Leibniz Institute for Baltic Sea Research Warnemünde

r/v „Heincke“

Monitoring cruise

Cruise- No. 06 / HK / 10 / 02

13th – 20th May 2010

Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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Monitoring cruise Warnemünde 24th May 2010
Cruise No. 06/HK/10/02
r/v „Heincke“

The third monitoring cruise of the Leibniz Institute for Baltic Sea Research Warnemünde in 2010 was carried out with r/v „Heincke“ between May 13th and May 20th 2010. The cruise is part of the German contribution to the HELCOM COMBINE programme and contributes to IOW's long term data series in the central Baltic Sea.

Scientific staff participating:

Günther Nausch (scientist in charge)	13.05. – 20.05.2010
Jan Donath	13.05. – 20.05.2010
Anna Hagenmeier	13.05. – 20.05.2010
Jenny Jeschek	13.05. – 20.05.2010
Lars Kreuzer	13.05. – 20.05.2010
Lars Kumala	13.05. – 20.05.2010
Günter Plüschke	13.05. – 20.05.2010
Stefan Weinreben	13.05. – 20.05.2010

The area under investigation covered the Baltic Sea between Kiel Bight and the northern Gotland Sea. Marine meteorological, hydrographic, hydrochemical and hydrobiological investigations were performed according to the COMBINE programme of HELCOM. The station map is attached to this report.

The weather situation during the cruise was dominated by a low located over central Europe and the southern part of Scandinavia. Wind speed was moderate, normally 3-4 Bft from varying directions and increased only occasionally to Bft 5 allowing good working conditions throughout the whole cruise. Air temperature varied only slightly during day and night. On average 6-7°C were measured.

The following hydrographic and hydrochemical characteristics have been observed during the cruise (cf. Tables 1 and 2 and Figs. 3 and 4):

- Surface temperatures varied between 8.70°C (Lübeck Bight) and 4.87°C (Karlsö Deep). Despite the cold and long winter, temperatures are above the long term mean for the period 1971-1990 (in brackets). Exceptions are the Bornholm Basin and the Karlsö Deep.

Lübeck Bight	..8.60°C (4.71°C)
Arkona Basin	5.65°C (4.30°C)
Bornholm Deep	5.81°C (6.12°C)
Gotland Deep	6.24°C (5.62°C)
Farö Deep	6.89°C (5.20°C)
Landsort Deep	5.74°C (4.76°C)
Karlsö Deep	4.87°C (6.76°C)

- The major Baltic inflow from January 2003 was the last strong inflow event into the Baltic Sea. In the Bornholm and Gdansk Basin baroclinic inflow events influenced the deep water conditions in the following years. Thus, the deep water of the Bornholm Basin was free of hydrogen sulphide during the present cruise. However, the effects of these inflows could not influence the deep basins around Gotland. Thus, the stagnation period continues there documented by decreasing salinity in the bottom layer with the exception of the Karlsö Deep

	May 2006	May 2007	May 2008	May 2009	May 2010
Gotland Deep	12.64 psu	12.89 psu	12.68 psu	12.54 psu	12.44psu
Farö Deep	12.11 psu	12.13 psu	12.13 psu	12.13 psu	11.77psu
Landsort Deep	11.01 psu	11.04 psu	10.91 psu	10.84 psu	10.77psu
Karlsö Deep	10.13 psu	10.13 psu	9.98 psu	10.00 psu	10.16psu

- The oxygen situation in the deep water of these basins documented this stagnation period. Hydrogen sulphide concentrations (expressed as negative oxygen equivalents) in the near-bottom layer increased in the eastern Gotland Basin (Gotland and Farö Deep), remained relatively stable in the Landsort Deep and increased in the Karlsö Deep as well. Hydrogen sulphide concentrations were among the highest recorded so far.

- Also the vertical extension of the hydrogen sulphide is remarkable. At stations 271 (Gotland Deep) and 286 (Farö Deep) hydrogen sulphide was found between around 130 m and the bottom. At station 284 (Landsort Deep) the layer between 80 m and the bottom (431 m) was anoxic.
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	May 2006	May 2007	May 2008	May 2009	May 2010
Gotland Deep	-3.61 ml/l	- 0.14 ml/l	- 4.25 ml/l	- 5.33 ml/l	-8.60 ml/l
Farö Deep	- 2.33 ml/l	- 1.37 ml/l	- 2.47 ml/l	- 1.27 ml/l	-4.83 ml/l
Landsort Deep	- 0.50 ml/l	- 0.71 ml/l	- 1.81 ml/l	- 1.34 ml/l	-1.18 ml/l
Karlsö Deep	- 0.86 ml/l	- 1.09 ml/l	- 1.57 ml/l	- 0.71 ml/l	-2.88 ml/l

- As a result of the major Baltic inflow 2003, bottom water temperature had decreased in the Baltic deep water. Meanwhile, several baroclinic inflow events have increased the temperature again exceeding the long-term mean again. This is especially evident in the Bornholm Basin whereas these inflows affected the more central basins only marginally if any. Thus bottom temperatures remained more or less unchanged in the eastern Gotland Basin, but increased somewhat in the western Gotland Basin.

	May 2007	May 2008	May 2009	May 2010	Mean 1971/90
Bornholm D.	9.25 °C	7.15 °C	8.66 °C	8.88°C	6.12 °C
Gotland Deep	6.88 °C	6.45 °C	6.31 °C	6.33°C	5.62 °C
Farö Deep	6.01 °C	6.16 °C	6.74 °C	6.78°C	5.20 °C
Landsort D.	5.68 °C	5.61 °C	5.71 °C	6.06°C	4.76 °C
Karlsö Deep	5.14 °C	5.18 °C	5.32 °C	5.49°C	4.18 °C

- The nutrient situation in the surface layer was characteristic for the season. The spring phytoplankton bloom had exhausted the nitrate reservoir of the surface layer whereas measurable concentrations of phosphate remained (table 1). Only in the Landsort Deep area an ongoing phytoplankton bloom had consumed phosphate as well.

- In the deep waters of the central basins, the hydrographic situation is mirrored. Oxygenation of the Bornholm Basin deep water caused low phosphate and ammonium concentrations and high nitrate values. The permanent stagnation caused the absence of nitrate and very high phosphate and ammonium concentrations in the eastern and western Gotland Basin (table 2).

Attachments

Tables 1 and 2: Preliminary results of selected parameters in the surface layer and the near bottom layer (unvalidated results)
Figs. 1-2: Track charts
Fig. 3: Transect from the Kiel Bight to the northern Gotland Basin for temperature, salinity and oxygen (unvalidated data)
Fig. 4: Oxygen/hydrogen sulphide in the bottom near layer for selected stations

Günther Nausch

Scientist in charge

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

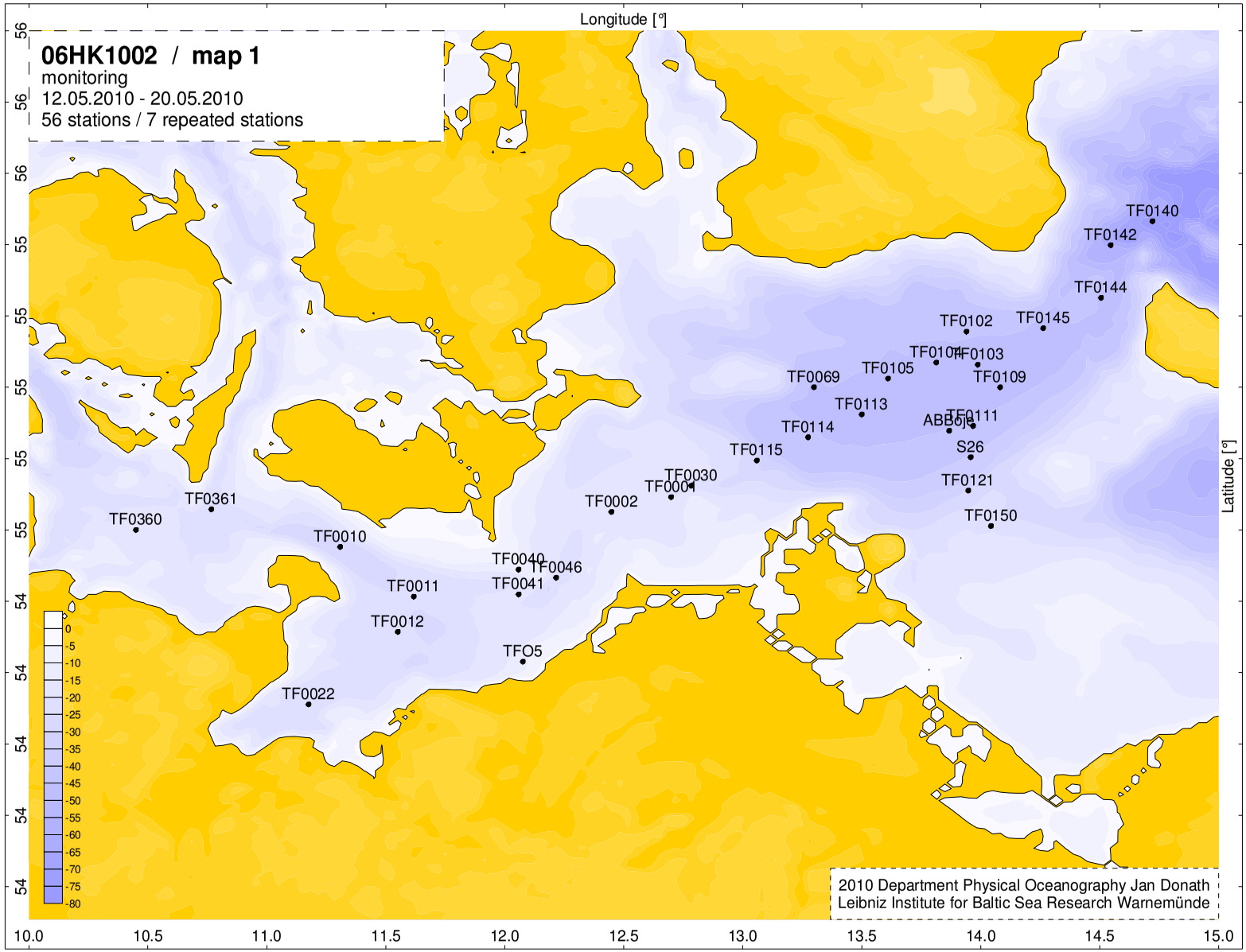
Area Date	Stat. Name/No.*	Temp. °C	Sal. psu	O_2 ml/l	PO4	NO23 µmol/l	SiO4
Kiel Bight 13.05.2010	360/0004	8.70	12.71	7.56	0.08	0.08	..3.5
Meckl.Bight 13.05.2010	012/0002	7.01	. 8.39	7.93	0.12	0.01	4.8
Lübeck Bight 13.05.2010	022/0003	8.67	11.47	7.57	0.00	0.07	3.0
Darss Sill 14.05.2010	030/0013	6.91	7.57	8.10	0.18	0.00	4.7
Arkona Basin 14.05.2010	113/0017	5.65	7.35	8.55	0.20	0.00	7.6
Bornholm Deep 15.05.2010	213/0035	5.81	7.17	9.01	0.15	0.00	..8.9
Stolpe Channel 15.05.2010	222/0038	5.72	7.05	8.80	0.10	0.02	..8.8
SE Gotland Basin 15.05.2010	259/0040	5.60	7.22	9.29	0.15	0.04	..9.4
Gotland Deep 16.05.2010	271/0047	6.24	6.88	9.66	0.14	0.01	8.7
Farö Deep 17.05.2010	286/0049	6.89	6.79	9.57	0.11	0.00	8.7
Landsort Deep 17.05.2010	284/0051	5.74	5.86	9.69	0.00	0.03	..7.1
Karlsö Deep 18.05.2010	245/0054	4.87	6.59	9.63	0.05	0.05	8.0

* see attached map

Table 2: Near bottom layer

Area Date	Stat. Name/No.*	Depth m	Temp. °C	Sal. psu	O_2 ml/l	PO4	NO23 µmol/l	SiO4
Kiel Bight 13.05.2010	360/0004	16	4.93	19.49	6.30	0.26	0.42	..7.0
Meckl.Bight 13.05.2010	012/0002	23	4.79	24.13	3.82	0.73	2.06	25.0
Lübeck Bight 13.05.2010	022/0003	22	3.15	20.64	4.09	0.35	0.56	11.2
Darss Sill 14.05.2010	030/0013	20	4.93	17.71	5.24	0.38	0.20	11.4
Arkona Basin 14.05.2010	113/0017	45	3.52	18.64	7.19	0.26	0.00	7.6
Bornholm Deep 15.05.2010	213/0035	87	8.88	16.55	0.39	1.67	..9.01	49.2
Stolpe Channel 15.05.2010	222/0038	88	6.26	14.06	2.94	1.60	5.26	36.2
SE Gotland Basin 15.05.2010	259/0040	87	5.78	12.72	3.29	1.50	..4.09	32.6
Gotland Deep 16.05.2010	271/0047	233	6.33	12.44	-8.60**	6.40	0	85.0
Farö Deep 17.05.2010	286/0049	192	6.78	11.77	-4.83**	3.10	0	74.9
Landsort Deep 17.05.10	284/0051	431	6.06	10.77	-1.18**	5.00	0	58.2
Karlsö Deep 18.05.2010	245/0054	108	5.49	10.16	-2.88**	4.75	0	64.0

* see attached map
** hydrogen sulphide was converted into negative oxygen equivalents


06HK1002 / map 1
monitoring
12.05.2010 - 20.05.2010
56 stations / 7 repeated stations
Longitude [°]
Latitude [°]
TF0140
TF0142
TF0144
TF0102
TF0145
TF0104
TF0103
TF0105
TF0069
TF0109
TF0113
TF0111
ABB6J
TF0114
S26
TF0115
TF0030
TF0001
TF0121
TF0361
TF0002
TF0360
TF0150
TF0010
TF0040
TF0046
TF0011
TF0041
TF0012
TFO5
TF0022
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
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10.0
10.5
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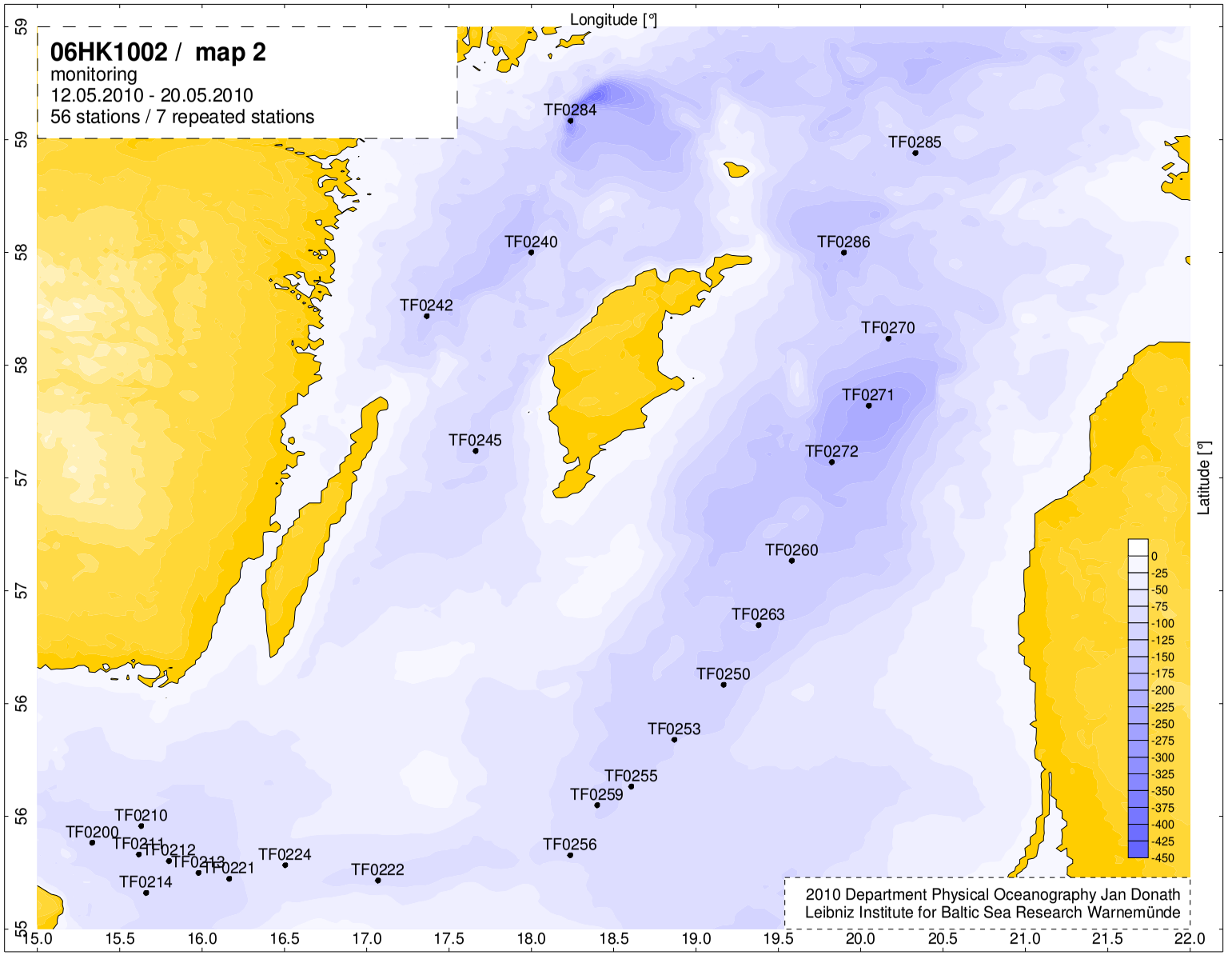
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
56
55
54


06HK1002 / map 2
monitoring
12.05.2010 - 20.05.2010
56 stations / 7 repeated stations
Longitude [°]
Latitude [°]
TF0284
TF0285
TF0240
TF0286
TF0242
TF0270
TF0271
TF0245
TF0272
TF0260
TF0263
TF0250
TF0253
TF0255
TF0259
TF0256
TF0210
TF0200
TF0211
TF0212
TF0213
TF0221
TF0224
TF0222
TF0214
0
-25
-50
-75
-100
-125
-150
-175
-200
-225
-250
-275
-300
-325
-350
-375
-400
-425
-450
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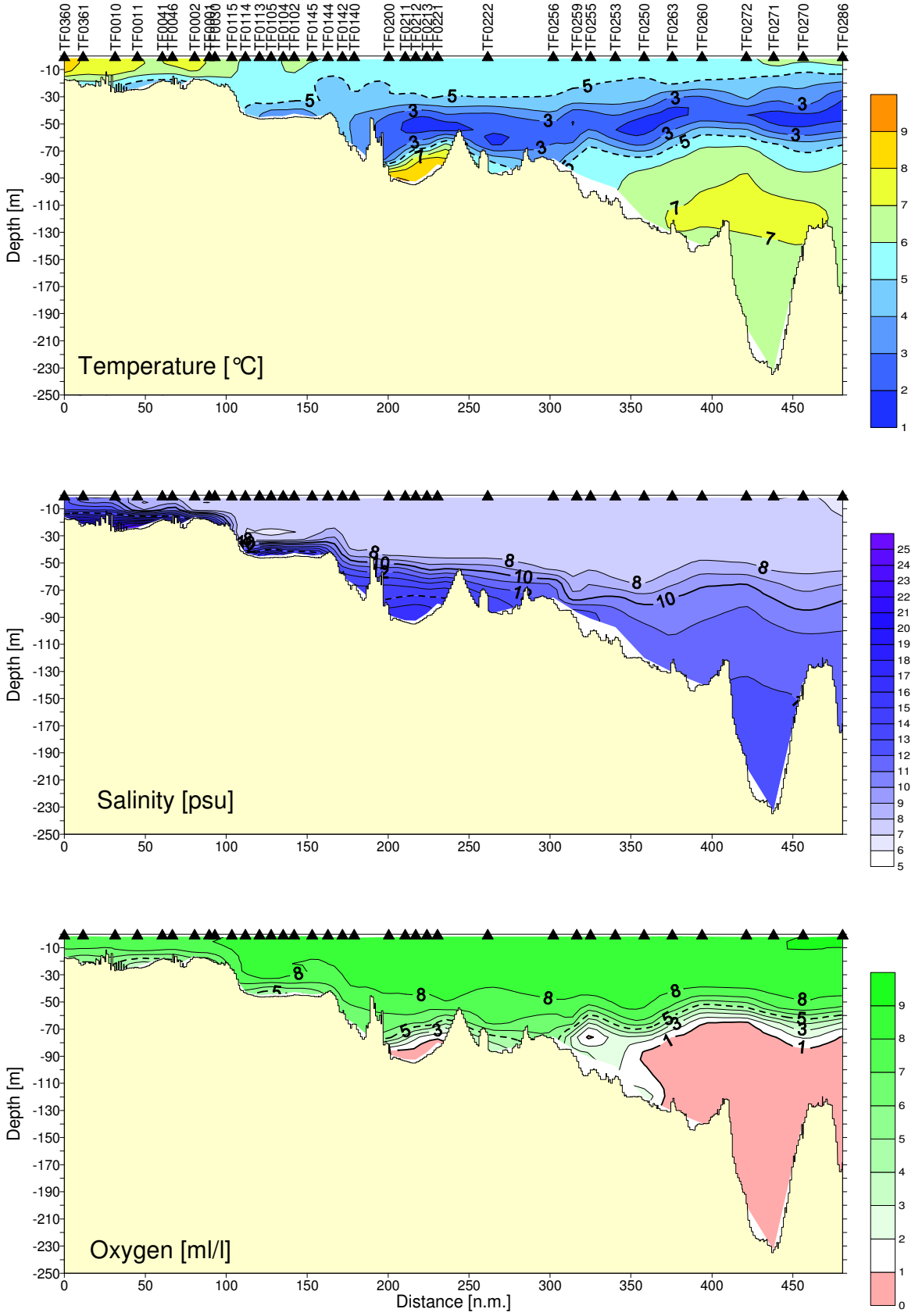
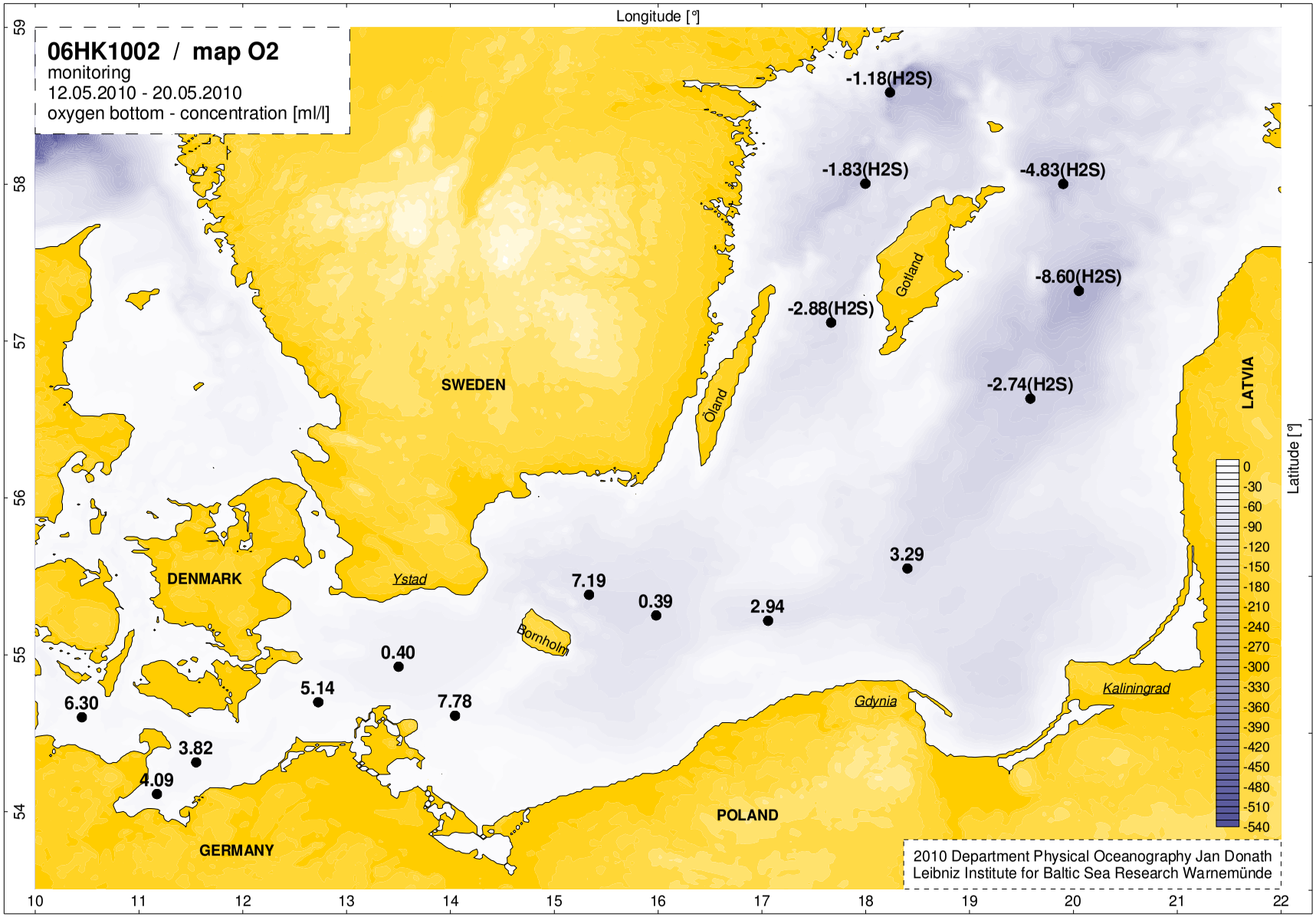
06HK1002

monitoring - Kiel Bight - Gotland Sea
13.05.2010 16:49 - 17.05.2010 12:09 UTC




06HK1002 / map O2
monitoring
12.05.2010 - 20.05.2010
oxygen bottom - concentration [ml/l]
Longitude [°]
Latitude [°]
-1.18(H2S)
-1.83(H2S)
-4.83(H2S)
-8.60(H2S)
-2.88(H2S)
-2.74(H2S)
3.29
7.19
0.39
2.94
0.40
5.14
7.78
6.30
3.82
4.09
SWEDEN
DENMARK
GERMANY
POLAND
LATVIA
Gotland
Öland
Bornholm
Ystad
Gdynia
Kaliningrad
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-90
-120
-150
-180
-210
-240
-270
-300
-330
-360
-390
-420
-450
-480
-510
-540
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