EMODnet
European Marine Observation and Data Network

EMODnet Sea-basin Checkpoints
Tender no MARE/2014/09-Lot3

EMODNET Oil Platform Leak Bulletin

(72 hour report)

Date: 13/05/2016

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European Commission

Executive Summary

An oil spill case was issued by EMODNET in 11:30CET in 10/5/2016. The request for prediction and impact assessment was sent to BSCP coordinator. BSCP oil spill task team, led by SMHI, react quickly. Within 24 hours, the general environment (e.g. Marine Protected Areas in Natura2000 and other human activities) in the accident area was investigated. The weather and sea state conditions are diagnosed for potential oil spill combatting.

At 8:15 CET 10/05/2016, a borehole located at (55,39974N ; 18,72303E) started to leak oil at a rate of 2500 barrels/day for a period of 3 days, which is equivalent to about 15tons/hour. The accident area is about 119 km northeast of Polish coast (Wladyslawowo) and 153 km west of Klaipeda, where there are Marine Protected Areas in Natura2000. The oil spill site has a water depth of about 86 meters.

BSCP oil spill task team, leading by SMHI, reacted quickly after receiving the request from EMODNET. The general environment (e.g. Marine Protected Areas in Natura2000 and other human activities) and meteo-ocean conditions in the accident area was investigated. The weather and sea state conditions are diagnosed for potential oil spill combatting: the accident area is dominated by a high pressure system in the afternoon of 10 May. Good weather and sea state conditions will last to the noon of 11 May. The winds will then increase up to Scale 6 and waves to 1-2 meters in the Polish waters in the following 24 hours. For the 48-72h of the spill, the weather condition will become better than that in 24-48h period. The weather and sea state conditions are in general good for oil spill combatting activities.

Two operational oil drift forecasting systems (SMHI SEATRACKWEB and DMI BSHdmod) were started to generate the forecasts in the afternoon of 10 May. The forecast showed that, for the first 24h of the spill, the oil has been drifted WSW-ward to about 10km. About 60% of the leaked oil quickly reached the surface. The oil slick is spread to 0.8km in radius and covering an area of 2km2. The oil thickness has been decreased sharply in the first few hours of the spill.

At 8:15CET 12th, the oil has been drifted WSW-ward to about 30km away from the spill site. About 60% of the leaked oil is at the surface and 5.5% remain in the bottom. The oil spread is increased to 1.2km in radius and covers an area of 5km2.

During 48-72h of the spill, the oil will drift SW-ward. At 7:00CET 13/05/2016, the oil is expected to reach (55.2N, 18.1E) A new simulation was made at 6:00UTC 12/05/2016. The results show that, for the next 24hours, the oil will drift SW-ward. At 8:00CET 13/05/2016, the oil is expected to reach (55.2N, 18.1E). The percentage of the oil at bottom remains as unchanged.

Based on the forecasts made by DMI and SMHI, there will be no oil landing on the coast, and no impacts on the SPA areas in Natura2000. However, the impact on the marine ecosystems (especially benthic community and fishery) should be significant, and should be further investigated.

1. The oil spill case description

At 8:15 CET this morning (10/05/2016), a borehole located at (55,39974N; 18,72303E) started to leak oil at a rate of 2500 barrels/day for a period of 3 days (1BBL=159L), which is equivalent to about 15tons/hour.

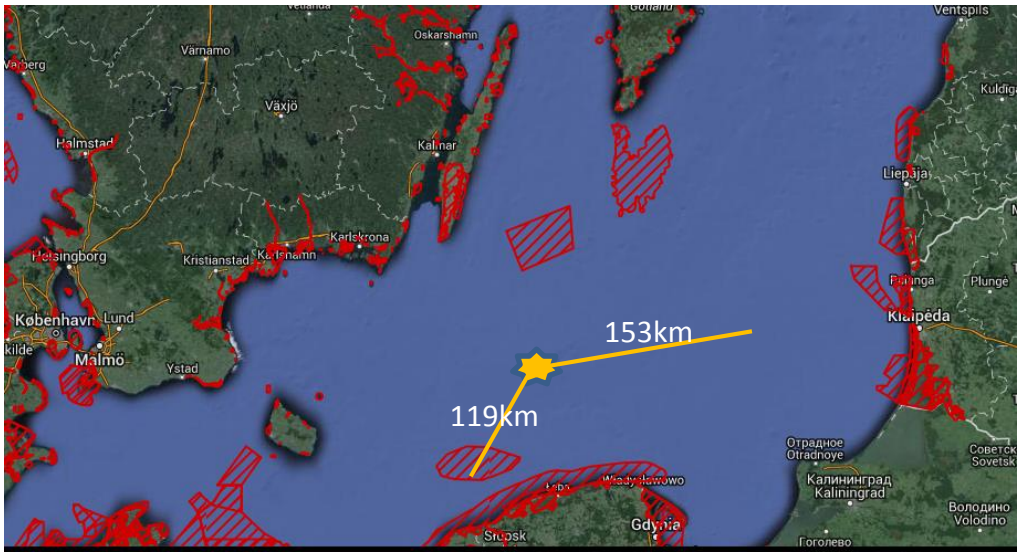

Figure 1. The location of the oil spill event (the location of the yellow star). The Natura2000 Areas (e.g., SPA) are marked with shadowes.

The accident area is about 119 km northeast of Polish coast (Wladyslawowo) and 153 km west of Klaipeda, where there are Spatial Protected Areas in Natura2000 (Figure 1). The oil spill site has a water depth of about 86 meters.

2. The methods used

Two operational oil spill system are used for this case study. A continuous release of crude oil at the bottom of the sea is assumed in this event.

SMHI uses Seatrack Web (https://stw.smhi.se/) system to predict the drift of the oil spill. The system is developed by SMHI. HIROMB, is used as the ocean model, and the meteorological data is from the HIRLAM (HIgh Resoluted Limited Area weather Model), 2 days ahead with the horizontal grid resolution of 1 nautical miles, and ECMWF (the European Centre for Medium-Range Weather Forecasts), 5 days ahead with the horizontal grid resolution of 3 nautical miles.

DMI uses BSHdmod calculates oil drift and weathering. BSHdmod is an add-on module to the hydro-dynamical model HBM (HIROMB-BOOS model), and was also developed at the Bundesamt für Seeschiffahrt und Hydrographie, Hamburg, Germany, specifically for the North Sea - Baltic Sea. DMI has generalised BSHdmod, to it may be combined with other ocean models, and used in other regions.

Input data used for the oil drift forecast include wind forecasts from DMI operational forecasting model HIRLAM (hourly, 3km resolution) and currents forecast from HBM (15minutes, 3nm resolution).

3. The impact data

A digital geographical database of the location and nature of bathing beaches and Natura 2000 nature protection sites was obtained from HELCOM Natura 2000 (and is included and available into the EMODnet BSCP data portal - Figure 2)

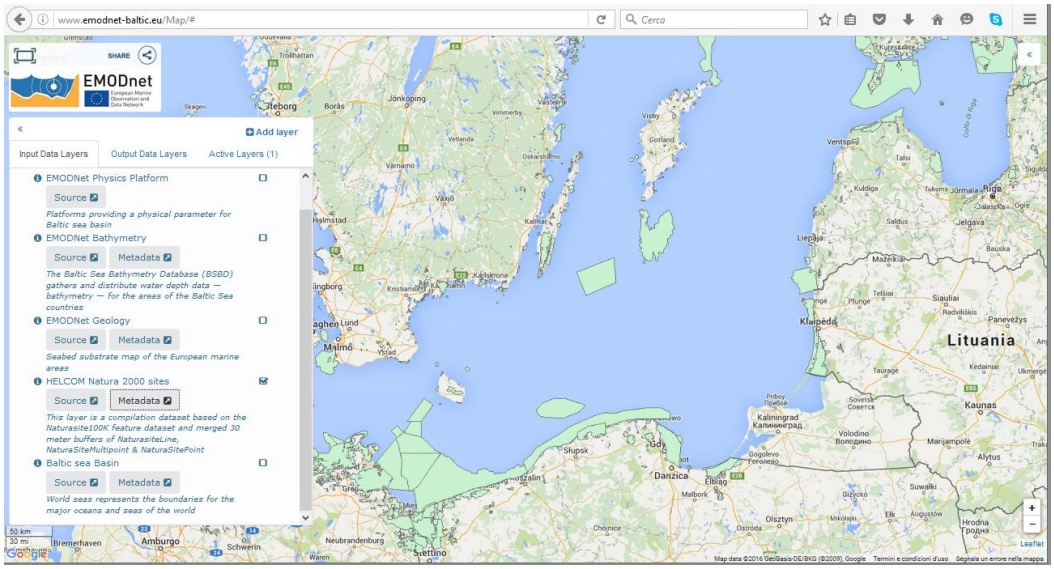

Figure 2. HELCOM Natura 2000 layer in the EMODnet BSCP (http://www.emodnet-baltic.eu/Map/)

The real-time ship traffic can be obtained from:
https://www.marinetraffic.com/dk/ais/home/centerx:17/centery:56/zoom:10 .
Figure 3 presents a snapshot in 2016051015CET

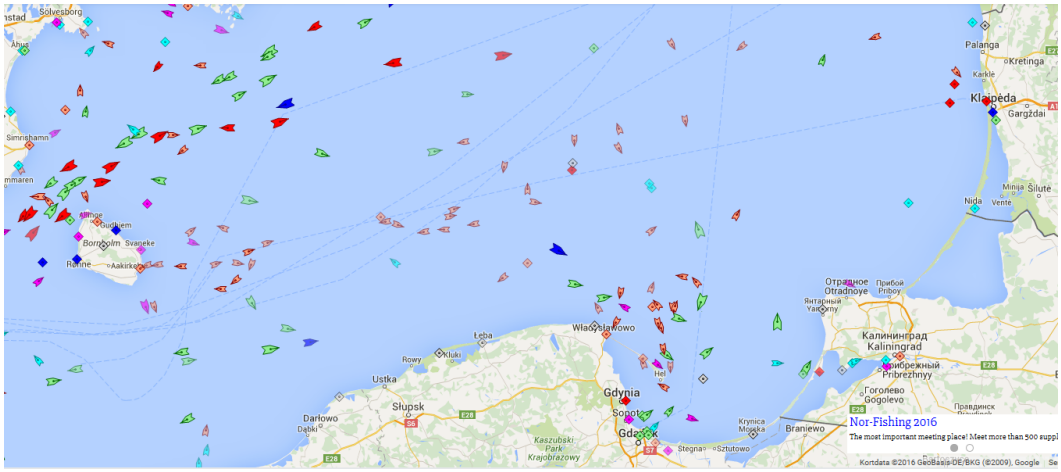

Figure 3. Ship traffic at 2016051015:15CET

4. Results after 24 hours

4.1 Weather and ocean conditions in the area

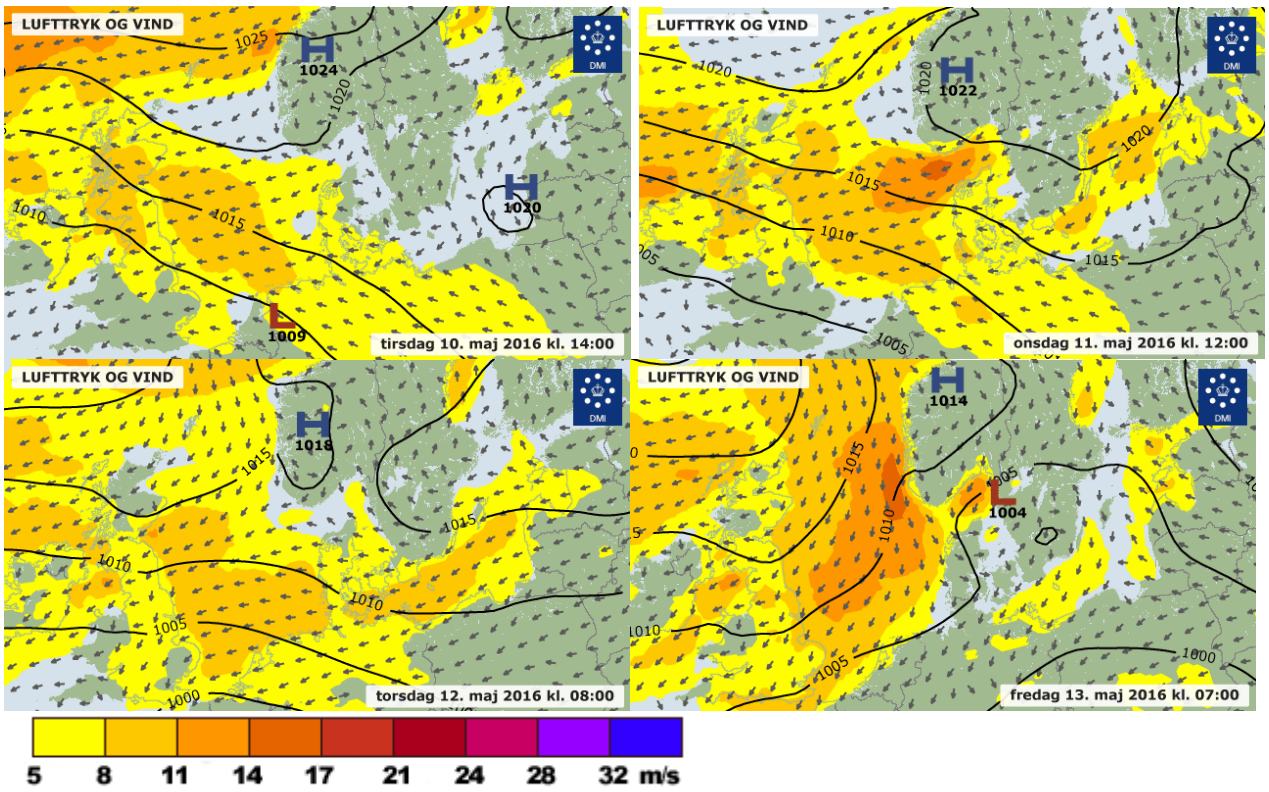

Figure 4. Pressure and wind forecast snap-shorts in the first 72h of the spill event

The weather conditions in the interested area for the first 72h of the spill event is shown in Figure 4. The accident area is dominated by a high pressure system in the afternoon of 10 May. Good weather and sea state conditions will last to the noon of 11 May. The winds will then increase up to Scale 6 and waves to 1-2 meters in the Polish waters in the following 24 hours. For the 48-72h of the spill, the weather condition will become better than that in 24-48h period. The weather and sea state conditions are in general good for oil spill combatting activities.

4.2 Fate and transport of the leaked oil

The wind is expected to weaken on late 12th, so the oil will not be drifting as much WSW-ward as it did the earlier 24 hours. According to our HIROMB/ECMWF-simulation the oil has been drifting WSW-ward at least 21 km in 72hours and the western part of it has reached an area near 55.4N, 018.4E.

SHMI made several runs with Seatrack Web using both HIRLAM forcing and ECMWF forcing for the first 48 hours, and then only ECMWF forcing for the 72 hours simulation. The simulations were made both with a horizontal grid resolution of 3 nautical miles and the other one using HIRLAM/HIROMB with a horizontal grid resolution is 1 nautical miles and on the 11th and on the 12th and the trajectories of the different oil spills don't differ that much and confirm previous considerations.

The result of the simulations can be reached at:

48h HIRLAM forcing, made on the 10th:

https://stw.smhi.se/oil/player/?id=960a41cc-615a-46fb-ba93-cefc12213a23

48h HIRLAM forcing, made on the 11th:

https://stw.smhi.se/oil/player/?id=960a41cc-615a-46fb-ba93-cefc12213a23

48h HIRLAM forcing, made on the 12th:

https://stw.smhi.se/oil/player/?id=842a0ce9-fe3a-469b-9bb4-0d1e22d37308

72h ECMWF forcing, made on the 10th:

https://stw.smhi.se/oil/player/?id=d2d336cc-768e-444f-bf16-a03468cbcffa

72h ECMWF forcing, made on the 11th:

https://stw.smhi.se/oil/player/?id=ef666582-6b1d-4289-9bab-7851c4a29f49

72h ECMWF forcing, made on the 12th:

https://stw.smhi.se/oil/player/?id=bb0f64bc-832a-4681-8d59-7f6e9aad78d5

DMI run a 96h forecast by using a mixed HIRLAM and ECMWF weather forcing.
Due to the calm weather condition, the oil does not drift too far from the incident site.

Figure 5 displays the oil tracks in the first 48h from SMHI simulation and Fig. 6 for the first 72h simulation with DMI model. Both simulations show that the oil will drift WSW-SW-ward although there are some differences. During the first day, the oil drifted less than 10km due to the calm weather. During the

second day, with stronger winds, the oil drifted to SW-ward by about 30km, and reaches 50km away from the spill site (Fig. 7)

Figure 5. The simulated oil trajectories for the first 48h(top) and 72h (bottom) of the spill, shown together with wind vectors (SMHI)

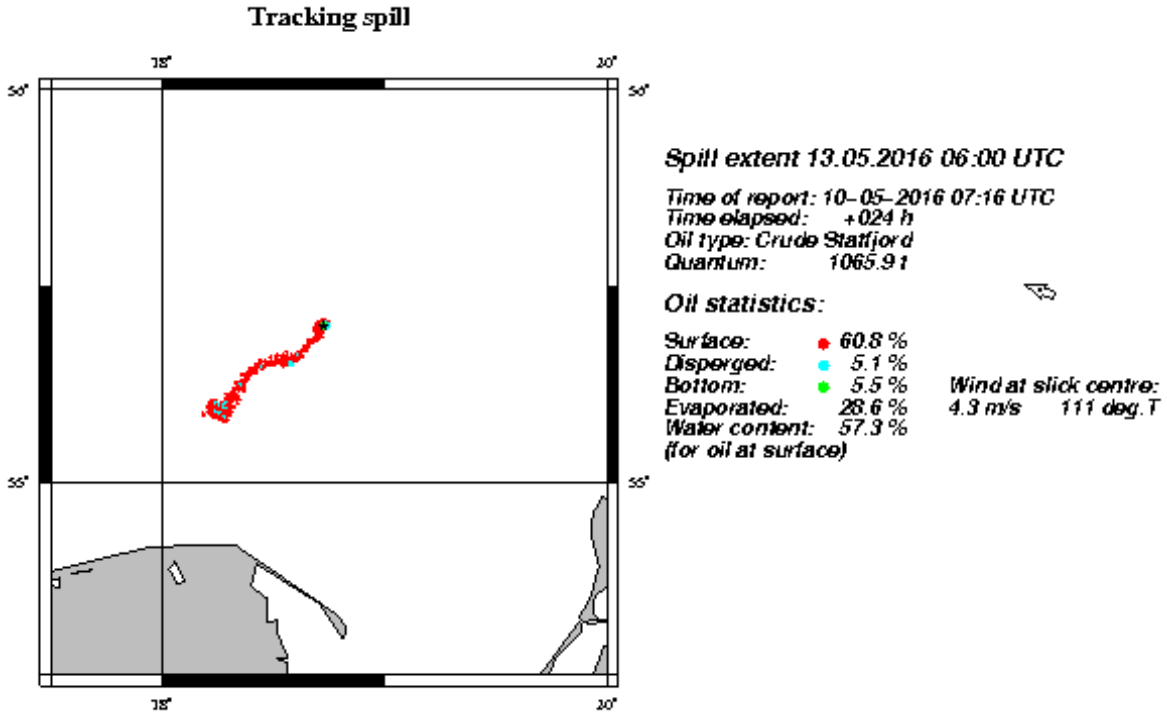

Figure 6. The simulated oil trajectories for the first 72h of the spill (DMI)

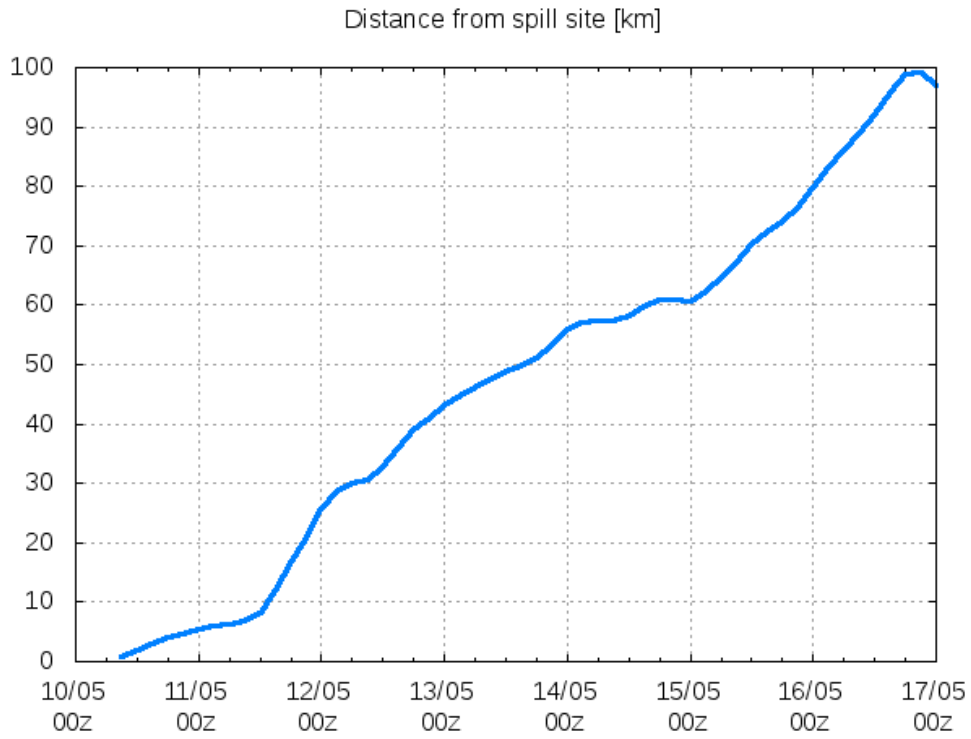

Figure 7. Distance of the oil slick from the spill site

As this is a spill at sea bottom, the vertical movement of the oil is also important. The total percentage of the oil at surface and bottom are shown in Figure 8. It is shown that, after 18h of the spill, the oil in the surface has been kept around 60% and last for another 4 days. The amount of oil in the bottom reaches steady (~5.5%) after a few hours.

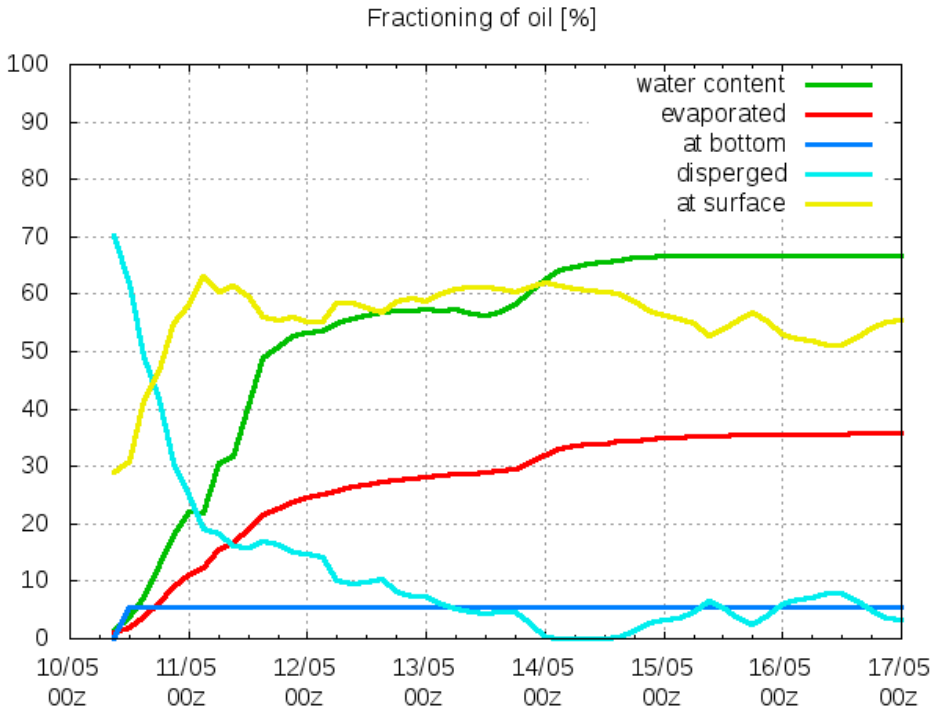

Figure 8. Percentage of oil characters after the oil spill starts

The oil characters e.g. thickness, radius, total mass, volume and area are shown in Figs. 9-10. During the first day, the oil slick is spread to 0.8km in radius and covering an area of 2km^2, and the oil thickness decreased sharply in the first few hours of the spill.

At 8:15CET 12th, the oil spread is increased to 1.2km in radius and covers an area of 5km^2. After 00UTC in 14/05/2016, the oil thickness is expected to decrease rapidly again. The total volume and mass of the oil will keep unchanged while the total area affected will quickly increase to 90km^2 at 00UTC in 17/05/2016. A simulation of the oil tracks up to that time is shown in Figure 11. After 72h, the oil will move much faster but will not reach the coast.

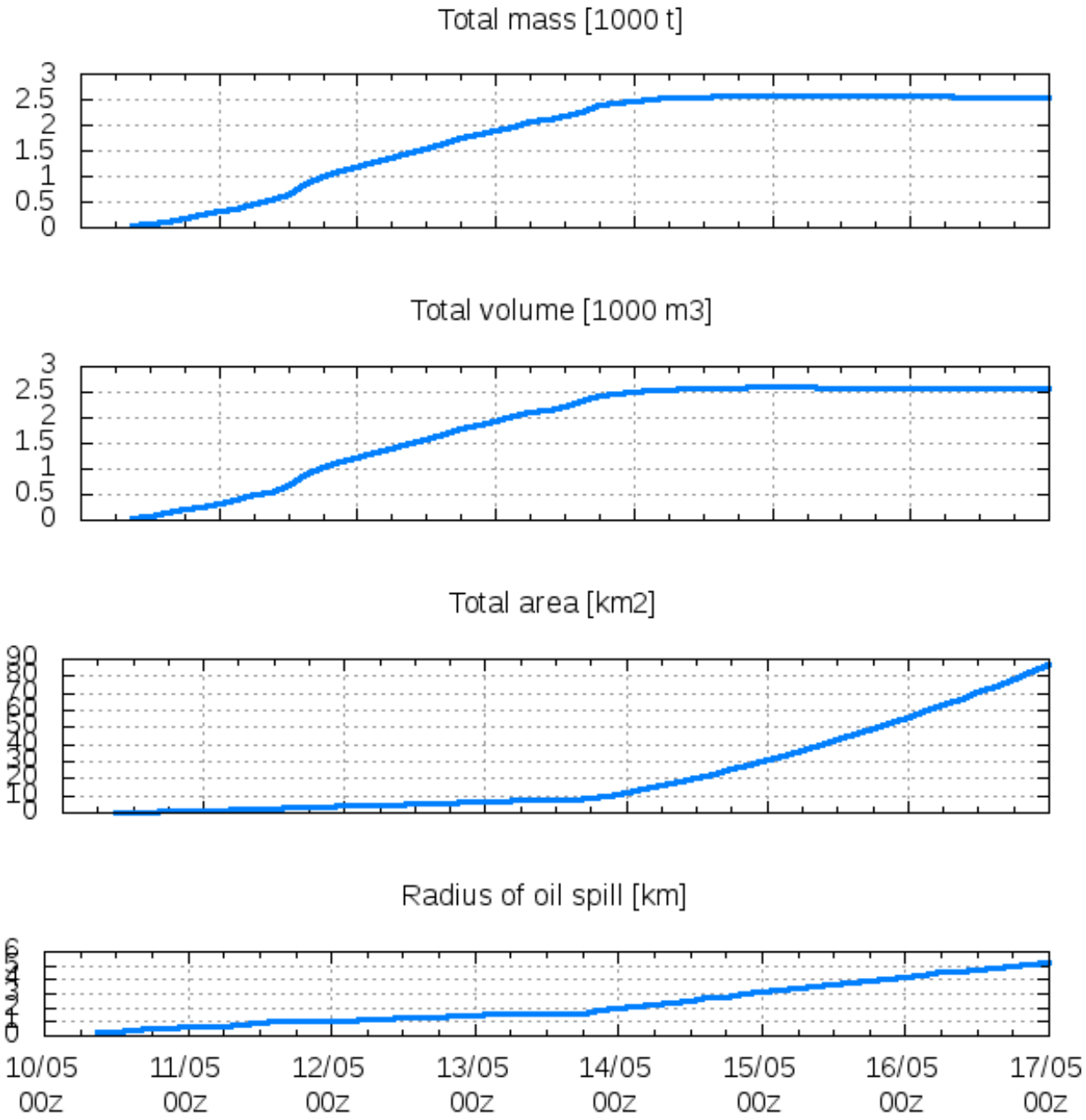

Figure 9. Forecast of Oil characteristics

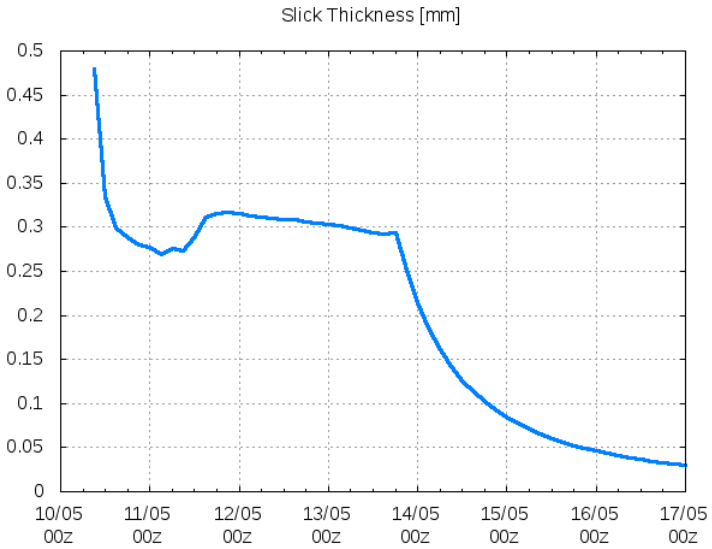

Figure 10. Forecast of Oil characteristics (continue)

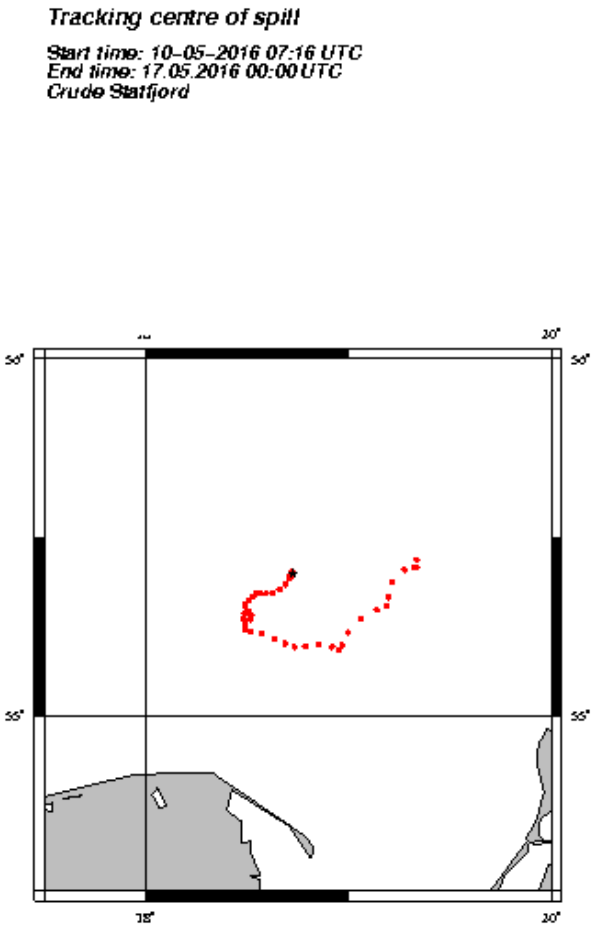

Figure 11. Simulated oil track during 2016051007UTC-2016051700UTC

4.3 Expected impact on environmental and human activity

Based on the forecasts made by DMI and SMHI, there will be no oil landing on the coast, and no impacts on the SPA areas in Natura2000. However, the impact on the marine ecosystems (especially benthic community and fishery) should be significant, and should be further investigated.

The Baltic fishery has experienced a decline in last 30 years, as shown in Figure. 12. The oil spill may further damage the fragile marine ecosystems in the region.

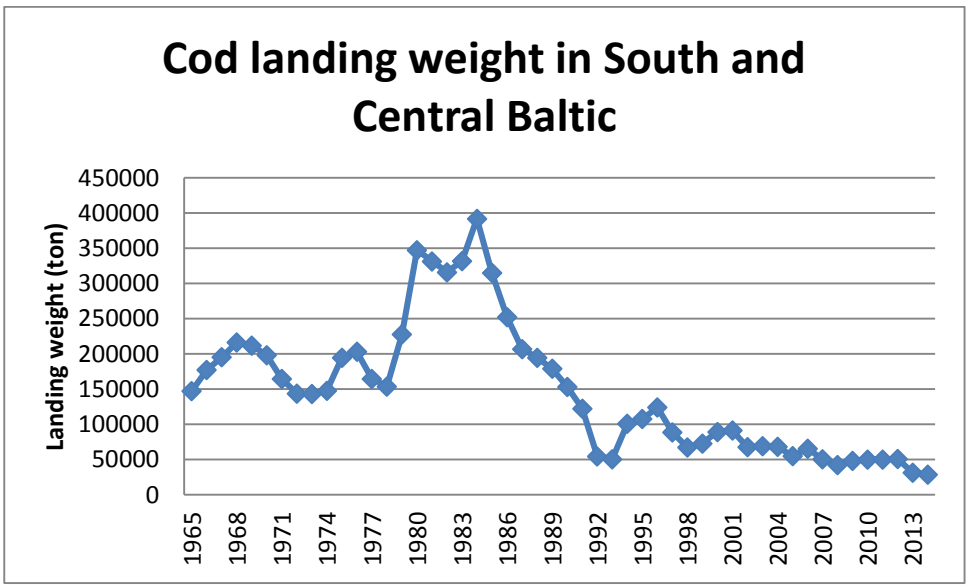

Figure 12. Baltic fishery decline for past 30 years.

4.4 Assumptions necessary to perform the assessment

SMHI simulation: It is assumed that the event is a continuous leaking from the sea bottom. A type of Heavy Crude oil type (with a density of 990.0 kg/m^3) has been used in SMHI's simulation.

DMI simulation: It is assumed that the event is a continuous leaking from the sea bottom. A type of Crude Statfjord oil type (with a density of 886kg/m^3) has been used in DMI's simulation and Crude Heavy oil in SMHI's simulation

4.5 Forecast analysis

Since the oil floats to the surface rather fast, it is the wind that has the strongest influence on the oil drift direction and speed. The first 24h there was rather smooth weather conditions with weak winds in the area. The next 24h the wind increased and the oil started to drift WSW-wards. The last 24 hours the wind weaken somewhat, but the drifting direction remained more or less.

During the first 72h, the dominant winds are northeasterly, which is consistent with the oil slick movement, while the surface currents in the area has been highly variable.
No figures shown here but they can be viewed in CMEMS website:
http://marine.copernicus.eu/web/69-interactive-catalogue.php?option=com_csw&view=details&product_id=BALTICSEA_ANALYSIS_FORECAST_PHYS_003_006

At SMHI we made several runs with Seatrack Web using both HIRLAM forcing and ECMWF forcing for the first 48 hours, and then only ECMWF forcing for the 72 hours simulation. The simulations were made both on the 11th and on the 12th and the trajectories of the different oil spills do not differ that much, anyhow they can shall the importance of winds

4.6 Bottlenecks and weaknesses

For this particular event, the technology for prediction of the oil tracks is mature and forcing data have good quality. As it does not affect the coast and sensitive areas in Natura2000, the impact may not be disastrous to these areas. However, it is important to investigate the impact of the oil spill on the fishery in the region, which is a long-term task.

4.7 Recommendations

The existing data collection and provision services are operational and mature. For DMI, the post-processing and plotting took quite some time, which can be further automatized. In addition, the human activity data can be used as a background for making the oil track maps.