Cruise Report

R/V "ALKOR"

Cruise- No. HE-365 ( 06AK1101 )

01 February - 13 February 2011

This report is based on preliminary data!

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1. **Cruise No.:** AL-365 (06AK10101)

2. **Dates of the cruise:** from 01/02/2011 to 13/02/2011

3. **Particulars of the research vessel:**
   - **Name:** r/v 'ALKOR'
   - **Nationality:** Germany
   - **Operating Authority:** Leibniz Institute of Marine Sciences at Kiel University (IFM - GEOMAR), 24148 Kiel

4. **Geographical area in which ship has operated:**
   Baltic Sea between Kiel Bight and central Gotland Sea

5. **Dates and names of ports of call**
   - 02/02/2011 Kiel
   - 04 - 06/02/2011 Saßnitz
   - 08 - 09/02/2011 Slite
   - 11 - 12/02/2011 Saßnitz

6. **Purpose of the cruise**
   Joint cruise for Monitoring in the frame of the COMBINE program of HELCOM and long term observation program of IOW

7. **Crew:**
   - **Name of master:** J.P. Lass
   - **Number of crew:** 10

8. **Research staff:**
   - **Chief scientist:** Klaus Nagel
   - **Participants:**
     - 01/02 - 13/02/2011: Jan Donath, Ingo Schuffenhauer, Ines Hand, Erika Trost, Ursula Hennings, Andrea Tschakste, Lars Kreuzer
     - 01/02 – 05/02/2011: Arkadiusz Lis, Sven Trinkler
     - 05/02 - 13/02/2011: Uwe Hehl, David Meyer, Hildegard Kubsch, Verona Vandieken

9. **Co-operating institutions:**
   All institutions dealing with the COMBINE program of HELCOM
10. **Scientific equipment**: CTD
    water samplers
    plankton net

11. **General remarks and preliminary results**
    The cruise AL365 was a joint cruise between the German contribution to the COMBINE program of HELCOM and the long term data series of IOW. The area under investigation covered the Baltic Sea between Kiel Bight and the central Gotland Basin as shown in the attached maps. Marine meteorological, hydrographic, chemical and biological investigations were performed at 49 stations. The measurements were supplemented by continuous registration of standard meteorological parameters as well as surface water temperature and salinity.

    For selected stations, which are characteristic for different regions of the Baltic Sea, preliminary data of hydrographic and hydrochemical parameters in the surface and the near-bottom layer are compiled in the attached tables. These results are also compared with mean values calculated from the measurements performed during the February cruises of the years 1993 to 2007.

    The weather during the cruise was dominated by some high and low pressure areas passing the area under investigation. Strong pressure gradients caused some heavy storms and several windy days preventing the sampling at some stations (see attached figure).

    Compared to the last years air temperature was rather moderate varying between 0°C and +4°C during most of the time. Only between 04/02/2011 and 06/20/2011 air temperatures up to +10°C and on 12/02/2011 of -5°C to -2°C had been observed. Although there were a few days with some sunny periods, the sky was clouded almost all the time.

    Salinity in the surface layer was within the values expected from long term measurements in all regions of the Baltic Sea and varied between 7 - 8 g/kg except Kiel and Mecklenburg Bight, where 10 - 15 g/kg were measured. A halocline was observed between 40 m and 45 m in the Arkona Basin, between 50 m and 60 m in the Bornholm Basin and in the Eastern Gotland Basin. Salinities found in the bottom layer in the central areas of the Baltic Sea are in the range expected from long term observations and varied around 12. Only salinities in the bottom layer of the Arkona basin are lower than expected (10 - 13 g/kg).

    No indication for inflow of high saline water from the North Sea had been detected.

    The western Baltic Sea and the Arkona basin were well oxygenated down to the sea floor with oxygen concentrations around 7 ml/l to 9 ml/l at most stations. Oxygen concentration in the Bornholm Basin dropped below 2 ml/l at depths exceeding 70 m, but Oxygen is detectable at the bottom layer of all stations in this area. Anoxic conditions had been observed only in the central eastern Gotland Basin at depths below 110 m. In the bottom layer of the eastern Gotland Basin concentrations of up to 5.1 mg/l H₂S were found, which is slightly more the value measured last year at the same time.
Nitrate concentrations in the surface layer were normal for this time of the year and vary between 3 µmol/l and almost 5 µmol/l, which is within the range expected from long term observations. Phosphate concentrations in the surface layer were found between 0.5 µmol/l and 0.8 µmol/l and are in good agreement with the values expected from IOW's long term data series. In the bottom layer concentrations of nitrate and phosphate are controlled by the presence of oxygen or hydrogen sulphide and were found in the expected range. Due to the ongoing stagnation phosphate concentrations at the bottom of the Eastern Gotland Basin were higher than that measured one year ago (>6 µmol/l) and correlate with relatively high amounts of H₂S (>5 mg/l H₂S).

Samples for the determination of trace metals (15 stations), HCH, CKW/PAK (11 stations) and Phyto- and Zooplankton (11 stations) were taken for later analysis in the laboratory.

At station TF0271, an automatic analyser fixed to the CTD system is used to determine the *in situ* concentration of Fe(II). The method based on a spectrophotometric assay using Ferene as reagent. Two profiles in the range between surface and 200 m were taken, lowering the analyser with a speed of 0.1 m/s. Additional discrete controls were sampled for later analysis in the laboratory.

During the cruise a profiling mooring has been recovered at position 57° 19.22' N, 020° 07.96' E.

Klaus Nagel
Scientist in charge

Attachments:
- station charts
- figure showing air pressure gradients during the cruise
- tables of preliminary results for selected stations (surface layer and near bottom layer)
- comparison of actual data with mean values calculated from the measurements during the February cruises of the years 1993 – 2007 (surface layer and near bottom layer)
- transect of temperature, salinity and oxygen concentration between Kiel Bight and Gotland Sea
- map showing oxygen concentrations in near the bottom water layer (hydrogen sulphide concentration is given as negative O₂ equivalents)
06AK1101 / map 1

Monitoring
01.02.2011 - 13.02.2011
45 stations / 4 repeated stations

2011 Department Physical Oceanography Jan Donath
Leibniz Institute for Baltic Sea Research Warnemünde
Air pressure gradients during the cruise AL365
Preliminary results of hydrographic and hydrochemical parameters at selected stations

* surface layer *

<table>
<thead>
<tr>
<th>Station Name</th>
<th>Date</th>
<th>Stat.Name Stat.No.</th>
<th>Temp. °C</th>
<th>Salinity</th>
<th>NO$_3$ *) µmol/l</th>
<th>PO$_4$ µmol/l</th>
<th>SiO$_4$ µmol/l</th>
<th>O$_2$ ml/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiel Bight</td>
<td>01/02/2011</td>
<td>TF0360 5</td>
<td>0.31</td>
<td>15.29</td>
<td>6.50</td>
<td>0.58</td>
<td>15.2</td>
<td>8.93</td>
</tr>
<tr>
<td>Mecklenburg Bight</td>
<td>02/02/2011</td>
<td>TF0012 6</td>
<td>0.19</td>
<td>11.25</td>
<td>5.75</td>
<td>0.54</td>
<td>14.1</td>
<td>9.47</td>
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<tr>
<td>Arkona Basin</td>
<td>03/02/2011</td>
<td>TF0113 16</td>
<td>1.11</td>
<td>7.56</td>
<td>3.29</td>
<td>0.50</td>
<td>12.3</td>
<td>9.37</td>
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<tr>
<td>Bornholm Deep</td>
<td>10/02/2011</td>
<td>TF0213 27</td>
<td>1.98</td>
<td>7.19</td>
<td>3.85</td>
<td>0.53</td>
<td>15.1</td>
<td>8.80</td>
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<tr>
<td>Stolpe Channel</td>
<td>10/02/2011</td>
<td>TF0222 25</td>
<td>1.75</td>
<td>7.19</td>
<td>3.40</td>
<td>0.56</td>
<td>12.4</td>
<td>9.25</td>
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<tr>
<td>SE Gotland Basin</td>
<td>10/02/2011</td>
<td>TF0259 24</td>
<td>1.98</td>
<td>7.27</td>
<td>3.44</td>
<td>0.56</td>
<td>12.7</td>
<td>9.00</td>
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<td>Gotland Deep</td>
<td>07/02/2011</td>
<td>TF0271 20</td>
<td>2.02</td>
<td>7.43</td>
<td>3.50</td>
<td>0.57</td>
<td>10.5</td>
<td>9.02</td>
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<td>Fårö Deep</td>
<td></td>
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<td>Landsort Deep</td>
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<tr>
<td>Karlsö Deep</td>
<td></td>
<td>TF0245</td>
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</tbody>
</table>

*) NO$_3$ is given as sum of NO$_3$ and NO$_2$. (in most samples NO$_2$ was present only in traces)

**) see attached maps
Preliminary results of hydrographic and hydrochemical parameters at selected stations

- near bottom layer -

<table>
<thead>
<tr>
<th>Station Date</th>
<th>Stat.Name Stat.No. **</th>
<th>Depth m</th>
<th>Temp. °C</th>
<th>Salinity PSU</th>
<th>NO\textsubscript{3} *) µmol/l</th>
<th>PO\textsubscript{4} µmol/l</th>
<th>SiO\textsubscript{4} µmol/l</th>
<th>O\textsubscript{2} ml/l</th>
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</thead>
<tbody>
<tr>
<td>Kiel Bight 01/02/2011</td>
<td>TF0360 5</td>
<td>17</td>
<td>1.16</td>
<td>16.50</td>
<td>5.87</td>
<td>0.58</td>
<td>15.3</td>
<td>8.97</td>
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<tr>
<td>Mecklenburg Bight 02/02/2011</td>
<td>TF0012 6</td>
<td>23</td>
<td>2.28</td>
<td>19.12</td>
<td>6.37</td>
<td>0.78</td>
<td>18.4</td>
<td>7.88</td>
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<td>Arkona Basin 03/02/2011</td>
<td>TF0113 16</td>
<td>45</td>
<td>2.29</td>
<td>12.09</td>
<td>8.67</td>
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<td>6.70</td>
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<tr>
<td>Bornholm Deep 10/02/2011</td>
<td>TF0213 27</td>
<td>87</td>
<td>7.64</td>
<td>15.39</td>
<td>7.46</td>
<td>1.97</td>
<td>59.5</td>
<td>0.13</td>
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<td>89</td>
<td>6.83</td>
<td>11.70</td>
<td>7.76</td>
<td>1.62</td>
<td>36.3</td>
<td>3.36</td>
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<tr>
<td>SE Gotland Basin 10/02/2011</td>
<td>TF0259 24</td>
<td>85</td>
<td>6.36</td>
<td>11.15</td>
<td>7.07</td>
<td>2.13</td>
<td>43.9</td>
<td>1.65</td>
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<tr>
<td>Gotland Deep 07/02/2011</td>
<td>TF0271 20</td>
<td>234</td>
<td>6.44</td>
<td>12.34</td>
<td>-</td>
<td>6.60</td>
<td>79.3</td>
<td>-6.81 (H\textsubscript{2}S)</td>
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<td>Fårö Deep</td>
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<td>Landsort Deep</td>
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<td>Karlsö Deep</td>
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</tr>
</tbody>
</table>

*) NO\textsubscript{3} is given as sum of NO\textsubscript{3} and NO\textsubscript{2} (in most samples NO\textsubscript{2} was present only in traces)

**) see attached maps

H\textsubscript{2}S was converted into negative O\textsubscript{2} equivalents
Selected stations / February cruises: near-surface layer

Temperature (°C)

Salinity

Nitrate (µmol/l)

Phosphate (µmol/l)

Oxygen (ml/l)

Means & s.dev. February cruises 1993 - 2007

○ Monitoring cruise February 2010

● Monitoring cruise February 2011

K. Nagel \ st_1102s \ 12/02/2011
Selected stations / February cruises: near-bottom layer

- Temperature (°C)
- Salinity
- Nitrate (µmol/l)
- Phosphate (µmol/l)
- Oxygen (m³/l)

**): H₂S was converted to negative O₂ equivalents

K. Nagel \ st_1102b \ 12/02/2011