INSTITUT FÜR OSTSEEFORSCHUNG WARNEMÜNDE
an der Universität Rostock
BALTIC SEA RESEARCH INSTITUTE

Leibniz Institute for Baltic Sea Research Warnemünde

C r u i s e R e p o r t

r/v "Alkor"

Cruise-No. 06AK/10/03

Monitoring Cruise
16 July – 25 July 2010
Kiel Bight to Northern Baltic Proper

This report is based on preliminary data

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1. **Cruise No.:** 06AK/10/03

2. **Dates of the cruise:** from 16 July to 25 July 2010

3. **Particulars of the research vessel:**
   Name: "Alkor"
   Nationality: Germany
   Operating Authority: Leibniz Institute of Marine Sciences at Kiel University (IFM-GEOMAR)

4. **Geographical area in which ship has operated:**
   Kiel Bight to Northern Baltic Proper

5. **Dates and names of ports of call**
   18./19.06.2010: Saßnitz

6. **Purpose of the cruise**
   Baltic monitoring in the frame of the COMBINE Programme of HELCOM

7. **Crew:**
   Name of master: Norbert Hechler
   Number of crew: 10

8. **Research staff:**
   Chief scientist: Dr. N. Wasmund

   Participants: Donath, Jan
   Weinreben, Stefan
   Hennings, Ursula
   Trost, Erika
   Lerz, Astrid
   Tschakste, Andrea
   Trinkler, Sven
   Goldstein, Josephine
   Wagner, Carola
   Heene, Christian

9. **Co-operating institutions:**
All institutions dealing with HELCOM monitoring programmes.

10. **Scientific equipment**
CTD, water samplers, plankton nets, in-situ-pump

11. **General remarks and preliminary results**
The area under investigation extended from Kiel Bight to the Northern Gotland Sea (station map see Figs. 1 and 2). On the way back, selected HELCOM stations in the Bornholm Sea, Arkona Sea and Mecklenburg Bight were sampled a second time for nutrient and phytoplankton data. The meteorological, hydrographical, chemical and biological investigations were performed according to the Manual of the COMBINE Programme of HELCOM.
The cruise was divided into two parts. The first part covered the western Baltic and the Arkona Sea and ended on 18 July. Two participants, whose tasks were fulfilled, left the ship. The ship continued the cruise on 19 July with its track into the Bornholm Sea, Eastern Gotland Sea, northern Baltic Proper and Western Gotland Sea.

The weather was sunny and warm (up to 25 °C air temperature) with easterly wind up to 7 m/s and air pressure of 1014-1016 hPa on 16.7.09. The period of 17.7. to 18.7.2010 started cloudy with a change to westerly winds (up to 12 m/s) and to sunny and high-pressure conditions (up to 1026 hPa). It stayed sunny and warm until 22.7.2010, with southerly winds. The wind speed increased to 10 m/s on 22.7.2010 together with a quick drop in air pressure from 1017 to 1009 hPa, but both air pressure and wind speed increased on 23.7.2010 (1017 hPa and 14 m/s, respectively, with sudden change to north-eastern direction). The weather was worst in the morning of the 24.7.2010, with rain and strong wind (18 m/s) from north. It improved on 25.7.2010.

As wind-induced mixing was weak at the beginning of the cruise, there was almost no homogenous surface layer found in sheltered areas (Lübeck Bight). In open areas of Kiel Bight and Mecklenburg Bight, the mixed layer extended to 6-7 m depth, and in the central Arkona Sea to 7-12 m. The halocline became deeper and more distinct from west to east. It started at a depth of 6 m in Kiel Bight, 14 m in Kadet Channel (stat. TF0046) and 18 m at Darss Sill (stat. TF0030). At station TF0115 (in the western Arkona Sea), the water column was complete mixed to the bottom (28 m). In the deeper regions of the Arkona Sea, the halocline started at 38 m depth. In the Bornholm Basin, the thermocline started at 8-10 m depth and the halocline at 45-50 m depth. Oxygen concentrations became zero below approximately 85 m depth in the Bornholm Basin. In the Eastern Gotland Basin, the halocline was located at 55-60 m depth and the oxicline at 120-135 m depth. The depth of the oxicline was further raised in the other basins: Farö Deep 115 m, Landsort Deep 68 m, Karlsö Deep 58 m (cf. Fig. 4c; "negative oxygen" due to H_2S see Fig. 5).

The surface water temperatures (0-10 m) of selected stations of this cruise are compared with long-term mean values (1971-1990, numbers in brackets) collected during our summer cruises (end of July-beginning of August) in earlier decades in the table below. The recent water temperature data are in all cases higher:

Area:	2010:	(1971-1990):
Mecklenburg Bight (stat. TF0012)	19.0 °C	(17.7 °C)
Arkona Sea (stat. TF0113)	22.6 °C	(17.0 °C)
Bornholm Sea (stat. TF0213)	18.4 °C	(17.6 °C)
Eastern Gotland Sea (stat. TF0271)	22.0 °C	(17.3 °C)
Farö Deep (stat. TF0286)	20.9 °C	(17.7.°C)
Landsort Deep (stat. TF0284)	19.4 °C	(18.2 °C)
Karlsö Deep (stat. TF0245)	20.9 °C	(16.9 °C)

The long-term trend of increasing water temperature in the deep water layers is continuing in the western and northern deeps but not in the Bornholm and Gotland Deep:.

	July 2010	July 2007	July 2005	July 2003	Mean 1971-1990
Bornholm Deep	7.53°C	8.80°C	6.97°C	3.71 °C	6.12 °C
Gotland Deep	6.36°C	6.82°C	5.97°C	4.63 °C	5.62 °C
Farö Deep	6.79°C	6.06°C	6.03°C	6.00 °C	5.20 °C
Landsort Deep	6.09°C	5.73°C	5.82°C	5.88 °C	4.76 °C
Karlsö Deep	5.51°C	5.14°C	5.34°C	4.90 °C	4.18 °C

Some aggregates of filamentous Cyanobacteria were suspended in the upper water layer of the north-eastern Arkona Sea (stat. TF0145, TF0144) and in the Bornholm Basin (stat. TF 0210 to stat. TF0221). East of that location, approximately between 16.6 °E and 18.5°E, patches of dense yellow surface mats of *Nodularia spumigena* occurred. North of 55.5 °N, these blooms disappeared, and only a few cyanobacteria aggregates were still found suspended in the water in some areas of the Eastern Gotland Sea. In the western Gotland Sea, no cyanobacteria aggregates were visible.

Attachments

Tables 1& 2: Preliminary results for selected parameters in the surface layer and the near bottom layer (unvalidated results)

Figs. 1-3: Station grid (total grid and two sub-maps)

Fig. 4: Transsect from the Kiel Bight to the Farö Deep for temperature, salinity and oxygen (unvalidated data)

Fig. 5: Oxygen /hydrogen sulphide concentrations in the bottom near layer for selected stations

Dr. Norbert Wasmund

Scientist in charge

Table 1: Surface layer (0 - 10m)

Area	Station	Temperature	Salinity	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	°C	PSU	µmol/dm^3	µmol/dm^3
Kiel Bight 16.7.2010	TF0360/ 006	19.0	12.86	0.00	0.04
Meckl. Bight 16.7.2010	TF0012/ 003	19.0	8.37	0.06	0.04
Lübeck Bight 16.7.2010	TF0022/ 004	18.1	9.56	0.03	0.04
Arkona Basin 17.7.2010	TF0113/ 019	22.6	7.00	0.03	0.04
Bornholm Deep 20.7.2010	TF0213/ 041	18.4	6,96	0.01	0.03
Stolpe Channel 20.7.2010	TF0222/ 043	20.4	7.16	0.01	0.03
SE Gotland Basin 20.7.2010	TF0259/ 045	21.0	7.03	0.03	0.01
Gotland Deep 21.7.2010	TF0271/ 052	22.0	7.00	0.02	0.02
Fårö Deep 22.7.2010	TF0286/ 054	20.9	6.04	0.00	0.01
Landsort Deep 23.7.2010	TF0284/ 056	19.4	5.84	0.00	0.01
Karlsö Deep 23.7.2010	TF0245/ 059	20.9	6.37	0.00	0.01

* Σ NO_2^- + NO_3; NO_2 was present only in traces in most areas under investigation

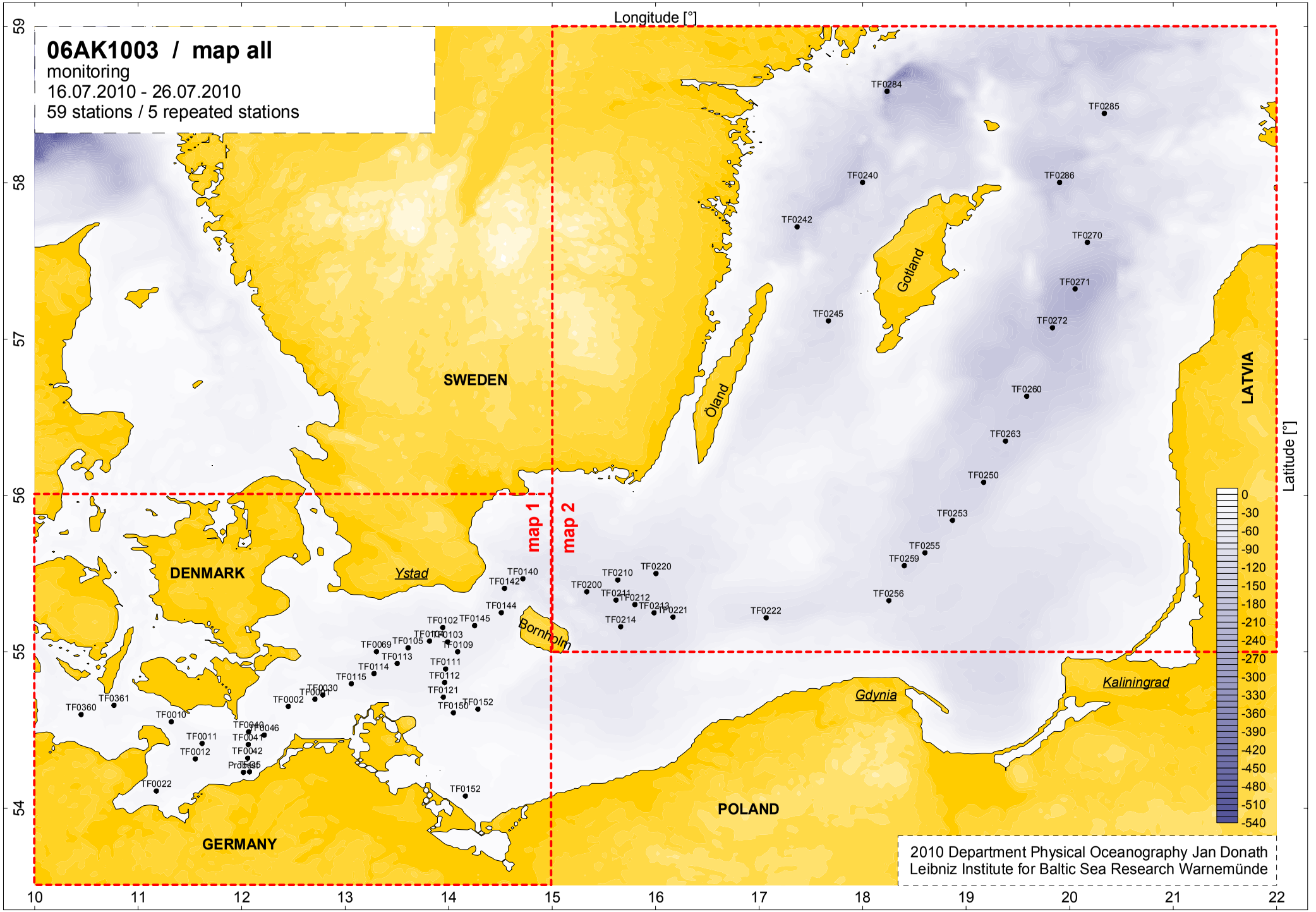
** Station name see maps (Fig. 1 and 2)

Table 2: Bottom-near water layer

Area	Station	Sampl. Depth	Temp.	Salinity	O_2	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	m	°C	PSU	cm^3/dm^3	$\mu mol/dm^3$	$\mu mol/dm^3$
Kiel Bight 16.7.2010	TF0360/ 006	18	7.37	19.58	3.19	0.68	1.65
Meckl. Bight 16.7.2010	TF0012/ 003	24	8.67	26.12	2.11	1.47	7.63
Lübeck Bight 16.7.2010	TF0022/ 004	22	6.67	21.97	0.90	1.32	5.34
Arkona Basin 17.7.2010	TF0113/ 019	46	5.00	15.84	0.71	1.37	2.57
Bornholm Deep 20.7.2010	TF0213/ 041	88	7.53	16.15	0.09	2.33	8.01
Stolpe Channel 20.7.2010	TF0222/ 043	90	5.22	13.67	2.63	1.77	7.99
SE Gotland Basin 20.7.2010	TF0259/ 045	87	5.80	10.72	0.75	2.60	6.70
Gotland Deep 21.7.2010	TF0271/ 052	234	6.36	12.43	-6.17	5.75	0.28
Fårö Deep 22.7.2010	TF0286/ 054	187	6.79	11.93	-4.22	4.95	0.31
Landsort Deep 23.7.2010	TF0284/ 056	436	6.09	10.77	-1.32	3.70	0.22
Karlsö Deep 23.7.2010	TF0245/ 059	105	5.51	10.19	-2.87	4.35	0.30

* Σ NO_2^- + NO_3; NO_2 was present only in traces in most areas under investigation

** Station name see maps (Fig. 1 and 2)


06AK1003 / map all
monitoring
16.07.2010 - 26.07.2010
59 stations / 5 repeated stations
Longitude [°]
Latitude [°]
SWEDEN
DENMARK
GERMANY
POLAND
LATVIA
Ystad
Bornholm
Öland
Gotland
Gdynia
Kaliningrad
map 1
map 2
TF0284
TF0285
TF0240
TF0286
TF0242
TF0270
TF0271
TF0245
TF0272
TF0260
TF0263
TF0250
TF0253
TF0255
TF0259
TF0256
TF0222
TF0210
TF0220
TF0200
TF0211
TF0212
TF0213
TF0221
TF0214
TF0140
TF0142
TF0144
TF0102
TF0145
TF0103
TF0104
TF0069
TF0105
TF0109
TF0113
TF0111
TF0114
TF0112
TF0115
TF0121
TF0030
TF0002
TF0150
TF0152
TF0361
TF0360
TF0010
TF0040
TF0046
TF0011
TF0004
TF0012
TF0042
TF0022
TF0152
0
-30
-60
-90
-120
-150
-180
-210
-240
-270
-300
-330
-360
-390
-420
-450
-480
-510
-540
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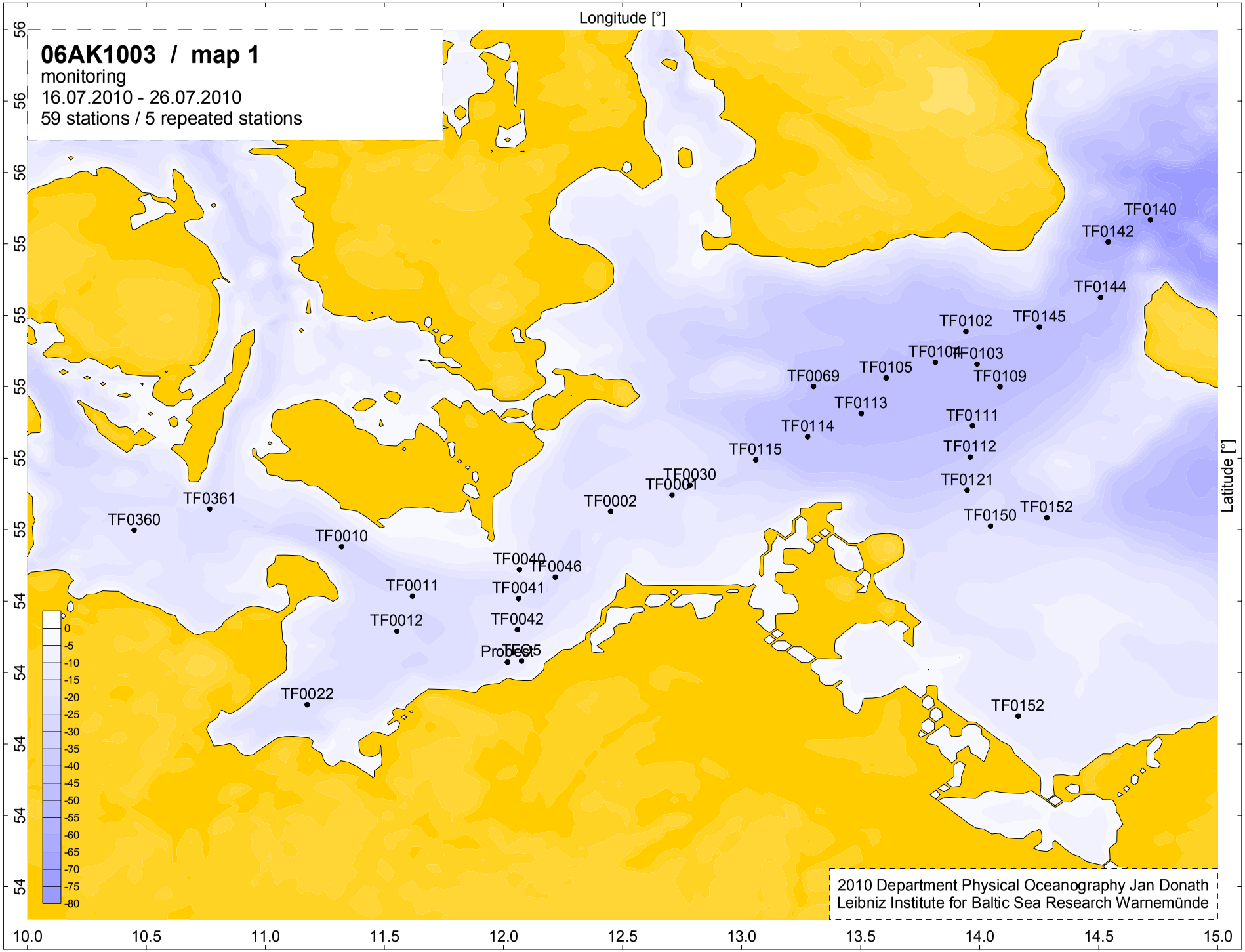
06AK1003 / map 1
monitoring
16.07.2010 - 26.07.2010
59 stations / 5 repeated stations
Longitude [°]
Latitude [°]
TF0140
TF0142
TF0144
TF0102
TF0145
TF0104
TF0103
TF0105
TF0069
TF0109
TF0113
TF0111
TF0114
TF0115
TF0112
TF0030
TF0001
TF0121
TF0361
TF0002
TF0152
TF0360
TF0150
TF0010
TF0040
TF0046
TF0011
TF0041
TF0012
TF0042
TF0005
TF0022
TF0152
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
54
55
56
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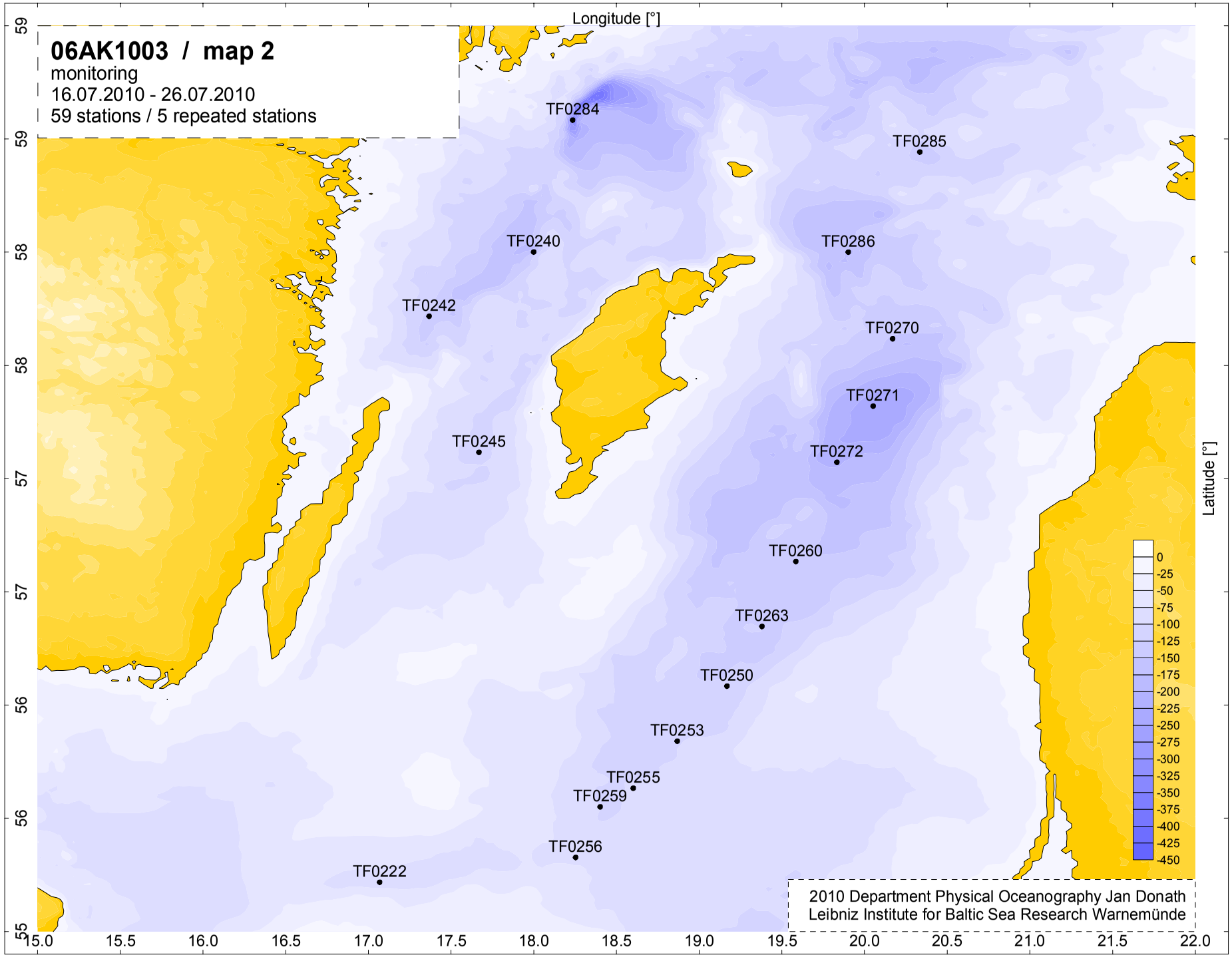
06AK1003 / map 2
monitoring
16.07.2010 - 26.07.2010
59 stations / 5 repeated stations
Longitude [°]
Latitude [°]
TF0284
TF0285
TF0240
TF0286
TF0242
TF0270
TF0271
TF0245
TF0272
TF0260
TF0263
TF0250
TF0253
TF0255
TF0259
TF0256
TF0222
0
-25
-50
-75
-100
-125
-150
-175
-200
-225
-250
-275
-300
-325
-350
-375
-400
-425
-450
59
58
57
56
55
15.0
15.5
16.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
20.5
21.0
21.5
22.0
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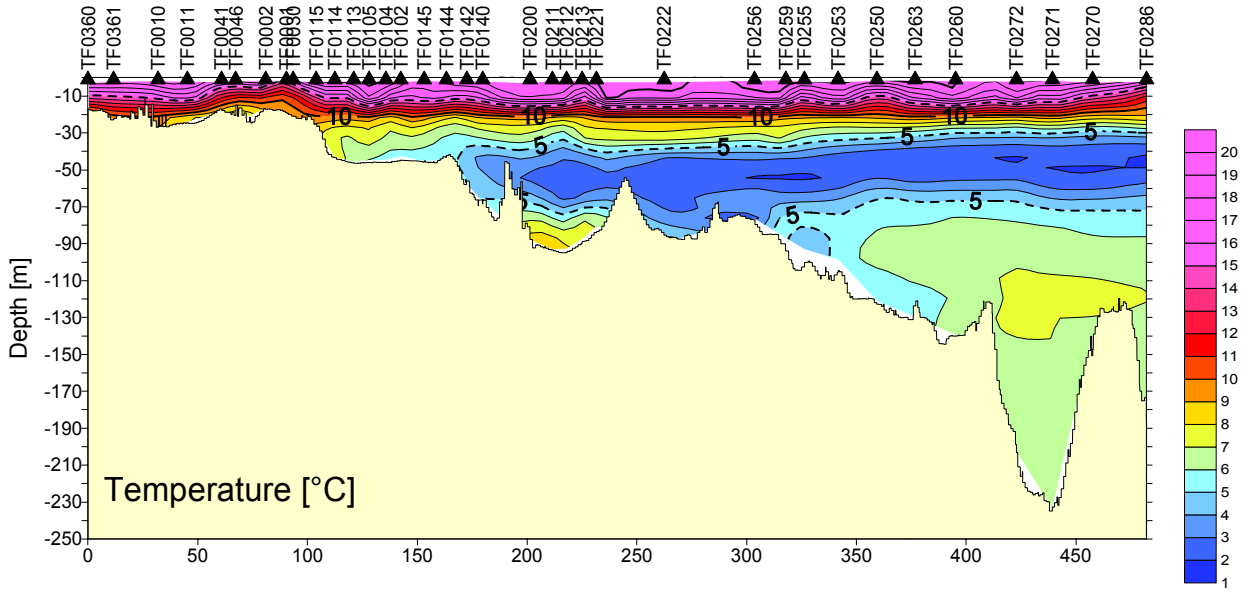
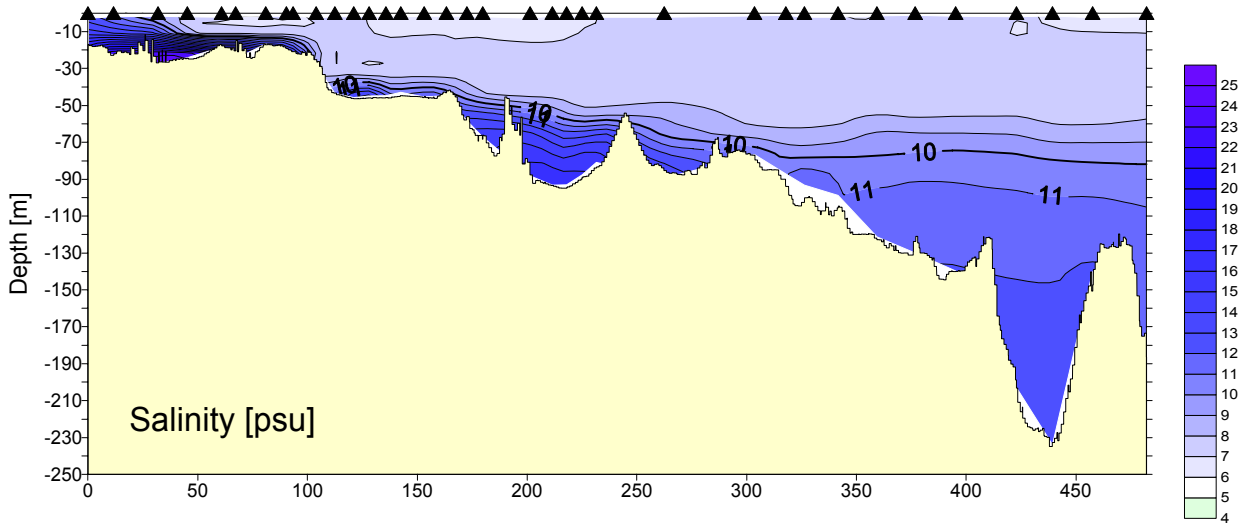
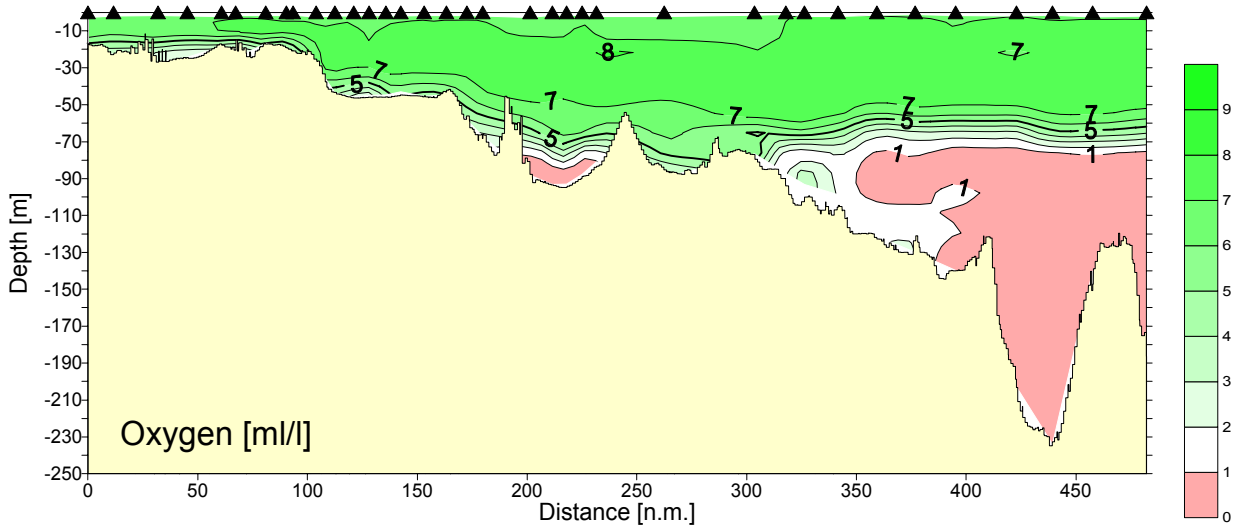
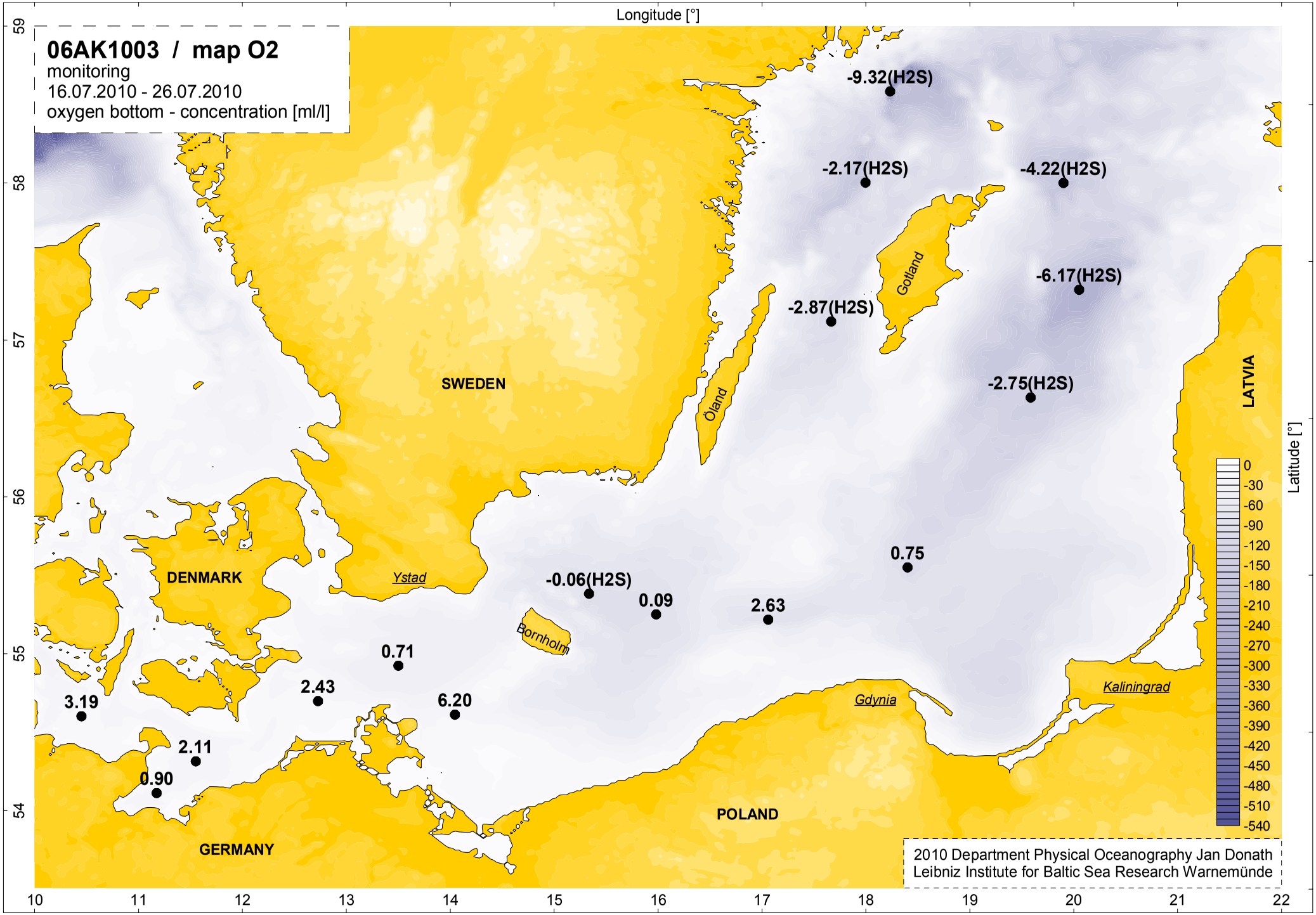
06AK1003

Kiel Bight - Gotland Sea
16.07.2010 19:04 - 22.07.2010 15:02 UTC








06AK1003 / map O2
monitoring
16.07.2010 - 26.07.2010
oxygen bottom - concentration [ml/l]
Longitude [°]
Latitude [°]
-9.32(H2S)
-2.17(H2S)
-4.22(H2S)
-6.17(H2S)
-2.87(H2S)
-2.75(H2S)
-0.06(H2S)
0.75
0.09
2.63
0.71
2.43
6.20
3.19
2.11
0.90
SWEDEN
DENMARK
GERMANY
POLAND
LATVIA
Gotland
Öland
Bornholm
Ystad
Gdynia
Kaliningrad
0
-30
-60
-90
-120
-150
-180
-210
-240
-270
-300
-330
-360
-390
-420
-450
-480
-510
-540
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