Institut für Ostseeforschung Warnemünde

an der Universität Rostock BALTIC SEA RESEARCH INSTITUTE

Baltic Sea Research Institute Warnemünde

r/v „Professor Albrecht Penck“

Monitoring cruise

Cruise- No. 07/PE/07/10

04th May – 12th May 2007

Kiel Bight to northern Gotland Sea

this report is based on preliminary data

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Monitoring cruise — Warnemünde
CruiseNo. 07PE0710 (r/v "Professor Albrecht Penck") — 14st July 2007

The third monitoring cruise in 2007 performed by the Baltic Sea Research Institute Warnemünde in the frame of the HELCOM COMBINE program was carried out with r/v „Professor Albrecht Penck" between May 04th and May 12th 2007.

Scientific staff participating:

Günther Nausch (scientist in charge)	04.05. – 12.05.2007
Susanne Busch	04.05. – 12.05.2007
Jan Donath	04.05. – 12.05.2007
Bernd Sadkowiak	04.05. – 12.05.2007
Ingo Schuffenhauer	04.05. – 12.05.2007
Sven Trinkler	04.05. – 12.05.2007

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 program of HELCOM. The station map is attached to this report.

During the first part of the cruise weather was influenced by a high pressure cell with its centre over the Gulf of Bothnia. Air pressure varied only slightly around 1015 hPa. Wind speed was generally low, mostly between 2-3 Bft, only occasionally up to 4 Bft. Weather was sunny and air temperature ranged between 5°C and 10°C. The second part of the cruise was influenced by a change of lows passing from west to east over the area under investigation causing strongly undulating air pressure. However, wind speed remained low with the exception of two short periods when wind increased up to 6-7 Bft.

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 13.90°C (Kiel Bight) and 5.57°C (Farö Deep) and are well above the long term mean for the period 1971-1990 (in brackets). The reason can be seen in the extremely mild winter and unusually warm and sunny months March and especially April.

Lübeck Bight	10.53°C (4.71°C)
Arkona Basin	8.02°C (4.30°C)
Bornholm Deep	7.35°C (6.12°C)
Gotland Deep	6.10°C (5.62°C)
Farö Deep	5.57°C (5.20°C)
Landsort Deep	6.25°C (4.76°C)

- The major Baltic inflow from January 2003 was the last strong inflow event into the Baltic Sea. The deep basins were additionally influenced by a warm summer inflow in 2003. The

effects of these events phased out and a new stagnation period started already in 2005 and continued in 2006 in all deep basins of the central Baltic Sea. Weak baroclinic inflow activity in 2006 temporarily eased the stagnation conditions up to the eastern Gotland Basin indicated by a remarkable increase in the near bottom layer salinity. Salinity in the other deeps of the central Baltic Sea remained unchanged during the last year.

	May 2006	March 2007	May 2007
Gotland Deep	12.64 psu	12.63 psu	12.89 psu
Farö Deep	12.11 psu	12.18 psu	12.13 psu
Landsort Deep	11.01 psu	11.06 psu	11.04 psu
Karlsö Deep	10.13 psu	10.10 psu	10.13 psu

- This small inflow is reflected also in decreasing hydrogen sulphide concentrations (expressed as negative oxygen equivalents) in the bottom layer of the eastern Gotland Basin. At 225 m water depth even traces of oxygen (0.02 – 0.04 ml/l) replaced the anoxic conditions.

	May 2006	March 2007	May 2007
Gotland Deep	- 3.61 ml/l	- 2.45 ml/l	- 0.14 ml/l
Farö Deep	- 2.33 ml/l	- 0.95 ml/l	- 1.37 ml/l
Landsort Deep	- 0.50 ml/l	- 0.45 ml/l	- 0.71 ml/l
Karlsö Deep	- 0.86 ml/l	- 0.61 ml/l	- 1.09 ml/l

- But, in general the stagnation period is continuing and covers wide areas in the deep basins. Thus, at station 271 (Gotland Deep) with the above mentioned exception, hydrogen sulphide was found between around 137 m and the bottom, and at station 286 (Karlsö Deep) the layer between 120 m and the bottom was anoxic. Especially extreme was the situation at station 284 (Landsort Deep). Already in 80 m water depth a hydrogen sulphide concentration of – 0.38 ml/l was measured. The whole water body below that depth was anoxic.

- 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. Whereas in the northern and western Gotland Basin no clear changes could be observed within the last year, the above mentioned inflow event has increased the near bottom temperature by 0.90 °C since the last cruise.

	May 2006	March 2007	May 2007	Mean 1971/1990
Gotland Deep	5.94 °C	5.98 °C	6.88 °C	5.62 °C
Farö Deep	6.09 °C	6.01 °C	6.01 °C	5.20 °C
Landsort Deep	5.73 °C	5.68 °C	5.68 °C	4.76 °C
Karlsö Deep	5.13 °C	5.12 °C	5.14 °C	4.18 °C

- The nutrient situation in the bottom near layer reflects the present stagnation period. The phosphate and silicate as well as the ammonium concentrations in the anoxic water layers increased further compared to the observation in March 2007. In contrast, the slight ventilation in the Gotland Deep caused decreasing phosphate and ammonium concentrations in these layers.

- The nutrient situation in the surface layer reflects the development in spring. In the whole area under investigation, the nitrate reservoir is completely exhausted. Due to the low N/P ratio in winter, phosphate remains after the spring bloom. However, it is noticeable that in nearly all areas this amount is relatively high compared to long term observations. Phosphate surface values range between 0.24 µmol/l in the eastern Gotland Basin and 0.51 µmol/l in the Bornholm Basin. Only the Lübeck Bight shows lower concentrations (Table 1).

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	PO_4^{3-}	NO_{23}^{-} * µmol/l	SiO_4
Kiel Bight 04.05.2007	360/0002	13.90	13.98	0.34	0	2.6
Meckl.Bight 05.05.2007	012/0007	9.68	8.85	0.35	0.06	12.9
Lübeck Bight 05.05.2007	022/0006	10.53	12.50	0.06	0	5.8
Arkona Basin 06.05.2007	113/0020	8.02	8.02	0.34	0	11.6
Bornholm Deep 07.05.2007	213/0035	7.35	7.60	0.51	0.13	16.0
Stolpe Channel 07.05.2007	222/0037	7.09	7.60	0.36	0.03	12.2
SE Gotland Basin 07.05.2007	259/0039	6.40	7.34	0.28	0.03	9.8
Gotland Deep 08.05.2007	271/0046	6.10	7.25	0.24	0.05	10.4
Farö Deep 08.05.2007	286/0048	5.57	7.14	0.26	0	12.2
Landsort Deep 09.05.2007	284/0050	6.25	6.81	0.31	0	15.2
Karlsö Deep 10.05.2007	245/0053	6.99	7.04	0.38	0	15.4

* $\sum NO_2^- + NO_3^-$
** see attached map

Table 2: Near bottom layer

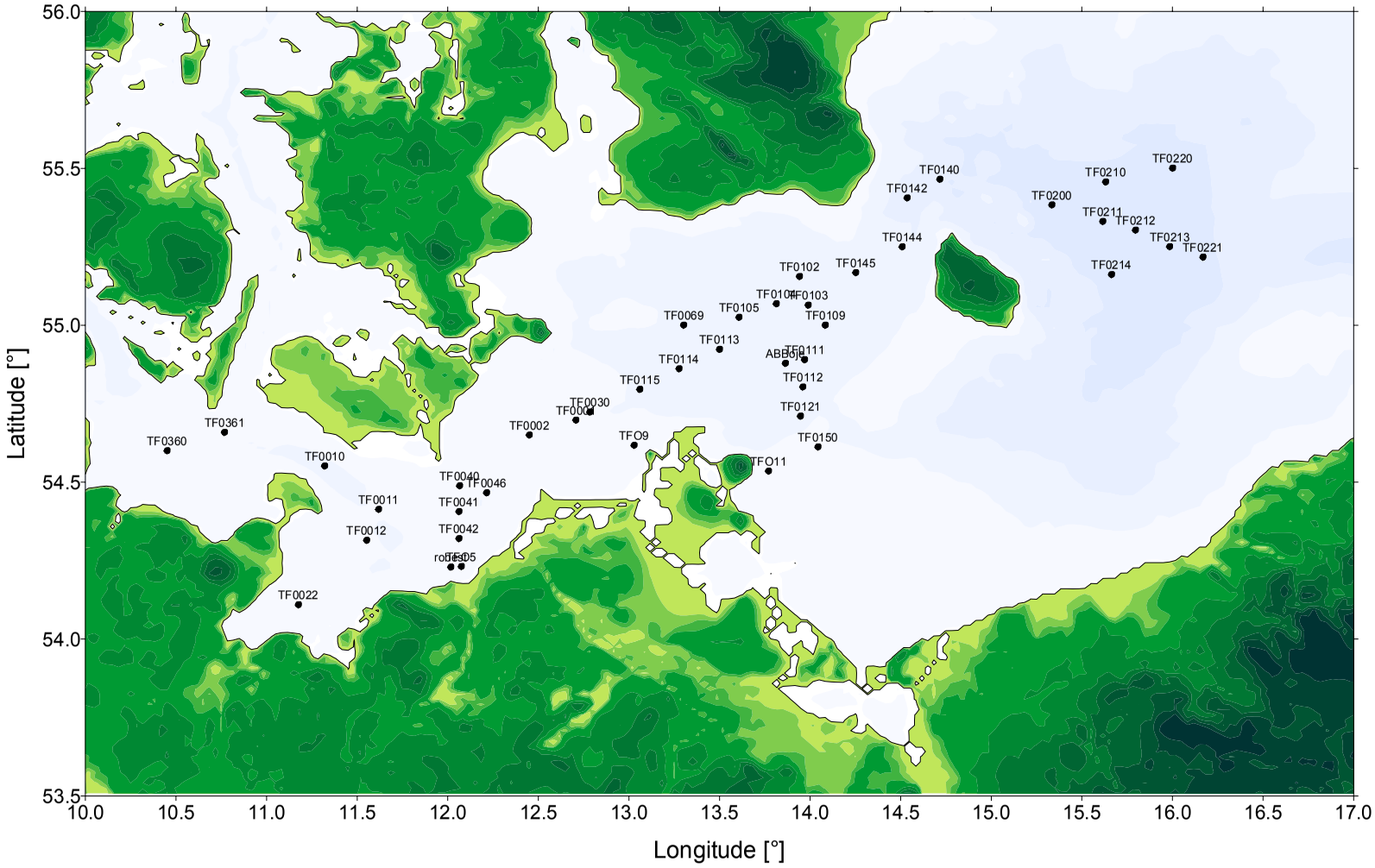
Area Date	Stat. Name/No.**	Depth m	Temp. °C	Sal. psu	O_2 ml/l	PO_4^{3-}	NO_{23}^{-} * µmol/l	SiO_4
Kiel Bight 04.05.2007	360/0002	17	9.68	15.78	7.26	0.05	0	3.0
Meckl.Bight 05.05.2007	012/0007	23	9.68	8.85	5.35	0.25	0.26	18.2
Lübeck Bight 05.05.2007	022/0006	20	10.53	12.50	4.82	0.11	2.67	10.1
Arkona Basin 06.05.2007	113/0020	43	5.57	17.83	3.73	0.46	1.96	14.7
Bornholm Deep 07.05.2007	213/0035	86	9.25	16.40	0.08	2.46	9.58	63.6
Stolpe Channel 07.05.2007	222/0037	88	8.01	14.24	2.03	1.50	8.82	37.5
SE Gotland Basin 07.05.2007	259/0039	84	5.81	11.19	0.33	2.98	6.14	50.4
Gotland Deep 08.05.2007	271/0046	231	6.88	12.89	-0.14	2.90	0	54.5
Farö Deep 08.05.2007	286/0048	188	6.01	12.13	-1.37	4.05	0	60.6
Landsort Deep 09.05.2007	284/0050	437	5.68	11.04	- 0.71	3.60	0	56.3
Karlsö Deep 10.05.2007	245/0053	105	5.14	10.13	-1.09	3.90	0	57.8

* $\sum NO_2^- + NO_3^-$
** see attached map

07PE0710 monitoring

station map 1
04.05.2007 07:49 UTC - 11.05.2007 11:39 UTC
20 Stationen

Figure 1



K1.srf

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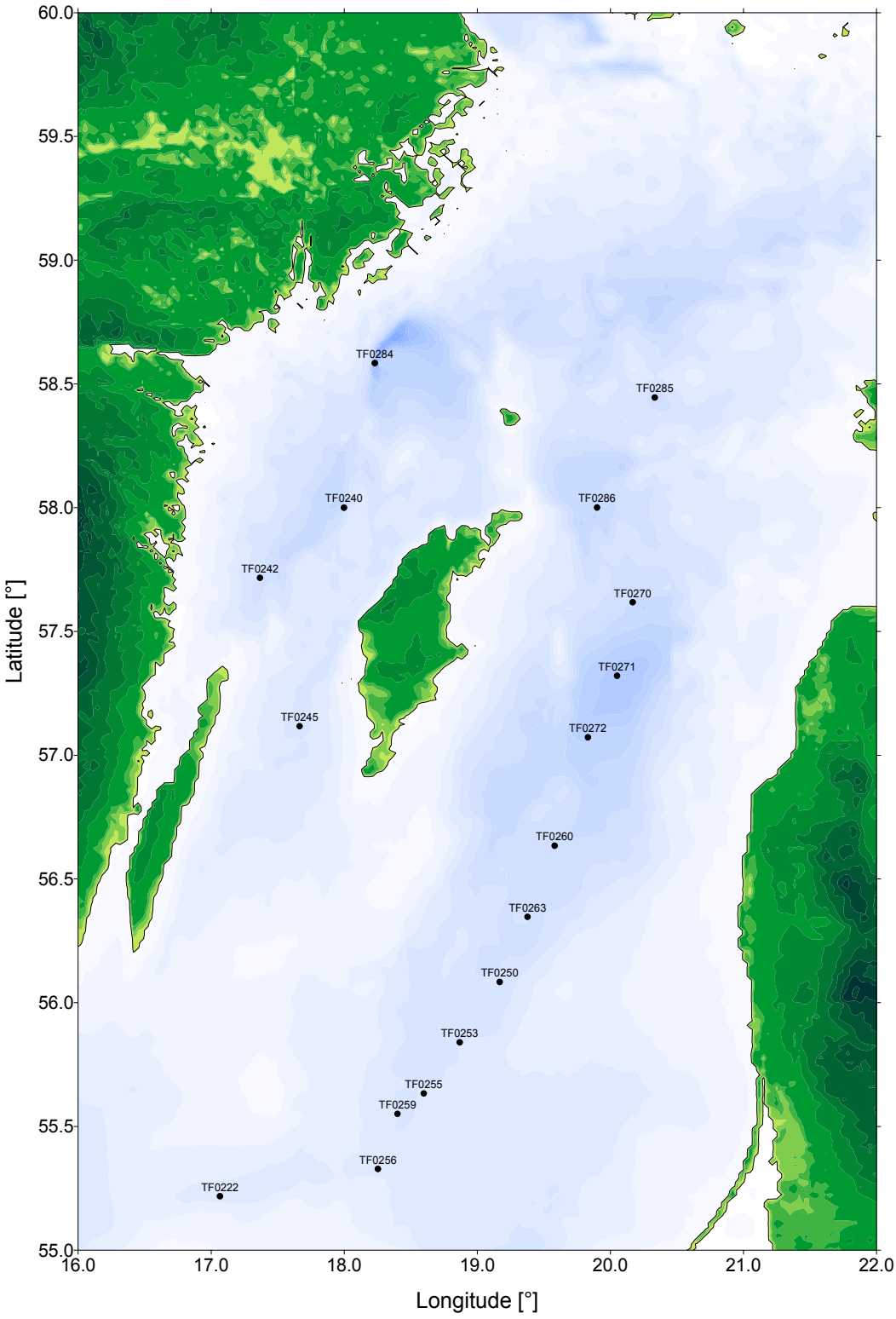
Figure 2

07PE0710 monitoring

station map 2
07.05.2007 07:37 UTC - 10.05.2007 00:16 UTC
17 Stationen



K2.srf

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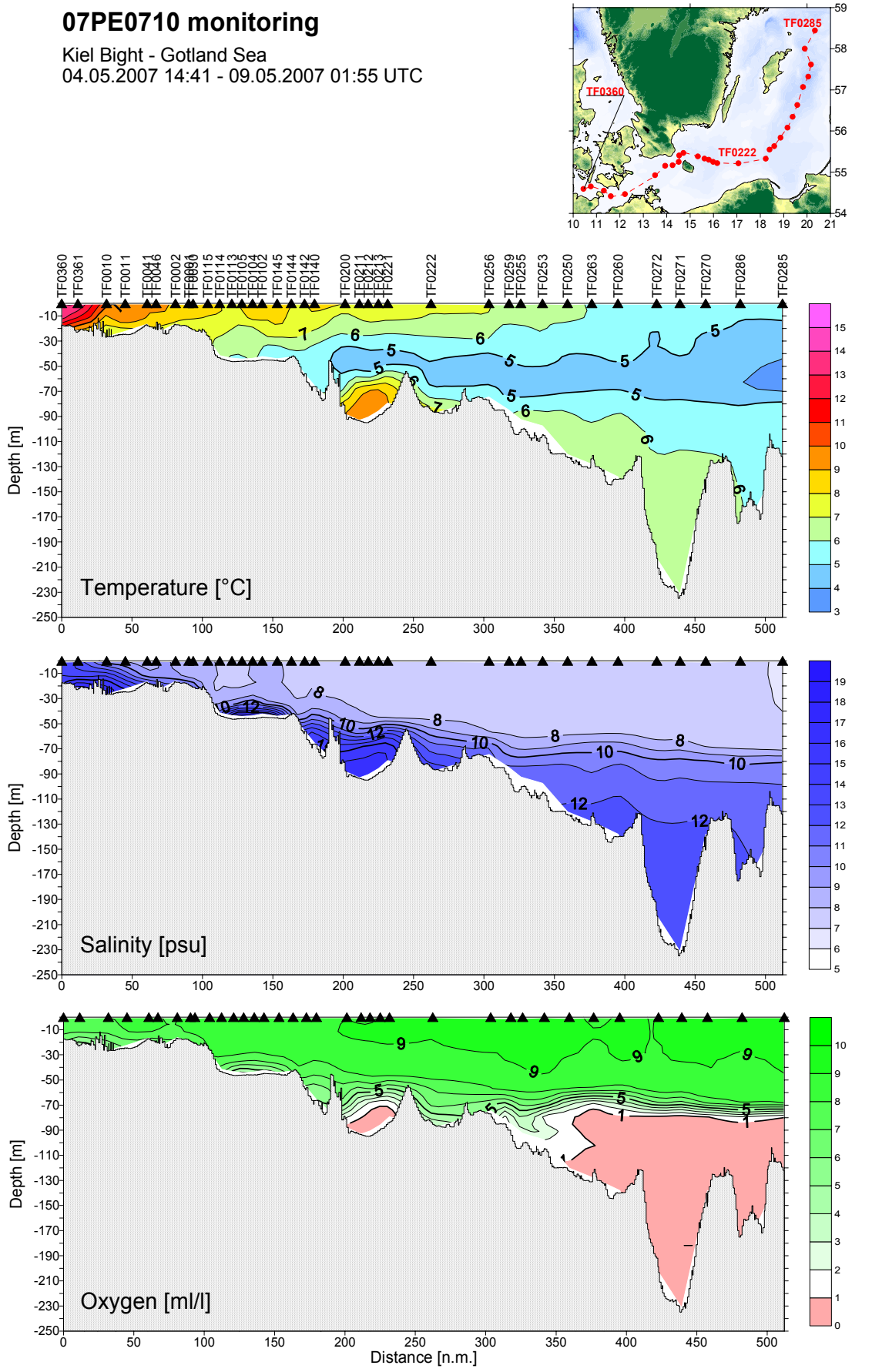
Figure 3


07PE0710 monitoring
Kiel Bight - Gotland Sea
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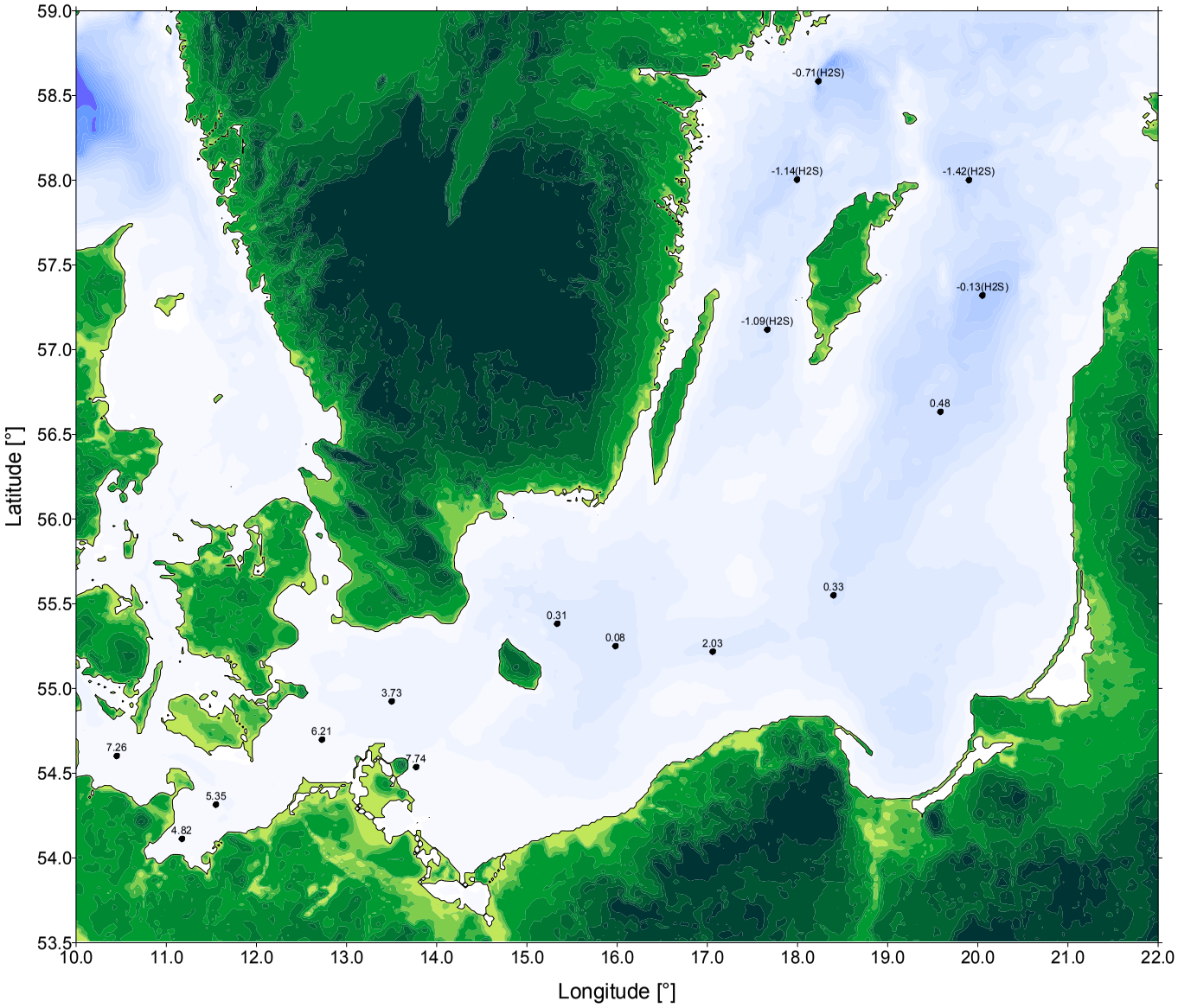
TF0285
TF0360
TF0222
Temperature [°C]
Salinity [psu]
Oxygen [ml/l]
Depth [m]
Distance [n.m.]

Figure 4

Monitoring
07PE0710
04.05. - 14.05.2007

oxygen bottom
concentration [ml/l]



O2.srf

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