

Leibniz Institute for Baltic Sea Research Warnemünde

Monitoring cruise

FS „Elisabeth Mann Borgese“

Cruise- No. EMB-120

26th January – 8th February 2016

Western and Central Baltic Sea

This report is based on preliminary data

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1. Basic information

Ship: FS Elisabeth Mann Borgese
Nationality: Germany
Operating Authority: Baltic Sea Research Institute Warnemünde (IOW)
Cruise: EMB-120
Date: 26.01.-08.02.2016
Master: Uwe Scholz
Number of crew: 11
Chief scientist: Dr. Michael Naumann
Number of research staff: 12

Geographical area in which ship has operated:

western and central Baltic Sea

Purpose of the cruise

Monitoring cruise in the framework of HELCOM programme, additional measurement programmes to follow the impact of the Major Baltic Inflows of December 2014 and November 2015.

Research staff:

	Name	On board	Institution	Responsibility
1	Michael Naumann	26.01.-08.02.2016	IOW	CTD, sediment coring, chief scientist
2	Johann Ruickoldt	26.01.-08.02.2016	IOW	CTD, CTD-maintenance
3	Jan Donath	26.01.-08.02.2016	IOW	CTD, QM CTD-measurements
4	Birgit Sadkowiak	26.01.-08.02.2016	IOW	Nutrients, QM laboratory analysis
5	Andrea Tschakste	26.01.-08.02.2016	IOW	Organic contaminants
6	Ines Hand	26.01.-08.02.2016	IOW	Organic contaminants
7	Jenny Jeschek	26.01.-08.02.2016	IOW	Dissolved oxygen
8	Simone Peter	26.01.-08.02.2016	IOW	Biogeochemical fluxes in surface sediments, water sampling
9	Mareike Floth-Peterson	26.01.-08.02.2016	IOW	Mooring work (GODESS, ADCP Darss Sill), water sampling
10	Michael Pötzsch	26.01.-08.02.2016	IOW	Biological sampling, sediment coring
11	Arne Estelmann	26.01.-08.02.2016	IOW	Dissolved oxygen
12	Gerhard Müller	26.01.-27.01.2016	Kieler Nachrichten	Zeitungsreportage zur Ostsee

Scientific equipment:

CTD + Rosette water sampler, glass bowl sampling and in situ pump for sampling of organic pollutants (PAH), Phytoplankton net (Apstein), Zooplankton net (WP2),

Secchi disk, nutrient analyser, oxygen analyser, Frahmplot sediment corer,
Multicorer

2. General remarks and preliminary result:

The first monitoring cruise of the year 2016 in a series of five expeditions performed annually by the Leibniz Institute for Baltic Sea Research Warnemünde was carried out with FS “Elisabeth Mann Borgese“ between January 26th and 8th February 2016. The cruise is part of the German contribution to the HELCOM COMBINE program and contributes to IOW’s long term data series in the central Baltic Sea. The data acquired are used for regular national and international assessments of the state of the Baltic Sea, are analysed in numerous publications, and provide the scientific basis for measures to be taken for the protection of the ecosystem Baltic Sea.

Additionally, the measurements were focused to investigate the propagation of the Major Baltic Inflows from December 2014, November 2015 and their impact on environmental conditions in the deep basins of the central Baltic. Surprisingly, on the tour back to the western Baltic Sea a next Major Baltic Inflow could be measured in its initial stage in the Arkona Basin and Bornholm Gat.

The area under investigation covered the Baltic Sea between Kiel Bight and the northern Gotland Sea (Fig. 1). Marine meteorological, hydrographic, hydrochemical and hydrobiological investigations were performed according to the COMBINE program of HELCOM. The majority of stations is located along a SW-NE transect, describing the state in the succession of basins from the western to the central Baltic as main information (Fig. 5). Additional stations were done in the western Gotland Basin to investigate possible influences from the intensified ongoing inflow activity since 2014 in this distant region (Fig. 6). In the Eastern Gotland Basin a few additional stations were sampled to get a more area-wide overview of the physical, chemical and biological conditions after the large Major Baltic Inflow of December 2014. At the Gotland Deep the arrival of the new inflow water from November 2015 was measured. The mooring “GODESS – Gotland Deep Environmental Sampling Station” equipped with multiple hydrographic and chemical sensors in daily profiling mode through the water column was recovered. The deployment failed by difficult increasing wind and swell conditions on 4th February. On the tour back home to Rostock additional stations were sampled in the Arkona Basin to gather hydrographic parameters of the main inflow phase. The continuous windy to stormy weather forced again huge amounts of highly saline water into the Baltic and raised the mean sea level around 60 cm (205 km³) during this cruise.

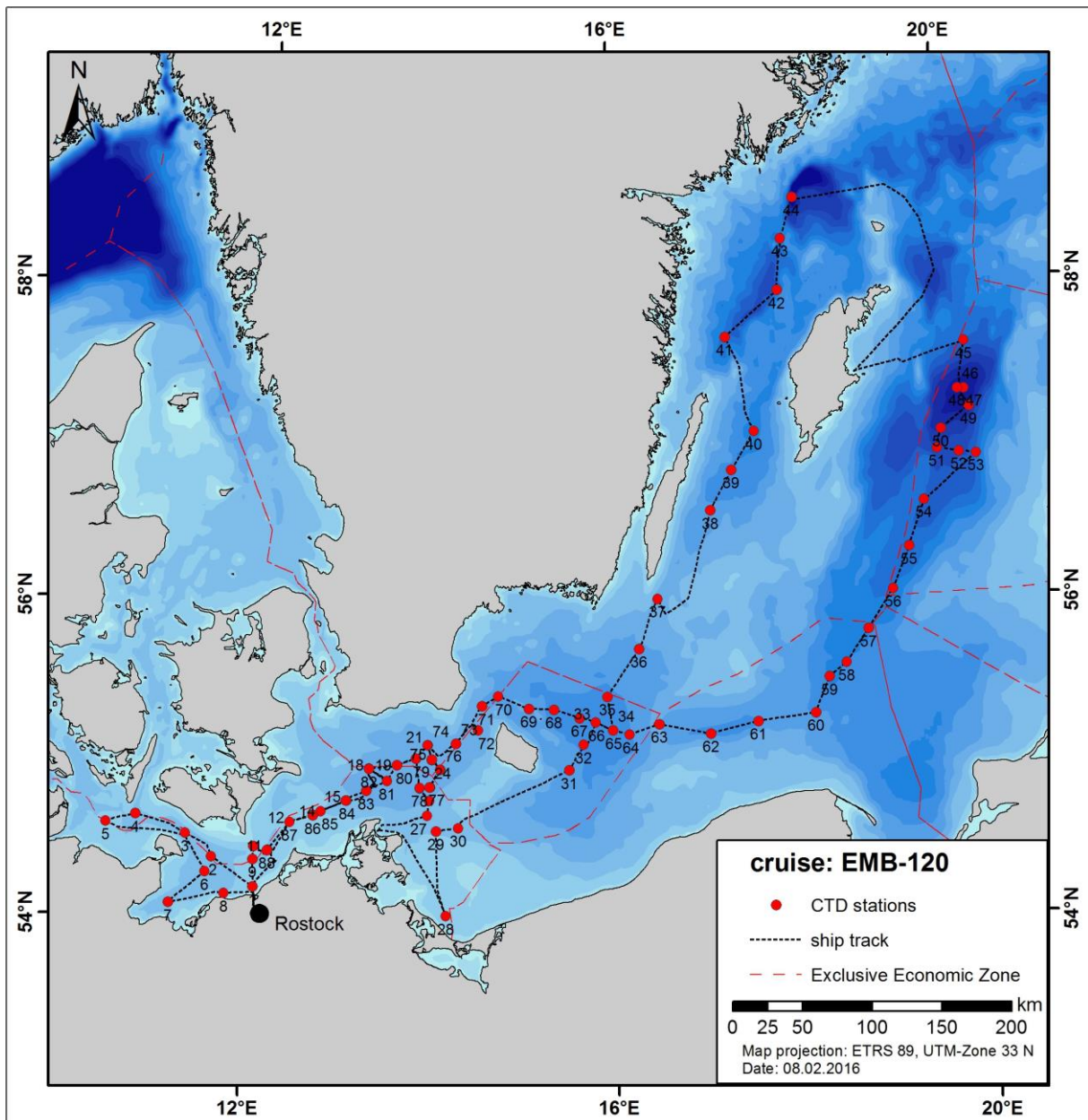


Figure 1: Map of stations and ship track of cruise EMB-120 from 26th January to 8th February 2016. Red dots indicate the position of CTD stations with labels of the station number (Tab. 3).

- The **weather situation** during the cruise was continuously windy to stormy. It was influenced by row of low pressure cells “Karin”, “Leonie”, “Marita”, “Norkys”, “Pia” and “Quirina” moving from the north Atlantic Ocean to northern Europe and extensive Highpressures “Dietrich” and “Edwin” over central Europe. Air pressure ranged between 979 and 1019 hPa. The wind speed changed between 3 and 10 Bft (7-51 kn), but ranged 96 % over 5 Bft. Southwestern to northwestern wind directions dominated the cruise by over 90 %. Two periods of gales with gusts up to 11 Bft hampered the work about three days and we had to stay in the cover of Kap Arkona in the north of Rügen island (28.-30. January) and the spit Östergarn at the eastern coast

of Gotland (2.-3. February). Air temperature ranged between -0.1 °C (1st Feb.) in the western Gotland Basin up to 10.5 °C (27th Jan.) in the Darss Sill.

The following hydrographical and hydrochemical characteristics have been observed during the cruise (cf. Tables 1 and 2, Figures 4 to 8):

- **Surface temperatures** varied slightly between 1.2 °C (Mecklenburg Bight) and 5.8 °C (Stolpe Channel). After three weeks of cold winterly weather and easterly winds in the Baltic since the beginning of January the temperatures cooled down rapidly. Especially in the western Baltic Sea the surface temperatures are ranging between 1-2 °C (cf. Fig. 5). All in all a mild winter season 2015/16 occurred in the Baltic Sea with a cold sum of 63.5 K d at the weather station Warnemünde. The water column is mixed completely down to the halocline (see fig. 5).
- **Deep water layer temperatures** (bottom near depths) increases in the central Baltic Proper during the last year due to the intensified inflow activity starting in 2014. Actually the Bornholm Deep is affected by warm bottom water due to the a row of three intrusions during this winter with a Major Baltic Inflow from 14th to 22nd November. These intrusions of highly saline water showed warm temperatures from 12-8 °C in the western Baltic Sea and passed the Bornholm Basin below the halocline in 45-70 m water depth (cf. cruise reports EMB-119, Solea-714) in December 2015 and beginning of January 2016. At the Gotland Deep (station TF271) the arrival of this water warm water volumes was measured during this cruise, rising the bottom temperature to 7.8 °C. The CTD measurement of February 4th is shown in figure 6. At all key stations the temperatures are still higher as the long-term mean. Figure 7 shows the situation of cooler bottom layer temperatures in the western Gotland Basin. This distant areas are not arrived by new water since 2003. In Figure 5 a longitudinal cross section of the basins and pathway of the salt water intrusion can be seen.

	Feb 2013	Febr. 2014	Febr. 2015	Febr. 2016	Mean 1971/90
Bornholm D.	5.82 °C	8.65 °C	7.15 °C	8.39 °C	6.1 °C
Gotland Deep	6.41 °C	6.36 °C	6.71 °C	7.86 °C	5.6 °C
Farö Deep	5.98 °C	5.76 °C	6.17 °C	not sampled	5.2 °C
Landsort D.	5.58 °C	5.34 °C	not sampled	5.84 °C	4.8 °C
Karlsö Deep	5.29 °C	5.08 °C	5.03 °C	5.22 °C	4.2 °C

- The major Baltic inflow from December 2014 and the following events of winter 2015/16 increased the **salinity in the bottom layer** in the central Baltic Proper rapidly to a recent value of 13.84 at the Gotland Deep. Compared to long term data at this station in the eastern Gotland Basin this level is among the highest values ever measured and comparable to the largest Major Baltic Inflow of 1951. The salinity in the northerly Farö Deep and the western Gotland Basin stay nearly constant.

	Nov. 2013	Nov. 2014	Feb. 2015	Feb. 2016
Gotland Deep	12.07	12.23	12.31	13.84
Farö Deep	11.43	11.60	11.81	not sampled
Landsort Deep	10.43	10.45	not sampled	11.03
Karlsö Deep	10.10	9.75	9.78	9.97

- Thus, the **oxygen situation in the deep water** of central basins (>100 m water depth) documents this recent inflow activity since 2014 very well. Hydrogen sulphide concentrations (expressed as negative oxygen equivalents) in the near-bottom layer were high in November 2013 as maximum stage of the stagnation period and decreased drastically in the Eastern Gotland Basin (Gotland Deep, Farö Deep). Northern parts and the Western Gotland Basin are not effected by this intrusions so far, but probably the latest two Major Baltic Inflows of the winter season 2015/16 in interplay with the earlier events will have a chance to reach this distant areas. Figure 5 and 6 visualize the propagation of the inflowing highly saline water from November 2015 from the Bornholm Basin to the eastern Gotland Basin and the arrival at the Gotland Deep. The thesis of a direct overflow from the Bornholm Basin via the Middle Bank into the Western Gotland Basin cannot be approved. Even with the preconditioning of highly saline deep water in the Bornholm Basin by the large MBI of December 2014 the recent inflows couldn't pass this sill, because of more or less constant Hydrogen sulphide values and cold water temperatures in the Karlsö Deep since November 2013 (cf. fig. 7).

	Nov. 2013	Nov. 2014	Feb. 2015	Feb. 2016
Gotland Deep	-8.75 ml/l	-1.71 ml/l	-0.92 ml/l	1.7 ml/l
Farö Deep	-7.74 ml/l	-2.41 ml/l	-1.07 ml/l	not sampled
Landsort Deep	-1.32 ml/l	-0.95 ml/l	not sampled	-1.28 ml/l
Karlsö Deep	-1.20 ml/l	-1.25 ml/l	-0.86 ml/l	-0.90 ml/l

- The **nutrient situation** in the surface layer is typical for the winter season. In all key areas phosphate and nitrate values are on a higher winter level, because the biological production like the diatom bloom has not been started (table 1).
- In the deep waters of the **central basins** (>100 m water depth), the hydrographic situation is mirrored. The ventilation of the Eastern Gotland Basin since summer 2014 caused decreasing phosphate, ammonium and silicate concentrations and rising nitrate concentrations (table 2). The values are halved or even more decreased since November 2013. Also silicate concentrations have decreased from 126.8 $\mu\text{mol/l}$ to 43.7 $\mu\text{mol/l}$ since that stage at the Gotland Deep.
- Samples for **phyto- and zooplankton** were collected for later analysis in the laboratory.

- **Additional program:**

One complete depth profile of station TF284 and TF271 for all longterm data collection of CT, AT, and pH (photospectrometric)(responsible scientist: Dr. B. Schneider)

Water samples for CH₄ and N₂O measurements in different water depths at 12 stations along the cruise track. Part of a Phd work on studies about greenhouse gas conversion in marine systems with distinct oxygen dynamics (responsible scientist: Prof. G. Rehder, Jan Werner).

At station TF213 (Bornholm Basin) are additional phyto- and microzooplankton samples taken by WP2 and Apstein nets as well as water samples. Additionally a 1000 l water sample is taken at station TF11 in the Mecklenburg Bight are (responsible scientist: Dr. J. Dutz).

In the Gotland Deep (station TF271) are water samples from the oxic and anoxic water layer taken for a long-term study of redox-sensitive trace-elements such as iron and manganese. The main aim of the study is to assess the impact of the inflow from December 2014 on the concentrations of the dissolved species Fe(II) and Mn(II) (responsible scientist: Dr. D. Meyer).

At the stations TF272, TF263, TF259 a Frahm lot sediment cores of the surface sediments up to 80 cm depth are taken to analyse biogeochemical fluxes and the concentrations of organic pollutants (responsible scientist: D. Simone Peter).

For the analysis of organic pollutants are done watersampling by an in situ pumpsystem in the deep water layer of the Bornholm Deep and Gotland Deep (stations TF213, TF271) (responsible scientist: Ines Hand, Prof. D. Schulz-Bull).

For the ZOOM project are water sampling and phytoplankton done at three stations in the eastern Gotland Basin (responsible scientist: Dr. Beate Stawiarski, Dr. Oliver Schmale, Dr. Jörg Dutz, PD M. Labrenz).

A mooring with an ADCP sensor was deployed as backup system at the measuring site of the MARNET station Darss Sill, because the standard ADCP at this site delivered only sporadic data since mid of January (responsible scientists: W. Roeder, S. Krüger).

Attachments:

Tables 1 and 2: Preliminary results of selected parameters in the surface layer and the near bottom water layer - (unvalidated results)

Figures 2 and 3: detailed Track charts

Figure 4: Oxygen/hydrogen sulphide in the bottom near layer for selected stations

Figure 5: Cross section from Kiel Bight to eastern Gotland Basin showing the hydrographic parameters temperature, salinity and oxygen on the “Thalweg” of Major Baltic Inflows.

Figure 6: CTD measurement at the station Gotland Deep (TF271) showing the arrival of the MBI 2015.

Figure 7-9: Additional cross sections showing the situation in the western Gotland Basin and the latest Major Baltic Inflow of January-February 2016 in the western Baltic Sea.

Table 3: List of stations

Attachment 11: Protocol of mooring deployment „ADCP – Darss Sill”, 27th January 2016

Warnemünde 18th April 2016

Dr. Michael Naumann
(scientist in charge)

Table 1: Surface water layer (about 1 m depth)

Area Date	Station Name /No.*	Temp. °C	Sal. psu	O ₂ ml/l	PO ₄ μM	NO ₃ μM	SiO ₄ μM
Kiel Bight 26.01.2016	TFO360/05	1.69	14.56	8.77	0.64	4.22	11.4
Meckl.Bight 27.01.2016	TFO012/06	1.65	14.12	8.72	0.68	4.64	12.0
Lübeck Bight 27.01.2016	TFO022/07	2.23	15.07	8.52	0.7	6.42	13.2
Darss Sill 27.01.2016	TFO030/14	2.77	10.06	8.69	0.64	3.24	10.3
Arkona Basin 27.01.2016	TFO113/17	3.64	8.59	8.42	0.65	3.07	8.0
Bornholm Deep 30.01.2016	TFO213/34	4.64	8.06	8.22	0.64	2.96	8.95
Stolpe Channel 06.02.2016	TFO222/62	4.67	8.03	8.21	0.64	3.23	10.0
SE Gotland Basin 06.02.2016	TFO259/59	4.69	7.54	8.16	0.69	3.38	12.3
Gotland Deep 04.02.2016	TFO271/46	4.34	7.16	8.13	0.62	3.64	14.8
Farö Deep not sampled	TFO286						
Landsort Deep 01.02.2016	TFO284/44	2.84	6.88	8.47	0.76	3.9	17.3
Karlsö Deep 31.01.2016	TFO245/40	3.32	7.13	8.42	0.84	3.44	17.3

* see attached map

Table 2: Deep water layer (bottom near layer depths)

Area Date	Station Name /No.*	Temp. °C	Sal. psu	O ₂ ml/l	PO ₄ µM	NO ₃ µM	SiO ₄ µM
Kiel Bight 26.01.2016	TFO360/05	4.18	22.99	6.96	0.82	6.49	16.5
Meckl.Bight 27.01.2016	TFO012/06	4.05	21.99	7.04	0.67	4.77	12.0
Lübeck Bight 27.01.2016	TFO022/07	3.93	21.36	6.57	0.96	6.52	17.8
Darss Sill 27.01.2016	TFO030/14	4.03	18.36	7.23	0.89	5.56	14.1
Arkona Basin 27.01.2016	TFO113/17	6.60	17.82	5.16	1.04	7.57	19.9
Bornholm Deep 30.01.2016	TFO213/34	8.39	19.19	1.47	1.91	8.91	47.95
Stolpe Channel 06.02.2015	TFO222/62	8.83	14.67	3.15	1.59	8.60	32.5
SE Gotland Basin 06.02.2016	TFO259/59	7.46	12.94	1.39	2.52	6.99	45.6
Gotland Deep 04.02.2016	TFO271/46	7.86	13.84	1.7	2.13	8.5	43.75
Farö Deep not sampled	TFO286						
Landsort Deep 01.02.2016	TFO284/44	5.84	11.03	-1.28	3.47	0	57
Karlsö Deep 31.01.2016	TFO245/40	5.22	9.97	-0.90	3.8	0	57

* see attached map

** hydrogen sulphide was converted into negative oxygen equivalent

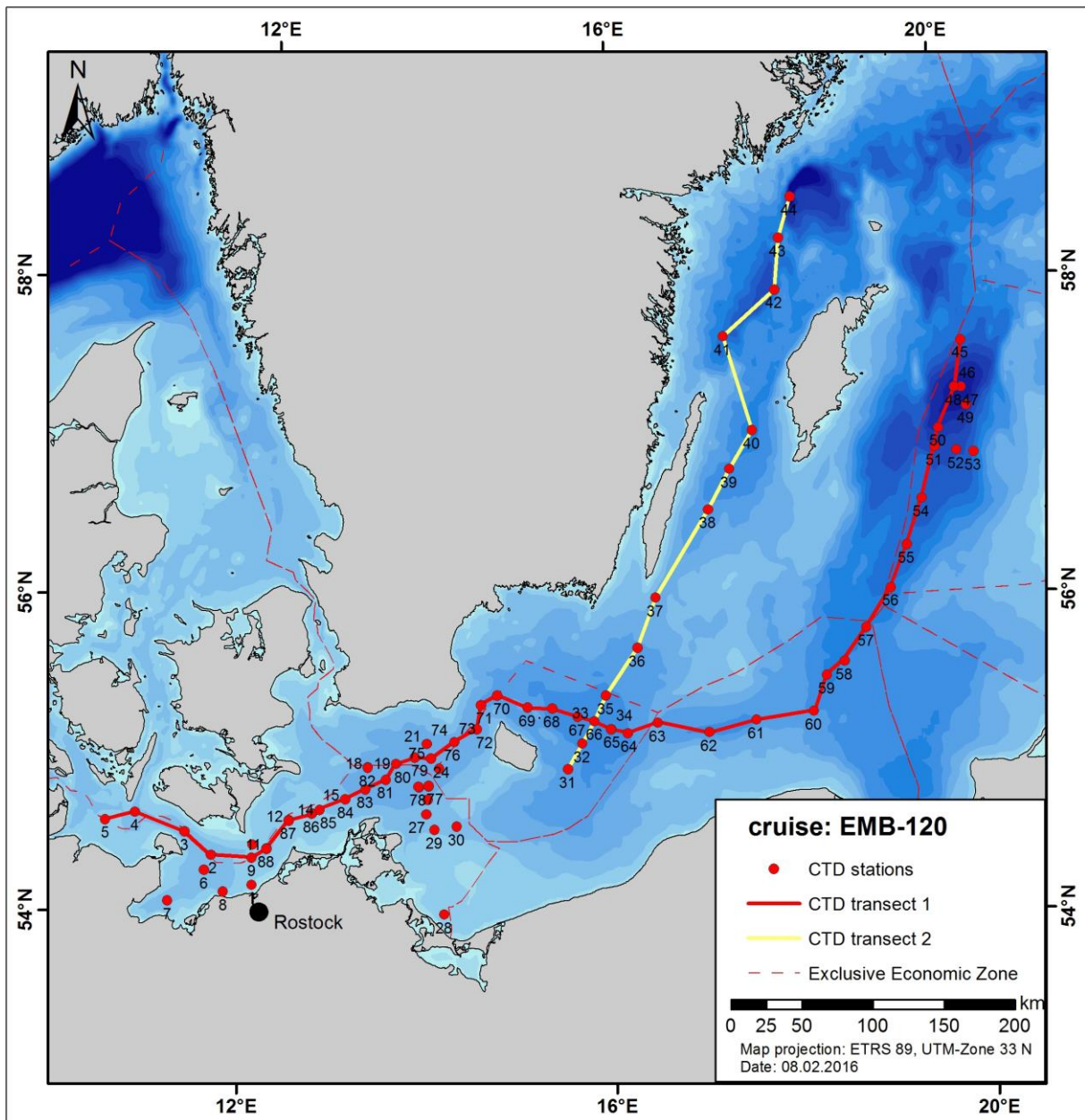


Fig. 2: Stations (labeled with station number → Tab. 3) and shown hydrographic cross sections 1 and 2 from the western to the central Baltic Sea.

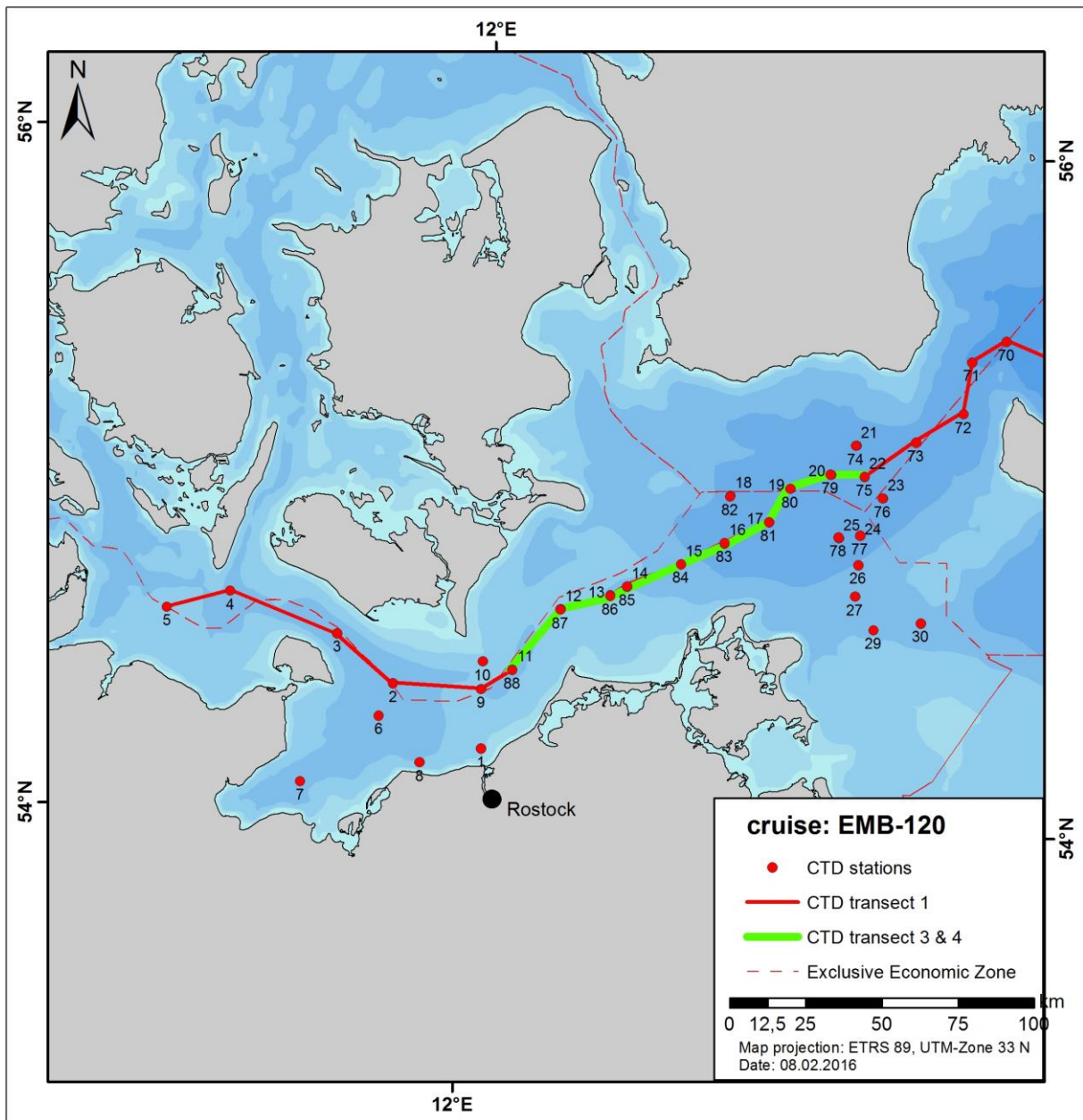


Fig. 3: Stations (labeled with station number -> Tab. 3) and shown cross sections 3 and 4 in the western Baltic Sea

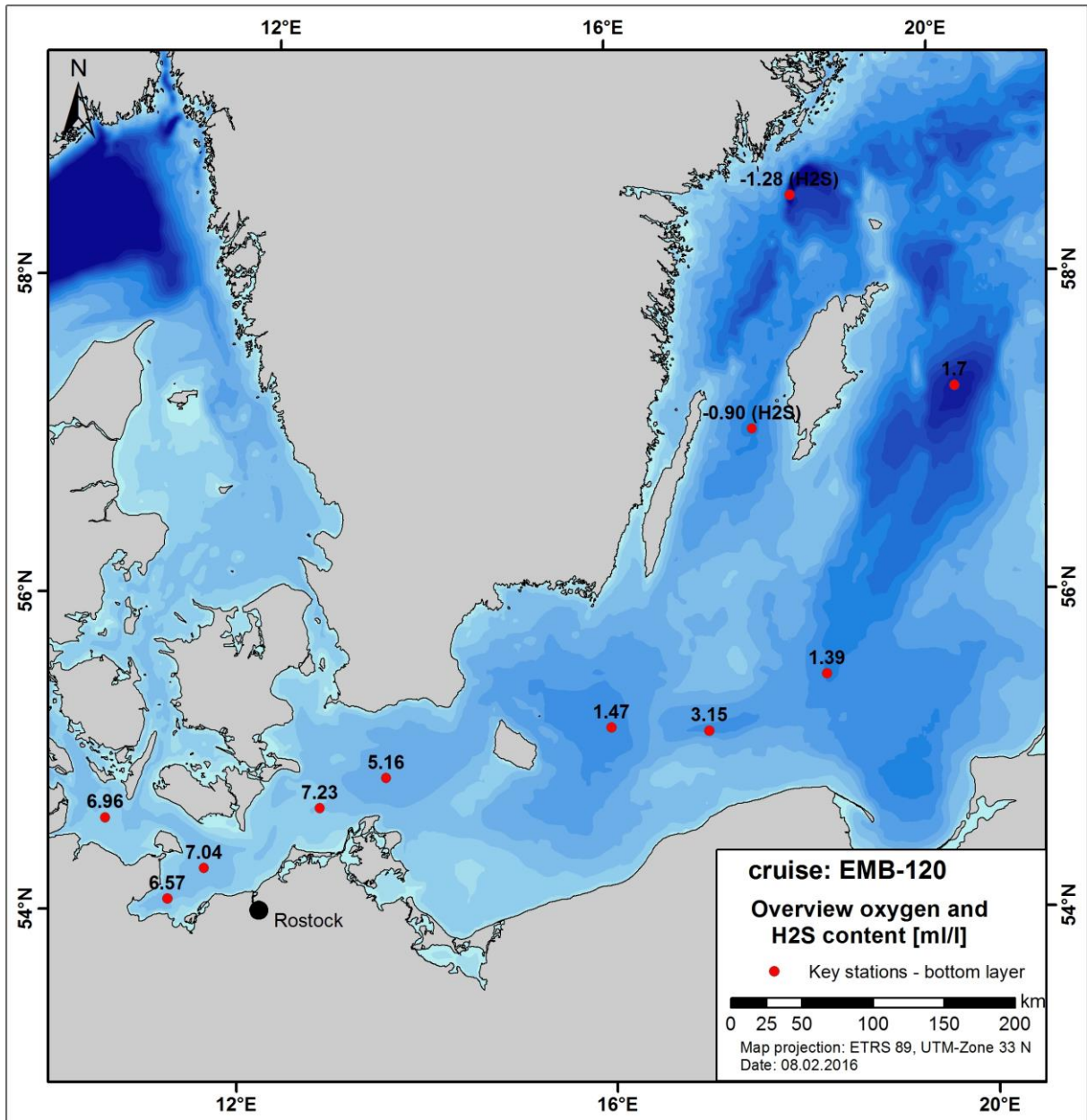


Fig. 4: Oxygen/hydrogen sulphide in the bottom near layer for selected stations

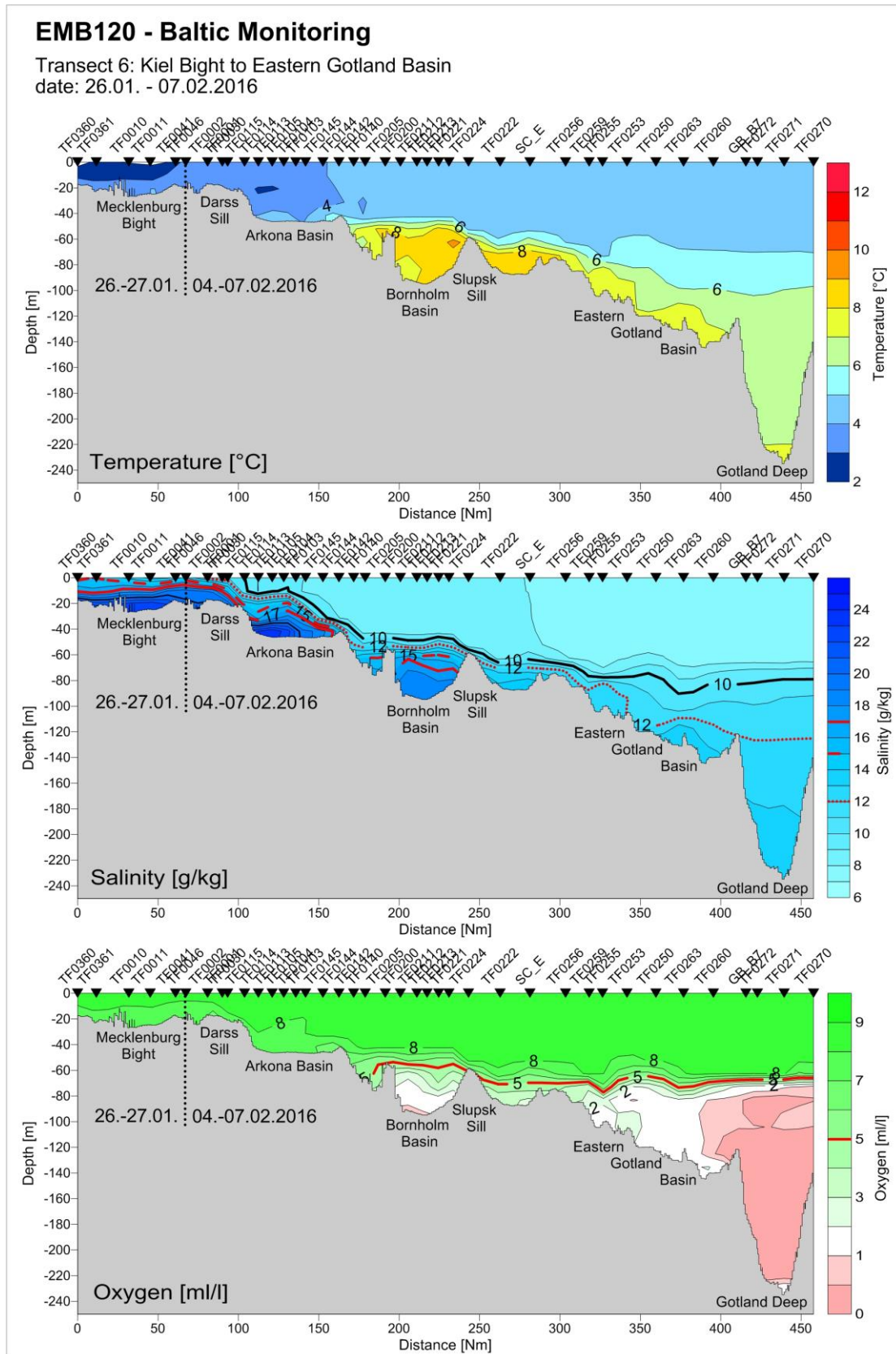


Fig. 5: Cross section 1 from Kiel Bight to the northern part of the Eastern Gotland Basin on the “Thalweg” of Major Baltic Inflows. The propagation of warm water of the

MBI from 14th to 22nd November 2015 can be followed from the Bornholm Basin to the Gotland Deep.

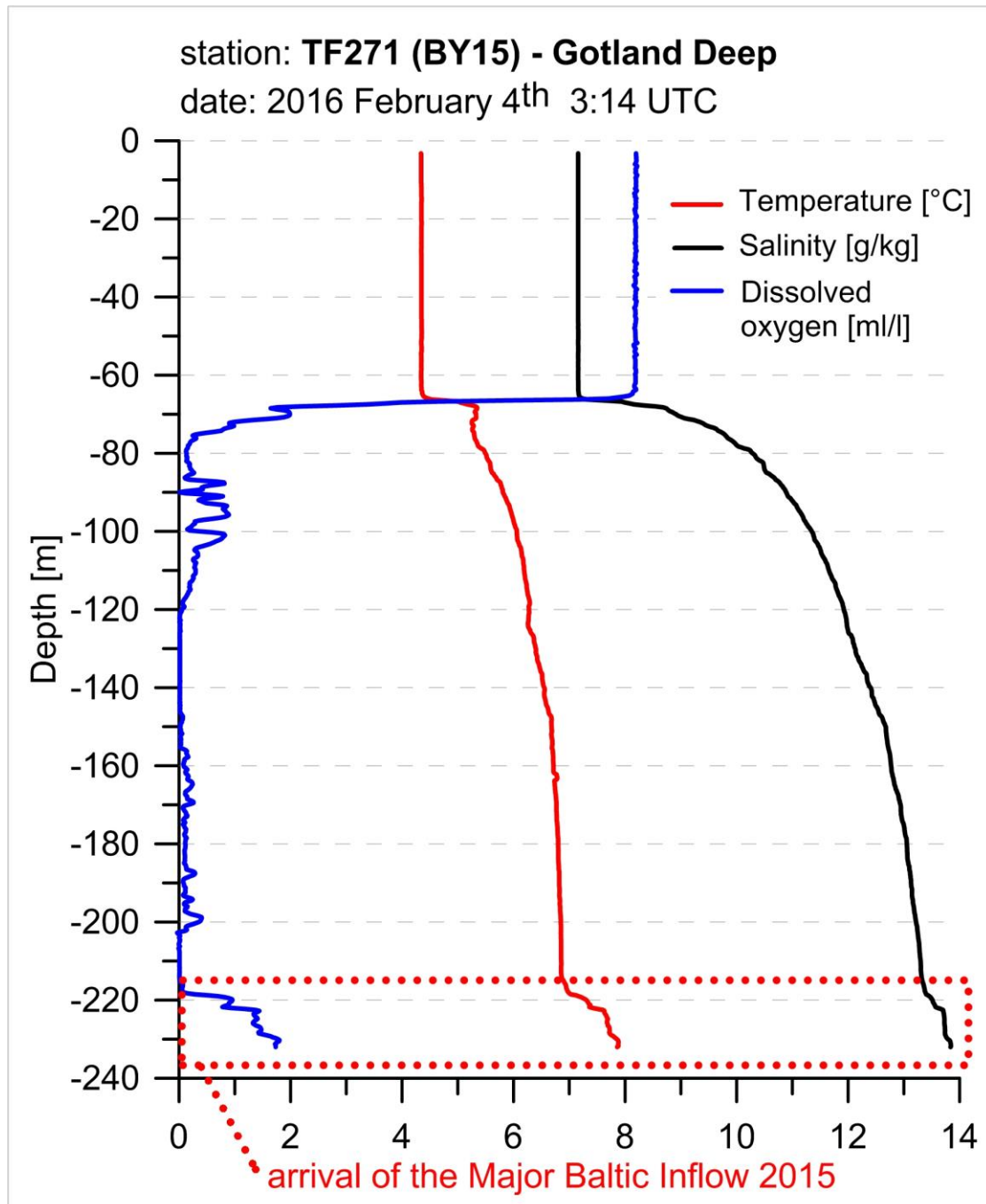


Fig. 6: CTD measurement at the station Gotland Deep (TF271) showing near bottom the arrival of very warm highly saline and oxygenized water from the MBI November 2015.

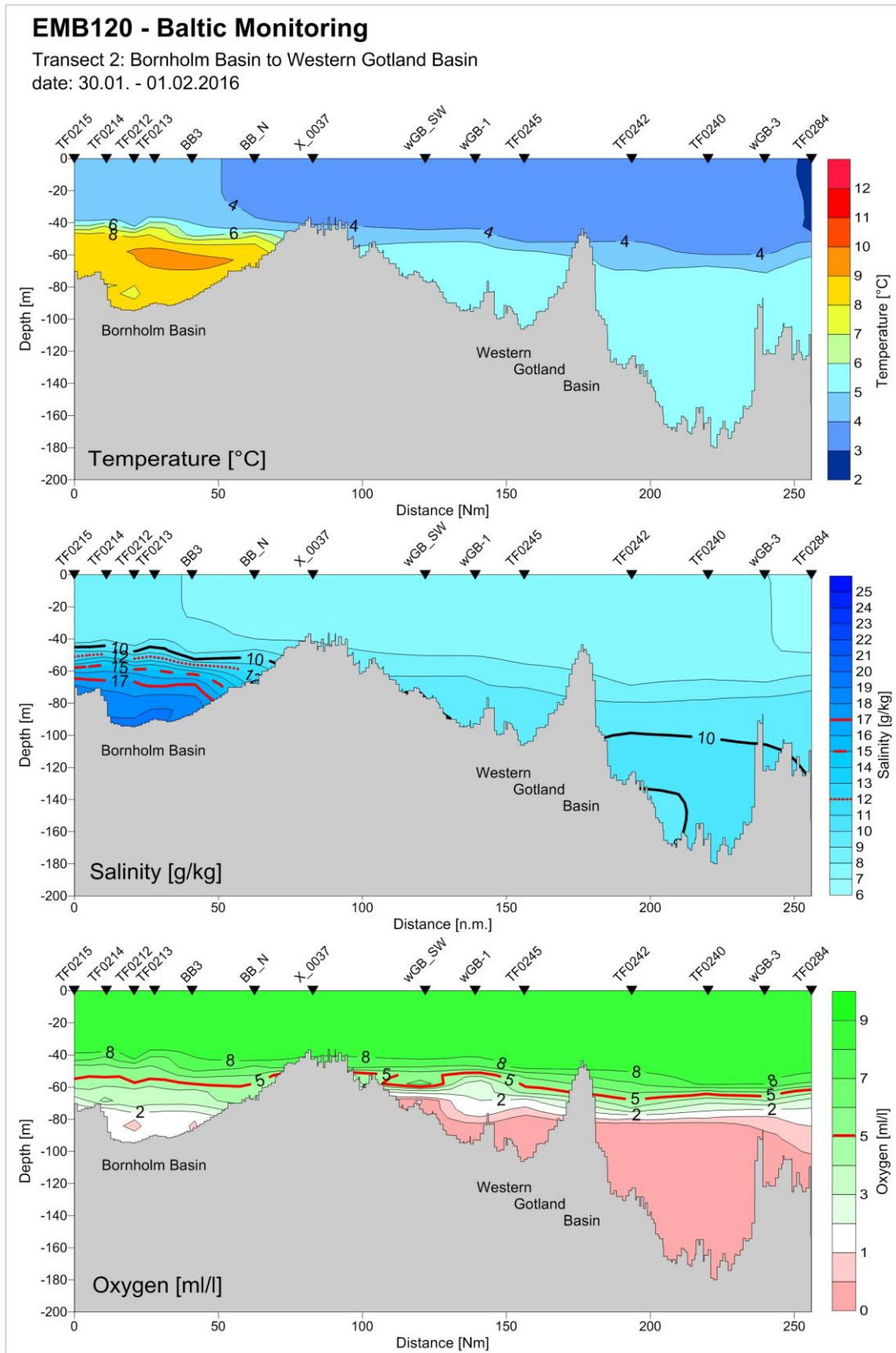


Fig. 7: Cross section 2 from the southern Bornholm Basin to the Western Gotland Basin showing the warm water of the wintery inflow activity in the Bornholm Basin. Anoxic conditions remain in the western Gotland Basin and no signs of ventilation processes since the start of intensified inflow activity in 2014 are visible up to this stage.

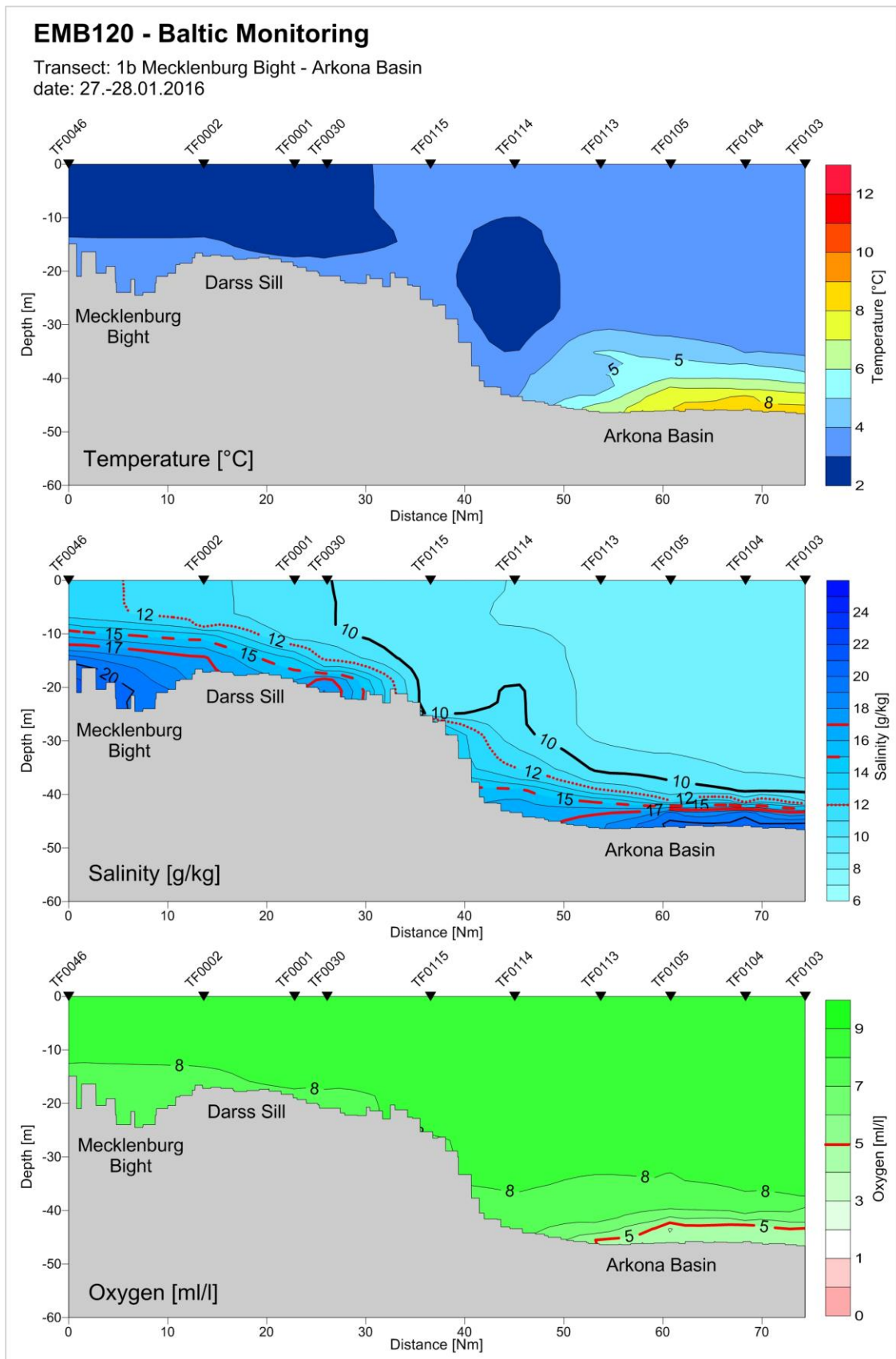


Fig. 8: Cross section 3 from Mecklenburg Bight to central Arkona Basin showing the pre-inflow situation in the western Baltic Sea to the end of January 2016.

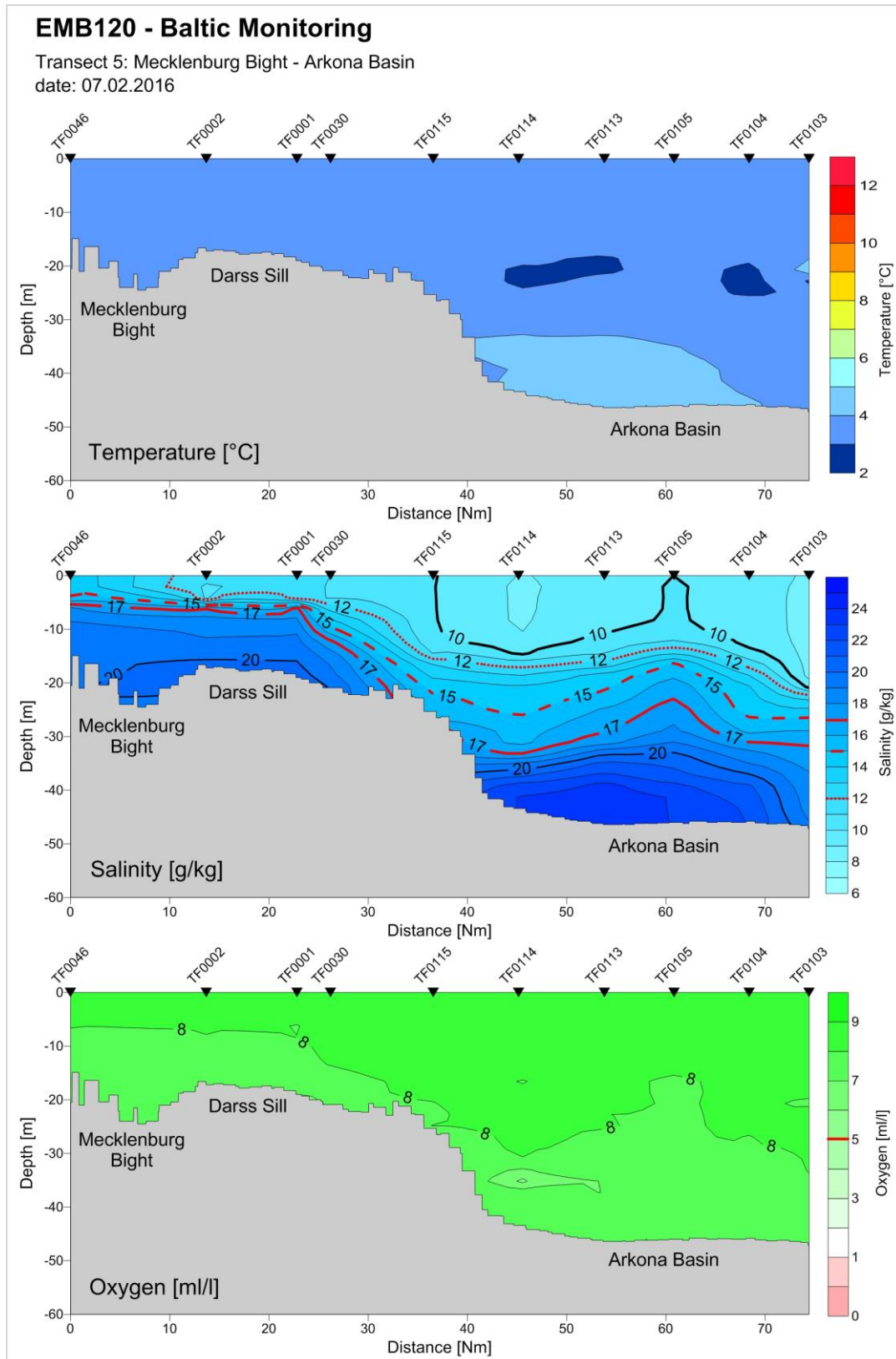


Fig. 8: Cross section 4 from Mecklenburg Bight to central Arkona Basin showing a drastic change in the bottom water of the Arkona Basin compared to cross section 3. The situation of the main inflow period of the Major Baltic Inflow from 31th January to 6th February 2016 is visible by cooler water temperatures, increasing salinity values and uplift of the halocline as well as increasing dissolved oxygen values.

Tab. 3: List of stations, mooring recovery and deployments carried out during the cruise EMB-120.

Stat.No.	Stat.Name	Latitude	Longitude	Lot-Depth [m]		Date	Time [UTC]	CTD cast(s)	Remarks
	Marienehe harbour				Begin	26.01.2016	7:00		Start of cruise
1	TF05	54°13,9016N	12°04,5227E	13,09	Begin	26.01.2016	9:14	V0001F01.hex	Bio net
					End		9:20		
2	TF0011	54°24,7181N	11°36,9732E	24,65	Begin	26.01.2016	11:48	V0002F01.hex	1000 l surface water sample
					End		11:51		
3	TF0010	54°33,0897N	11°19,2585E	27,61	Begin	26.01.2016	14:16	V0003F01.hex	Glas bowl sampling
					End		14:20		
4	TF0361	54°39,4939N	10°46,0007E	22,84	Begin	26.01.2016	18:04	V0004F01.hex	
					End		18:09		
5	TF0360	54°35,9977N	10°27,0320E	17,98	Begin	26.01.2016	19:46	V0005F01.hex	Glas bowl sampling;
					End		19:53		Bio net
6	TF0012	54°18,9045N	11°33,0766E	24,54	Begin	27.01.2016	1:13	V0006F01.hex	Glas bowl sampling;
					End		1:17		Bio net
7	TF0022	54°06,5802N	11°10,4373E	23	Begin	27.01.2016	4:02	V0007F01.hex	
					End		4:07		
8	TF0018	54°10,9716N	11°46,0441E	20,16	Begin	27.01.2016	6:36	V0008F01.hex	
					End		6:39		
9	TF0041	54°24,4001N	12°03,7505E	18,72	Begin	27.01.2016	9:50	V0009F01.hex	
					End		9:55		
10	TF0040	54°29,2807N	12°03,9816E	11,67	Begin	27.01.2016	10:44	V0010F01.hex	
					End		10:48		
11	TF0046	54°28,0414N	12°13,0775E	25,21	Begin	27.01.2016	11:55	V0011F01.hex	Glas bowl sampling;
					End		11:59		Bio net
12	TF0002	54°39,0318N	12°27,0152E	17,9	Begin	27.01.2016	13:49	V0012F01.hex	
					End		13:52		
13	TF0001	54°41,8484N	12°42,1041E	21	Begin	27.01.2016	15:34	V0013F01.hex	ADCP mooring
					End		15:40		deployment
14	TF0030	54°43,4122N	12°47,0552E	22,5	Begin	27.01.2016	16:20	V0014F01.hex	Glas bowl sampling;
					End		16:25		Bio net
15	TF0115	54°47,7001N	13°03,4921E	29,68	Begin	27.01.2016	18:11	V0015F01.hex	
					End		18:19		
16	TF0114	54°51,5913N	13°16,5995E	44,93	Begin	27.01.2016	19:34	V0016F01.hex	
					End		19:41		
17	TF0113	54°55,5072N	13°30,0442E	47,01	Begin	27.01.2016	20:53	V0017F01.hex	Glas bowl sampling;
					End		21:33	V0017F02.hex	Bio net
18	TF0069	55°00,0152N	13°18,0189E	46,34	Begin	27.01.2016	23:20	V0018F01.hex	Glas bowl sampling
					End		23:26		
19	TF0105	55°01,5247N	13°36,4332E	46,52	Begin	28.01.2016	0:47	V0019F01.hex	
					End		0:54		

Stat.No.	Stat.Name	Latitude	Longitude	Lot-Depth [m]		Date	Time [UTC]	CTD cast(s)	Remarks
20	TF0104	55°04,1191N	13°48,8267E	45,7	Begin	28.01.2016	1:51	V0020F01.hex	
					End		1:58		
21	TF0102	55°09,2923N	13°56,5458E	45,12	Begin	28.01.2016	2:52	V0021F01.hex	
					End		3:02		
22	TF0103	55°03,8036N	13°59,3083E	45,37	Begin	28.01.2016	3:59	V0022F01.hex	
					End		4:05		
23	TF0109	55°00,0196N	14°05,0477E	47,62	Begin	28.01.2016	4:52	V0023F01.hex	Glas bowl sampling;
				47,24	End		5:42	V0023F02.hex	Bio net
24	TF0111	54°53,3738N	13°58,1423E	44,85	Begin	28.01.2016	7:28	V0024F01.hex	
					End		7:34		
25	ABBOJE	54°52,8540N	13°51,6838E	45,09	Begin	28.01.2016	8:31	V0025F01.hex	
					End		8:35		
26	TF0112	54°48,2319N	13°57,6569E	39,78	Begin	28.01.2016	9:29	V0026F01.hex	
				40,54	End		9:39	V0026F02.hex	
27	TF0121	54°42,5799N	13°56,8411E	30,23	Begin	28.01.2016	10:55	V0027F01.hex	
					End		11:02		
	Arkona, Tromper Wiek				Begin	28.01.2016			anchored, wow (waiting on weather, 8-9 Bft)
					End	30.01.2016			transit to OBBOJE
28	OBBOJE	54°04,6736N	14°09,6821E	15,39	Begin	30.01.2016	7:12	V0028F01.hex	Glas bowl sampling
					End		7:15		
29	TF0150	54°36,7193N	14°02,6113E	21,62	Begin	30.01.2016	10:58	V0029F01.hex	
					End		11:06		
30	TF0152	54°38,0456N	14°17,1049E	31,08	Begin	30.01.2016	12:09	V0030F01.hex	Glas bowl sampling
					End		12:17		
31	TF0215	55°00,0007N	15°30,0370E	75,73	Begin	30.01.2016	17:11	V0031_01.hex	
					End		17:17		
32	TF0214	55°09,6168N	15°39,6149E	93,04	Begin	30.01.2016	18:43	V0032F01.hex	
					End		18:54		
33	TF0212	55°18,0871N	15°47,8060E	95,13	Begin	30.01.2016	20:10	V0033F01.hex	
					End		20:20		
34	TF0213	55°15,0213N	15°59,0798E	89,45	Begin	30.01.2016	21:22	V0034F01.hex	Glas bowl sampling;
				89,76				V0034F02.hex	Bio net
				89,76				V0034F03.hex	
				89,85	End	30.01.2016	23:39	V0034F04.hex	
35	BB3	55°27,7341N	15°55,7115E	85,5	Begin	31.01.2016	2:03	V0035_01.hex	
					End		2:09		
36	BB_N	55°45,7045N	16°17,4429E	63,46	Begin	31.01.2016	4:57	V0036_01.hex	
					End		5:02		
37	X_0037	56°04,5626N	16°30,3956E	51,14	Begin	31.01.2016	7:37	V0037_01.hex	
					End		7:41		
38	wGB_SW	56°37,5155N	17°07,8131E	78,49	Begin	31.01.2016	13:21	V0038F01.hex	
					End		13:29		

Stat.No.	Stat.Name	Latitude	Longitude	Lot-Depth [m]		Date	Time [UTC]	CTD cast(s)	Remarks
39	wGB-1	56°52,6027N	17°23,3926E	94,87	Begin	31.01.2016	15:26	V0039_01.hex	
					End		15:34		
40	TF0245	57°07,0035N	17°39,9811E	109,6	Begin	31.01.2016	17:38	V0040F01.hex	
				109,95	End		18:31	V0040F02.hex	
41	TF0242	57°42,9833N	17°21,9357E	138,26	Begin	31.01.2016	22:33	V0041_01.hex	
					End		22:50		
42	TF0240	57°59,9932N	18°00,0847E	163,69	Begin	01.02.2016	1:37	V0042F01.hex	
				165,22				V0042F02.hex	
				164,55				V0042F03.hex	
				164,45	End	01.02.2016	2:35	V0042F04.hex	
43	wGB-3	58°19,5300N	18°04,1622E	147,4	Begin	01.02.2016	4:53	V0043_01.hex	
					End		5:03		
44	TF0284	58°34,9139N	18°14,1107E	434,8	Begin	01.02.2016	7:16	V0044F01.hex	
				442,29				V0044F02.hex	
				442,29				V0044F03.hex	
				442,29				V0044F04.hex	
				442,29	End	01.02.2016	11:14	V0044F05.hex	
	Gotland, Östergarn				Begin	02.02.2016	3:20		anchored, wow (waiting on weather, 9-10 Bft)
					End	03.02.2016	15:00		transit to TF0270
45	TF0270	57°36,9775N	20°10,0157E	143,29	Begin	03.02.2016	19:58	V0045F01.hex	
					End		20:13		
46	TF0271	57°19,2456N	20°03,0168E	236,16	Begin	04.02.2016	3:14	V0046F01.hex	Glas bowl sampling;
				237,61				V0046F02.hex	Bio net
				237,81				V0046F03.hex	
				237,9				V0046F04.hex	
				237,81				V0046F05.hex	
				237,81	End	04.02.2016	8:08	V0046F06.hex	
47	GODESS	57°19,0394N	20°07,6897E	240,79	Begin	04.02.2016	10:14	V0047F01.hex	recovery of the GODESS mooring
					End	04.02.2016	11:44	V0047K02.hex	
48	TF0271	57°19,2353N	20°02,9566E	237,5	Begin	04.02.2016	17:26	V0048F01.hex	
				238,16	End	05.02.2016	1:25	V0048F02.hex	
49	GB_B14	57°12,1450N	20°10,3598E	230,84	Begin	05.02.2016	2:30	V0049F01.hex	
					End		2:43		
50	TF0272	57°04,2980N	19°49,8303E	206,01	Begin	05.02.2016	4:44	V0050F01.hex	2 Frahmplot cores
					End		5:07		
51	GB_B7	56°57,1004N	19°46,1815E	181,59	Begin	05.02.2016	7:34	V0051_01.hex	
					End		7:46		
52	GB_B8	56°55,3536N	20°01,1834E	164,41	Begin	05.02.2016	8:55	V0052_01.hex	
					End		9:08		
53	GB_B9	56°54,3367N	20°13,0038E	144,55	Begin	05.02.2016	10:09	V0053F01.hex	
					End		10:20		
54	TF0260	56°38,0126N	19°35,0308E	143,99	Begin	05.02.2016	14:51	V0054F01.hex	

Stat.No.	Stat.Name	Latitude	Longitude	Lot-Depth [m]	End	Date	Time [UTC]	CTD cast(s)	Remarks
					End		14:59		
55	TF0263	56°20,8105N	19°22,7226E	132,71	Begin	05.02.2016	17:27	V0055F01.hex	1 Frahmplot core
					End		17:37		
56	TF0250	56°05,0003N	19°10,0501E	123,68	Begin	05.02.2016	20:14	V0056F01.hex	
					End		20:29		
57	TF0253	55°50,3967N	18°52,0339E	101,4	Begin	05.02.2016	22:34	V0057F01.hex	
					End		22:48		
58	TF0255	55°38,0219N	18°36,0638E	94,81	Begin	06.02.2016	0:42	V0058F01.hex	
					End		0:52		
59	TF0259	55°33,0179N	18°24,0592E	89,91	Begin	06.02.2016	1:58	V0059F01.hex	Glas bowl sampling;
				89,63	End		2:47	V0059F02.hex	Bio net; 1 Frahmplot core
60	TF0256	55°19,5646N	18°14,1726E	76,87	Begin	06.02.2016	5:08	V0060F01.hex	
				77,97				V0060K02.hex	
				77,77	End	06.02.2016	5:58	V0060K03.hex	
61	SC_E	55°17,1750N	17°35,6237E	83,33	Begin	06.02.2016	8:34	V0061_01.hex	
					End		8:40		
62	TF0222	55°13,0085N	17°04,0195E	91,23	Begin	06.02.2016	10:50	V0062F01.hex	
					End		11:00		
63	TF0224	55°17,0269N	16°30,0511E	62,54	Begin	06.02.2016	13:25	V0063_01.hex	
					End		13:29		
64	TF0221	55°13,3223N	16°09,9836E	82,26	Begin	06.02.2016	14:57	V0064F01.hex	
					End		15:07		
65	TF0213	55°15,0257N	15°59,0048E	90,15	Begin	06.02.2016	16:05	V0065F01.hex	Glas bowl sampling;
				90,19	End		17:00	V0065F02.hex	Bio net
66	TF0212	55°18,0895N	15°47,8157E	95,4	Begin	06.02.2016	18:02	V0066_01.hex	
					End		18:09		
67	TF0211	55°19,7832N	15°36,9366E	96,08	Begin	06.02.2016	19:11	V0067F01.hex	
					End		19:22		
68	TF0200	55°22,9872N	15°20,0029E	91,44	Begin	06.02.2016	20:41	V0068F01.hex	
					End		20:53		
69	TF0205	55°23,4001N	15°03,4103E	75,68	Begin	06.02.2016	22:02	V0069_01.hex	
					End		22:09		
70	TF0140	55°27,9977N	14°42,9705E	69,62	Begin	06.02.2016	23:44	V0070F01.hex	
					End		23:54		
71	TF0142	55°24,3046N	14°32,1553E	60,34	Begin	07.02.2016	0:54	V0071F01.hex	
					End		1:01		
72	TF0144	55°15,0983N	14°29,7578E	45,1	Begin	07.02.2016	2:22	V0072F01.hex	
					End		2:28		
73	TF0145	55°10,0410N	14°15,0508E	47,16	Begin	07.02.2016	4:34	V0073F01.hex	
					End		4:44		
74	TF0102	55°09,3208N	13°56,4842E	45,04	Begin	07.02.2016	6:29	V0074_01.hex	
				45,44				V0074K02.hex	
				45,44	End		6:52	V0074K03.hex	

Stat.No.	Stat.Name	Latitude	Longitude	Lot-Depth [m]		Date	Time [UTC]	CTD cast(s)	Remarks
75	TF0103	55°03,8163N	13°59,2884E	47,16	Begin	07.02.2016	7:46	V0075_01.hex	
					End		7:50		
76	TF0109	55°00,0141N	14°04,9755E	48,37	Begin	07.02.2016	8:44	V0076_01.hex	
					End		8:48		
77	TF0111	54°53,4205N	13°58,1165E	45,11	Begin	07.02.2016	9:52	V0077F01.hex	
					End		9:55		
78	ABBoje	54°53,0448N	13°51,4954E	46,17	Begin	07.02.2016	10:36	V0078F01.hex	
					End		10:42		
79	TF0104	55°04,1491N	13°48,7906E	46,47	Begin	07.02.2016	11:54	V0079_01.hex	
					End		12:01		
80	TF0105	55°01,5071N	13°36,4133E	46,37	Begin	07.02.2016	12:59	V0080F01.hex	
					End		13:03		
81	TF0113	54°55,5103N	13°30,0266E	47,42	Begin	07.02.2016	13:59	V0081F01.hex	
					End		14:09		
82	TF0069	54°59,8869N	13°17,9186E	46,94	Begin	07.02.2016	15:34	V0082_01.hex	
					End		15:39		
83	TF0114	54°51,6370N	13°16,6167E	45,15	Begin	07.02.2016	17:01	V0083_01.hex	
					End		17:05		
84	TF0115	54°47,7087N	13°03,3697E	30,18	Begin	07.02.2016	18:21	V0084_01.hex	
					End		18:23		
85	TF0030	54°43,4483N	12°47,0263E	22,94	Begin	07.02.2016	19:41	V0085F01.hex	Bio net
					End		19:47		
86	TF0001	54°41,7308N	12°42,0261E	21,27	Begin	07.02.2016	20:48	V0086F01.hex	
					End		20:51		
87	TF0002	54°38,9768N	12°26,9608E	18,13	Begin	07.02.2016	21:57	V0087_01.hex	
					End		21:59		
88	TF0046	54°27,9668N	12°13,0122E	25,05	Begin	07.02.2016	23:48	V0088F01.hex	
					End		23:52		
	Marienehe harbour				End	08.02.2016	7:00		End of cruise

Briese Schifffahrts Gmb & Co. KG
 Abtlg. Forschungsschifffahrt
 FS "Elisabeth Mann Borgese"



VERANKERUNGSPROTOKOLL

Datum: 27.01.2016 **Beginn:** 14:50 **Ende:** 15:10 **UTC**

Gerät: ADCP **Reise EMB** 120

Code Name: _____

Lottiefe: Wassertiefe 21 m

Wetter: Wind: 220 ° 15,1 m/s
 Strömung: 50 ° 1,4 kn

Absetzposition: **Breite:** 54° 41,906' N (WGS 84, DGPS)
Länge: 12° 42,069' E
KrK: 230 °

Grundleine: **Breite:** 54° 41,889' N
 (Ende) **Länge:** 12° 42,090' E
KrK: _____

Richtung: 150 ° (vom Gerät)
 Länge: ca. 40 m

Oberfläche: keine

Bemerkungen: Positionen sind die Position Hauptdeck Stb. - Seite


 Kapitän


 Exp.-Leiter

Verteiler: Reederei
 EMB
 IOW
 Fahrtlfr.