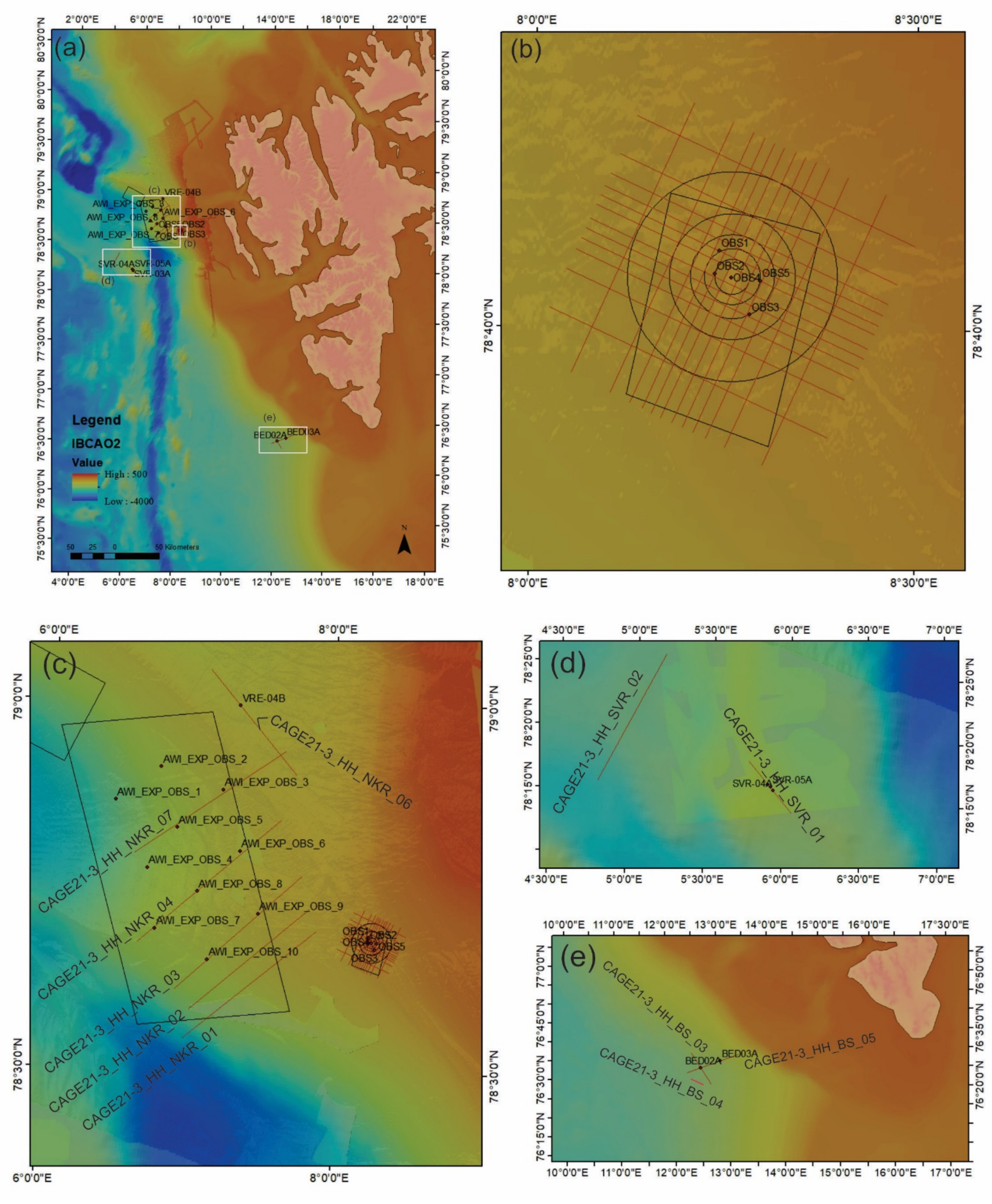


Figure 1: Overview of the working areas and surveys. Inset (b): active source experiment; inset (c): location of OBSs deployed in 2020 and recovered during this cruise in addition to seismic lines collected; inset (d): seismic lines Svvatogor Ridge, side survey for IODP proposal and heat-flow transect; inset (e): lines collected in the Bellsund area as side survey for the IODP proposal.

METHODS

Seismic methods

The high-resolution streamers from UiT's P-Cable 3D seismic system were used in 2D mode together with a Granzow high-pressure (210bar) compressor and mini-GI guns. Onboard seismic processing provided migrated 2D seismic sections for quality assessment and preliminary interpretations.

During this cruise we used 12 streamer sections for a 300 m long active hydrophone cable with 96 channels at a receiver spacing of 3,125 m. The lead-in cable to the active streamer had a length of 70 m behind the ship. The depth of the streamer cable was controlled by two ION Digicourse II birds and set to 2.5 m, and to 3 m when weather conditions were worse and wave height above 2 m. Each digital streamer is 25 meters long and consists of an A/D-module and 8 channels. Geometrics solid state streamers are used that are much less affected by sea swell and hence provide data with significantly less noise. The A/D-module converts the analogical signal from the channels to digital signals. The group spacing of channels along the streamer is 3.125 m.

A 300-m long signal cable is run off the P-Cable winch and connects to the starboard termination of the cross cable. It contains wiring for power and data transmission. The data is transferred via Ethernet protocol. Ethernet-to-Coax switches at the ends of the signal cable allow data transmission over long distances. The digital data is recorded using Geometrics GeoEel software.

Details on the acquisition parameters like recording length, sampling rates, etc. can be found in tables below and the seismic line log in the Appendix of this report.

Single-beam and multibeam echosounder

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.

The R/V Helmer Hanssen is equipped with the keel-mounted SIMRAD EK60 single beam echosounder 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. The EK60 echosounder controls the ping rate of both the multibeam echosounder and the chirp sub-bottom profiler.

Multi-beam echosounders use a swath of beams giving off-track depth. Basic components of a multi-beam system are two linear transducer arrays in a Mills cross configuration with separate units for transmitting and receiving. Echosounders measure the two-way travel time that a sound wave initiated by the transmitter needs to reach the seafloor and be reflected back to the receiver. The time-depth conversion can be done using the sound velocity through seawater calculated from the closest CTD (Conductivity, Temperature, Depth) measurements.

The multibeam echosounder system on the R/ Helmer Hanssen is the hull-mounted Kongsberg Simrad EM302. Its nominal sonar frequency of the sound waves is 30 kHz with an angular coverage sector of up to 150° with a maximum of 864 beams per ping. The EM302 provides high resolution bathymetric data up to a water depth of 7000m.The system was mainly used with a 45°/45° opening angle but reduced to 30°/35° at times to remove poor quality outer beams in bad weather and automatically increased to 55°/55° in deep water (>1700m). A reduced opening angle also reduces the number of beams and swath width coverage, to less than the normal 5.5 times the water depth.

Another application of the EM302 is to monitor the water column. We actively monitored the water column, for gas flares, during the NKR water column survey (CAGE21-3-HH-2), at a structure suspected to release methane that is not easily detectable in the water column. In the SIS acquisition software, we increased the water column gain to 35 logR and the dB offset to 20, (recommended by Kongsberg) to enhance amplitudes for gas flare detection.

During almost the entire cruise, the EM302 provided continuous bathymetric and water column data. The QPS Qimera software (version 2.2.5) was used to create preliminary high-resolution bathymetric maps.

Sub-bottom profiler

The X-STAR (model SB-218H) sub-bottom profiler is a full spectrum sonar system that transmits a frequency modulated (FM) pulse, linearly swept over a full spectrum frequency range (also referred to as a “chirp pulse”). The chirp system comprises a hull mounted 4 x 4 transducer array operated at an energy level of 4 kW. The frequency range is 2-18 kHz and the ping rate is controlled externally by the EK60 echosounder. The system is designed for profiling up to 7 knots and it can operate in up to 8000m water depth.

Data are acquired using the edgetech discover sub-bottom (version 3.52) real time software and logged in the native edgetech format (.jsf). The vertical resolution depends on the transmitted pulse length. At 40ms (2-8 kHz) the resolution is ~12cm (inverse bandwidth x half sound speed). To achieve the theoretical temporal resolution predicted by the inverse of the bandwidth, the FM pulse is compressed using a digital compression filter. The compression filter maximizes the SNR of the acoustic image. The amplitude spectrum of the pulse is Gaussian in shape to limit temporal resolution losses, during attenuation while traveling through the sediment. Other signal processing includes correlation which increases signal energy.

During the chirp survey over the NKR active seismic site, the penetration of the sub-bottom was < 30m using a 40ms pulse length which is typical in coarse sand.

Post processing of the chirp data involves: 1) converting from. jsf to. segy using the playback in the edgetech discover software; 2) automatic projection of the. segy to the correct UTM zone (31N), and relocating X,Y source coordinates (to bytes 73 and 77) using seismic unix.

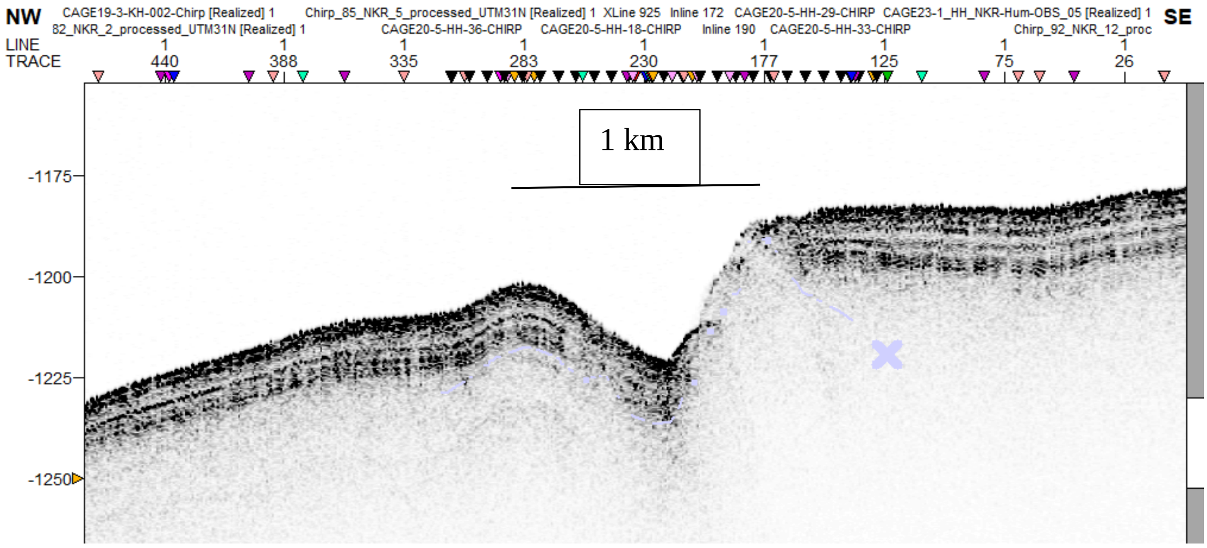


Figure 2: Example of chirp data collected from the hummocky area in the depression on the continental slope to the north of the northern termination of the Knipovich Ridge (NKR area). The vertical axes is in ms. The horizontal scale is ca. 10 m/trace. The violet horizon and marker indicate the 130.000 yr reflection correlated with the MeBo reference site (Dessandier et al., 2020)

Multi-component ocean bottom seismometer (OBS)

The OBS systems are autonomous sea floor recording platforms, designed to record both, compressional and shear waves from regional seismicity or reflected and refracted through the sediments during active experiments (figure 3). It consists of a titanium frame with buoyancy made of syntactic foam, a KUMQUAT acoustic release system, and a digital data recorder (6D6) in a separate titanium pressure cylinder. A hydrophone and a 3-component seismometer are used to record the seismic wavefield. The Tromsø OBS has a 4.5 Hz K/MT 210 seismometer (three-component geophone) attached whereas the 8 OBS from AWI have a Trillium broadband seismometer that is self-levelling and has a broader frequency range. While the hydrophone is fixed to the frame of the OBS, the geophone is detached from it for the UiT OBS. This design insures that the geophone is mechanically decoupled from the frame, to avoid noise generated by the frame being recorded by the geophone. On the AWI OBS the Trillium Seismometer is located between frame and anchor weight so coupling to the ground is via the anchor. The whole system is rated for a depth of up to 6000 m. The OBS is attached to a ground weight (anchor) via the acoustic release system in order to make it descend to the sea floor after deployment. When the seismic experiment is completed, the OBS is released from its ground weight by sending an acoustic code and it rises to the sea surface by its buoyancy.

Figure 2: Ocean-bottom seismometers of UiT (left) and AWI (right).

The OBS systems were prepared, programmed and the releasers tested at 2000 m water depth prior to deployment. The first channel records the hydrophone data, while channel two, three and four are connected to horizontal and vertical components of the geophone. The locations were selected based on seismic anomalies in the 3D seismic data and previously acquired OBS data. The station list is given in the appendix.

NARRATIVE OF THE CRUISE

The cruise was narrated via a blog by Frances Cooke that can be found at the SEAMSTRESS project website site.uit.no/SEAMSTRESS

Main activities include:

- Passive source seismological experiment
- Active source seismic experiment
- Repetition of bathymetry at steep flanks with gravitational collapse structures and slides
- Acquisition of side surveys for the FRAME IODP proposal

Passive seismology north of Knipovich Ridge and acoustic surveying

We arrived on site on Saturday the 10th of July to an unstable weather. We started collecting the instruments on the 10th and ended on the 14th utilizing weather windows with waves below 2 meters, winds below 11 m/s and visibility beyond 1 km. Within this period we travelled to and back from Longyearbyen to pick up a replacement for the machinery chief mate who got injured.

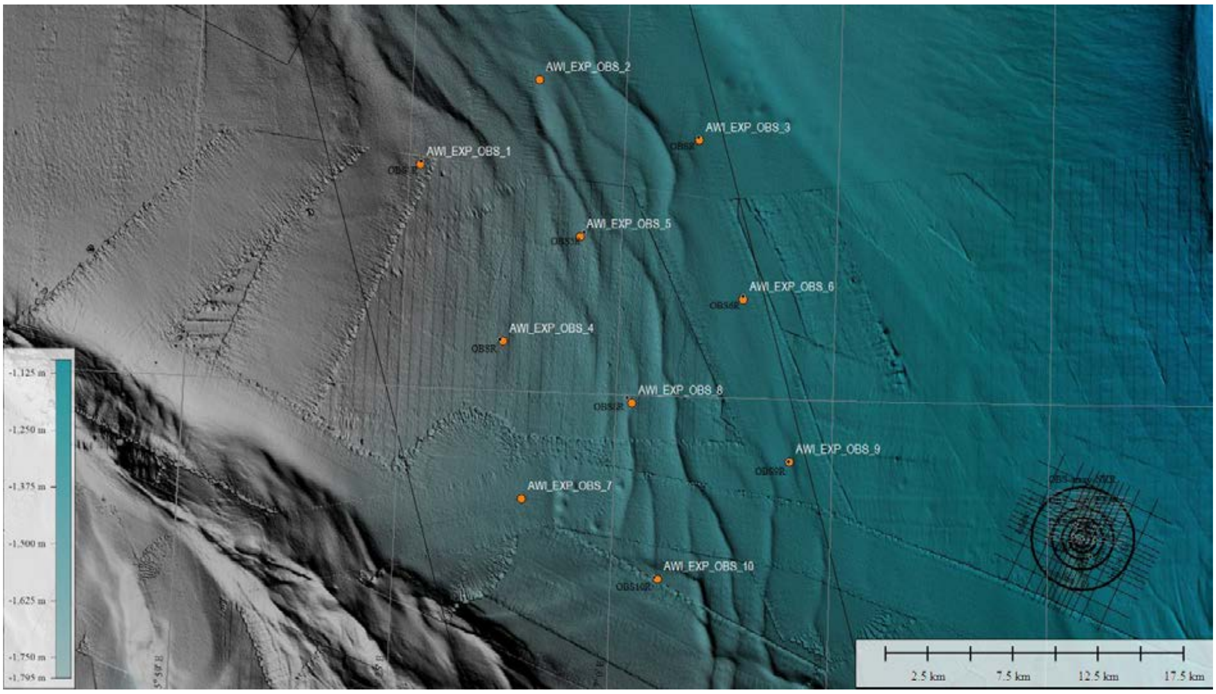


Figure 4: Positions of the OBS recovered during CAGE21-3.

Long-term experiment

Table 1: Deployment and recovery positions

	Deployment		Deployment Position			Recovery		Recovery Position	
Stat-ion	Date	Time UTC	Latitude	Longitude	Depth (m)	Date	Time	Latitude	Longitude
VSN01	22.08.2020	16:29	78° 51.983' N	06° 26.925' E	1960	13.07.2021	12:09	78°52.273'N	6°27.337'E
VSN02	22.08.2020	19:23	78° 54.796' N	06° 45.797' E	1507	13.07.2021	13:44	78°54.874'N	6°46.128'E
VSN03	23.08.2020	16:09	78° 53.056' N	07° 12.306' E	1237	13.07.2021	15:06	78°53.215'N	7°12.265'E
VSN04	22.08.2020	20:22	78° 46.536' N	06° 41.439' E	1679	13.07.2021	10:24	78°46.588'N	6°40.963'E
VSN05	22.08.2020	17:46	78° 49.899' N	06° 53.411' E	1539	12.07.2021	18:29	78°50.014'N	6°53.453'E
VSN06	23.08.2020	15:08	78° 48.097' N	07° 20.095' E	1215	12.07.2021	19:55	78°48.212'N	7°20.038'E
VSN07	23.08.2020	11:25	78° 41.601' N	06° 45.452' E	1526	14.07.2021	07:58	78°41.809'N	6°44.644'E
VSN08	23.08.2020	10:40	78° 44.728' N	07° 02.603' E	1412	13.07.2021	18:17	78°44.830'N	7°01.202'E
VSN09	23.08.2020	13:34	78° 43.017' N	07° 28.305' E	1162	13.07.2021	17:01	78°43.028'N	7°27.720'E
VSN10	23.08.2020	12:20	78° 39.206' N	07° 07.615' E	1425	09.07.2021	18:18	78°39.395'N	7°06.103'E

Table 2: Recording parameters

	Recording	Sample	Gain	Seismo-meter	Hydro phone	6d6	Recording

Station	Start time	Rate (Hz)	HXYZ	Type	Inverted (I)	SN	End Time
VSN01	22.08.2020 15:38:43	100	2 1 1 1	Trillium	H	61607077	13.07.2021 13:16:58
VSN02	22.08.2020 14:43:08	100	4 4 4 4	3C Geophone	H	61607191	13.07.2021 14:42:00
VSN03	23.08.2020 14:59:58	100	2 1 1 1	Trillium	H	61607084	13.07.2021 16:01:21
VSN04	22.08.2020 18:34:43	100	2 1 1 1	Trillium	H	61607073	15.07.2021 08:50:36
VSN05	22.08.2020 17:02:02	100	2 1 1 1	Trillium	H	61607204	12.07.2021 19:34:06
VSN06	23.08.2020 14:19:38	100	2 1 1 1	Trillium	I	61607080	13.07.2021 08:47:41
VSN07	23.08.2020 09:23:43	100	2 1 1 1	Trillium	H	61607201	14.07.2021 10:47:30
VSN08	23.08.2020 09:29:52	100	2 1 1 1	Trillium	I	61607102	13.07.2021 19:21:31
VSN09	23.08.2020 12:30:17	100	2 1 1 1	Trillium	H	61607069	24.11.2024 02:58:04
VSN10	22.08.2020 14:49:30	100	4 4 4 4	3C Geophone	H	61607185	09.07.2021 17:19:40

Table 3: Clock parameters

	Synchronisation		Skew time		Skew (microsec)
Station	Date	Time UTC	Date	Time UTC	
VSN01	22.08.2020	15:34:50	13.07.2021	13:18:00	-10843560
VSN02	22.08.2020	14:42:43	13.07.2021	14:42:00	-5250917
VSN03	23.08.2020	14:58:51			
VSN04	22.08.2020	18:31:01			
VSN05	22.08.2020	16:58:57	12.07.2021	19:35:54	-412094
VSN06	23.08.2020	14:18:18			
VSN07	23.08.2020	09:23:14	14.07.2021	10:48:44	-3730012
VSN08	23.08.2020	09:01:46	13.07.2021	19:22:54	-2769751
VSN09	23.08.2020	12:24:11			
VSN10	22.08.2020	14:47:45	09.07.2021	19:40:00	154921

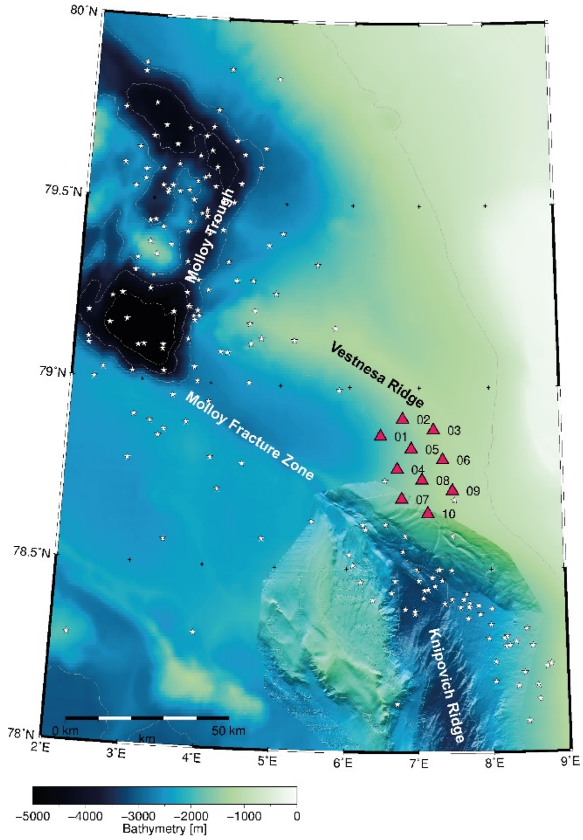


Figure 5: Deployment locations, regional view with potential seismic source regions

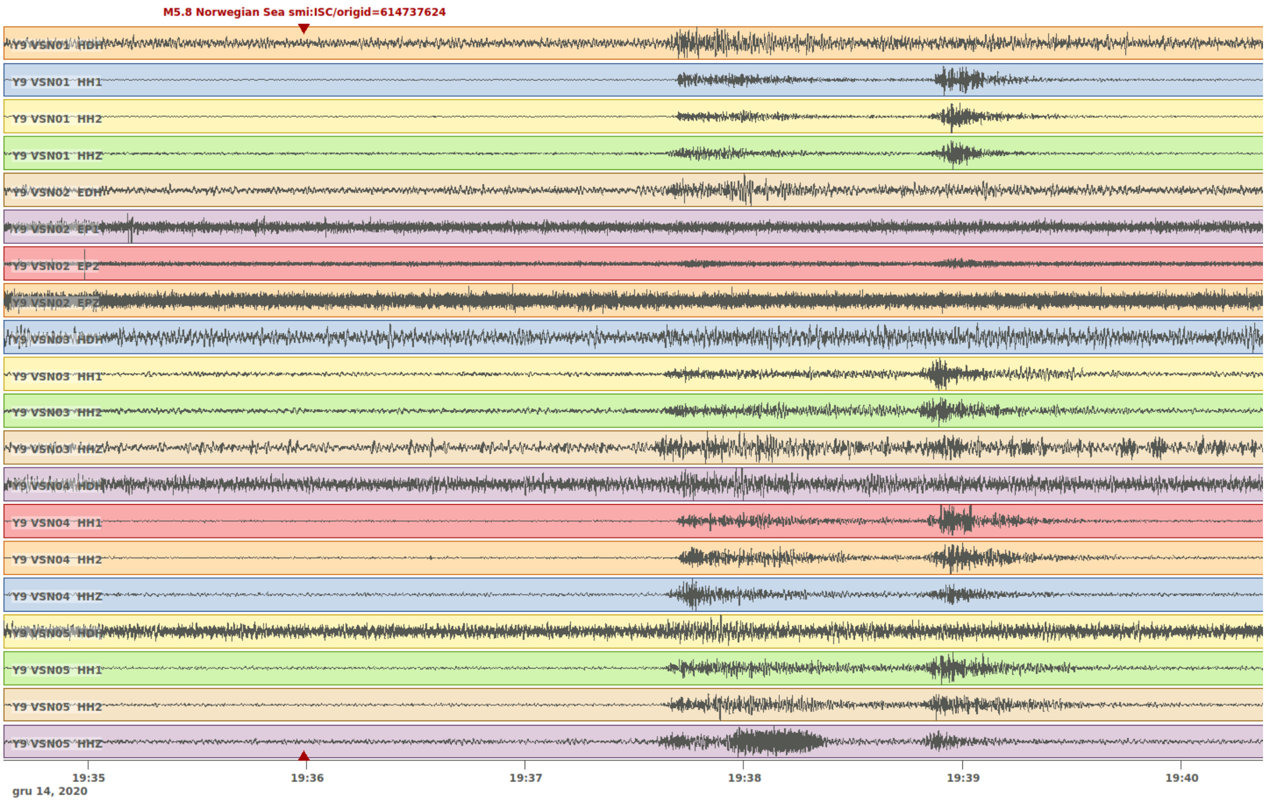


Figure 6: Example of seismograms recorded by 5 of the 4-componenet ocean bottom seismometers. One earthquake located at the Norwegian sea is indicated for reference. Energy from that earthquake arrived to the study area ca. 3 minutes after its origin.

Between windows of good weather and overnight we filled in an area with a repeated bathymetry for morphological comparison with the available bathymetry from 2009. The aim is to investigate whether we are able of seeing topographic changes potentially indicating gravitational sliding of faulted blocks on the steepest part of the Vestnesa Ridge flank (figure 7). We also collected additional 2D seismic lines to complete a 2D seismic survey for studding in more detail gravitational collapse structures in the area. These surveys were planned for the study of submarine land slide systems in the area under a current collaboration with NGI.

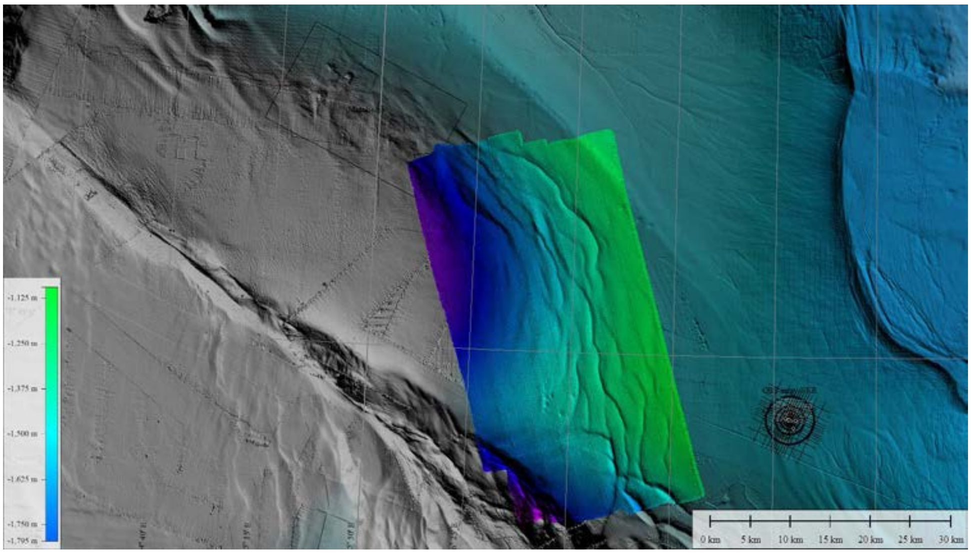


Figure 7: Areas where multibeam surveys were repeated for comparison of seabed morphology over a decade on steep flanks (i.e., gravitational collapse features and small scale slides observable at present day). The northernmost area was not cover (only a small portion) due to the presence of ice.

Active source OBS experiments and acoustic surveying on NKR-Hummocky depression

The main objective of the active source experiment is to investigate local stress field variations from the propagation pattern of shear waves (horizontal) components. The fastest shear wave component aligns with the direction of maximum horizontal stress. Hence, by mapping the azimuth of shear waves propagating in the near-surface it is possible to retrieve information about the stress regime. Originally we wanted to conduct the experiment on the western Vestnesa Ridge segment to compare to a similar experiment conducted on the eastern Vestnesa Ridge segment in 2019. Due to the presence of drifting ice in the region we decided to not risk deployment of the OBSs. We conducted the experiment on the elongated Hummocky-seafloor depression referred to as NKR depression because it is located at the corner between the Molloy Transform Fault and the Knipovich Ridge. This is the same depression where Piezometer data from CAGE19-3 cruise indicate pressure pulses and methane release periodicities that are comparable to the periodicity of diurnal tides (Sultan et al., 2020).

We deployed 5 OBS (3 from Awi, 2 from UiT). We shoot a seismic array consisting of symmetrically spaced inlines and crosslines in addition to circles (figure 8). The OBSs will be relocated via inversion of X,Y and Z to satisfy direct arrival times from shot lines.

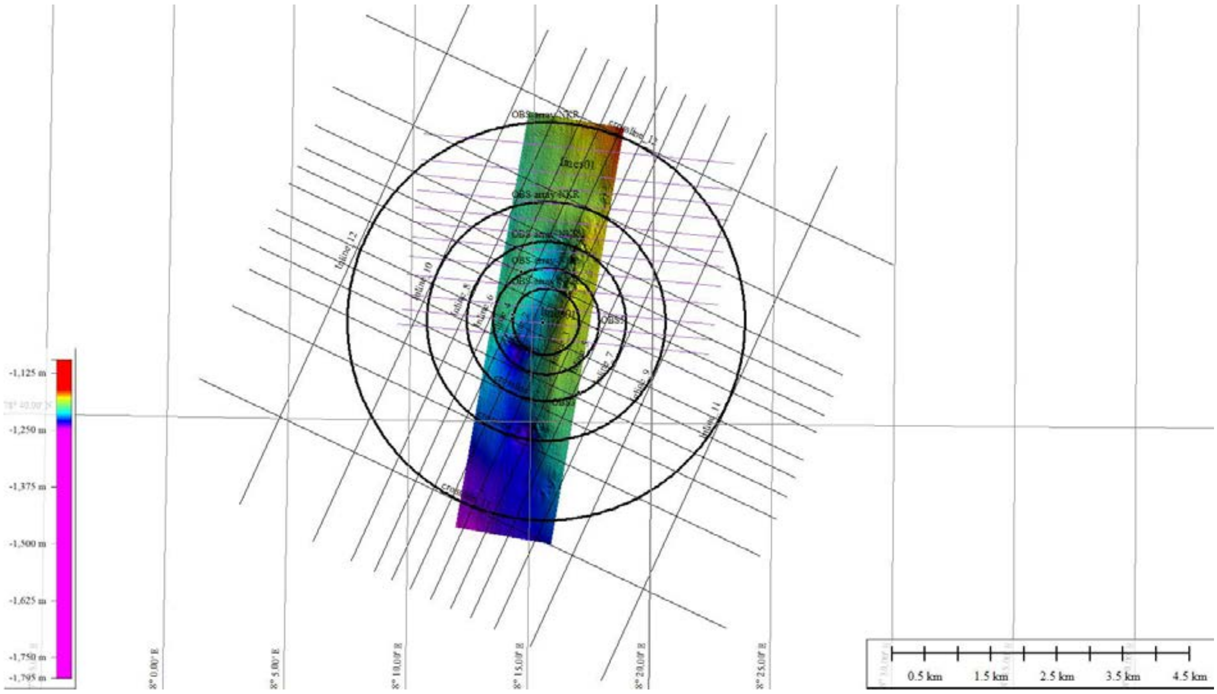


Figure 8: Design of the shot lines and OBS distribution on the NKR-Hummocky depression

Table 4: Deployment and recovery positions

	Deployment		Deployment Position			Recovery		Recovery Position	
Station	Date	Time UTC	Latitude	Longitude	Depth (m)	Date	Time	Latitude	Longitude
VPM01	15.07.2021	06:46	78° 41.216' N	08° 14.533' E	887	17.07.2021	21:37	78° 41.430' N	08° 14.634' E
VPM02	15.07.2021	06:59	78° 40.856' N	08° 14.160' E	889	17.07.2021	20:15	78° 41.216' N	08° 15.147' E
VPM03	15.07.2021	07:15	78° 40.237' N	08° 16.946' E	881	17.07.2021	19:38	78° 40.419' N	08° 16.939' E
VPM04	15.07.2021	07:54	78° 40.806' N	08° 15.536' E	892	18.07.2021	06:22	78° 41.036' N	08° 15.207' E
VPM05	15.07.2021	08:21	78° 40.765' N	08° 17.730' E	881	18.07.2021	06:57	78° 40.970' N	08° 17.248' E

Table 5: Recording parameters

	Recording	Sample	Gain	Seismo-meter	Hydro phone	6d6	Recording
Station	Start time	Rate (Hz)	HXYZ	Type	Inverted (I)	SN	End Time
VPM01	14.07.2021 18:42:31	500	2 1 1 1	Trillium	H	61607204	
VPM02	14.07.2021 14:43:08	500	2 1 1 1	Trillium	H	61607201	17.07.2021 21:02:57
VPM03	14.07.2021 14:59:58	500	2 1 1 1	Trillium	I	61607102	17.07.2021 20:10:43
VPM04	14.07.2021 18:31:17	1000	4 4 4 4	3C Geophone	H	61607185	18.07.2021 09:14:33

VPM05	14.07.2021 17:25:38	1000	4 4 4 4	3C Geophone	H	61607191	18.07.2021 10:03:32

Table 6: Clock parameters

	Synchronisation		Skew time		Skew (microsec)
Station	Date	Time UTC	Date	Time UTC	
VPM01	14.07.2021	18:42:31	-	-	-
VPM02	14.07.2021	14:43:08	17.07.2021	21:02:57	-29943
VPM03	14.07.2021	14:59:58	17.07.2021	20:10:43	-48953
VPM04	14.07.2021	18:31:01	-	-	-
VPM05	14.07.2021	16:58:57	18.07.2021	10:03:32	-83960

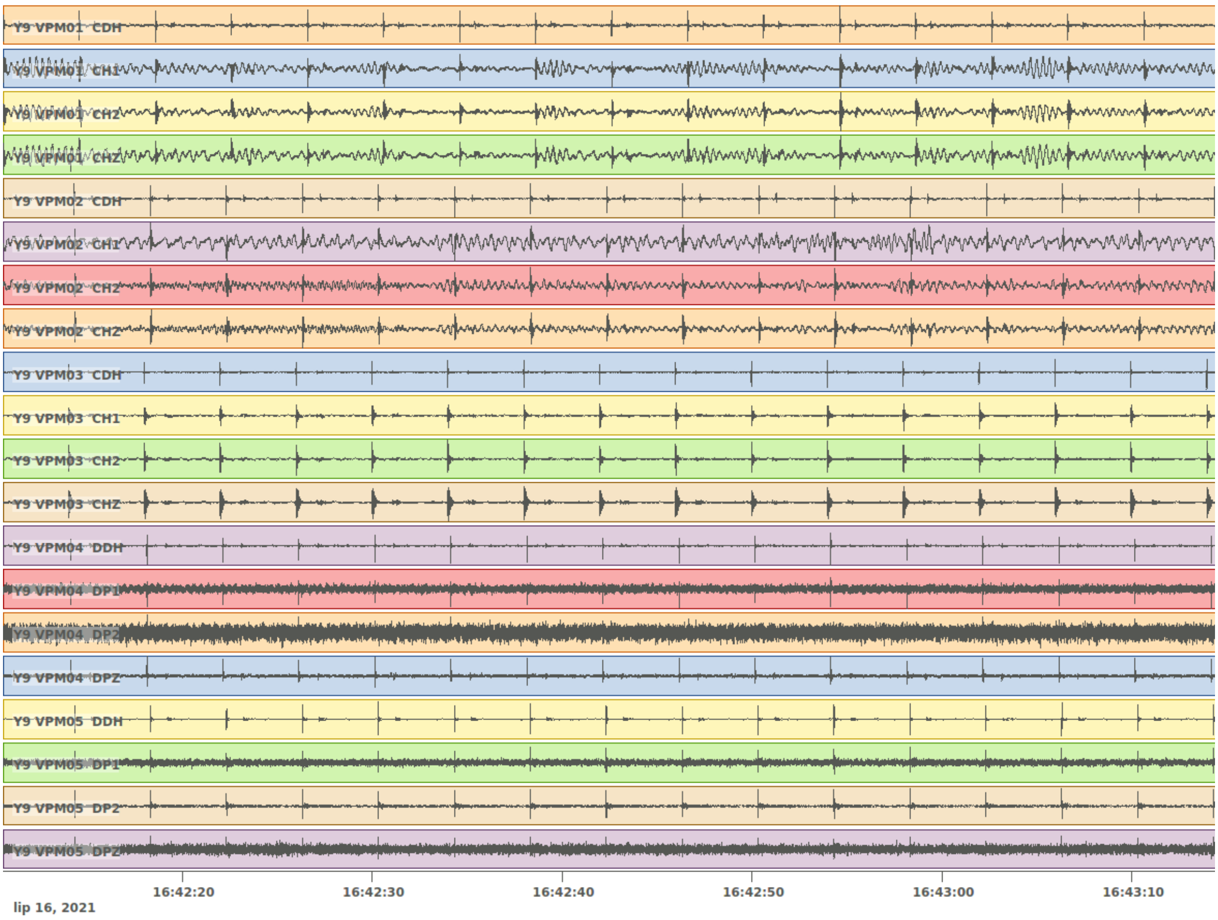


Figure 9: Example of the energy recorded by the 5 4-component instruments deployed for the experiment. The shooting rate was 4 s.

2D seismic processing

We processed 2D seismic data on board using RadExPro 2020.1 software, following a standard processing routine consisting of SEG-D import, geometry assignment, bad channels removal, burst noise removal, band pass filtering, stacking, migration and post-migration amplitude equalization (Table 8). Figure 10 shows an example of the data quality achieved after migration.

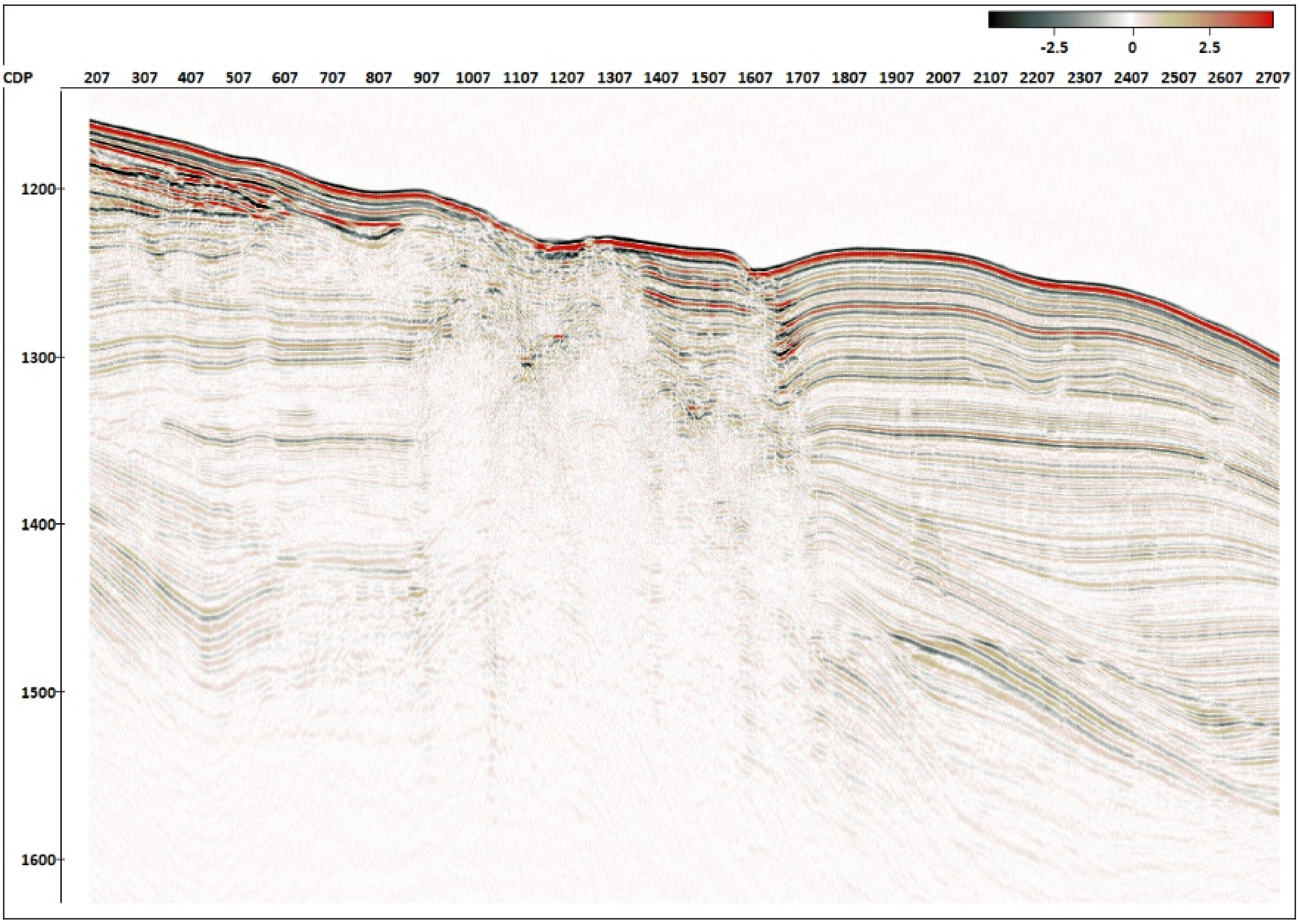
Table 7: The detailed survey parameters for the 2D seismic survey.

Survey parameters	
Deployment / recovery	0,5 h
Survey speed	4-5 kt
Source	1 mini GI 30/30 in^3 & 1 mini GI 15/15 in^3
Shooting rate	4-5 s
Shooting pressure	170 bar
Source towing depth	2 m
Dominant frequency (bandwidth)	140-180 Hz (20-400 Hz)
Positioning	GPS transponder on gun raft
Streamer length	370 m
Active section	300 m
Across track position relative to gun	11 m to port
Number of channels	96
Receiver group spacing	3.125 m
Streamer towing depth, 2 ION DigiCourse II Depth birds	2 m, 3 m on some lines in bad weather (see line log in appendix)
Sampling rate / interval	4000 Hz / 0.25 ms
Recording length	3-4 s

Table 8: Processing parameters for the 2D seismic survey.

Seismic processing flow	
SEG-D import and geometry assignment	Input of SEG-D files Geometry assignment and offset calculation
Filtering in the shot gathers	Removal of bad channels Bandpass filter 20-40-250-380 Hz

	Burst noise removal
NMO and stacking	NMO (1480 m/s) Ensemble Stack
Migration	Pre/post-Stack Kirchhoff Time Migration ; constant Vp (1500-1700 m/s); 300-900
SEG-Y output	IBM floating point CDP_X,4R,IBM,181/ CDP_Y,4R,IBM, 185 Coordinate system: WGS-84-UTM32N



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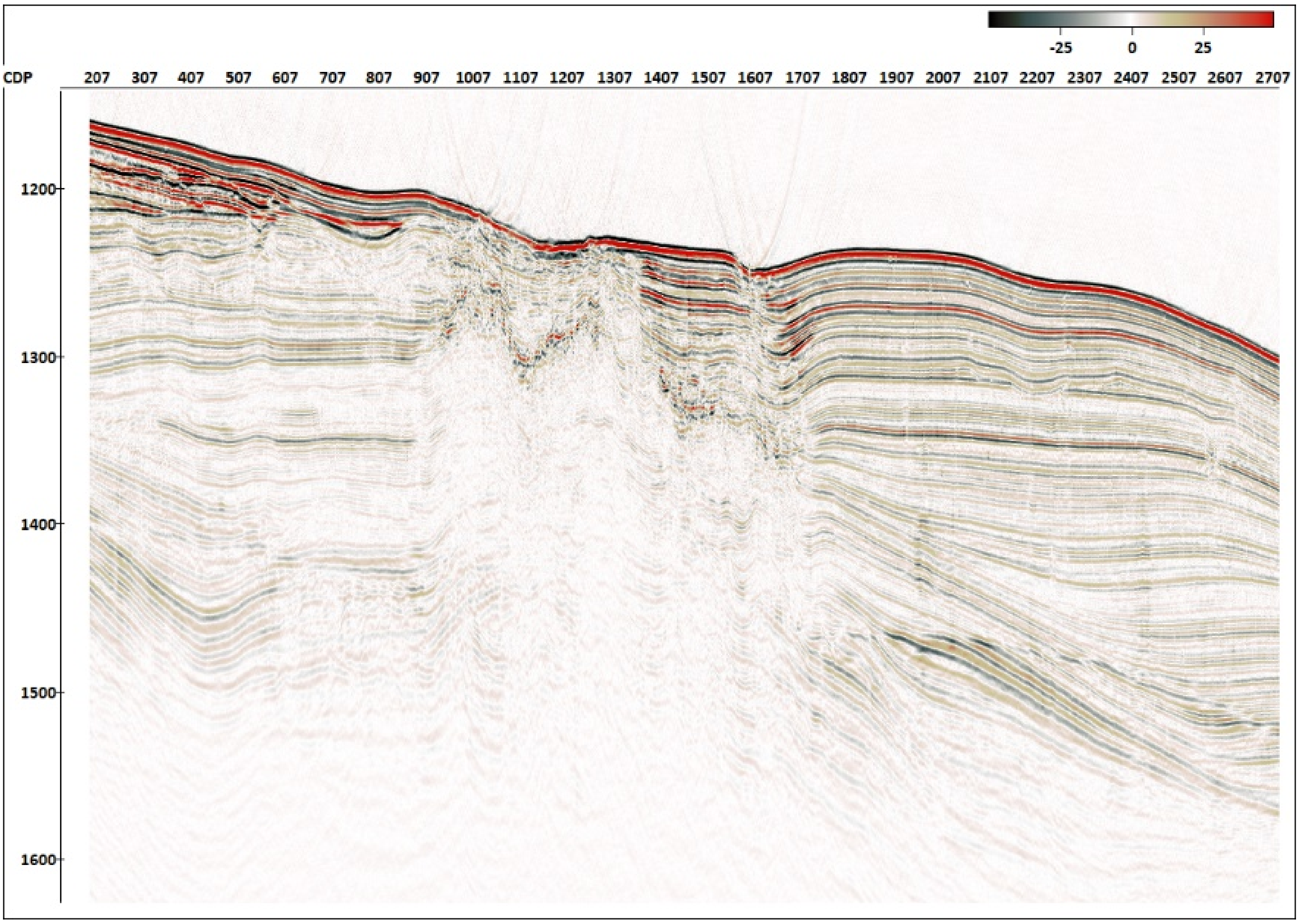


Figure 10: Above: example of stack; Below: example of Kirchhoff migrated versions for line 16 in the NKR-HummockyDepression-OBS survey. Vertical axis in TWT (ms); CDP binning 3.125 m.

ACKNOWLEDGEMENT

We thank the captain and his crew of R/V Helmer Hanssen of UiT the Arctic University of Norway for their amazing support and wise advice during the scientific surveys. This cruise was conducted in affiliation with the Centre of Excellence on Gas Hydrates, Environment and Climate (CAGE) (Norwegian Research Council (NFR) project number 223259/F5 at the University of Tromsø. The cruise is part of the SEAMSTRESS project (Tectonic stress effects on Arctic methane seepage) supported by the Tromsø Research Foundation (TFS) and the Research Council of Norway (RCN-Frinatek) through two starting grants awarded to Andreia Plaza-Faverola (situ.uit.no/seamstress)

APPENDIX

- CAGE21-3 Station log
- CAGE21-3 line log
- Pictures OBS ensembles

CAGE21-3 Station log from the ship

07072021	12.07.2021	01:45:29	17611.570	CTD med vannhenter STOPP	802		0.4	7904.976371 N	00656.963713 E	1347.69	3.2	5.3	14.1	90.0	175.5	4	2	8			34.9794		
07072021	12.07.2021	03:33:35	17618.457	Seismisk profil START	803		4.5	7903.459877 N	00702.808366 E	1318.62	3.7	5.0	11.5	90.7	227.3	4	2	8			50.6705		
07072021	12.07.2021	06:18:06	17629.389	Seismisk profil STOPP	803		2.0	7855.171183 N	00739.964609 E	1142.91	4.2	5.5	12.0	86.1	221.5	4	2	8			175.6492		
07072021	12.07.2021	08:05:18	17640.855	Multibeam survey START	804		8.0	7859.249131 N	00707.032926 E	1217.02	4.3	4.8	12.1	88.8	177.5	4	2	8			112.3278		
07072021	12.07.2021	18:21:11	17737.755	Multibeam survey STOPP	804		8.0	7850.224627 N	00655.684992 E	1492.60	3.6	5.5	8.4	89.5	191.0	4	2	8			95.9974		
07072021	12.07.2021	19:09:03	17739.086	OBS recovery-punkt	805		1.0	7850.033915 N	00653.532727 E	0.00	3.2	5.8	6.5	90.4	177.9	4	2	8			85.8817		
07072021	12.07.2021	20:27:59	17745.305	OBS recovery-punkt	806		0.1	7848.033166 N	00719.740426 E	1211.12	3.4	5.3	9.0	91.6	192.7	4	2	8			91.3388		
07072021	12.07.2021	22:23:20	17757.242	Seismisk profil START	807		2.5	7850.398916 N	00747.488932 E	1061.09	3.9	5.4	9.1	92.0	209.0	4	2	8			65.9575		
07072021	13.07.2021	02:38:07	17773.034	Seismisk profil STOPP	807		3.9	7903.075153 N	00704.612353 E	1306.52	3.9	4.4	10.5	91.7	203.9	4	2	8			35.9664		
07072021	13.07.2021	04:04:07	17783.622	CTD med vannhenter START	808		0.8	7900.845862 N	00750.561274 E	1148.37	4.3	4.2	11.2	92.3	205.7	4	2	8			82.2518		
07072021	13.07.2021	04:44:35	17784.128	CTD med vannhenter STOPP	808		1.3	7900.675796 N	00752.988125 E	1134.93	4.1	4.6	10.4	92.2	215.7	4	2	8			94.9232		

07072021	13.07.2021	05:23:00	17785.948	Seismisk profil START	809	2D	4.7	7858.921174 N	00750.957712 E	1128.46	3.8	4.2	11.9	91.2	205.0	4	2	8			141.7535		
07072021	13.07.2021	09:30:22	17804.451	Seismisk profil STOPP	809	2D	4.2	7847.754174 N	00635.892855 E	1459.35	2.4	5.5	9.6	89.4	192.4	4	2	8			489.0669		
07072021	13.07.2021	11:04:50	17808.176	OBS recovery-punkt	810		0.5	7846.587400 N	00640.957251 E	0.00	2.1	5.7	7.6	90.6	207.0	4	2	8			588.0587		
07072021	13.07.2021	12:58:58	17816.021	OBS recovery-punkt	811		0.3	7852.271664 N	00627.346618 E	0.00	2.7	5.7	6.9	89.6	196.1	4	2	8			445.4899		
07072021	13.07.2021	14:21:21	17821.252	OBS recovery-punkt	812		0.6	7855.114092 N	00647.338472 E	0.00	2.4	4.4	7.3	90.1	182.9	4	2	8			423.3809		
07072021	13.07.2021	15:36:36	17827.144	OBS recovery-punkt	813		0.1	7853.145155 N	00712.169541 E	0.00	2.5	5.5	8.2	92.0	186.1	4	2	8			331.8141		
07072021	13.07.2021	17:30:07	17838.608	OBS recovery-punkt	814		0.7	7843.028438 N	00727.748197 E	0.00	2.4	5.6	7.4	93.2	176.1	4	2	8			208.9270		
07072021	13.07.2021	18:51:48	17845.184	OBS recovery-punkt	815		0.5	7844.796955 N	00701.605062 E	0.00	2.3	5.7	8.4	93.1	178.4	4	2	8			153.2717		
07072021	13.07.2021	20:41:55	17856.554	CTD med vannhenter START	816		1.1	7846.776343 N	00659.648907 E	1433.25	2.4	5.7	9.9	93.6	183.4	4	2	8			167.3229		
07072021	13.07.2021	21:38:33	17857.189	CTD med vannhenter STOPP	816		1.3	7846.198346 N	00658.354467 E	1447.09	2.6	5.5	9.0	93.6	185.0	4	2	8			169.1319		
07072021	13.07.2021	21:52:46	17859.321	Multibeam survey START	817		10.5	7847.880299 N	00659.025189 E	1439.93	2.7	5.7	9.9	93.5	195.3	4	2	8			160.7828		
07072021	13.07.2021	23:02:31	17870.970	Multibeam survey STOPP	817		1.9	7859.068987 N	00643.699724 E	1306.52	3.6	3.5	8.8	92.1	179.2	4	2	8			245.1873		
07072021	13.07.2021	23:04:38	17871.023	CTD med vannhenter START	818		1.5	7859.093842 N	00643.937501 E	1303.82	3.7	3.3	9.9	91.8	184.5	4	2	8			262.3883		

07072021	13.07.2021	23:54:12	17871.876	CTD med vannhenter STOPP	<u>**818**</u>		1.0	7859.798443 N	00646.416388 E	1257.59	4.1	3.2	9.3	88.5	179.7	4	2	8			205.0510		
07072021	14.07.2021	00:20:45	17874.909	Multibeam survey START	<u>**819**</u>		9.4	7859.140248 N	00634.371718 E	1396.44	4.4	2.8	8.7	85.5	189.2	4	2	8			258.3269		
07072021	14.07.2021	07:46:44	17948.336	Multibeam survey STOPP	<u>**819**</u>		7.9	7841.501127 N	00641.561022 E	1565.23	4.6	5.3	12.2	90.7	231.9	4	2	8			243.6054		
07072021	14.07.2021	08:35:21	17949.968	OBS recovery-punkt	<u>**820**</u>		0.2	7841.686240 N	00644.320686 E	0.00	4.9	5.4	12.3	88.7	176.0	4	2	8			192.9177		
07072021	14.07.2021	08:47:30	17951.158	Multibeam survey START	<u>**821**</u>		9.3	7841.542609 N	00641.085702 E	1570.92	4.7	5.1	12.2	87.5	199.6	4	2	8			264.1663		
07072021	14.07.2021	12:22:06	17986.869	Multibeam survey STOPP	<u>**821**</u>		10.1	7858.166511 N	00606.440712 E	1923.60	4.1	5.0	11.6	90.7	190.5	4	2	8			135.2623		
07072021	14.07.2021	13:45:23	18000.015	Multibeam survey START	<u>**822**</u>		9.5	7906.122002 N	00528.994584 E	1390.24	2.4	1.8	8.0	92.2	201.2	4	2	8			171.5966		
07072021	14.07.2021	14:52:59	18010.059	Multibeam survey STOPP	<u>**822**</u>		1.5	7859.370441 N	00552.068141 E	2045.57	4.2	3.4	10.6	90.8	185.4	4	2	8			152.2381		
07072021	14.07.2021	14:54:02	18010.084	CTD med vannhenter START	<u>**823**</u>		1.4	7859.357931 N	00552.180168 E	2044.46	4.3	3.3	10.2	90.9	182.7	4	2	8			150.0427		
07072021	14.07.2021	16:07:04	18011.192	CTD med vannhenter STOPP	<u>**823**</u>		1.1	7858.716637 N	00556.778663 E	2033.60	4.3	3.6	10.2	91.2	159.6	4	2	8			138.7663		
07072021	14.07.2021	16:12:33	18011.414	Multibeam survey START	<u>**824**</u>		6.8	7858.755175 N	00556.039513 E	2047.20	4.3	3.5	10.9	91.1	165.8	4	2	8			159.4129		
07072021	14.07.2021	17:10:46	18017.532	Multibeam survey STOPP	<u>**824**</u>		8.3	7859.868009 N	00538.119009 E	2126.72	3.5	1.1	11.9	91.7	186.2	4	2	8			128.3378		
07072021	14.07.2021	20:48:30	18052.024	CTD med vannhenter START	<u>**825**</u>		0.7	7842.494985 N	00804.887246 E	947.75	5.6	5.0	10.4	93.7	174.2	4	2	8			72.8054		

07072021	14.07.2021	21:27:57	18052.334	CTD med vannhenter STOPP	**825**		0.7	7842.191771 N	00804.652238 E	951.97	5.5	5.1	10.2	93.6	156.6	4	2	8			51.8896		
07072021	14.07.2021	21:39:17	18053.387	Multibeam survey START	**826**		9.4	7842.362989 N	00809.409745 E	920.68	5.5	5.1	15.5	93.7	208.0	4	2	8			56.1470		
07072021	15.07.2021	06:06:37	18099.629	Multibeam survey STOPP	**826**		4.8	7842.368350 N	00810.055894 E	917.53	5.1	5.6	3.3	94.2	157.7	4	2	8			125.9414		
07072021	15.07.2021	06:46:33	18101.454	OBS drop-punkt	**827**		0.6	7841.213380 N	00814.536286 E	887.22	5.2	5.6	3.8	94.2	133.2	4	2	8			311.0204		
07072021	15.07.2021	06:59:38	18101.872	OBS drop-punkt	**828**		0.7	7840.856275 N	00814.195773 E	890.75	5.5	5.3	4.9	94.2	128.8	4	2	8			341.1104		
07072021	15.07.2021	07:15:36	18102.733	OBS drop-punkt	**829**		0.6	7840.234592 N	00816.981718 E	881.19	5.3	5.3	5.0	94.1	131.2	4	2	8			309.2489		
07072021	15.07.2021	07:54:35	18103.993	OBS drop-punkt	**830**		0.4	7840.799125 N	00815.551181 E	891.45	5.2	5.5	6.2	94.0	160.6	4	2	8			401.2877		
07072021	15.07.2021	08:20:53	18104.630	OBS drop-punkt	**831**		0.9	7840.760475 N	00817.791701 E	874.26	5.4	5.6	6.7	93.8	156.2	4	2	8			344.8487		
07072021	15.07.2021	10:14:51	18112.611	Seismisk profil START	**832**		3.2	7843.336725 N	00807.418439 E	927.68	5.5	5.6	6.2	93.7	140.2	4	2	8			332.6051		
07072021	16.07.2021	16:59:20	18266.733	Seismisk profil STOPP	**832**		6.1	7841.277303 N	00817.880855 E	871.15	5.6	6.5	4.6	87.8	15.9	4	2	8			179.5146		
07072021	16.07.2021	22:37:22	18306.916	Seismisk profil START	**833**		2.6	7813.876501 N	00621.356753 E	1738.54	4.8	5.7	5.4	89.9	6.2	4	2	8			73.5607		
07072021	17.07.2021	00:28:56	18316.530	Seismisk profil STOPP	**833**		5.1	7818.272048 N	00544.636624 E	1642.08	4.0	5.4	6.4	91.0	3.2	4	2	8			55.6419		
07072021	17.07.2021	02:48:09	18333.437	Seismisk profil START	**834**	2D	5.0	7814.839315 N	00445.067234 E	2417.48	3.7	4.6	6.6	88.4	339.8	4	2	8			81.6622		

07072021	17.07.2021	05:22:29	18346.157	Seismisk profil STOPP	834	2D	4.6	7826.372517 N	00511.499044 E	1956.79	3.6	5.5	10.0	83.1	324.0	4	2	8			246.6069		
07072021	17.07.2021	11:10:12	18386.776	Seismisk profil START	835	2D	4.3	7840.697902 N	00817.745820 E	874.33	3.6	6.0	10.7	87.0	311.1	4	2	8			488.6088		
07072021	17.07.2021	19:07:13	18423.457	Seismisk profil STOPP	835	2D	2.9	7838.064392 N	00811.891812 E	0.00	3.4	6.1	6.3	92.4	317.1	4	2	8			70.3707		
07072021	17.07.2021	20:01:17	18427.276	OBS recovery-punkt	836		0.7	7840.443904 N	00816.980761 E	0.00	3.0	6.3	7.0	92.7	281.2	4	2	8			59.3154		
07072021	17.07.2021	20:42:46	18428.616	OBS recovery-punkt	837		0.4	7841.223756 N	00815.275777 E	894.28	2.9	6.5	5.5	93.1	310.2	4	2	8			64.1253		
07072021	17.07.2021	22:03:09	18430.249	OBS recovery-punkt	838		0.3	7841.443858 N	00814.657265 E	0.00	2.9	6.7	5.2	93.3	274.5	4	2	8			45.9763		
07072021	17.07.2021	23:12:03	18436.147	Seismisk profil START	839		4.9	7838.213614 N	00815.210413 E	922.80	3.1	6.4	2.2	93.6	285.9	4	2	8			41.5017		
07072021	18.07.2021	00:04:20	18440.948	Seismisk profil STOPP	839		4.2	7842.593077 N	00825.151707 E	806.61	3.1	6.5	1.5	93.5	155.3	4	2	8			40.5894		
07072021	18.07.2021	00:29:58	18442.599	CTD med vannhenter START	840		0.2	7841.811793 N	00821.547175 E	842.37	3.1	6.3	2.5	93.5	184.7	4	2	8			48.5635		
07072021	18.07.2021	00:59:45	18442.813	CTD med vannhenter STOPP	840		0.2	7841.860498 N	00822.591013 E	838.33	3.2	6.7	2.5	93.5	159.0	4	2	8			65.5142		
07072021	18.07.2021	01:08:00	18443.333	Multibeam survey START	841		4.0	7841.879105 N	00820.511702 E	849.39	3.3	6.6	4.0	93.4	131.9	4	2	8			71.4639		
07072021	18.07.2021	04:44:42	18461.315	Multibeam survey STOPP	841		3.7	7842.801972 N	00814.823295 E	882.03	3.3	6.8	9.0	93.0	147.7	4	2	8			93.1210		
07072021	18.07.2021	06:42:15	18466.623	OBS recovery-punkt	842		1.1	7841.045488 N	00815.202588 E	0.00	4.0	6.7	10.0	90.9	140.1	4	2	8			203.6720		

07072021	18.07.2021	07:20:39	18467.883	OBS recovery-punkt	**843**		1.1	7840.982906 N	00817.240253 E	872.87	4.1	6.7	8.7	91.1	140.0	4	2	8			144.4923		
07072021	18.07.2021	21:36:24	18604.059	Seismisk profil START	**844**		5.0	7635.947011 N	01223.216920 E	1647.87	4.8	7.2	3.4	75.9	221.1	4	2	8			227.5472		
07072021	19.07.2021	04:38:08	18639.287	Seismisk profil STOPP	**844**		4.5	7634.756617 N	01317.444266 E	1176.22	5.4	7.2	6.5	76.8	97.6	4	2	8			218.7556		

CAGE21-3 line log

Location	Line ID	Date	Time (UTC) START	Lat. [N] Long. [E] START	Time (UTC) STOP	Lat. [N] Long. [E] STOP	Pulse mode	Shot Rate (HZ)	Ship Speed (kn)	Comments
NKR	CAGE21-3-HH-001-2D	09.07	23:34	78°41.222' 07°49.628'	02:36	78°33.080' 07°00.310'		5	4	wind 8.5, wind direction 195 degrees, 2m swell, birds at 3m depth, sample interval 0.25 ms, rec length 4s, guns leaked at around shot 2721 and line terminated shortly after
NKR	CAGE21-3-HH-002-2D	10.07	03:44	78°35.017' 06°59.970'	6.56.00	78°43.570' 07°49.669'		5	4	wind 3.7, wind direction 300, birds 3m
NKR	CAGE21-3-HH-003-2D	10.07	08:10	78°46.462' 07°49.911'	11:18	78°36.722' 06°54.288'		5	4	wind 10.7, wind direction 345, birds 3 m
NKR	CAGE21-3-HH-001-CHIRP	10.07	07.27.00							Chrip lines 001 to 006 correspond to 2D line 003
NKR	CAGE21-3-HH-004-2D	10.07	12:39	78°40.624' 06°37.377'	16:18	78°50.453' 07°33.935'		5	4	wind 11, direction 306, birds 3m
NKR	CAGE21-3-HH-002-CHIRP	10.07	12.39.00	78°40.624' 06°37.377'						Chrip lines 008 to 014 correspond to 2D line 004

NKR	CAGE21-3-HH-005-2D	12.07	03.32.55	78°03.482' 07°02.742'	06.18.06	78°55.410' 07°38.900'	5	4	wind 12.8, direction 213.4, birds 3m, IODP line, chan 26,27,35,39,48,74,87 weak or dead, spikes in ch 75, recording bird depths from time 04.35
NKR	CAGE21-3-HH-003-CHIRP	12.07	00:00	78°03.482' 07°02.742'		78°55.410' 07°38.900'			Lines 15 to 20 ? IODP line first run
NKR	CAGE21-3-HH-004-CHIRP	12.07	06.15.00		10.53.00				Line/gap filling chirp line 20 to 23? (file size 100MB) corresponds to MB line001
NKR	CAGE21-3-HH-001-MB	12.07	06.45.50		10.45.00				Line/gap filling
NKR	CAGE21-3-HH-005-CHIRP	12.07	10.53.00		13.36.00				lines 24 to 27 corresponds with MBline002
NKR	CAGE21-3-HH-002-MB	12.07	00:00		13.34.00				Line/gap filling
NKR	CAGE21-3-HH-006-CHIRP	12.07	13.36.00		16.34.00	78°34.590' 07°25.190'			Lines 28 to 33 corresponds with MB line003
NKR	CAGE21-3-HH-003-MB	12.07	13.47.55			78°34.590' 07°25.190'			Line/gap filling

NKR	CAGE21-3-HH-007-CHIRP	12.07	16.44.00	78°34.770' 07°18.570'	18:21	78°50.219' 06°54.729'			Line 34 corresponds with MB line004 (part complete)
NKR	CAGE21-3-HH-004-MB	12.07	16.44.00	78°34.770' 07°18.570'	18:21	78°50.219' 06°54.729'			Line/gap filling (part complete line004)
NKR	CAGE21-3-HH-006-2D	12.07	23.40.58	78°53.950' 07°45.210'	02.29.20	79°03.134' 07°04.330'	5	4	Wind 9, direction 205, repeat of IODP line004, birds at 2m, bad channels 26, 35,39,48,74,87, wind picked up to 11 from time 01.45
NKR	CAGE21-3-HH-008-CHIRP	12.07	23.32.00	78°53.437' 07°47.440'	02.38.00	79°03.085' 07°04.530'			Lines 40 to 45
NKR	CAGE21-3-HH-007-2D	13.07	05.23.00	78°58.907' 07°50.914'	09:30	78°47.733' 06°35.719'	5	9	Wind 11, direction 204, birds at 2m, start line 50mins early. Playing with birds depth 6:40-7
NKR	CAGE21-3-HH-009-CHIRP	13.07	05.23.41	78°58.860' 07°50.830'	09:31	78°47.711'		9	Lines 46 to 52
NKR	CAGE21-3-HH-004-MB	13.07	21.44.16	78°44.728' 06°59.970'	14:09	78°58.960' 06°43.365'		9	Line/gap filling
NKR	CAGE21-3-HH-010-CHIRP	13.07	00:00	78°44.728' 06°59.970'	14:09	78°58.960' 06°43.365'		9	Continue of grid, Line 53 to 55

NKR	CAGE21-3-HH-005-MB	14.07	00.18.00	78°59.430' 06°33.897'	00:00	78°34.039' 07°10.354'	9	Line/gap filling
NKR	CAGE21-3-HH-011-CHIRP	14.07	00.18.00	78°59.430' 06°33.897'	00:00	78°34.039' 07°10.354'	9	Lines 56 to 58
NKR	CAGE21-3-HH-006-MB	14.07	03.14.31	78°34.029' 07°01.562'	05:48	78°58.817' 06°24.720'	9	Line/gap filling
NKR	CAGE21-3-HH-012-CHIRP	14.07	03.14.31	78°34.029' 07°01.562'	05:48	78°58.817' 06°24.720'	9	Lines 59 to 61
NKR	CAGE21-3-HH-007-MB	14.07	00:00	78°58.411' 06°15.877'	09:38	78°34.038' 06°51.282'	9	Line/gap filling
NKR	CAGE21-3-HH-013-CHIRP	14.07	00:00	78°58.411' 06°15.877'	09:38	78°34.038' 06°51.382'	9	Lines 62 to65
NKR	CAGE21-3-HH-008-MB	14.07	09:52	78°33.526' 06°42.094'	12.49.00	78°57.691' 06°07.168'	9	Line/gap filling
NKR	CAGE21-3-HH-014-CHIRP	14.07	09:52	78°33.526' 06°42.094'	12.49.00	78°57.691' 06°07.168'	9	Lines 67 (line 67 cut off) to 70 (no chirp lines found)

NKR	CAGE21-3-HH-009-MB	14.07	00:00	78°57.691' 06°07.168'			9	New Survey to NW first line
NKR	CAGE21-3-HH-015-CHIRP	14.07	00:00	78°57.691' 06°07.168'			9	Lines 71 to (no chirp lines found)
NKR	CAGE21-3-HH-010-MB	14.07	14.48.00	78°59.467' 05°51.598'			9	New Survey to NW second line, stop after this line to do CTD
NKR	CAGE21-3-HH-016-CHIRP	14.07	14.48.00	78°59.467' 05°51.598'			9	Lines to 76 last file before CTD (no chirp lines found)
NKR	CAGE21-3-HH-011-MB	14.07	16.22.00	78°59.380' 05°50.207'	17.18.00	78°59.940' 05°44.950'	9	New Survey to NW third line, entered ice 79 00.7714 N and 005 36.716 E, 16.54.00 abort line shortly after and transit east to TEW area
NKR	CAGE21-3-HH-017-CHIRP	14.07	16.22.00	78°59.380' 05°50.207'	17.18.00	78°59.940' 05°44.950'	9	Lines 77 to 78 entered ice abort line and survey transit east to TEW area
NKR	CAGE21-3-HH-012-MB	14.07	17.18.00	78°59.940' 05°44.950'			9	Transit from survey area west to east
NKR	CAGE21-3-HH-018-CHIRP	14.07	17.18.00	78°59.940' 05°44.950'	17.55.11	78°58.770' 06°13.430'	9	Transit from survey area west to east, cut short Lines 79

NKR	CAGE21-3-HH-013-MB	14.07	21.41.00	78°42.322' 08°11.314'	22.00.00	78°42.096' 08°24.155'	8	Reduced speed to 8 knots for NKR chirp survey line1
NKR	CAGE21-3-HH-019-CHIRP	14.07	21.41.00	78°42.322' 08°11.314'	22.00.00	78°42.096' 08°24.155'	8	Files 80 to 81
NKR	CAGE21-3-HH-014-MB	14.07	22.15.38	78°41.904' 08°23.590'	22.42.03	78°42.113' 08°10.010'	6	Reduced speed to 6 knots for NKR chirp survey line2
NKR	CAGE21-3-HH-020-CHIRP	14.07	22.15.38	78°41.904' 08°23.590'	22.41.58	78°42.113' 08°10.010'	6	File 82
NKR	CAGE21-3-HH-015-MB	14.07	22.51.00	78°41.993' 08°10.577'	23.19.00	78°41.774' 08°23.413'	6	NKR chirp survey line3
NKR	CAGE21-3-HH-021-CHIRP	14.07	22.51.00	78°41.993' 08°10.577'	23.19.00	78°41.774' 08°23.413'	6	File 83
NKR	CAGE21-3-HH-016-MB	14.07	23.30.46	78°41.677' 08°22.905'	00:01	78°41.870' 08°08.610'	6	NKR chirp survey line4 narrowed beams to 30
NKR	CAGE21-3-HH-022-CHIRP	14.07	23.30.46	78°41.677' 08°22.905'	00:01	78°41.870' 08°08.610'	6	File 84

NKR	CAGE21-3-HH-017-MB	15.07	00.07.00	78°41.714' 08°10.520'	00.38.00	78°41.505' 08°23.153'	6	NKR chirp survey line5 narrowed beams to 20
NKR	CAGE21-3-HH-023-CHIRP	15.07	00.07.00	78°41.714' 08°10.520'	00.38.00	78°41.505' 08°23.153'	6	File 85
NKR	CAGE21-3-HH-018-MB	15.07	00.48.00	78°41.400' 08°22.700'	01.15.00	78°41.607' 08°09.807'	6	NKR chirp survey line6 beams to 20
NKR	CAGE21-3-HH-024-CHIRP	15.07	00.48.00	78°41.400' 08°22.700'	01.15.00	78°41.607' 08°09.807'	6	File 86
NKR	CAGE21-3-HH-019-MB	15.07	01.24.00	78°41.487' 08°10.136'	01.54.00	78°41.295' 08°22.932'	6	NKR chirp survey line7 beams to 20
NKR	CAGE21-3-HH-025-CHIRP	15.07	01.24.00	78°41.487' 08°10.136'	01.54.00	78°41.295' 08°22.932'	6	File 87
NKR	CAGE21-3-HH-020-MB	15.07	00:00	78°41.130' 08°22.730'	02.32.00	78°41.355' 08°08.463'	6	NKR chirp survey line8 beams to 20
NKR	CAGE21-3-HH-026-CHIRP	15.07	00:00	78°41.130' 08°22.730'	02.32.00	78°41.355' 08°08.463'	6	File 88

NKR	CAGE21-3-HH-021-MB	15.07	02.46.34	78°41.144' 08°12.135'	00:00	78°40.962' 08°22.960'	5	NKR chirp survey line9 beams to 20
NKR	CAGE21-3-HH-027-CHIRP	15.07	02.46.34	78°41.144' 08°12.135'	00:00	78°40.962' 08°22.960'	5	File 89 (missing the start of the line)
NKR	CAGE21-3-HH-022-MB	15.07	03.19.00	78°40.798' 08°23.417'	03.46.53	78°41.019' 08°09.499'	6	NKR chirp survey line10 beams to 20
NKR	CAGE21-3-HH-028-CHIRP	15.07	03.19.00	78°40.798' 08°23.417'	03.46.53	78°41.019' 08°09.499'	6	File 90
NKR	CAGE21-3-HH-023-MB	15.07	03.55.12	78°40.902' 08°08.970'	04.28.52	78°40.671' 08°22.999'	6	NKR chirp survey line11 beams to 20
NKR	CAGE21-3-HH-029-CHIRP	15.07	03.55.12	78°40.902' 08°08.970'	04.28.52	78°40.671' 08°22.999'	6	File 91
NKR	CAGE21-3-HH-024-MB	15.07	04.37.45	78°40.581' 08°22.138'	00:00	78°40.822' 08°08.081'	6	NKR chirp survey line12 beams to 20
NKR	CAGE21-3-HH-030-CHIRP	15.07	04.37.45	78°40.581' 08°22.138'	00:00	78°40.822' 08°08.081'	6	File 92

NKR	CAGE21-3-HH-025-MB	15.07	05.31.59	78°40.589' 08°20.332'					6	NKR chirp survey extra ine13 beams to 20
NKR	CAGE21-3-HH-031-CHIRP	15.07	05.31.59	78°40.589' 08°20.332'					6	File 93
NKR-OBS	CAGE21-3-HH-001-2D	15.07	10.15.50	78°43.327' 08°07.559'	11:28:2 8	78°41.204' 08°32.996'		4	4	true wind speed 5.9 m/s. First streamer line OBS survey, sample rate 0.25ms, record length 3sec
NKR-OBS	CAGE21-3-HH-002-2D	15.07	11:48	78°40.688' 08°29.052'	12:43	78°42.775' 08°05.640'		4	6	Wind 6.6
NKR-OBS	CAGE21-3-HH-026-MB	15.07	11:50	78°40.772' 08°28.011'	12:43	78°42.775' 08°05.640'			6	MB beam angles changed back to 45 degrees
NKR-OBS	CAGE21-3-HH-003-2D	15.07	13:02	78°42.478' 08°04.850'	14:03	78°40.309' 08°28.796'		4	5	Wind speed 5.4
NKR-OBS	CAGE21-3-HH-027-MB	15.07	13:02	78°42.478' 08°04.850'	14:03	78°40.309' 08°28.796'			5	
NKR-OBS	CAGE21-3-HH-004-2D	15.07	14.22.00		15.15.24	78°42.190' 08°05.370'		4	5	Wind speed 5.5

NKR-OBS	CAGE21-3-HH-028-MB	15.07	14.22.00		15.15.32	78°42.190' 08°05.370'		5	
NKR-OBS	CAGE21-3-HH-005-2D	15.07	15.34.37	78°42.077' 08°04.860'	16.32.06	78°40.045' 08°27.500'	4	5	Wind speed 4.8 start log late at FFID 3860
NKR-OBS	CAGE21-3-HH-029-MB	15.07	15.34.37	78°42.077' 08°04.860'	16.32.06	78°40.045' 08°27.500'		5	
NKR-OBS	CAGE21-3-HH-006-2D	15.07	16.54.00	78°39.964' 08°26.570'	17:51	78°42.024' 08°03.520'	4	5	wind speed 6.2
NKR-OBS	CAGE21-3-HH-030-MB	15.07	16.54.00	78°39.964' 08°26.570'	17:51	78°42.024' 08°03.520'		5	
NKR-OBS	CAGE21-3-HH-007-2D	15.07	18:07	78°41.953' 08°01.420'	19:16	78°39.590' 08°27.635'	4	5	
NKR-OBS	CAGE21-3-HH-031-MB	15.07	18:07	78°41.953' 08°01.420'	19:16	78°39.590' 08°27.635'		5	
NKR-OBS	CAGE21-3-HH-008-2D	15.07	19:37	78°39.491' 08°27.237'	20:44	78°41.903' 08°00.206'	4	5	wind 5.6

NKR-OBS	CAGE21-3-HH-032-MB	15.07	19:37	20:44		5	
NKR-OBS	CAGE21-3-HH-009-2D	15.07	20:58	22:04	4	5	wind 4.9 guns GPS dropping out too much so guns brought in on the line turn. The air hoses were found to be loose and GPS was changed
NKR-OBS	CAGE21-3-HH-032-MB	15.07	20:58	22:04		5	
NKR-OBS	CAGE21-3-HH-010-2D	16.07	00.21.00	01.18.00	4	5	GPS changed back to original (problems changing to new one) wind 5.0
NKR-OBS	CAGE21-3-HH-033-MB	16.07	00.21.00	01.18.00		5	
NKR-OBS	CAGE21-3-HH-011-2D	16.07	01.33.11	02.29.31	4	5	Wind speed 4.2
NKR-OBS	CAGE21-3-HH-034-MB	16.07	01.33.11	02.29.31		5	
NKR-OBS	CAGE21-3-HH-012-2D	16.07	02.45.40	03.42.00	4	5	Wind speed 3.6

NKR-OBS	CAGE21-3-HH-035-MB	16.07	02.45.40	03.42.00		5	
NKR-OBS	CAGE21-3-HH-013-2D	16.07	04.15.38	00:00	4	5	wind speed 4.8 - start inlines
NKR-OBS	CAGE21-3-HH-036-MB	16.07	04.15.38	00:00		5	
NKR-OBS	CAGE21-3-HH-014-2D	16.07	05.27.42	06:24	4	5	wind speed 4.2
NKR-OBS	CAGE21-3-HH-037-MB	16.07	05.27.42	06:24		5	
NKR-OBS	CAGE21-3-HH-015-2D	16.07	06:36	07:34	4	5	wind speed 7.6
NKR-OBS	CAGE21-3-HH-038-MB	16.07	06:36	07:34		5	
NKR-OBS	CAGE21-3-HH-016-2D	16.07	07:59	08:52	4	5	

NKR-OBS	CAGE21-3-HH-039-MB	16.07	07:59	08:52		5
NKR-OBS	CAGE21-3-HH-017-2D	16.07	09:10	10:05	4	5
NKR-OBS	CAGE21-3-HH-040-MB	16.07	09:10	10:05		5
NKR-OBS	CAGE21-3-HH-018-2D	16.07	10:18	11:20	4	5
NKR-OBS	CAGE21-3-HH-041-MB	16.07	10:18	11:20		5
NKR-OBS	CAGE21-3-HH-019-2D	16.07	11:38	12:34	4	5

CAGE21-3 documentation of OBS ensembles

OBS configurations with flag and beacon positions. Recovery buoy is attached to the OBS frame until release.

VSN01

Flag pole black

Beacons and flag on the same side

VSN03

Flag pole black

Beacons and flag on opposite sides

VSN04

Flag pole white

Beacons and flag on opposite sides

VSN05

Flag pole white

Beacons and flag on opposite sides

VSN06

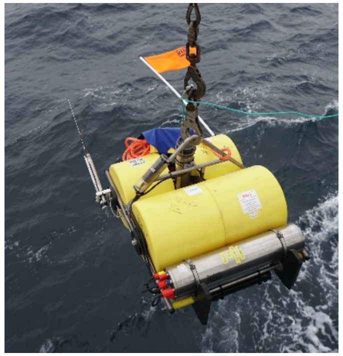
Flag pole black

Beacons and flag pole on opposite sides

VSN07

Flag pole white

Beacons and flag pole on one side



VSN08

Flag pole white

Beacons and flag on opposite sides

UiT OBS with flag pole damaged

Beacon placed vertically next to releaser (the screws in the piece that holds the beacon and the light are demage and the piece does not sit firm on the OBS)

VSN09

Shortened white flag pole

Beacons and flag pole on opposite sides