Marius Becker
Institute of Geosciences
Christian-Albrechts-University zu Kiel
Otto-Hahn-Platz 1
24118 Kiel, Germany

Tel.: 0049 431 880-7148
email: marius.becker@ifg.uni-kiel.de

Short Cruise Report
MARIA S. MERIAN cruise MSM97/2 (GPF 20-2_062)

Emden - Emden (Germany)
12.12.2020 - 24.12.2020

Chief Scientist: Marius Becker
Captain: Björn Maaß

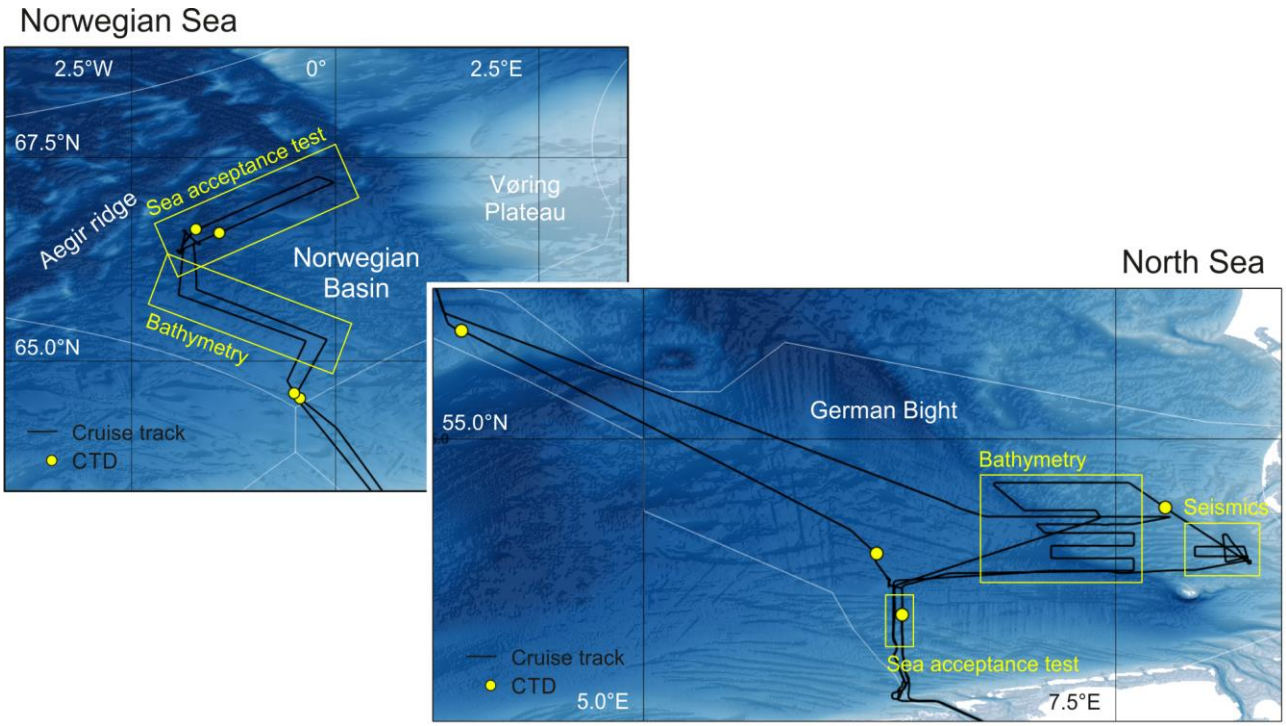

Figure 1: track lines and working areas of MARIA S. MERIAN cruise MSM97/2.

Objectives

The program of the cruise MSM97/2 is partly technical and partly scientific, combining tasks of the DAM (German Marine Research Alliance) Underway data project, the sea acceptance test of a new sediment echo sounder system installed on MARIA S. MERIAN, and scientific data collection. Due to the very different agendas in cruise MSM97/2, scientific data collection was limited to hydroacoustic surveys. This was in accordance with the original proposal, which was accepted as a transit cruise from St. John's, Canada, to Barranquilla, Colombia, before the Covid-19 pandemic.
Aims of the DAM Underway data project included the configuration of a newly installed mass storage system in connection to ships data management system (DSHIP). Each underway device was meant to be configured in the framework of this mass data storage. This included a certain number of smaller technical steps, not listed here. Devices handled by the DAM Underway data project were the acoustic Doppler current profiler (ADCP), multibeam echo sounder (MBES), sediment echo sounder (PARASOUND), the thermo-salinograph (TSG), and the CTD, all part of the built-in scientific instrumentation. A FerryBox was additionally installed on the ship for the DAM data quality work package. The FerryBox was then used in parallel to the TSG.
Tasks of the DAM underway project required time on transit and continuous scientific data collection. Accordingly, and considering recent scientific projects in the German Bight, one PARASOUND-survey was planned to trace marine-terrestrial boundaries, linking information from several sediment cores, which were taken south of the Amrum Bank, previously in 2020. These sedimentary records include the Eem Interglacial and the Weichselian glaciation, showing event layers, which are possibly linked to extreme storms or tsunamis, and which demonstrate rapid changes to the environment. The collected data shall assist reconstructing the impact of such extreme events and the related changes to the North Frisian palaeo-environment.
In addition, one bathymetric survey was planned along wide-spaced lines to map the occurrence of pockmarks across and along the north-eastern bank of the Elbe palaeo-valley. The region was recently shown to exhibit an unexpected variability in the emergence and disappearance of pockmarks, whereas the governing processes are unknown. The multibeam survey will allow determining the present state of a recently discovered pockmark field, contributing to the overall understanding, especially the time scales, of the dynamics of pockmarks in the German Bight.

Narrative

Before departure, the crew of the ship and the scientific staff had already spent four days in quarantine, in a hotel in Leer near the port of Emden, in single rooms. Twice, on the first and last day of quarantine, all of us were tested for Covid-19. Only after being tested negatively we were allowed to enter R/V MARIA S. MERIAN on Friday, December 11, where we set up the labs and installed our equipment. The cruise MSM97/2 then started on the following day, at 08:00 local time. We left the pier at the inland port of Emden aiming at our first measuring location, west to the North-Frisian islands in the North Sea. The North Sea was uncommonly quiet for this time of the year. No wind, no waves, and we could use the time until the first CTD station to configure the new mass data storage system, connect the storage to DSHIP and perform the first tests of semi-autonomous underway data acquisition. One aspect of the DAM Underway data project is quality control of underway data and the comparison between the different sensors of the autonomous through-flow systems. Accordingly, next to the thermosalinograph we installed a FerryBox and started the sampling program, collecting and processing water samples, which we continued during the entire cruise.

We started the hydroacoustic surveys in the evening of the same day. First, we collected seismic data south of the Amrum Bank, linking locations of a number of sediment cores, which were taken during previous projects. These will allow to better reconstruct rapid changes to the palaeo-environment, which occurred during the Eem Interglacial and the Weichselian glaciation. The following day, Sunday, December 13, we measured bathymetry along wide spaced tracks, also in continuation of previous projects, mapping the distribution of pockmarks across the north-eastern bank of the Elbe palaeo-valley. Already during these first two days we made considerable progress regarding semi-autonomous collection and homogeneous treatment of data, which was due to good cooperation on board and substantial technical support by the ship's crew, especially by the system operator. So the first two scientific surveys were relatively uneventful, and we worked on the technical tasks of the DAM Underway data project, while collecting hydroacoustic data.

However, with respect to the third task of the cruise, the sea acceptance test of the new sediment echo sounder, we had to reschedule. The acceptance test required deep water, and the weather forecast for the designated area south of Ireland included projections of more than 6 m waves in the Bay of Biscay and in the Celtic Sea. After discussing consequences for the other work packages, we skipped the plan to go west and decided to conduct the acceptance test in a region north of the Shetland Islands. Before sailing north, we went back to Borkum as planned, for one engineer to leave the ship, who was picked up by a pilot boat in the very early morning. Back on our way, just north of the East-Frisian Islands, we performed already one part of the acceptance test, testing various modes of the sediment echo sounder in shallow water. We continued the DAM underway data collection tests on the track up to the northernmost point of the German EEZ. We then spent two days on transit without any underway data acquisition, before arriving at the deep water location in international waters, in the late afternoon on Wednesday, December 16.

The measuring site was located outside the surrounding EEZs in the southern basin of the Norwegian Sea. Here, we had to find a compromise between the aims of the DAM Underway project and the sea acceptance test, which in addition to deep water required a specific sea bed configuration. We searched for nicely layered sediments, to demonstrate the system's abilities such as the improved vertical resolution. This was certainly challenging as local sedimentary features are controlled by comparatively unstructured and hydroacoustically transparent mass wasting deposits from the Norwegian margin, including those of the Storegga slide event, approx. 8200 years BP. We found suitable sediments east of the inactive Aegir ridge, in 3500 m water depth, located more or less at the polar circle. We spent two days on hydroacoustic data collection and a couple of CTD casts. In addition, we filled local gaps in the DCDB (IHO) bathymetrical chart, according to the aims of the DAM Underway data project.

Retrospectively we were lucky with the decision to go to the Norwegian Sea. Only after we finished to collect all required data, the weather turned bad, and we had to leave the location, sailing back south. We reached the German EEZ at 04:00, December 22, finished the shallow water part of the sea acceptance test of the sediment echo sounder, and used the remaining time to complete the bathymetric survey, mapping the pockmark distribution. The scientific program was finally finished at midnight. The pilot for the port of Emden arrived in the early morning. We cleared the labs, and, thankful for a smooth journey, the scientific crew of MSM97/2 left R/V MARIA S. MERIAN at 13:00 on December 23, right in time to travel home for Christmas.

Figure 2: Cruise participants of MARIA S. MERIAN cruise MSM97/2.

Acknowledgements

We would like to thank Captain Björn Maaß and the crew of R/V MARIA S. MERIAN for their help and support during the cruise and for the hospitality and friendliness on board. We would also like to thank the crew on deck, in the engine rooms and the galley for providing a pleasant working environment. We acknowledge all the help and the perfect organization by the German Research Fleet Coordination Centre. The ship time was provided by the German Research Foundation (DFG) within the METEOR/MERIAN program.

Cruise participants (scientific crew)

1.	Marius Becker	Chief Scientist	CAU
2.	Daniela Meier	Engineer, FerryBox	ICBM
3.	Christine Ridder	Engineer, DSHIP	GEOMAR
4.	Michael Schlundt	Oceanographer, TSG	GEOMAR
5.	Jörn Ewert	Engineer, Seismics	Teledyne
6.	Paul Wintersteller	Geologist, Seismics	Teledyne
7.	Ingo Schuffenhauer	Technician, CTD	IOW
8.	Robert Kopte	Oceanographer, ADCP	CAU
9.	Maximilian Betz	Engineer, DSHIP	AWI
10.	Stefan Kuhlmann	Engineer	WERUM
11.	Claudia Thölen	Biologist, FerryBox	ICBM
12.	Daniel Damaske	Geologist, Bathymetry	MARUM

Institutes:

CAU – Christian-Albrechts-Universität zu Kiel
ICBM – Institute for Chemistry and Biology of the Marine Environment, Oldenburg
GEOMAR – Helmholtz Centre for Ocean Research Kiel
MARUM – Center for Marine Environmental Sciences, University of Bremen
IOW – Leibniz Institute for Baltic Sea Research Warnemünde
AWI – Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research

Station list:

Date	Station no.	Device	Begin (UTC)	End (UTC)	Latitude	Longitude	Water depth [m]
2020 12 12	01-1	CTD	13:30	13:44	54° 04,288' N	006° 22,152' E	32.9
2020 12 12	02-1	PS	18:53		54° 18,419' N	007° 55,606' E	25.6
2020 12 13	02-1	PS		08:59	54° 36,227' N	007° 48,681' E	23.7
2020 12 13	03-1	EM712	08:59	20:00	54° 36,227' N	007° 48,681' E	23.7
2020 12 13	04-1	CTD	09:32	09:45	54° 38,343' N	007° 45,794' E	20.3
2020 12 14	05-1	PS	07:02	11:06	54° 14,936' N	006° 18,075' E	39
2020 12 14	06-1	CTD	11:59	12:16	54° 23,691' N	006° 14,026' E	40.8
2020 12 14	07-1	CTD	20:59	21:11	55° 34,417' N	004° 02,078' E	34.5
2020 12 16	08-1	CTD	16:57	18:59	64° 34,663' N	000° 29,490' W	4500
2020 12 16	09-1	PS	19:14		64° 35,192' N	000° 29,090' W	2730
2020 12 16	10-1	EM122	19:14		64° 35,192' N	000° 29,090' W	2730
2020 12 16	11-1	ADCP	19:14		64° 35,192' N	000° 29,090' W	2730
2020 12 17	12-1	CTD	08:30	11:04	66° 27,043' N	001° 41,922' W	3525
2020 12 17	09-1	PS		22:50	67° 15,451' N	000° 13,962' W	3702
2020 12 17	10-1	EM122		22:50	67° 15,451' N	000° 13,962' W	3702
2020 12 17	11-1	ADCP		22:50	67° 15,451' N	000° 13,962' W	3702
2020 12 17	13-1	EM122	23:33		67° 11,631' N	000° 01,074' W	3690
2020 12 17	14-1	ADCP	23:33		67° 11,631' N	000° 01,074' W	3690
2020 12 18	13-1	EM122		06:02	66° 22,931' N	001° 51,357' W	3554
2020 12 18	14-1	ADCP		06:01	66° 22,956' N	001° 51,319' W	3554
2020 12 18	15-1	PS	06:15		66° 21,783' N	001° 52,999' W	3543
2020 12 18	16-1	CTD	09:37	10:15	66° 29,588' N	001° 49,328' W	3567
2020 12 18	15-1	PS		16:45	66° 21,639' N	001° 53,064' W	3567
2020 12 18	17-1	ADCP	17:01	18:10	66° 21,230' N	001° 56,251' W	3567
2020 12 18	18-1	ADCP	18:31		66° 16,017' N	001° 52,379' W	3509
2020 12 18	19-1	EM122	18:32		66° 15,922' N	001° 52,395' W	3508
2020 12 19	18-1	ADCP		05:45	64° 36,371' N	000° 29,820' W	2707
2020 12 19	19-1	EM122		05:45	64° 36,331' N	000° 29,796' W	2706
2020 12 19	20-1	CTD	06:01	07:49	64° 35,201' N	000° 29,103' W	2695
2020 12 22	21-1	EM712	03:47		54° 35,334' N	007° 03,159' E	41.6
2020 12 22	22-1	PS	09:00		54° 33,466' N	007° 38,355' E	25.8
2020 12 23	21-1	EM712		00:31	54° 18,150' N	007° 09,678' E	41.4
2020 12 23	22-1	PS		00:31	54° 18,151' N	007° 09,638' E	41.7

CTD: CTD Rosette
ADCP: Acoustic Doppler current profiler
PS: PARASOUND
EM122 and EM712: Multibeam echo sounder