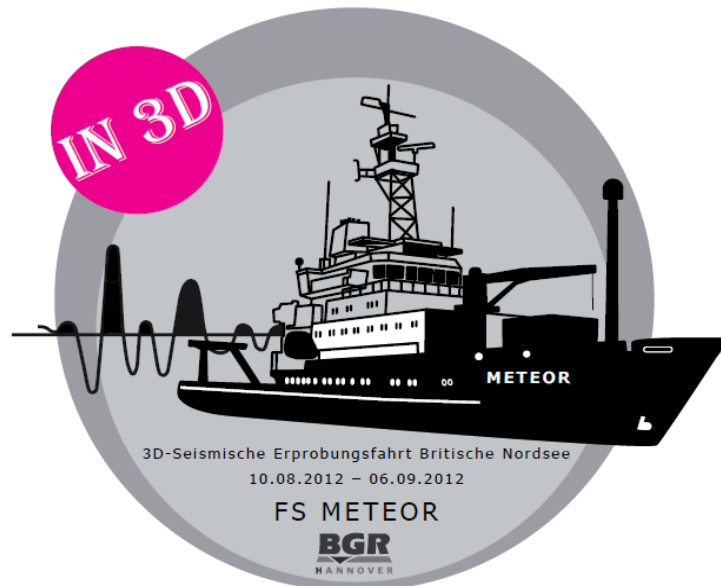


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Short Cruise Report Meteor M88/1

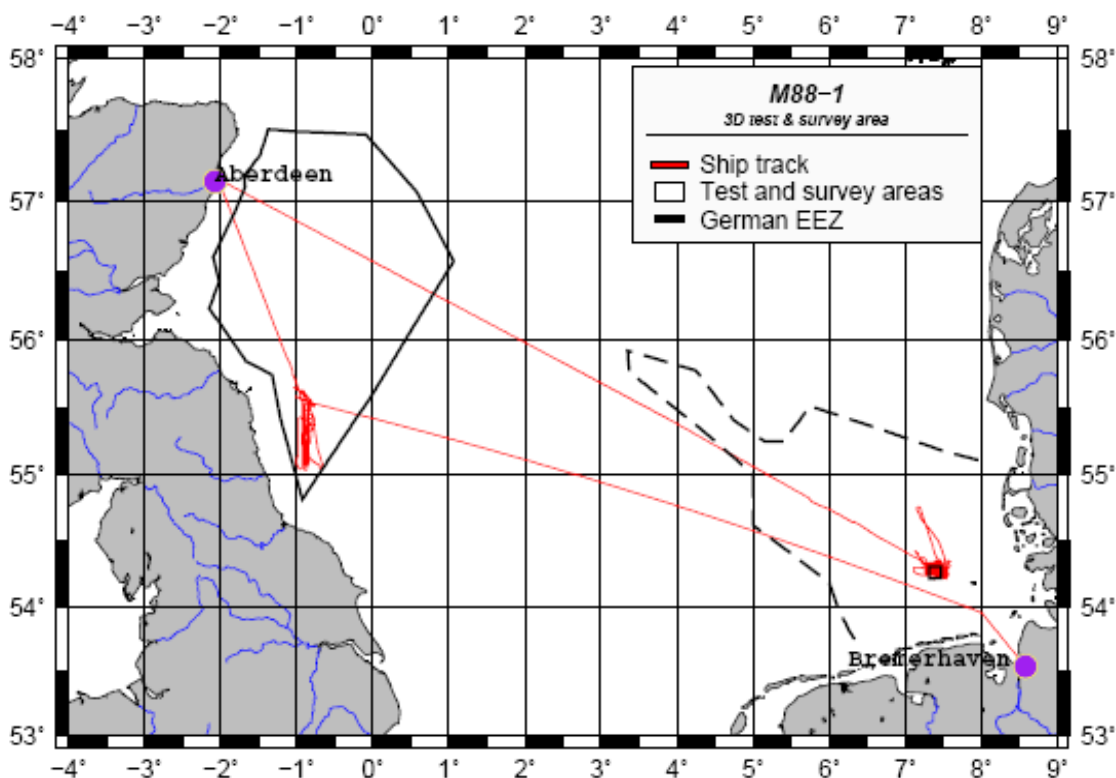
Bremerhaven – Aberdeen (Leg M88/1A)

Aberdeen- Bremerhaven (Leg M88/1B)

10.08.2012 – 06.09.2012

Chief Scientist: Volkmar Damm

Captain: Thomas Wunderlich



Objectives

Within the scope of its tasks as the German Geological Survey BGR conducts marine geoscientific research worldwide. Several marine geophysical and geological methods are used for this purpose. Among them multichannel seismic methods have been applied so far for 2D operations by means of a 4,5 km streamer cable using different multipurpose vessels as a platform.

There is an increasing demand for 3D seismic data in the German and international geoscientific community. Currently there are only a few marine 3D seismic systems available worldwide which belong to scientific institutions. The only scientific multichannel 3D seismic systems which meets all standards of the exploration industry is owned by Lamont Doherty Earth Observatory and permanently installed at the RV Marcus G. Langseth, a former 3D seismic vessel.

In May 2009 the marine seismic group of BGR was entrusted to assemble a mobile 3D seismic system able to be operated from several multipurpose research vessels. This mobile 3D system had to fulfill all requirements of precise 3D survey navigation, shot control and real-time quality control. According to the strategy two configurations of a mobile multi-channel 3D seismic system using two streamer cables were planned:

- a) a 3D seismic setup with 1500m cable length at maximum and 2 GI guns and
- b) a 3D seismic setup with 4000m cable length at maximum and 2 arrays consisting of 8 G-guns each.

The separation of the two streamer cables is achieved using paravans, which may be adjusted according to the used seismic setup (Fig. 1).

Beginning in May 2009 BGR purchased all necessary components to upgrade the already existing 2D multi-channel seismic system to a 3D system.

The cruise M88/1 was aimed at testing a 3D seismic setup with 900 m streamer cable and all new system components including training of survey navigation. A low traffic area in the British sector of the North Sea with water depth deeper than 40 m was selected for these operations. Subsequently, it was planned to acquire 3D seismic data in a test area of limited extent. To make benefit of the acquired data for a currently running mapping project in the German sector of the North Sea an area W of Heligoland was selected for the test survey. This small scaled 60 km² sized area was one of the four targets of special geological interest which were on focus during the survey operations of the subsequent cruise M 88/2.

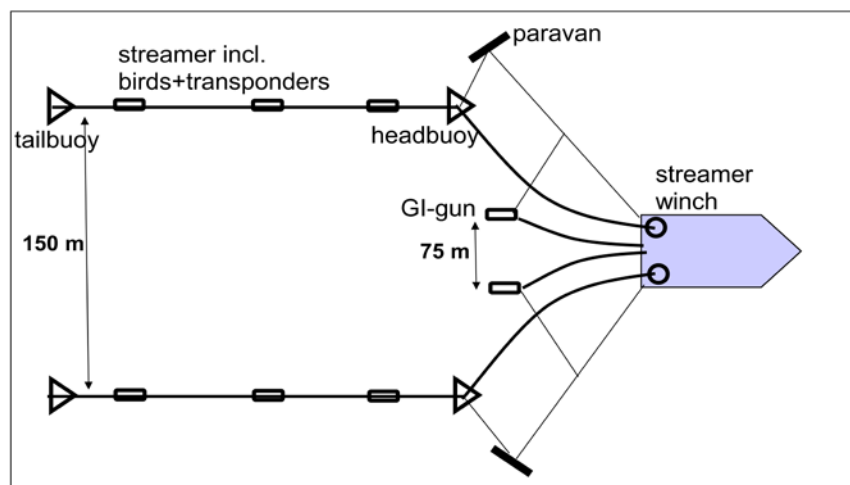


Fig. 1:
Setup of the BGR
marine multichannel 3D
seismic system with 2
streamers

Narrative

Week 32 (August 10th – August 12th)

RV Meteor was moored on the quay of Lloyds wharf and ready for loading operations and embarkation at Friday morning, August 10th. The scientific crew members arrived 8:00 am and started unloading the containers, which were assigned to stay in Bremerhaven until the return from the journey. Part of the seismic equipment was assembled on quay.

During the last stay in the shipyard the working deck of RV Meteor was partly modified for the special demands of the 3D equipment. Some welding for the foundations of the streamer winches had to be completed immediately before installation of the two winches and all other seismic equipment.

The loading operations were completed by 8:00 pm and RV Meteor unberthed at 10:30 pm heading for the first test site in the North Sea off the Scottish coast.

The 30 hours transit time was used for installation of all equipment and instruments necessary for data acquisition and positioning in the laboratories and for safety instructions.

Week 33 (August 13th – August 19th)

Main objectives during this period were testing of all new outboard components, optimum configuration of the paravans and training for handling the seismic outboard systems, in particular the heavy and stiff trawl doors. We experienced mainly good to fair weather with appropriate sea conditions, but had to interrupt our daylight program due to rough sea for two days. Installation of all navigation equipment was completed and configuration of the in-water sensors was in progress.

By the end of this week the setup of the 3D seismic systems as required was achieved and successfully tested under different conditions.

Week 34 (August 20th – August 26th)

During this week 3D seismic data acquisition along predefined lines was tested for the first time using the newly purchased navigation hard- and software. Navigation training included the permanent communication between responsible person in seismic navigation lab and the nautical navigator at the bridge. Due to optimum weather conditions we were able to complete the first 10 test lines which meet all demands of a 3D survey before the port call at Aberdeen on August, 24th. Based on the achieved progress it was decided to plan for a 3D survey in the German sector of the North Sea during the second leg of the cruise.

Week 35 (August 27th – September 2nd)

After arrival in the survey area W of Heligoland all outboard systems were deployed and the 3D seismic data acquisition was started on Monday, August 27th. The previously achieved experiences were of great benefit for the 3D survey operation at high quality standard.



Fig.2: Deck handling of paravan

Because of a storm front and bad weather conditions for our survey area forecasted for the end of this week it was decided to interrupt our continuous operations. By then 50% of the planned survey lines were measured. All outboard systems were recovered on Friday morning and back to water by Saturday evening.

Due to a cracked drag rope we lost a trawling door in the night from Saturday to Sunday. All outboard systems had to be recovered before starting searching operations. On early Sunday morning all seismic equipment was on deck and RV Meteor started a systematic search within a designated area. The paravan was localized later Sunday afternoon in a distance of appr. 9 nm.



Fig. 3: Recovery of outboard systems

Week 36 (September 3rd – September 6th)

All systems were deployed again into the water on Monday after minor repair of some components and 3D operations were restarted. Due to the additional off-time we had to slightly modify all planning for the remaining 3 days of survey operations to guarantee a full coverage of 3D seismic data within a finally 60 km² sized area. Data acquisition was terminated Wednesday morning, September 5th, and all equipment was recovered.

The rest of the last day was filled up with demobilization of all seismic equipment and packing. All equipment was ready for unloading before calling the port of Bremerhaven on early Thursday morning, September 6th.

Disembarkation and unloading was completed by Thursday afternoon, September 6th.

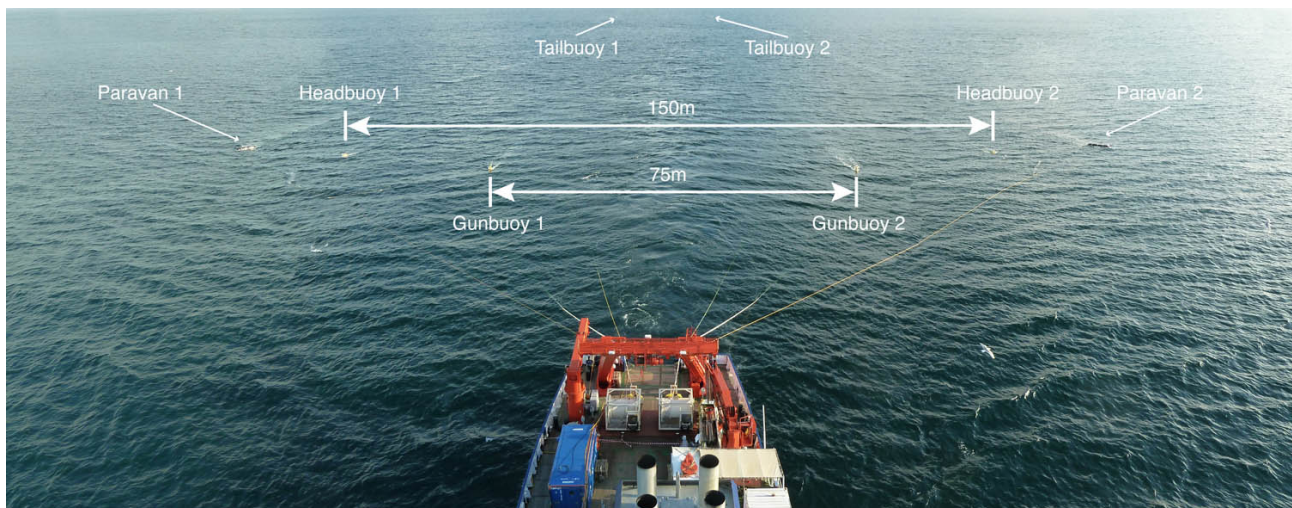


Fig. 4:

Bird's eye view of the working deck and the towed equipment. Please compare with Fig. 1.

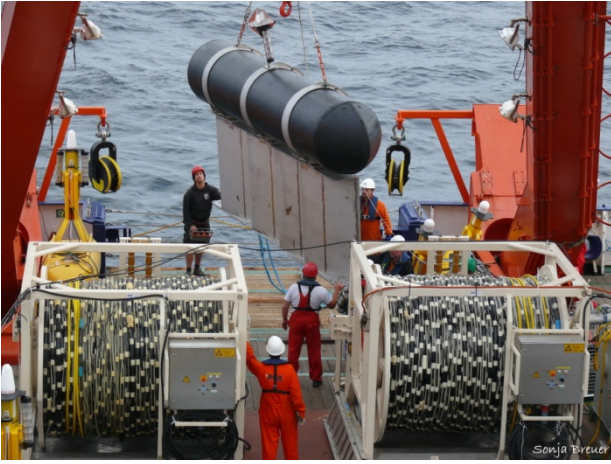


Fig. 5:
Trawling door (paravan), streamer winches and support frame constructions for for streamer deflection blocks (yellow-black).

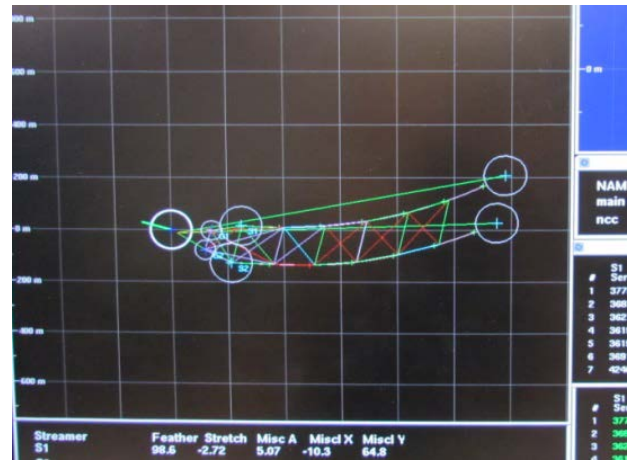
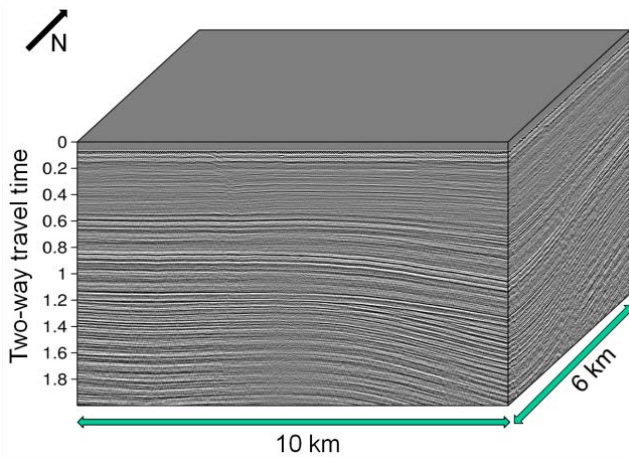


Fig. 6:
Navigation display showing streamer position and separation



Time slice at 0.95 sec

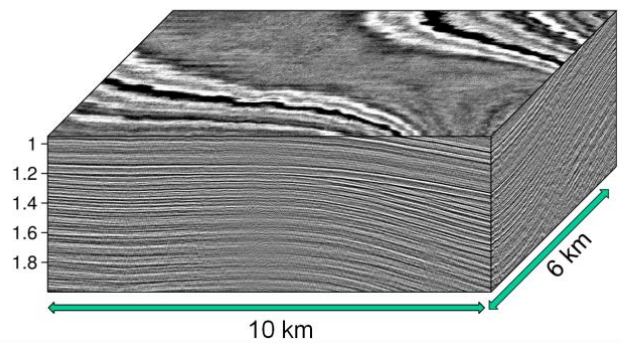


Fig. 7: Pre-processed seismic data cube and time slice at 0,95 sec two-way travelttime

Acknowledgements

Out of the normal schedule we got the opportunity from the Leitstelle Deutsche Forschungsschiffe, Institut für Meereskunde der Universität Hamburg to test the new multi-channel 3D seismic system during cruise M88/1. We are grateful for this option.

Preparing the cruise there was a long task list to be solved in very short time. We would like to thank the Reederei Laeisz for assistance and the Leitstelle Deutsche Forschungsschiffe for coordination of all necessary modifications at the vessel prior the cruise.

Many thanks go to Master Thomas Wunderlich and the whole crew of RV Meteor for their great support to solve all problems arising from handling our new equipment, to meet our special demands on navigation during the data acquisition and finally to complete our program successfully. Many thanks go to the crew of RV Meteor for making our stay onboard highly convenient and comfortable.

We would also like to thank the colleagues of the German Meteorological Service for continuously providing high resolution weather forecasting during the expedition.

List of Participants

Name	Discipline	Institution	Leg
Damm, Volkmar, Dr.	Chief Scientist	BGR	A, B
Adam, Jürgen	Technician	BGR	A, B
Bargeloh, Hans-Otto	Technician	BGR	A, B
Behrens, Thomas	Technician	BGR	A, B
Block, Martin	Geophysicist	BGR	A, B
Breuer, Sonja	Geologist	BGR	A, B
Demi, Ümit	Technician	BGR	A, B
Deppe, Joachim	Technician	BGR	A
Ehrhardt, Axel, Dr.	Geophysicist	BGR	A
Fordyce, Ian	Technician	ION	A
Kallaus, Günter	Technician	BGR	A, B
Karg, Matthias	Public Relation	BGR	A
Koopmann, Hannes	Geoscientist	BGR	A, B
Kuhlmann, Cornelia	Geoscientist	BGR	A, B
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Lutz, Rüdiger	Geologist	BGR	B
Papenberg, Cord, Dr.	Geophysicist	GEOMAR	B
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Schnabel, Michael, Dr.	Geophysicist	BGR	A
Schrader, Uwe	Technician	BGR	A
Schreckenberger, Bernd,	Geophysicist	BGR	A, B
Sonnabend, Hartmut	Technician	DWD	A, B
Steuer, Stephan	Geologist	BGR	A, B
Vinke, Christoph	Administration	BGR	B
Wrobel, Susanne	Administration	BGR	B

BGR Bundesanstalt für Geowissenschaften und Rohstoffe

DWD Deutscher Wetterdienst, Geschäftsfeld Seeschifffahrt

Geomar Helmholtz-Zentrum für Ozeanforschung Kiel

ION ION-Concept Systems, Edingburgh, Scotland, UK

A – Leg 1

B – Leg 2

Station List

Station lists are given in two different formats. Table 7.1 contains station numbering of RV Meteor to meet the request of relating this nomenclature to BGR station and line numbers. Because of the outboard equipment testing during part of the cruise there is no extra station number for each specific activity.

Station lists in Tables 7.2 and 7.3 only contain profiles with acquired data. In Table 7.2 all profiles are listed which were measured in UK waters, in Table 7.3 all profiles which were measured in the German sector of the North Sea, respectively.

Table 1: Station numbering of RV Meteor and BGR line numbering

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks/Recovery
Event label	BGR	2012		[UTC]	[°N]	[°E/°W]	[m]	
M88-1/1481		12.8.	3D-Seismic	06:05	55°29.62 N	00°53.07 W	82	Test handling seismic systems paravan
M88-1/1482		13.8.	3D-Seismic	08:36	55°30.89 N	00°52.75 W	87	Test handling seismic systems airgun
M88-1/1483		14.8.	3D-Seismic	04:56	55°32.67 N	01°02.06 W	89	Test handling seismic systems buoy,streamer,paravan
M88-1/1484		15.8.	3D-Seismic	07:18	55°33.08 N	00°46.82 W	89	Test handling seismic systems buoy,streamer,paravan
M88-1/1485		18.8.	3D-Seismic	06:17	55°31.58 N	00°50.42 W	83	Test handling seismic systems buoy,streamer,paravan
M88-1/1485		19.8.	3D-Seismic	00:09	55°30.85 N	00°52.95 W	87	Test seismic systems in water
M88-1/1485		20.8.	3D-Seismic	04:15	55°25.09 N	00°58.48 W	86	Test seismic systems in water
M88-1/1485	S286 -S174	21.8.	3D-Seismic	09:04	55°20.71 N	00°50.41 W	87	3D Seismic/Multibeam profiles
M88-1/1486		26.8.	Sound Vel	15:28	54°38.60 N	06°19.58 E	34	Sound velocity profiler
M88-1/1487		26.8.	Multibeam	20:27	54°18.50 N	07°23.67 E	38	Multibeam-Parasound-profiles
M88-1/1488		27.8.	Multibeam	03:00	54°12.89 N	07°23.83 E	34	Multibeam-Parasound-profiles
M88-1/1489	S342 -S182	27.8.	3D-Seismic	10:26	54°13.15 N	07°31.47 E	33	3D Seismic/Multibeam profiles
M88-1/1490		31.8.	Multibeam	03:15	54°17.86 N	07°18.47 E	36	Multibeam-Parasound-profiles
M88-1/1491	S286 -S218I	01.9.	3D-Seismic	08:15	54°14:23 N	07°32.81 E	35	3D Seismic/Multibeam profiles
M88-1/1492		02.9.	Multibeam	17:20	54°17:61 N	07°30.08 E	34	Multibeam-Parasound-profiles
M88-1/1493	S282 -S322I	03.9.	3D-Seismic	04:26	54°16:72 N	07°20.01 E	36	3D Seismic/Multibeam profiles

Table 2: BGR lines measured in the UK sector of the North Sea

BGR Line no.	Station no.	Date	Time	Shot point start/end	Latitude	Longitude	course	length	Sea (m)/ Wind (Bft) / Comments
	M88/1	2012	[UTC]		[°N°S]	[°E°W]	[deg]	[km]	
S286	1485-1	21.08	09:04	1421	55° 20' 46.46 N	0° 50' 26.47 W	180	11	0 / S 4
			11:05	981	55° 14' 50.84 N	0° 50' 46.60 W			
S190	1485-1	21.08	11:23	981	55°14' 58.01 N	0° 54' 05.37 W	0	11	0 / S 5
			13:56	1421	55°20' 53.64 N	0° 53' 46.56 W			
S282	1485-1	21.08	16:41	1421	55° 20' 46.32 N	0° 50' 36.81 W	180	11	0.5 / S 5
			17:50	981	55° 14' 51.08 N	0° 50' 56.24 W			
S278	1485-1	22.08	05:09	1421	55° 20' 46.74 N	0° 50' 43.43 W	180	11	1 / WSW 6
			06:21	981	55° 14' 51.16 N	0° 51' 03.46 W			
S186	1485-1	22.08	07:25	981	55° 14' 58.16 N	0° 54' 13.97 W	0	11	1 / SW 5
			08:57	1421	55° 20' 53.67 N	0° 53' 55.12 W			
S274	1485-1	22.08	09:56	1421	55° 20' 46.84 N	0° 50' 52.13 W	180	11	1 / WSW 5
			11:53	981	55° 14' 51.32 N	0° 51' 09.18 W			
S182	1485-1	22.08	12:43	981	55° 14' 58.28 N	0° 54' 20.46 W	0	11	1 / SW 5
			14:01	1421	55° 20' 53.88 N	0° 54' 04.13 W			
S270	1485-1	22.08	14:55	1421	55° 20' 47.08 N	0° 51' 00.17 W	180	11	1 / W 5
			16:11	981	55° 14' 51.63 N	0° 51' 19.68 W			
S178	1485-1	22.08	17:24	981	55° 14 58.53 N	0° 54' 30.33 W	0	11	1.5 / WSW 5
			19:23	1421	55° 20' 54.25 N	0° 54' 12.85 W			
S266	1485-1	23.08	04:45	1421	55° 20' 47.24 N	0° 51' 08.87 W	180	11	1.0 / WSW 5
			05:58	981	55° 14' 51.73 N	0° 51' 27.35 W			
S174	1485-1	23.08	07:16	981	55° 14' 58.70 N	0° 54' 38.92 W	0	11	1.0 / SW 5
			08:59	1421	55° 20' 54.16 N	0° 54' 21.40 W			

Table 7.3: BGR lines measured in the German sector of the North Sea

BGR Line no.	Station no.	Date	Time	Shot point start/end	Latitude	Longitude	course	length	Sea (m) / Wind (Bft) / Comments
	M88/1	2012	[UTC]		[°N°S]	[°E°W]	[deg]	[km]	
S182	1489-1	30.08	20:00	981	54° 14' 51.36 N	7° 28' 47.14 E	270	11	0 / E 2
		30.08	21:53	1421	54° 14' 43.69 N	7° 18' 39.86 E			
S186	1489-1	30.08	15:12	981	54° 14' 56.36 N	7° 28' 46.61 E	270	11	0 / SW 3
		30.08	16:29	1421	54° 14' 48.78 N	7° 18' 39.65 E			
S190	1489-1	30.08	09:54	981	54° 15' 00.17 N	7° 28' 47.05 E	270	11	0 / SW 4
		30.08	11:27	1421	54° 14' 53.08 N	7° 18' 39.20 E			
S194	1489-1	30.08	04:31	981	54° 15' 05.47 N	7° 28' 46.53 E	270	11	0 / SW 5
		30.08	06:20	1421	54° 14' 59.46 N	7° 18' 39.25 E			
S198	1489-1	29.08	22:58	981	54° 15' 14.93 N	7° 28' 46.50 E	90	11	0 / SW 4
		30.08	00:23	1421	54° 15' 03.22 N	7° 18' 38.63 E			
S202	1489-1	29.08	17:23	981	54° 15' 14.93 N	7° 28' 46.31 E	270	11	0.5 / ESE 3
		29.08	19:25	1421	54° 15' 07.66 N	7° 18' 38.86 E			
S206.2	1489-1	29.08	12:01	985	54° 15' 20.10 N	7° 28' 40.11 E	270	11	0.5 / SE 4
		29.08	13:12	1421	54° 15' 11.80 N	7° 18' 38.33 E			
S210	1489-1	29.08	04:39	981	54° 15' 24.85 N	7° 28' 45.96 E	270	11	0.5 / S 4
		29.08	06:38	1421	54° 15' 17.70 N	7° 18' 38.48 E			
S214	1489-1	28.08	23:19	981	54° 15' 28.86 N	7° 28' 45.35 E	270	11	0 / SW 3
		29.08	00:33	1421	54° 15' 20.88 N	7° 18' 37.99 E			
S218	1489-1	28.08	17:24	981	54° 15' 35.35 N	7° 28' 45.67 E	270	11	0.5 / W 4
		28.08	19:25	1421	54° 15' 27.70 N	7° 18' 38.12 E			
S222	1489-1	28.08	12:02	981	54° 15' 39.05 N	7° 28' 44.93 E	270	11	0.5 / SSW 5
		28.08	13:20	1421	54° 15' 31.33 N	7° 18' 37.79 E			
S226	1489-1	28.08	06:06	981	54° 15' 43.52 N	7° 28' 45.15 E	270	11	0.5 / S 5
		28.08	08:01	1421	54° 15' 36.77 N	7° 18' 37.67 E			

S230.1	1489-1	28.08	00:58	981	54° 15' 50.85 N	7° 28' 45.51 E	270	11	/ SSE 6
		28.08	02:19	1421	54° 15' 41.38 N	7° 18' 37.68 E			
S234	1489-1	27.08	19:42	981	54° 15' 53.55 N	7° 28' 44.62 E	270	11	1 / WNW 5
		27.08	21:11	1421	54° 15' 44.30 N	7° 18' 37.14 E			
S238	1493-1	03.09	16:06	981	54° 15' 58.08 N	7° 28' 44.47 E	270	11	0 / W 3
		03.09	17:15	1421	54° 15' 49.21 N	7° 18' 36.97 E			
S242	1493-1	03.09	21:42	981	54° 16' 02.51 N	7° 28' 44.63 E	270	11	/ W 4
		03.09	23:47	1421	54° 15' 55.12 N	7° 18' 36.88 E			
S246	1493-1	04.09	03:53	981	54° 16' 08.45 N	7° 28' 44.16 E	270	11	/ SW 4
		04.09	05:08	1421	54° 15' 59.38 N	7° 18' 36.71 E			
S250	1493-1	04.09	09:53	981	54° 16' 12.10 N	7° 28' 44.31 E	270	11	1 / SW 5
		04.09	12:03	1421	54° 16' 04.49 N	7° 18' 36.74 E			
S254	1493-1	04.09	15:54	981	54° 16' 15.76 N	7° 28' 19.43 E	270	11	1 / WNW 5
		04.09	17:09	1421	54° 16' 08.41 N	7° 19' 06.86 E			
S258	1493-1	04.09	22:07	983	54° 16' 20.62 N	7° 28' 19.25 E	270	11	/ WNW 5
		05.09	00:13	1421	54° 16' 13.26 N	7° 19' 06.66 E			
S262	1493-1	04.09	18:41	1421	54° 16' 18.11 N	7° 19' 06.46 E	90	11	1 / NW 5
		04.09	20:22	981	54° 16' 25.47 N	7° 28' 19.07 E			
S266	1493-1	04.09	13:04	1421	54° 16' 22.96 N	7° 19' 06.26 E	90	11	1 / WSW 5
		04.09	14:26	981	54° 16' 30.32 N	7° 28' 18.89 E			
S270	1493-1	04.09	06:16	1421	54° 16' 28.61 N	7° 18' 41.44 E	90	11	1 / SW 5
		04.09	08:10	981	54° 16' 36.90 N	7° 28' 49.25 E			
S274	1493-1	04.09	01:02	1421	54° 16' 33.82 N	7° 18' 41.00 E	90	11	/ WSW 4
		04.09	02:35	981	54° 16' 41.48 N	7° 28' 48.78 E			
S278	1493-1	03.09	18:42	1421	54° 16' 38.36 N	7° 18' 41.06 E	90	11	0.5 / W 5
		03.09	20:11	981	54° 16' 47.29 N	7° 28' 48.94 E			

S282	1493-1	03.09	13:20	1421	54° 16' 43.05 N	7° 18' 40.92 E	90	11	0.5 / WSW 4
		03.09	14:57	981	54° 16' 51.73 N	7° 28' 48.52 E			
S286	1491-1	01.09	15:12	1421	54° 16' 47.22 N	7° 19' 05.28 E	90	11	0.5 / SW 5
		01.09	17:11	981	54° 16' 54.58 N	7° 28' 17.99 E			
S290	1489-1	30.08	17:33	1421	54° 16' 52.07 N	7° 19' 05.08 E	90	11	0 / ENE 2
		30.08	18:47	981	54° 16' 59.43 N	7° 28' 17.81 E			
S294	1489-1	30.08	12:28	1421	54° 16' 55.75 N	7° 18' 40.36 E	90	11	0.5 / SW 4
		30.08	14:02	981	54° 17' 03.30 N	7° 28' 48.16 E			
S298	1489-1	30.08	07:26	1421	54° 16' 59.62 N	7° 18' 40.47 E	90	11	0.5 / WSW 4
		30.08	08:41	981	54° 17' 09.07 N	7° 28' 48.21 E			
S302	1489-1	30.08	01:28	1421	54° 17' 05.48 N	7° 18' 39.86 E	90	11	/ SW 5
		30.08	03:12	981	54° 17' 12.42 N	7° 28' 47.88 E			
S306	1489-1	29.08	20:30	1421	54° 17' 9.65 N	7° 18' 40.08 E	90	11	/ WSW 4
		29.08	21:45	981	54° 17' 18.26 N	7° 28' 47.78 E			
S310	1489-1	29.08	14:17	1421	54° 17' 15.13 N	7° 18' 39.56 E	90	11	0.5 / SE 3/ no seismic registration for SP 1272 - 1088
		29.08	16:02	981	54° 17' 23.63 N	7° 28' 47.57 E			
S314	1489-1	29.08	07:46	1421	54° 17' 19.76 N	7° 18' 39.56 E	90	11	0.5 / SSW 4
		29.08	09:07	981	54° 17' 27.64 N	7° 28' 47.34 E			
S318	1489-1	29.08	01:40	1421	54° 17' 25.03 N	7° 18' 39.15 E	90	11	/ SW 3
		29.08	03:20	981	54° 17' 31.88 N	7° 28' 47.11 E			
S322	1489-1	28.08	20:28	1421	54° 17' 29.20 N	7° 18' 39.14 E	90	11	/ W 3
		28.08	22:01	981	54° 17' 39.46 N	7° 28' 46.74 E			
S326	1489-1	28.08	14:28	1421	54° 17' 34.32 N	7° 18' 38.96 E	90	11	0.5 / SW 4
		28.08	15:50	981	54° 17' 43.95 N	7° 28' 46.88 E			
S330	1489-1	28.08	09:04	1421	54° 17' 39.84 N	7° 18' 38.64 E	90	11	1.5 / S 5
		28.08	10:41	981	54° 17' 46.83 N	7° 28' 46.54 E			

S334	1489-1	28.08	03:26	1421	54° 17' 43.82 N	7° 18' 38.64 E	90	11	/ S 6
		28.08	04:36	981	54° 17' 52.20 N	7° 28' 46.63 E			
S338	1489-1	27.08	22:15	1421	54° 17' 49.44 N	7° 18' 38.09 E	90	11	/ SSE 5
		28.08	00:03	981	54° 17' 56.77 N	7° 28' 46.23 E			
S342	1489-1	27.08	17:23	1421	54° 17' 53.46 N	7° 18' 38.13 E	90	11	1 / SE 5
		27.08	18:41	981	54° 18' 01.81 N	7° 28' 46.13 E			
S218 I	1491-1	01.09	18:29	981	54° 15' 32.64 N	7° 28' 45.45 E	270	9	1 /SW 5/ Paravan-break
		01.09		1345	54 °15' 30.82 N	7° 20' 14.10 E			
S258 I	1493-1	05.09	01:33	1421	54° 16' 13.26 N	7° 19' 06.66 E	90	11	/ NW 5
		05.09	03:04	981	54° 16' 20.62 N	7° 28' 19.25 E			
S310 I	1493-1	05.09	04:10	981	54° 17' 23.69 N	7° 28' 16.91 E	270	9	/ WNW 5
		05.09	05:11	1339	54° 17' 16.32 N	7° 19' 04.09 E			
S322 I	1493-1	05.09	06:11	1264	54° 17' 30.88 N	7° 19' 03.50 E	90	7	1.5 / NW 5
		05.09	07:23	981	54° 17' 38.24 N	7° 28' 16.37 E			