Leibniz Institute for Baltic Sea Research Warnemünde

VWFS „DENEB“

Monitoring cruise

Cruise- No. 06 / JK / 11 / 01

10th – 18th May 2011

Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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Monitoring cruise Warnemünde 20th May 2011
Cruise No. 06/JK/11/01
VWFS „DENEB“

The third monitoring cruise of the Leibniz Institute for Baltic Sea Research Warnemünde in 2011 was carried out with VWFS „DENEB“ between May 10th and May 19th 20110. 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.

Scientific staff participating:

Günther Nausch (scientist in charge)	10.05. – 18.05.2011
Jan Donath	10.05. – 18.05.2011
Anna Hagenmeier	10.05. – 18.05.2011
Jenny Jeschek	10.05. – 18.05.2011
Jingling Ren	10.05. – 18.05.2011
Birgit Sadkowiak	10.05. – 18.05.2011
Klaus-Peter Wlost	10.05. – 18.05.2011

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 high pressure cell located over Scandinavia. Air pressure varied between 1020 and 1012 hPa. 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 7-9°C were measured.

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

- Surface temperatures varied between 11.53°C (Lübeck Bight) and 5.64°C (Farö Deep). Despite the cold winter, temperatures are well above the long term mean for the period 1971-1990 (in brackets). This is mainly due to a long lasting high pressure period over the Baltic in April and May with sunny days warming up the surface layer, but steep temperature decrease downwards.

Lübeck Bight	11.53°C (4.71°C)
Arkona Basin	8.92°C (4.30°C)
Bornholm Deep	6.97°C (6.12°C)
Gotland Deep	6.91°C (5.62°C)
Farö Deep	5.64°C (5.20°C)
Landsort Deep	7.37°C (4.76°C)
Karlsö Deep	6.85°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 as already during the whole year 2010. However, the effects of these inflows could not influence the deep basins around Gotland. Thus, the stagnation period continues there documented by further decreasing salinity in the bottom layer, with the exception of the Farö Deep.

	May 2007	May 2008	May 2009	May 2010	May 2011
Gotland Deep	12.89 psu	12.68 psu	12.54 psu	12.44psu	12.27psu
Farö Deep	12.13 psu	12.13 psu	12.13 psu	11.77psu	11.88psu
Landsort Deep	11.04 psu	10.91 psu	10.84 psu	10.77psu	10.65psu
Karlsö Deep	10.13 psu	9.98 psu	10.00 psu	10.16psu	10.02psu

- The oxygen situation in the deep water of these basins documented this stagnation period. However, hydrogen sulphide concentrations (expressed as negative oxygen equivalents) in the near-bottom layer did not increased further, with the exception of the Landsort Deep.

	May 2007	May 2008	May 2009	May 2010	May 2011
Gotland Deep	- 0.14 ml/l	- 4.25 ml/l	- 5.33 ml/l	-8.60 ml/l	-5.63 ml/l
Farö Deep	- 1.37 ml/l	- 2.47 ml/l	- 1.27 ml/l	-4.83 ml/l	-3.62 ml/l
Landsort Deep	- 0.71 ml/l	- 1.81 ml/l	- 1.34 ml/l	-1.18 ml/l	-1.67 ml/l
Karlsö Deep	- 1.09 ml/l	- 1.57 ml/l	- 0.71 ml/l	-2.88 ml/l	-1.25 ml/l

- 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 135 m and the bottom. At station 284 (Landsort Deep) the layer between 100 m and the bottom (431 m) was anoxic. But, the vertical extension increased not further compared to the last year.

  Thus, oxygen situation remains worse in the central deep basin, but without further worsening.

- 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. In the Bornholm Basin, cold inflows decreased the bottom temperature compared to last year and also to the preceding cruise in March 2011. The bottom temperatures remained more or less unchanged in the basins around Gotland.

	May 2007	May 2008	May 2009	May 2010	May 2011	**Mean 1971/90**
Bornholm D.	9.25 °C	7.15 °C	8.66 °C	8.88°C	6.33°C	**6.12 °C**
Gotland Deep	6.88 °C	6.45 °C	6.31 °C	6.33°C	6.44°C	**5.62 °C**
Farö Deep	6.01 °C	6.16 °C	6.74 °C	6.78°C	6.45°C	**5.20 °C**
Landsort D.	5.68 °C	5.61 °C	5.71 °C	6.06°C	6.02°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). But, the intensive late spring bloom, seen also in the high oxygen concentrations, has decreased the phosphate reservoir more the in the last years, having mostly concentrations below 0.10 µM.

- 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). Also silicate is enriched.

Attachments

Tables 1 and 2: Preliminary results of selected parameters in the surface layer and the deep water layer (standard depths) - (invalidated results)
Figs. 1-3: Track charts
Fig. 4: Oxygen/hydrogen sulphide in the bottom near layer for selected stations
Fig. 5: Transect from the Kiel Bight to the northern Gotland Basin for temperature, salinity and oxygen (invalidated data)

Günther Nausch

Scientist in charge

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

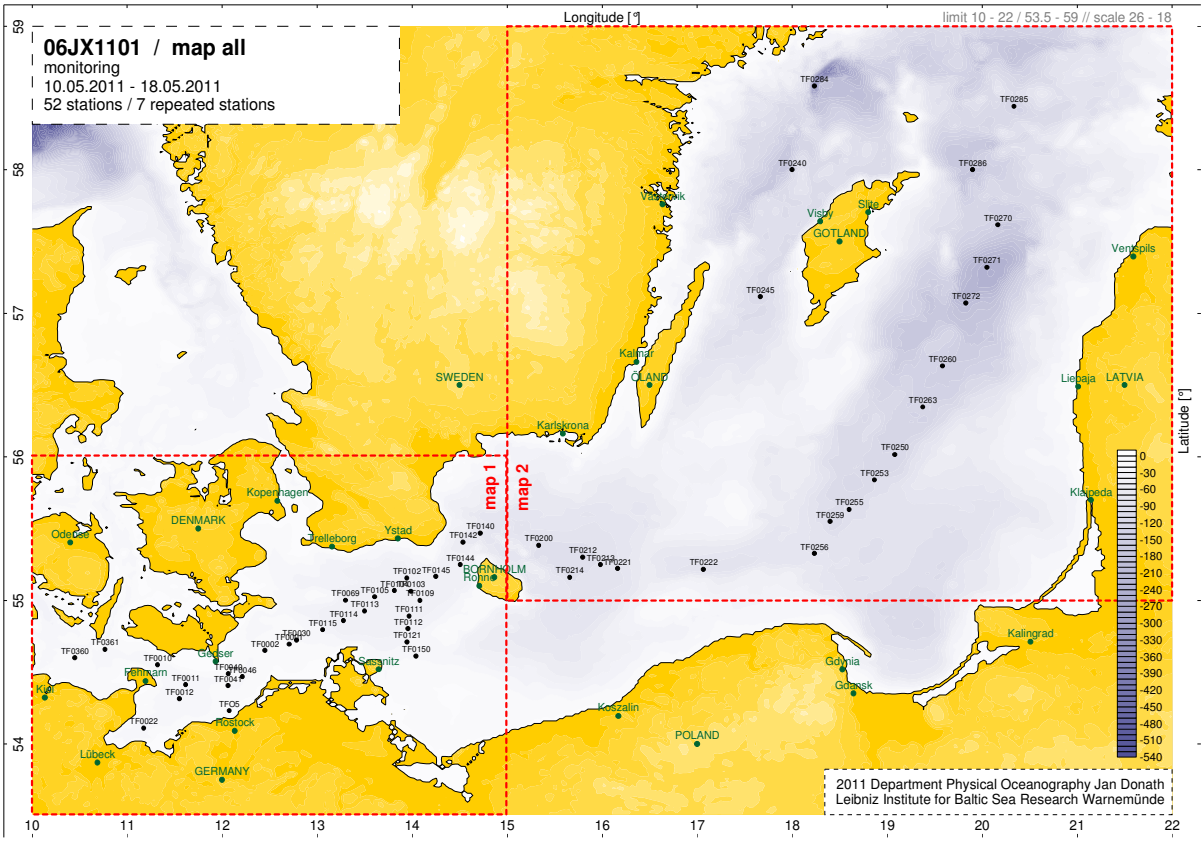
Area Date	Stat. Name/No.*	Temp. °C	Sal. psu	O_2 ml/l	PO4 µM	NO23 µM	SiO4 µM
Kiel Bight 10.05.2011	360/0005	10.33	12.84	7.30	0.02	0.06	6.6
Meckl.Bight 11.05.2011	012/0007	8.77	7.74	8.34	0.13	0.01	4.0
Lübeck Bight 10.05.2011	022/0006	11.53	12.76	7.45	0.08	0.03	7.2
Darss Sill 11.05.2011	030/0013	7.56	7.40	8.89	0.06	0.20	4.0
Arkona Basin 11.05.2011	113/0017	9.28	7.21	8.88	0.00	0.03	2.8
Bornholm Deep 12.05.2011	213/0030	6.97	7.26	11.76	0.13	0.02	..9.3
Stolpe Channel 12.05.2011	222/0032	8.57	7.16	10.37	0.03	0.07	..4.2
SE Gotland Basin 13.05.2011	259/0034	6.64	7.22	10.71	0.09	0.04	..5.6
Gotland Deep 14.05.2011	271/0041	6.91	7.21	10.76	0.03	0.02	4.9
Farö Deep 14.05.2011	286/0043	5.64	6.94	10.28	0.14	0.06	5.8
Landsort Deep 15.05.2011	284/0045	7.37	6.23	9.42	0.08	0.04	..9.3
Karlsö Deep 16.05.2011	245/0047	6.85	6.94	9.57	0.16	0.07	9.1

* see attached map

Table 2: Deep water layer (standard depths)

Area Date	Stat. Name/No.*	Depth m	Temp. °C	Sal. psu	O_2 ml/l	PO4 µM	NO23 µM	SiO4 µM
Kiel Bight 10.05.2011	360/0005	15	5.71	19.03	6.55	0.19	0.76	15.8
Meckl.Bight 11.05.2011	012/0007	20	5.25	19.86	5.47	0.29	0.48	18.2
Lübeck Bight 10.05.2011	022/0006	20	5.11	19.10	5.14	0.24	0.24	19.1
Darss Sill 11.05.2011	030/0013	20	5.04	15.86	4.90	0.18	0.19	15.2
Arkona Basin 11.05.2011	113/0017	40	4.98	8.43	7.07	0.05	0.06	5.8
Bornholm Deep 12.05.2011	213/0030	80	6.79	14.62	1.57	1.66	..7.21	43.4
Stolpe Channel 12.05.2011	222/0032	80	5.60	12.85	2.63	1.40	5.88	37.4
SE Gotland Basin 13.05.2011	259/0034	80	5.39	10.04	0.74	2.56	. 6.34	42.8
Gotland Deep 14.05.2011	271/0041	200	6.43	12.19	-4.24**	5.43	0	78.0
Farö Deep 14.05.2011	286/0043	150	6.45	11.76	-1.64**	3.97	0	61.3
Landsort Deep 15.05.11	284/0045	400	6.01	10.65	-1.09**	3.07	0	55.0
Karlsö Deep 16.05.2011	245/0047	100	5.48	10.01	-1.25**	3.80	0	57.2

* see attached map
** hydrogen sulphide was converted into negative oxygen equivalents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monitoring
10.05.2011 - 18.05.2011
52 stations / 7 repeated stations
Longitude [°]
limit 10 - 22 / 53.5 - 59 // scale 26 - 18
Latitude [°]
map 1
map 2
SWEDEN
DENMARK
GERMANY
POLAND
LATVIA
GOTLAND
ÖLAND
BORNHOLM
Kopenhagen
Odense
Trelleborg
Ystad
Karlskrona
Kalmar
Visby
Slite
Ventspils
Liepaja
Klaipeda
Kalingrad
Gdynia
Gdansk
Koszalin
Rønne
Gedser
Fehmarn
Sassnitz
Rostock
Kiel
Lübeck
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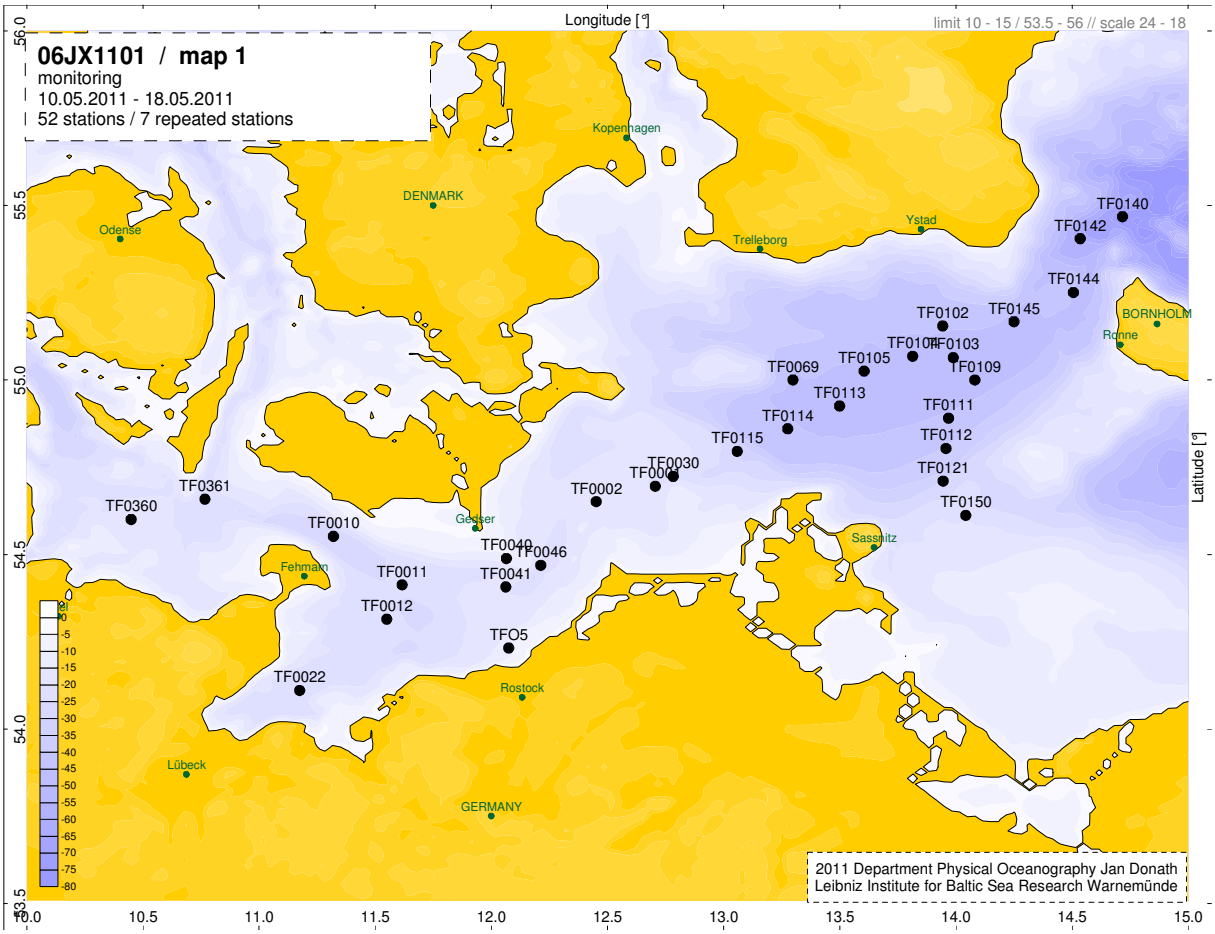
06JX1101 / map 1
monitoring
10.05.2011 - 18.05.2011
52 stations / 7 repeated stations
Longitude [°]
limit 10 - 15 / 53.5 - 56 // scale 24 - 18
Latitude [°]
DENMARK
GERMANY
Kopenhagen
Odense
Trelleborg
Ystad
Gedser
Fehmarn
Sassnitz
Rostock
Lübeck
Rønne
BORNHOLM
TF0140
TF0142
TF0144
TF0102
TF0145
TF0107
TF0103
TF0105
TF0069
TF0109
TF0113
TF0111
TF0114
TF0112
TF0115
TF0121
TF0030
TF0150
TF0002
TF0361
TF0360
TF0010
TF0040
TF0046
TF0041
TF0011
TF0012
TFO5
TF0022
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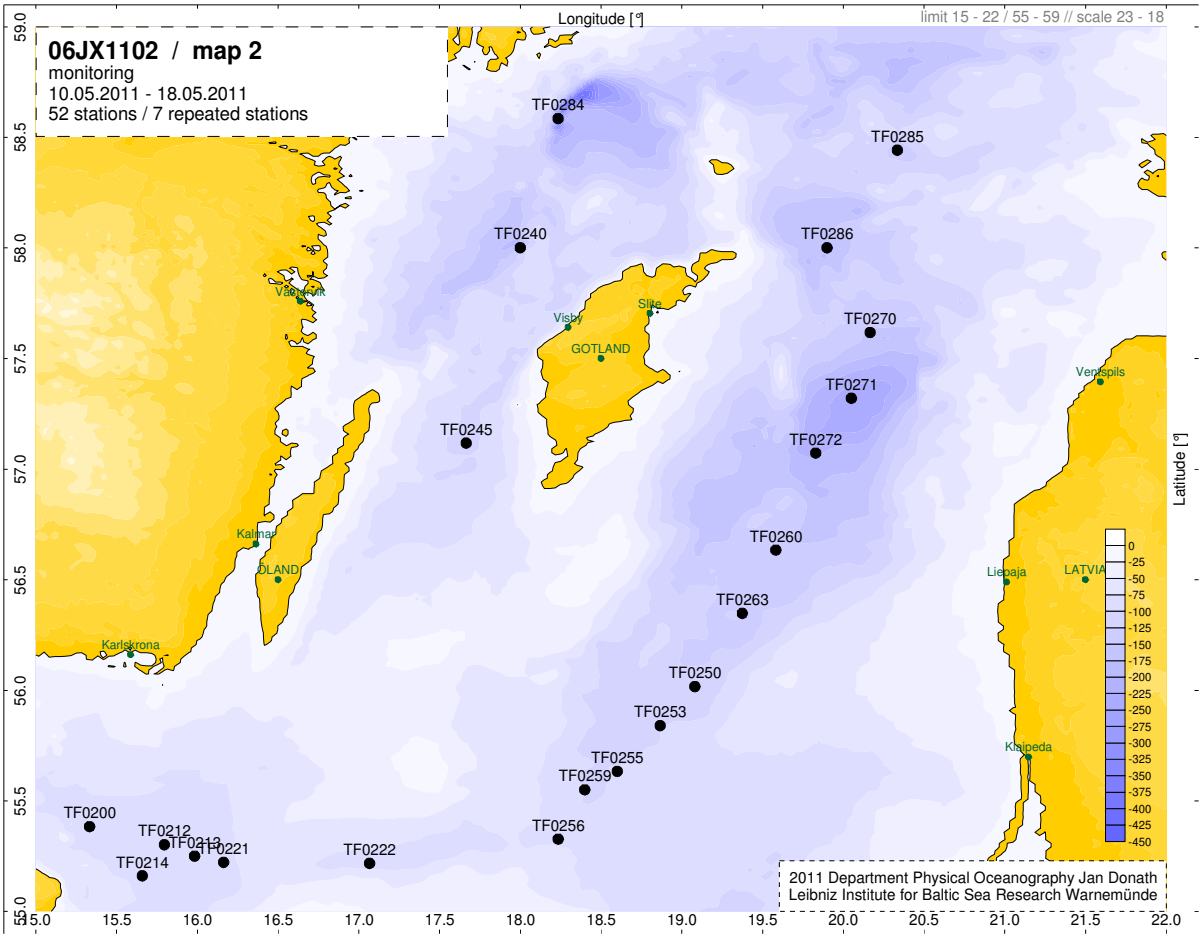
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monitoring
10.05.2011 - 18.05.2011
52 stations / 7 repeated stations
Longitude [°]
limit 15 - 22 / 55 - 59 // scale 23 - 18
Latitude [°]
TF0284
TF0285
TF0240
TF0286
TF0270
TF0271
TF0245
TF0272
TF0260
TF0263
TF0250
TF0253
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TF0256
TF0200
TF0212
TF0213
TF0221
TF0214
TF0222
Visby
Slite
GOTLAND
Ventspils
Kalmar
ÖLAND
Liepaja
LATVIA
Karlskrona
Klaipeda
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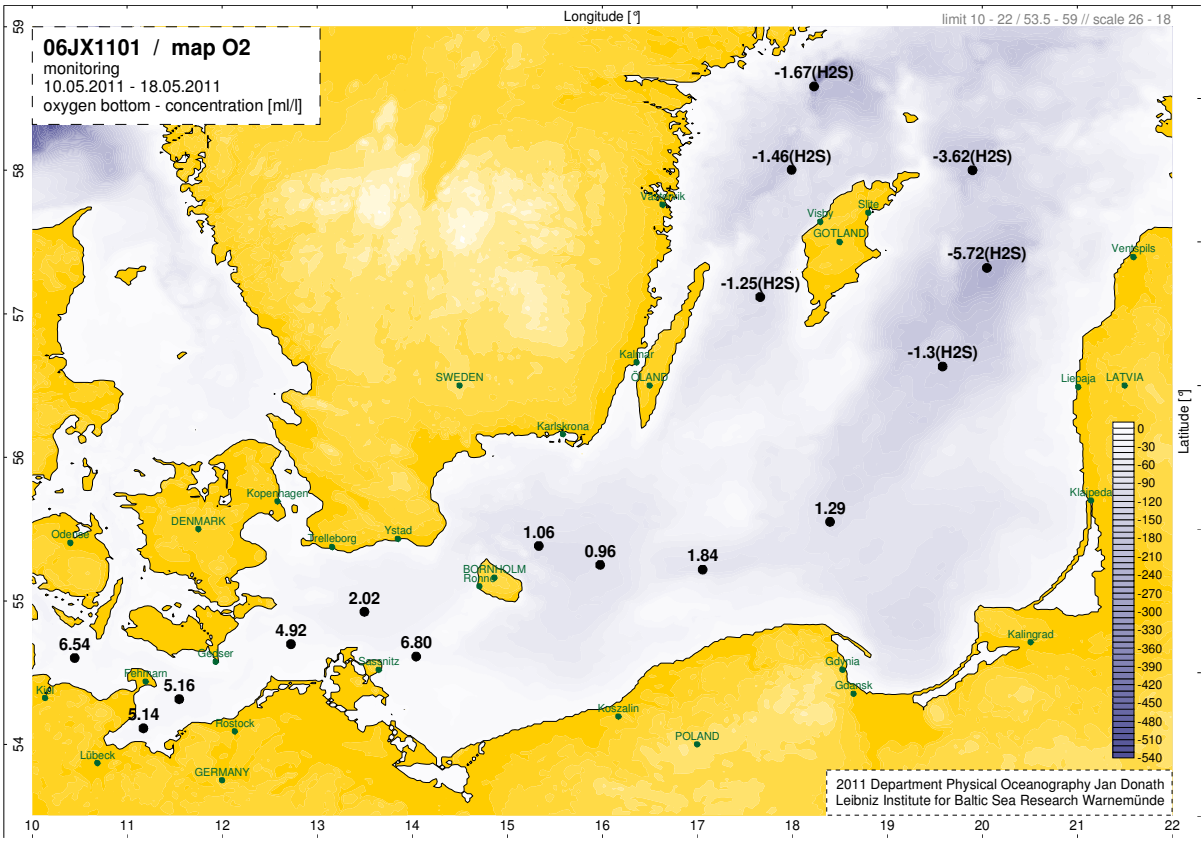
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monitoring
10.05.2011 - 18.05.2011
oxygen bottom - concentration [ml/l]
Longitude [°]
limit 10 - 22 / 53.5 - 59 // scale 26 - 18
Latitude [°]
-1.67(H2S)
-1.46(H2S)
-3.62(H2S)
-5.72(H2S)
-1.25(H2S)
-1.3(H2S)
1.29
1.06
0.96
1.84
2.02
4.92
6.80
6.54
5.16
5.14
Visby
Slite
GOTLAND
Ventspils
Kalmar
ÖLAND
SWEDEN
Liepaja
LATVIA
Karlskrona
Klaipeda
Kopenhagen
DENMARK
Odense
Helsingborg
Ystad
BORNHOLM
Rönne
Kalingrad
Gdynia
Gdansk
Rostock
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POLAND
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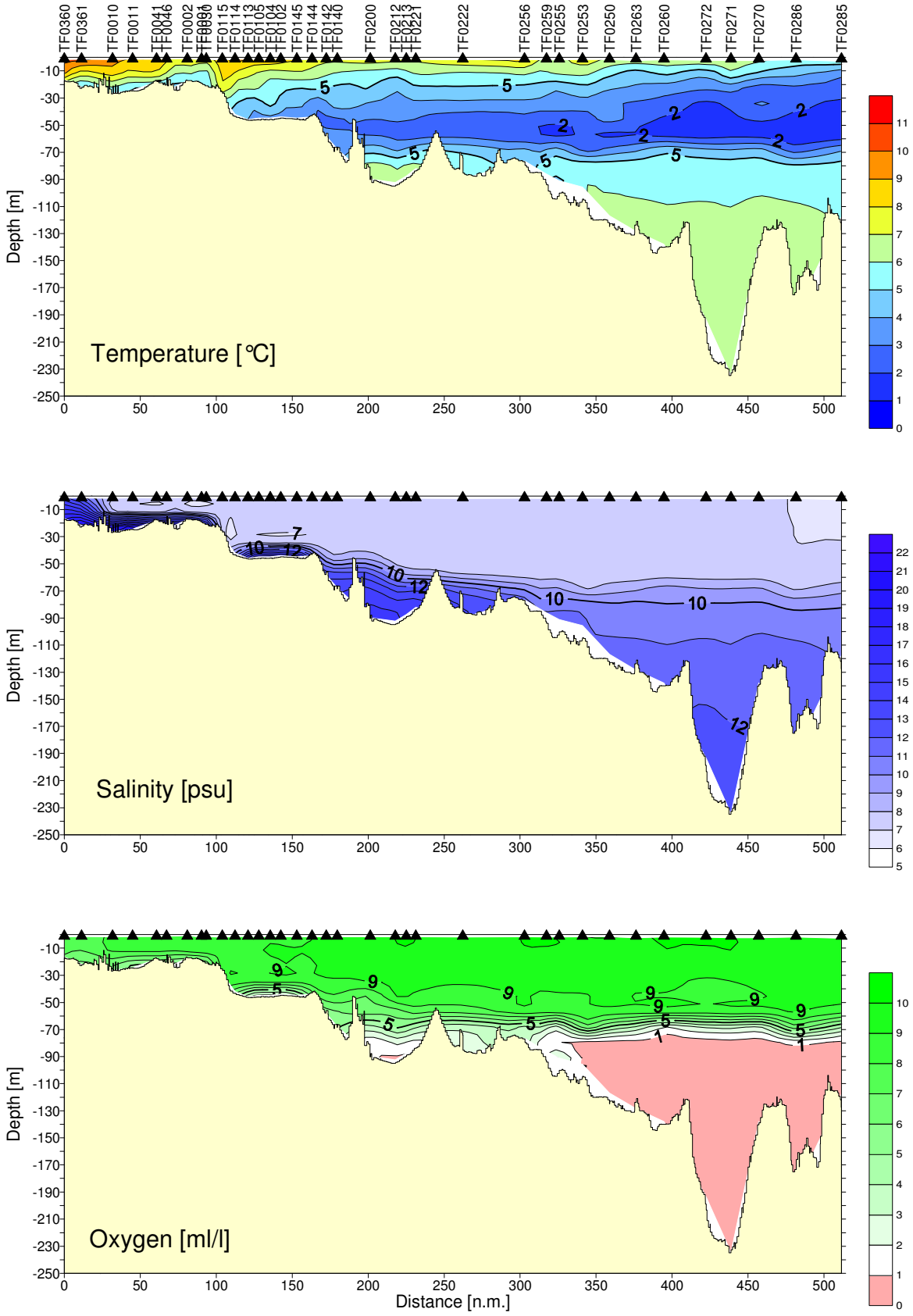
06JX1101

Kiel Bight - Gotland Sea
10.05.2011 09:42 - 15.05.2011 00:06 UTC



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