Cruise report – EMB-135

Leibniz Institute for Baltic Sea Research Warnemünde, Germany

On board, 12.08.2016

Content

Basic information

Ship: r/v **Elisabeth Mann Borgese**, cruise EMB-135,

Date: 02 August – 12 August 2016,

Chief scientist: Dr. Joachim Kuss

Objectives

The cruise EMB-135 was carried out as a joined cruise of the environmental monitoring programme of the Federal Maritime and Hydrographic Agency (BSH) and the Baltic Sea long-term observation programme of the Leibniz Institute for Baltic Sea Research Warnemünde (IOW). It was the fourth cruise in 2016 in a series of five expeditions performed annually.

The acquired data are used for the regular national and international assessments of the state of the Baltic Sea, and provide the scientific basis for measures to be taken for the protection of the Baltic Sea ecosystem. A special focus of the cruise was to monitor the consequences of the series of Major Baltic Infows that occurred between 2014 and 2016 on the environmental conditions of the central Baltic.

Staff and area of investigation

	Name	***On-board***	***Institution***	***Assignments***
1.	Kuss, Joachim	02.08.-12.08.16	IOW, Meereschemie	Chief Scientist
2.	Kolbe, Martin	02.08.-12.08.16	IOW, Phys. Ozeanogr	Hydrography, data processing
3.	Donath, Jan	02.08.-12.08.16	IOW, Phys. Ozeanogr	Hydrography, data processing
4.	Sadkowiak, Birgit	02.08.-12.08.16	IOW, Meereschemie	Analysis of chemical parameters
5.	Dierken, Madleen	02.08.-12.08.16	IOW, Meereschemie	Sample preparation, oxygen measurements
6.	Estelmann, Arne	02.08.-12.08.16	IOW, Meereschemie	Chemical parameter support
7.	Wassmann, Adrian	02.08.-12.08.16	IOW, Marine Geology	Sediment coring support, sampling
8.	Lehnert, Gerhard	02.08.-12.08.16	IOW, Marine Biology	Biological variables, sediment coring
9.	Skibior, Slawomir	02.08.-12.08.16	OIRM (Szczecin, PL)	Measurement observation in Polish territorial waters

The cruise EMB-135 was done in the frame of the Baltic monitoring programme (BMP), and is related to the Baltic long term observation programme of the (IOW). Data collection covered the western and central Baltic from the Kiel Bight to the northern Gotland Basin. The majority of stations are located in the German territorial waters and along the talweg transect of the Baltic Sea. The talweg stretches from the Darss sill via the Arkona Sea, the Bornholm Sea, the eastern Gotland Sea basin to the northern Gotland Sea and the Landsort deep. Along the southern rim of the eastern Gotland Basin a west-east transect of CTD stations were done, in order to gather information about the spatial distribution of the saline water masses of recent MBIs. Additionally, a number of CTD casts were carried out at stations in the northern Gotland Sea to figure out the fate of the inflowing water. An overview of the location of CTD stations is given in Figures 1, some more details are given in Figures 2 and 3. The list of stations is given in the Appendix.

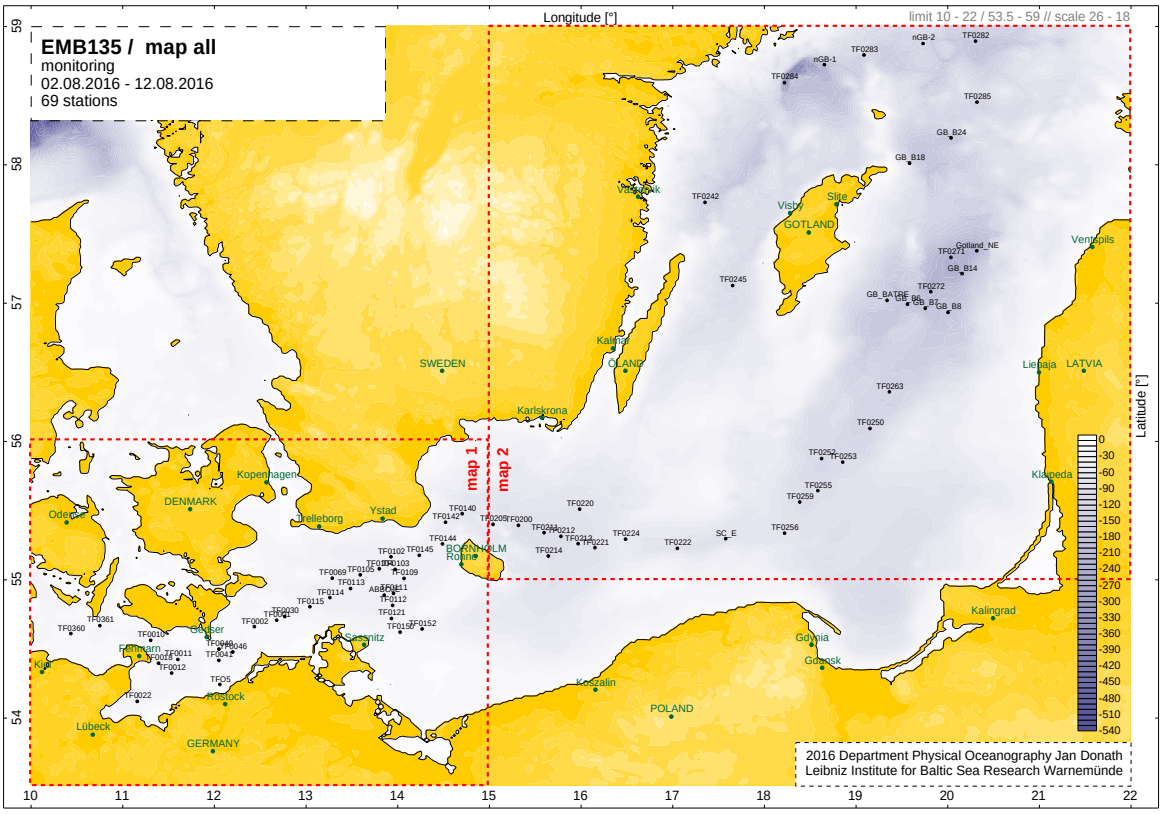

Figure 1: Map of stations (black crosses) of the cruise EMB-135 from 2nd – 12th August 2016.

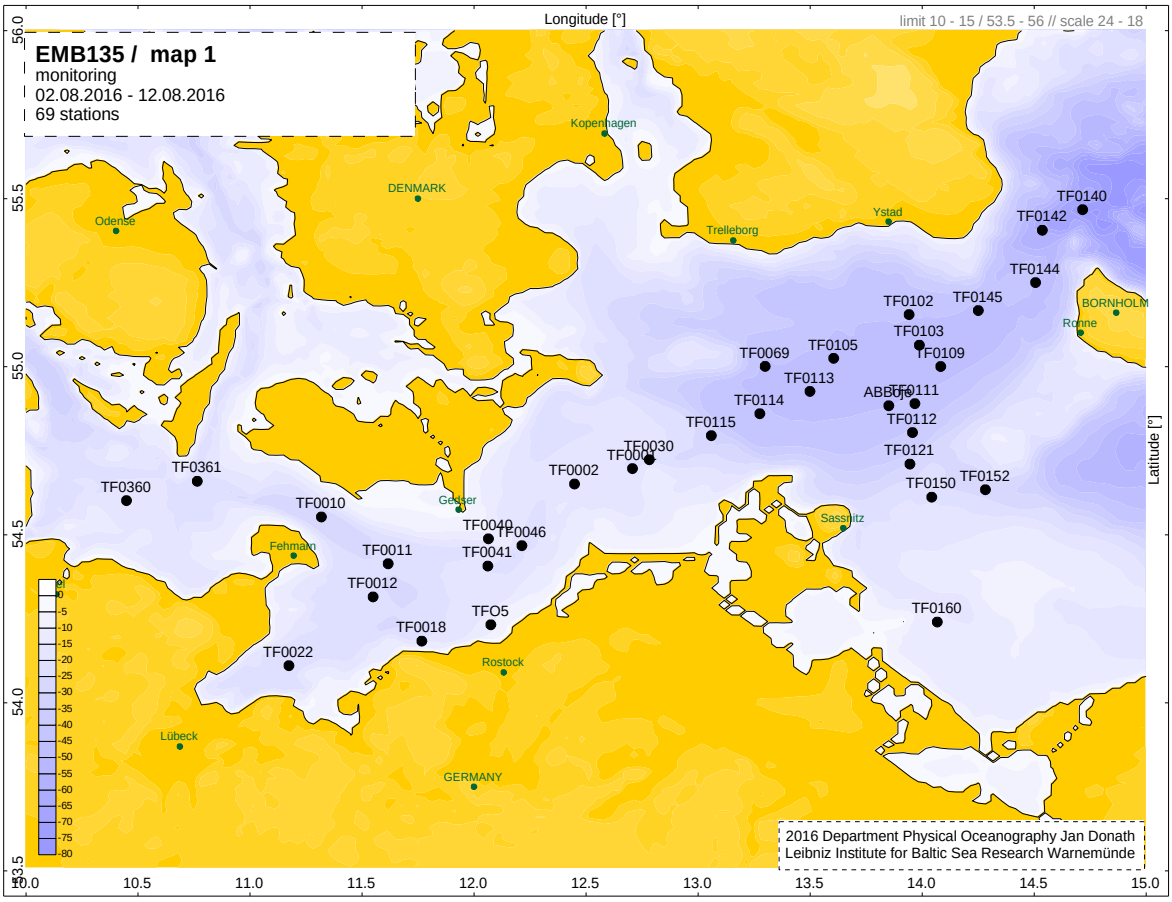

Figure 2: Detailed map of the investigated stations (black dots) in the western Baltic Sea and the Arkona Sea during the cruise EMB-135.

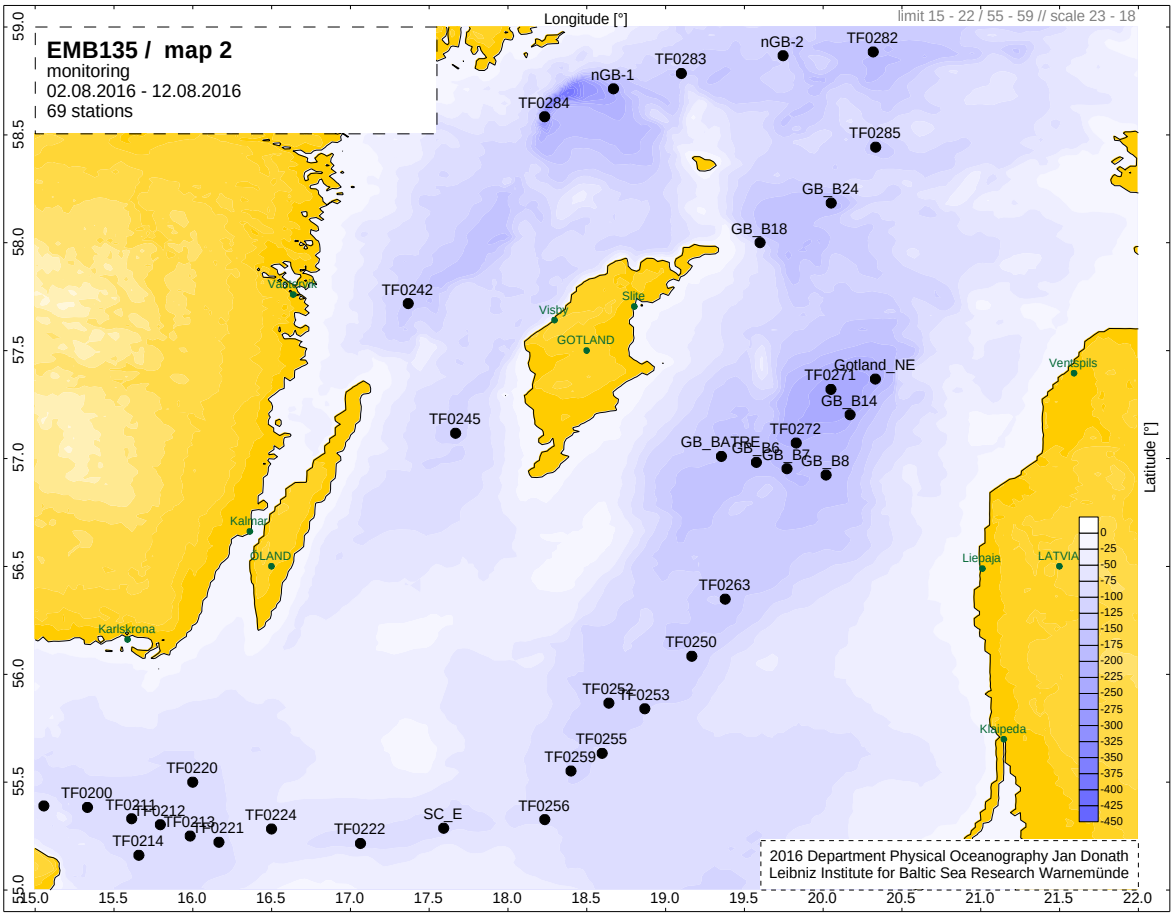

Figure 3: Detailed map of the investigated stations (black dots) in the Bornholm Sea and the Gotland Sea during the cruise EMB-135.

Work on-board and data acquisition with quality assurance

Equipment

Data acquisition was carried out using the following devices

On stations:

1. CTD SBE 911+ with rosette water sampler
2. Phytoplankton nets, Apstein net, Secci disk
3. Zooplankton net (WP2)
4. Multicorer

Continuous measurements on transect:

1. Underway measurements of surface water properties (Thermosalinograph)
2. Ship weather station

Laboratory work:

1. Autoanalyser (FlowSys, Alliance-Instruments, Ainring, Germany)
2. UV-VIS-Spektrophotometer UVmini 1240 (Shimadzu)
3. Titrino (Metrohm)

Stationwork

The station name is complemented for the respective cruise EMB-135 by a station number. The station number is based on a consecutive numbering of all stations during the cruise. The station work usually started with a CTD cast and already programmed sampling on standard depth levels. Then other CTD casts follow to meet the water sample requirements on the respective station. Net sampling, depth of visibility determinations by means of a Secci disk, and Multi corer casts were done on selected stations.

CTD and Sampling

The CTD-system "SBE 911plus" (SEABIRD-ELECTRONICS, USA) was used to measure the variables: Pressure, Temperature (2x SBE 3), Conductivity (2x SBE 4), Oxygen concentration (2x SBE 43), Chlorophyll-a fluorescence (683nm), Turbidity, Photosynthetic active radiation in water (PAR), and above the sea (SPAR).
The Rosette water sampler was equipped with 13 Free Flow bottles of 5l volume each. The CTD sensors were checked during the cruise by comparison measurements. In detail, for temperature a high precision thermometer SBE RT35 was used. Salinity samples were taken for measurement after the cruise by means of a salinometer. Slope and offset of the oxygen sensors SBE 43 are determined by comparison with Winkler titration.

Underway measurements

The FS Elisabeth Mann Borgese is equipped with sensors to measure weather parameters, surface water properties by means of a surface water pumping system with attached sensors (e.g., thermosalinograph, fluorometer), navigation information, rope length, winch speed and more.

Inorganic nutrients

Nitrate, nitrite, phosphate, and silicate were analyzed using standard colorimetric methods by means of an autoanalyser (FlowSys, Alliance-Instruments, Ainring, Germany) and Ammonium was determined manually as indophenole blue (Grasshoff et al., 1999) from water filtered through glass-fiber filters GF/F immediately after sampling.

Oxygen and Hydrogensulfide

Oxygen was analyzed by Winkler titration and hydrogensulfide was determined spectrophotometrically by Methylene Blue reaction (Grasshoff et al., 1999). For comparison, H2S concentration was transformed to negative oxygen values according to its reduction capacity: H2S + 2 O2 -> H2SO4. During CTD casts the SBE 43 oxygen sensor (doublicate installation) recorded oxygen values that are validated by Winkler titration results.

Plankton sampling

Plankton sampling was performed by means of a rosette sampler (combined with CTD) as well as with a small phytoplankton net and the zooplankton nets WP2 and Apstein. Samples were taken in a tight follow up of depths levels in order to get representative data from the euphotic zone. Additionally, samples for micro biological analyses were taken at some stations in the central Baltic: Gotland Deep and Landsort Deep station.

Long term investigations of CH_4, N_2O and CO_2 distribution

Sampling for simultaneous CH_4 and N_2O observation was carried out in frame of an accompanying project for long term data collection. All samples were fixed with 500 µL saturated $HgCl_2$-solution to prevent microbiological activity and stored dark. (Responsible scientists: Jan Werner, Prof. Gregor Rehder)

One complete depth profile was sampled at station TF0271 for the long term data collection of CT, AT, and pH. Also these samples were fixed with 500 µL saturated HgCl2-solution to prevent microbiological activity and stored dark. (Responsible Scientist: Dr. B. Schneider).

Sediment core sampling with MUC

The sampling of surface sediments at stations TF0263 and TF0271 contributes to the project “Anoxic sediments as a source of persistent organic pollutants: the role of organic carbon and iron reduction”. The sampled sediment cores will be used in a IOW laboratory for incubations. The effect of changing oxygen conditions on the distribution of persistent organic pollutants (POPs), particularly of polychlorinated biphenyls, in sediments of the Gotland basin in the Baltic Sea is investigated. Processes that are regulating organic carbon dynamics in the sediments might be a key to better explain the fate of POPs. Especially iron-bound organic carbon can be mobilized under anoxic conditions during reductive iron dissolution and diffuse from the sediment pore water into the water column.

Mercury speciation

The sampling for Total mercury (Hg^{tot}) and Methylmercury ($MeHg^{+}$) analyses were done on selected stations along the talweg of the Baltic Sea from Bornholm Deep to the Gotland Deep and further north to the northern Gotland Sea and the Landsort Deep. Water samples were taken from the CTD-rosette system from different water layers to cover surface, intermediate, deep, and bottom waters as well as the pycnocline range. The aim is to better understand the conditions, with regard to oxygen/hydrogensulfide and nutrient concentrations that lead to biotic $MeHg^{+}$ production. Neurotoxic $MeHg^{+}$ accumulates in the food chain and thus shows elevated concentration in fish. For later analysis at the IOW laboratory the 250 mL seawater samples were acidified in a cleanbench using either 1.5 mL subboiled nitric acid or 2 mL of suprapur sulfuric acid for Hg^{tot} and $MeHg^{+}$ analyses, respectively. In the IOW laboratory, the samples are subjected to permanganate oxidation and then analyzed by an automatic mercury analyzer for Hg^{tot} according to the method of Bloom and Crecelius. $MeHg^{+}$ is analyzed after derivatisation with the ethylating reagent sodium tetraethylborate. Subsequent analysis of Methylethylmercury is done by gas chromatography, pyrolizis, and cold-vapour atomic fluorescence spectroscopy.

Trace metal sampling

The trace metal samples were taken to investigate the impact of the major Baltic inflow from 2014 on manganese (Mn) and trace metal cycles in the Gotland Basin. Background: Since February 2015 vertical water column samples were taken at the monitoring station 271 in the Gotland Deep at about monthly resolution to determine the concentrations of dissolved Mn and redoxsensitive trace metals (e.g. Co, Mo, U, V, W) throughout the water column. While the first profiles in February 2015 still revealed typical patterns of a stagnation period with high enrichments of dissolved Mn in the sulfidic bottom waters, subsequent oxygenation in March 2015 initiated substantial transformation of dissolved Mn into particulate Mn oxides, which is assumed to affect sedimentary trace metal signatures via scavenging.

Narrative of the cruise

Embarkation of the scientific crew was on 2nd August at 7:00 AM. The research campaign started at 8:00 AM in Rostock-Marienehe at a moderate breeze and a cloudy sky. The ship headed north for the first stations (TFO5,TF0041) until the Cadet Furrow (TF0040) and then to the west to cover stations in Mecklenburg bay and Kiel bay (TF0011, TF0018, TF0010, TF0361, TF0360). Afterwards we turned to Southeast to reach Lübeck bay as the next working area. Station work usually comprises hydrographic measurements by means of a CTD and oxygen determinations by Winkler titration, dissolved and particulate nutrient as well as organic carbon determinations on selected stations.

On 3rd August the first station was sampled in the Lübeck bay (TF0022) at cloudy and rainy condition and a strong breeze. Then on the way to the Arkona Sea several stops were done for measurements and sampling (TF0012, TF0046, TF0002, TF0001, TF0030, TF0115, TF0114, TF0069, TF0113, TF0105, TF0104, TF0102, TF0103, TF0109).

On 4th August the weather showed sunny times at changing cloud coverage. The wind was weak and the sea calm. Station in the eastern Arkona Sea (TF0111, ABBOJE, TF0112, TF0121, TF0150, TF0152, TF0145, TF0144) and the transfer to the Bornholm Deep via the Stolpe Channel were on the schedule of this day (TF0142, TF0140, TF0205, TF0200, TF0220, TF0211).

The 5th August at a gentle to moderate breeze the Polish and a few Danish stations were in the centre of the

workplan (TF0214, TF0212, TF0213, TF0221, TF0224, TF0222, SC_E, TF0256, TF0259, TF0255, TF0252, TF0253) . During the first days the Polish observer started to visit the CTD casts in the measurement and registration room. He showed interest in the station work and the technical equipment used. In the Bornholm Sea additional sampling for trace gas measurements of N_2O and CH_4 was done.
The important and laborious Gotland Deep station (TF0271) was planned for the evening of the 6th August. But first some stations on the talweg, TF0250, TF0263, TF0260, a west-east transect of stations at the southern edge of the central Gotland Sea basin (GB_Batre, GB_B6, GB_B7, GB_B8), and finally TF0272 and GB_B14 were sampled. The weather was still good with sun and changing cloudiness, at a calm sea and a moderate breeze. A multi corer cast was scheduled after breakfast and was successful after the first grab. In the evening the wind speed increased partly to force 7 bft but the wind abated a few hours later. Air pressure was still stable at 2014 hPa and air temperature was about 20 °C. At 9 PM a series of 5 CTD casts were started to cover hydrographic data acquisition, chemical and biological sampling for nutrients, carbonate system, mercury species, biological and microbiological measurements.

On August 7th the work on the central Gotland Deep station (TF0271) went on until early morning. Then we included another hydrographic cast on a station about 10 nm away (Gotland_NE). At 8:00 AM we were already on position close to the Gotland Deep station for sediment sampling. The location of the multi corer haul was decided to be move a bit westward to avoid destroyed sediment layer on the international frequently sampled station. The first haul was again successful. Then the repetition of the chemical measurements on the TF0271 was on schedule and completed after lunch. From the weather forecast it became obvious that a strong wind system that was observed for last days would impair especially the planned research activities in the northern Gotland Sea. Thus, it was decided to prefer the northern station and to put the few missed central Gotland Sea stations on the schedule afterwards. GB_B24 on 58° North was reached at 5:30 PM and TF0285 later in the evening. The northern transect for sampling stations TF0282, nGB-2, TF0283, and nGB-1 was done during the night to Monday to investigate the spreading of the inflow water in the North.

On August 8th the wind was already force 6 bft in the morning with an increasing trend. Air temperature was 18°C and air pressure was 1006 hPa that was slightly decreasing. We reached the Landsort Deep station at 9:00 AM and started a series of CTD casts for oxygen/hydrogensulfide, nutrients, merury, planktological and microbiological analyses. The station work was completed without problems. In the afternoon (2:00 PM) we headed southwest to reach an area with a better wind and wave forecast. With reduced speed we arrived on GB_B18 after about 6 hours and another CTD cast was done. One hour later on TF0286 further offshore the work was aborted because of bad weather. A wave had entered the CTD room, luckily, no damage occurred. Based on the weather forecast of the following days it was decided to visit an area in lee of the island of Gotland, and to focus on stations in the western Gotland Sea in the next two days.

During the night and in the morning of August 9th we slowly approached the eastern cape of the island of Gotland. Even in the shadow of the island we had force 7 bft wind. Air temperature was 15°C, the air pressure of 1008 hPa was slightly increasing. Finally, from the weather and wave forecasts, the conditions seem adequate for a CTD cast in the western Gotland Sea. The station TF0245 and TF0242 were thus put on the schedule.

We reached the station TF0245 Karlsö Deep in the western Gotland Sea short after midnight. The sea was still rough on August 10th but the CTD cast was successful and we proceeded to the TF0242, about 40 nm further north. The station was completed at 4:15 PM and the long transect back to the Bornholm Sea began.

On August 11th at 3:15 AM the station work on TF0213 –Bornholm Deep station began with the first CTD cast, then various plankton net hauls followed, and finally a second CTD cast was done for biological investigations. 4:30 AM the ship was heading to reach the station TF0113 in the Arkona Sea in the afternoon and further to stations TF030 and TF046. The final station TF0012 was completed at 3:30 AM on August 12th at force 5 bft wind and some rain.

Preliminary results

The results presented in the following section are preliminary and many samples taken are to be analyzed and interpreted during the next weeks and months. The aim of this section is to give a first impression on the collected data set. An advanced data analysis will follow after all validated data sets are available.

Meteorological conditions

The development of on-board measured wind speed, air temperature during the cruise is shown in Figure 4. Wind showed mainly a westerly to southwesterly direction since August 4th, and partly biased the planned sequence of stations because of elevated wave height, especially from August 8th when wind speed approached gale force. Air temperature was about 20°C at the beginning of the cruise on August 2nd and dropped to 15°C and even 13 °C later on. In the last days of August 11th-12th the air temperature intermittently increased again see Figure 4.

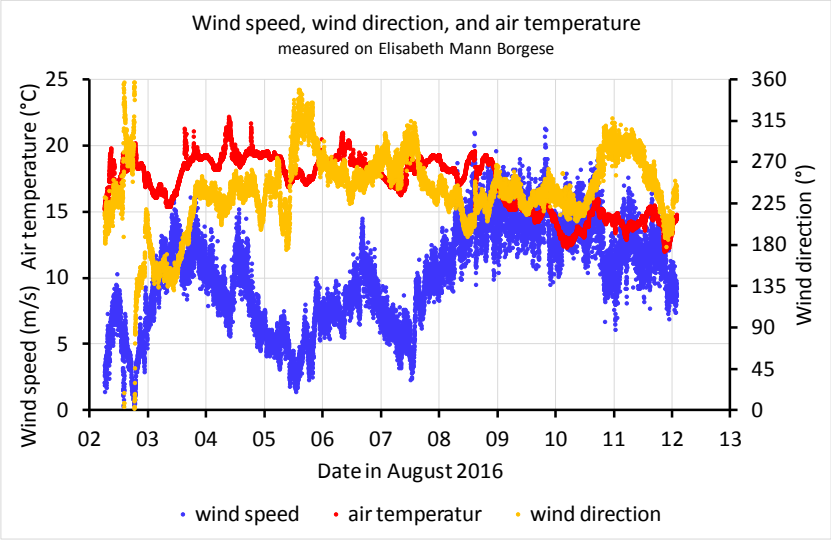

Figure 4: Air temperature, wind speed, and wind direction measured on-board by the DWD automatic measurement platform.

Sea surface temperature and salinity

Sea surface temperature and surface salinity distributions in the investigated area were measured by the ship's thermosalinograph. In addition, the recording of the actual water depths is given for spatial orientation (Figure 5). Surface water temperature was in a relative small range of around 19-20°C, except after increasing wind speed with an average of force 7 bft more areas of clearly lower temperature ~ 16°C were crossed. Surface water salinity decreases from southwest to the north from up to 14.5 in the Belt Sea to 5.5 in the northeastern Gotland Sea.

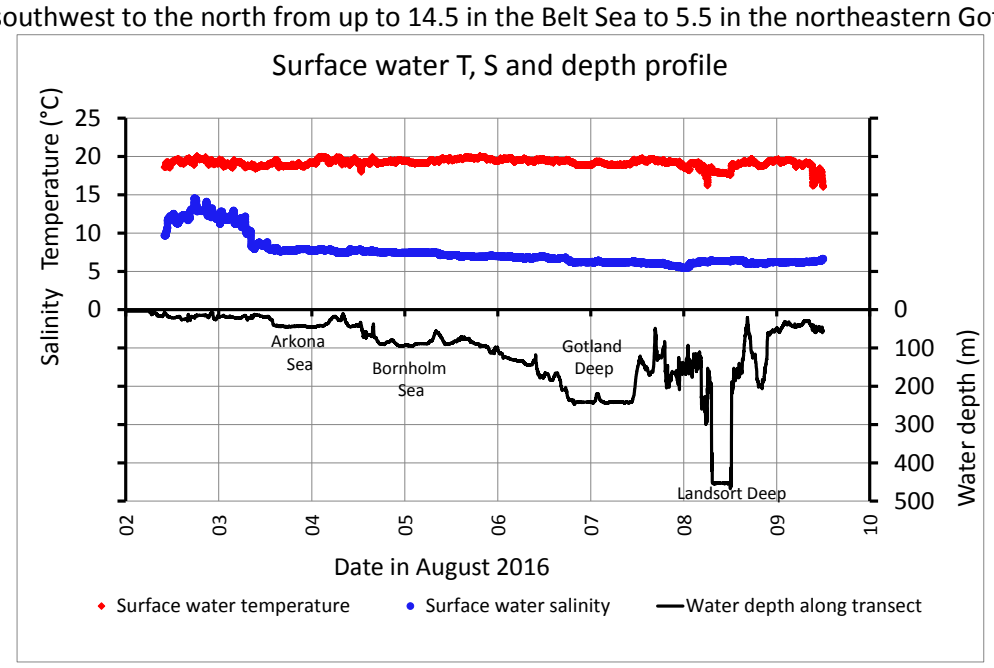

Figure 5: Surface salinity and temperature measured by means of a thermosalinograph and actual water depth during the Cruise EMB-135 of FS Elisabeth Mann Borgese from August 2nd to August 9th from the western Baltic Sea to the northern Baltic Sea.

Baltic talweg transect

The profiles of the stations that were alined along the talweg during the cruise EMB-135 from the Danish straits, through the western Baltic Sea, and further towards the northern Gotland basin were combined to a respective isosurface plots for salinity, oxygen, and temperature (Figure 6). This transect supplies a good overview of the hydrographic and environmental state of the entire Baltic Sea. It appears that in the central Gotland basin stagnation has begun and oxygen consumption took place below about 70 m depth. In this plot however H2S is ignored since the oxygen sensor is unable to record negative oxygen (see Figure 7).

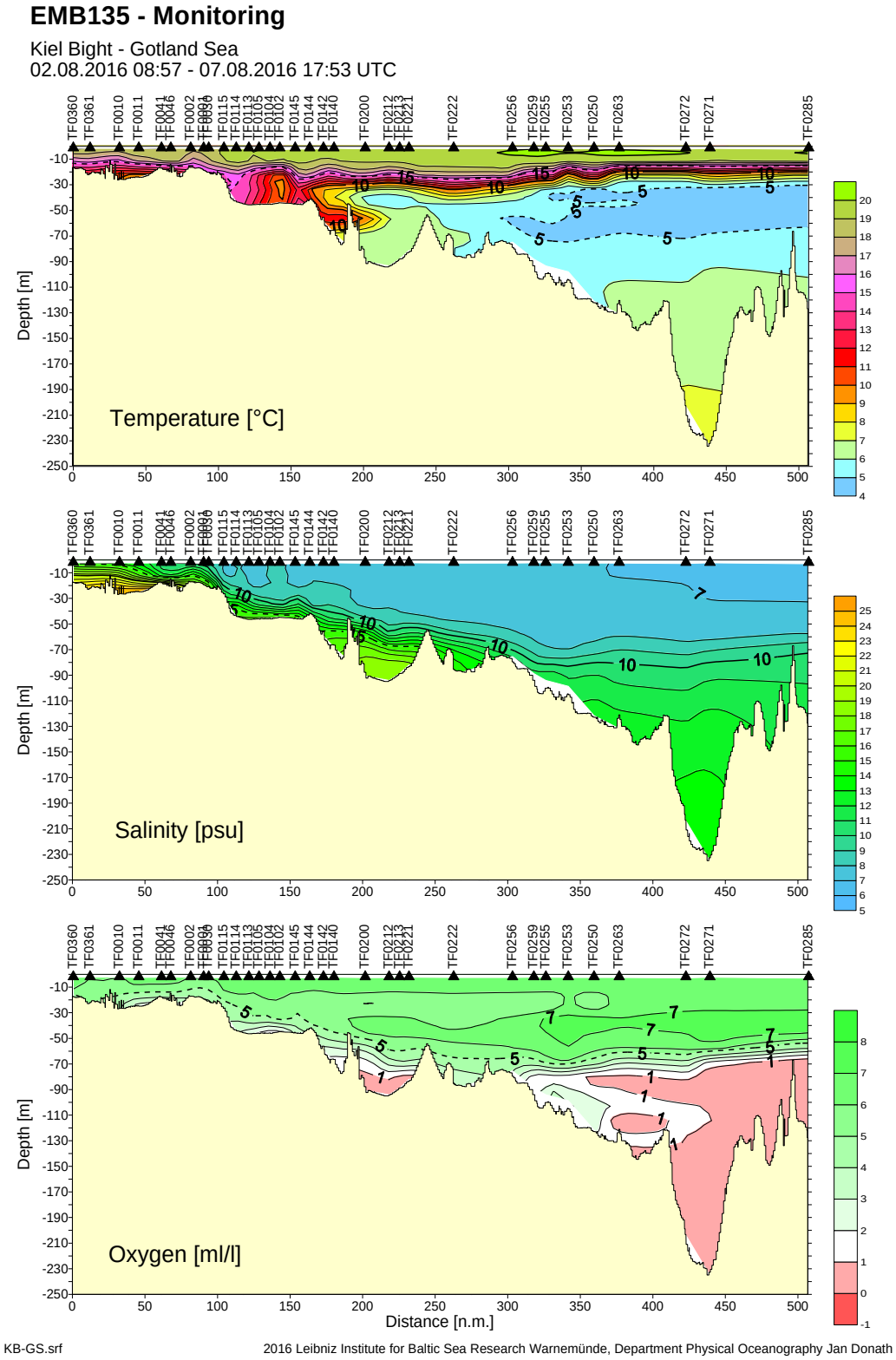

Figure 6: Distribution of temperature along the talweg of the Baltic Sea from the Kiel bight to the eastern Gotland Basin. The figure is based on the preliminary CTD data measured between August 2nd and 8th.

Development of Baltic Sea water masses - data of this campaign compared to previous cruises

Salinity

After a series of major Baltic inflows (MBI) that started in November 2013, with the strongest MBI being the Christmas MBI 2015, the temperature and salinity changes are propagating through the Baltic Sea. The changes started in the Bornholm Sea already in winter 2011/2012. The salinity, temperature, nutrient and oxygen conditions are compared to previous measurements to emphasize the meaning of the inflow events for the Baltic Sea after a long stagnation period with extended anoxic areas in the Baltic deep waters. The salinity in the bottom layer is shown in comparison to data from the cruises in July 2014, August 2015, and in February, March and May of this year is shown in the Table below. Unfortunately, because of persistent strong winds no data for the Farö Deep could be obtained for August 2016.

Table 1: Bottom water salinity of Baltic Sea deeps of this cruise (Aug16) compared to the last two years and from previous campaigns of this year.

	Jul-14	Jul-15	Feb-16	Mar16	May16	**Aug16**
Gotland Deep	12.25	13.42	13.84	13.85	13.77	**13.80**
Farö Deep	11.58	12.23	-	12.36	12.70	**-**
Landsort Deep	10.41	10.86	11.03	10.99	10.99	**11.26**
Karlsö Deep	9.58	9.65	9.97	9.94	9.87	**10.32**

It can be seen that salinity in Gotland Deep water remained almost stable this year but changes were strong in the Landsort Deep and the Karlsö Deep.

Table 2: Bottom water temperature (°C) of Baltic Sea deeps of this cruise (Aug16) compared to the last two years, to previous campaigns of this year, and to a former long-term average.

	Jul-14	Jul-15	Feb-16	Mar16	May16	**Aug16**	1971-1990
Bornholm Deep	5.90	7.01	8.39	5.72	7.00	**6.56**	6.12
Gotland Deep	6.00	6.87	7.86	7.62	6.88	**7.50**	5.62
Farö Deep	5.90	6.58	n/s	6.55	6.50	**-**	5.2
Landsort Deep	5.20	5.68	5.84	5.81	5.42	**6.02**	4.76
Karlsö Deep	5.20	5.02	5.22	5.22	5.01	**5.43**	4.18

Temperatures increased in the bottom waters from May to August 2016 in the Gotland Deep by 0.62 K, Landsort Deep by 0.60 K, and in the Karlsö Deep by 0.42 K. Thus, the long-term trend of increasing water temperature (°C) in the deep water layers of the central deeps of the Baltic Proper is confirmed by the recent measurements during EMB-135. Only in the Bornholm Deep, the bottom-near water was slightly colder than in May 2016.

Surface water temperature

The surface water temperatures of selected Baltic Sea areas during this cruise are compared to July 2014 and 2015, and early long-term mean values (1971-1990) collected during our Summer (July/August) cruises in the 1970s and 1980s in the table below. Surface water temperatures in July 2014 were much higher than recordings during this cruise. But July 2015 reflects an exception of especially low surface water temperatures in a mid summer month.

Table 3: Surface water temperature (°C) of Baltic Sea areas of this cruise (Aug16) compared to the last two years and to a former long-term average.

	Jul-14	Jul-15	**Aug16**	1971-1990
Mecklenburg Bight	18.8	18.3	**19.3**	17.7
Arkona Basin	19.4	16.3	**18.8**	17
Bornholm Deep	19.4	15.6	**19.2**	17.6
Gotland Deep	19.4	16.2	**18.9**	17.1
Farö Deep	20.4	16.8	-	17
Landsort Deep	21.8	15.2	**18.0**	18.2
Karlsö Deep	21.9	16.7	**18.4**	16.9

Oxygen

The development of the oxygen concentrations in the deep water layer is most interesting. Observed changes deviate significantly between the individual deeps. The deep water in the Gotland Deep is almost stable in the last month with regard to salinity and it appears that oxygen consumption already caused an oxygen deficit. Landsort Deep and Karlsö Deep waters clearly increased in salinity however no clear positive effect for the oxygen concentration was observed. In contrast for the Karlsö Deep the oxygen deficit increased from -1.13 ml/l to -1.87 ml/L. A little better was the situation in the Landsort Deep where the deficit slightly decreased (-1.05 ml/l to -0.92 ml/l).

Table 4: Bottom water oxygen concentration (ml/l) of Baltic Sea deeps of this cruise (Aug16) compared to the last two years, and to previous campaigns of this year.

	Jul-14	Jul-15	Feb-16	Mar16	May16	**Aug16**
Gotland Deep	0.37	0.86	1.7	0.34	0.08	**-0.79**
Farö Deep	-5.33	-1.54	n/s	0.43	0.05	-
Landsort Deep	-3.29	-0.88	-1.28	0.67	-1.05	**-0.92**
Karlsö Deep	-2.44	-1.22	-0.9	0.22	-1.13	**-1.82**

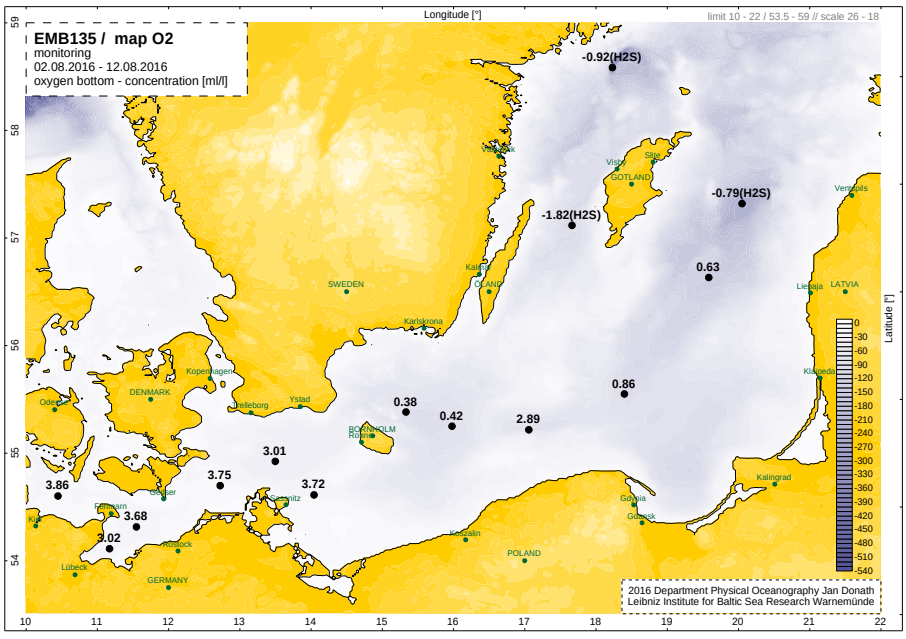

Figure 7: Oxygen concentration (ml/l) in bottom waters of selected Baltic Sea stations (H_2S is included as negative oxygen).

Nutrients

Reactive nitrogen species are almost depleted in the upper water column of the Baltic Proper in this summer situation, whereas remains of phosphorus are still available. Due to the relative deficit of nitrogen in comparison to phosphorus according to the Redfield ratio, diazotrophic cyanobacteria are favoured by this nutrient composition. In the bottom-near layer, the situation had changed strongly due to the inflow of oxygenated water in the Gotland Deep from July 2014 to July 2015: nitrate concentration increased in deep water layers. But because of the recent increase of hydrogensulfide in deep waters, nitrate was depleted there again and phosphate was accumulated by more than 50%. Landsort Deep and Karlsö Deep didn't show drastic changes from May to August 2016 neither in nitrate nor in phosphate concentrations of deep waters.

Table 5: Bottom water Nitrate (upper part) and phosphate (lower part) concentration (µM) of Baltic Sea deeps of this cruise (Aug16) compared to the last two years, and to previous campaigns of this year.

Nitrate (µM)	Jul-14	Jul-15	Feb-16	Mar16	May16	**Aug16**
Bornholm Deep	11.2	13.8	8.9	9.0	11.7	**10.65**
Gotland Deep	0.0	12.3	8.5	10.2	12.5	**0.00**
Farö Deep	0.0	0.0	n/s	0.0	4.9	**-**
Landsort Deep	0.0	0.0	0.0	0.0	0.0	**0.00**
Karlsö Deep	0.0	0.0	0.0	0.0	0.0	**0.00**

Phosphate (µM)	Jul-14	Jul-15	Feb-16	Mar16	May16	**Aug16**
Bornholm Deep	1.2	2.0	1.9	1.5	1.7	**2.19**
Gotland Deep	2.5	2.4	2.1	2.3	2.5	**3.90**
Farö Deep	4.3	3.0	n/s	2.8	2.6	**-**
Landsort Deep	3.3	3.3	3.5	3.8	3.2	**3.13**
Karlsö Deep	3.1	3.6	3.8	4.7	4.8	**4.30**

Attachment

List of Stations

Station No.	Start time	Station name	Latitude	Longitude	Water depth
1	02.08.2016 07:27	TFO5	54° 13.9005 N	12° 04.5667 E	13
2	02.08.2016 08:51	TF0041	54° 24.3977 N	12° 03.8135 E	19
3	02.08.2016 10:02	TF0040	54° 29.2779 N	12° 03.8997 E	13
4	02.08.2016 12:07	TF0011	54° 24.7817 N	11° 37.0331 E	25
5	02.08.2016 13:09	TF0018	54° 23.2285 N	11° 24.6146 E	23
6	02.08.2016 14:46	TF0010	54° 33.1031 N	11° 19.1901 E	29
7	02.08.2016 17:12	TF0361	54° 39.4784 N	10° 46.0190 E	23
8	02.08.2016 18:42	TF0360	54° 36.0242 N	10° 27.0154 E	19
9	03.08.2016 02:11	TF0022	54° 06.6383 N	11° 10.4414 E	24
10	03.08.2016 04:10	TF0012	54° 18.9434 N	11° 32.9700 E	25
11	03.08.2016 07:37	TF0046	54° 28.0207 N	12° 13.0163 E	26
12	03.08.2016 09:36	TF0002	54° 39.0150 N	12° 27.0770 E	18
13	03.08.2016 10:56	TF0001	54° 41.7635 N	12° 41.7383 E	21
14	03.08.2016 11:42	TF0030	54° 43.4418 N	12° 46.9713 E	23
15	03.08.2016 13:31	TF0115	54° 47.6585 N	13° 03.4969 E	30
16	03.08.2016 14:37	TF0114	54° 51.6353 N	13° 16.6260 E	45
17	03.08.2016 15:48	TF0069	55° 00.1001 N	13° 18.0564 E	47
18	03.08.2016 17:02	TF0113	54° 55.5722 N	13° 30.0095 E	47
19	03.08.2016 19:26	TF0105	55° 01.5078 N	13° 36.4563 E	47
20	03.08.2016 20:34	TF0104	55° 04.1006 N	13° 48.9164 E	46
21	03.08.2016 21:38	TF0102	55° 09.2833 N	13° 56.5200 E	46
22	03.08.2016 22:41	TF0103	55° 03.8359 N	13° 59.2740 E	47
23	03.08.2016 23:28	TF0109	54° 59.9890 N	14° 05.0160 E	48
24	04.08.2016 02:05	TF0111	54° 53.4247 N	13° 58.1464 E	45
25	04.08.2016 02:50	ABBOJE	54° 52.7065 N	13° 52.0537 E	45
26	04.08.2016 03:47	TF0112	54° 48.2299 N	13° 57.5864 E	40
27	04.08.2016 04:45	TF0121	54° 42.5793 N	13° 56.7892 E	30
28	04.08.2016 05:47	TF0150	54° 36.6760 N	14° 02.5501 E	21
29	04.08.2016 07:00	TF0152	54° 38.0407 N	14° 16.9399 E	31
30	04.08.2016 10:24	TF0145	55° 09.9554 N	14° 15.0085 E	47
31	04.08.2016 11:47	TF0144	55° 14.8807 N	14° 30.2223 E	45
32	04.08.2016 13:34	TF0142	55° 24.2764 N	14° 32.2389 E	61
33	04.08.2016 14:44	TF0140	55° 28.0249 N	14° 43.1369 E	69
34	04.08.2016 16:21	TF0205	55° 23.4434 N	15° 03.3924 E	76
35	04.08.2016 17:37	TF0200	55° 23.0347 N	15° 20.0442 E	92
36	04.08.2016 20:39	TF0220	55° 29.9793 N	16° 00.0430 E	81
37	04.08.2016 22:46	TF0211	55° 19.8077 N	15° 36.7836 E	96
38	05.08.2016 00:21	TF0214	55° 09.6333 N	15° 39.5118 E	94
39	05.08.2016 01:49	TF0212	55° 18.1864 N	15° 47.7500 E	96
40	05.08.2016 03:01	TF0213	55° 14.9817 N	15° 59.0585 E	90
41	05.08.2016 06:44	TF0221	55° 13.3017 N	16° 10.0507 E	83
42	05.08.2016 08:21	TF0224	55° 16.9939 N	16° 30.0886 E	63
43	05.08.2016 10:36	TF0222	55° 12.9617 N	17° 03.9002 E	92
44	05.08.2016 13:06	SC_E	55° 17.1795 N	17° 35.5873 E	84

45	05.08.2016 15:36	TF0256	55° 19.5845 N	18° 14.0567 E	78
46	05.08.2016 18:04	TF0259	55° 33.0230 N	18° 24.0001 E	90
47	05.08.2016 19:49	TF0255	55° 38.0734 N	18° 36.2594 E	96
48	05.08.2016 22:14	TF0252	55° 51.9234 N	18° 38.4957 E	114
49	05.08.2016 23:31	TF0253	55° 50.4050 N	18° 52.1466 E	100
50	06.08.2016 01:49	TF0250	56° 04.9704 N	19° 10.0645 E	123
51	06.08.2016 05:21	TF0263	56° 20.8087 N	19° 22.8096 E	133
52	06.08.2016 08:19	TF0260	56° 38.0446 N	19° 34.9112 E	143
54	06.08.2016 12:33	GB_B6	56° 58.8921 N	19° 34.6547 E	166
55	06.08.2016 13:42	GB_B7	56° 57.1347 N	19° 46.2100 E	182
56	06.08.2016 14:57	GB_B8	56° 55.3636 N	20° 01.2512 E	164
57	06.08.2016 16:36	TF0272	57° 04.2928 N	19° 49.8093 E	206
58	06.08.2016 18:39	GB_B14	57° 12.1491 N	20° 10.3492 E	234
59	06.08.2016 20:08	TF0271	57° 19.1941 N	20° 03.0605 E	237
60	07.08.2016 01:37	Gotland_NE	57° 22.0474 N	20° 19.9419 E	217
62	07.08.2016 07:22	TF0271	57° 19.3385 N	20° 02.9312 E	237
63	07.08.2016 15:36	GB_B24	58° 10.9081 N	20° 03.2396 E	162
64	07.08.2016 17:48	TF0285	58° 26.5498 N	20° 20.0776 E	123
65	07.08.2016 20:46	TF0282	58° 53.0171 N	20° 19.1340 E	166
66	08.08.2016 00:04	nGB-2	58° 51.9548 N	19° 44.8428 E	155
67	08.08.2016 02:54	TF0283	58° 47.0594 N	19° 06.0740 E	125
68	08.08.2016 04:44	nGB-1	58° 42.7760 N	18° 40.2788 E	234
69	08.08.2016 07:28	TF0284	58° 35.0170 N	18° 14.0406 E	441
70	08.08.2016 18:02	GB_B18	58° 00.0070 N	19° 36.0429 E	123
71	09.08.2016 22:24	TF0245	57° 06.9863 N	17° 40.1251 E	112
72	10.08.2016 02:51	TF0242	57° 43.0623 N	17° 22.0646 E	140
73	11.08.2016 01:15	TF0213	55° 15.0061 N	15° 59.0427 E	89
74	11.08.2016 14:26	TF0113	54° 55.5182 N	13° 29.9885 E	46
75	11.08.2016 18:25	TF0030	54° 43.4043 N	12° 47.0723 E	23
76	11.08.2016 22:01	TF0046	54° 28.0001 N	12° 12.9692 E	26
77	12.08.2016 01:22	TF0012	54° 18.9241 N	11° 33.1814 E	25