Growth and innovation in ocean economy
Gaps and priorities in sea basin observation and data
Black Sea Check point

EMODNET OPL Bulletin

EMODNET Oil Platform Leak Bulletin

The EMODNET Oil Platform Leak Bulletin contains the forecast/scenario information on the fate and transport of oil leaks emanating from fixed platforms.
The bulletin currently is built upon the University of Liege hydrodynamic forecasting products (http://www.seamod.ro/) and the high temporal SKIRON winds forecast and the new CYCOFOS waves in the Black Sea.

Date 11 May 2016

Bulletin Content
The bulletin presents the forecasts of the currents, wind and oil transport at the surface and the dispersed in the water column for 72 hours after the initial blowout of a pipeline located at the seabed supposed to have occurred on the 10/05/2016 at 08:15 CET.

Data and methods:
The position of the oil spill is supposed to coincide with a blowout of a pipeline located on the seabed at the depth of 50 meter at position LAT = 44°.2494 N, LON = 29°. 47508E. The overall amount of oil released is set to 300m3 crude oil released during a period of 2 days.

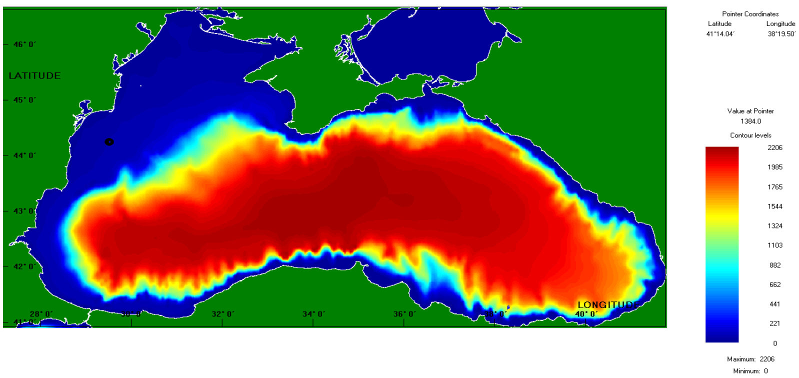

Figure 1. Bathymetry of the Black Sea with the location of the pipeline oil spill blowout (black dot).

Description of MEDSLIK oil spill prediction results

<u>Forecasting Data used:</u>

- 6 hourly surface currents and SST from the University of Liege Black Sea Forecast System
- 1-hourly SKIRON wind fields for the Black Sea
- 3-hourly CYCOFOS waves for the Black Sea

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Description of the results

<u>Oil spill after 24 hours</u> (11/05/2016 08:15 CET, figure 2)

The sea surface currents in the area of incident are North-North-East, while the wind is South-West with intensity around 4.0 m/s.

The oil spill 24 hours after the reported incident was at sea surface 65.23% of the total released oil at that time. The oil transport at sea surface follows the direction of winds and sea current, without any impact at the coastal zone. The evaporated oil constitutes the 34.17% of the oil released during the 1st day after the incident.

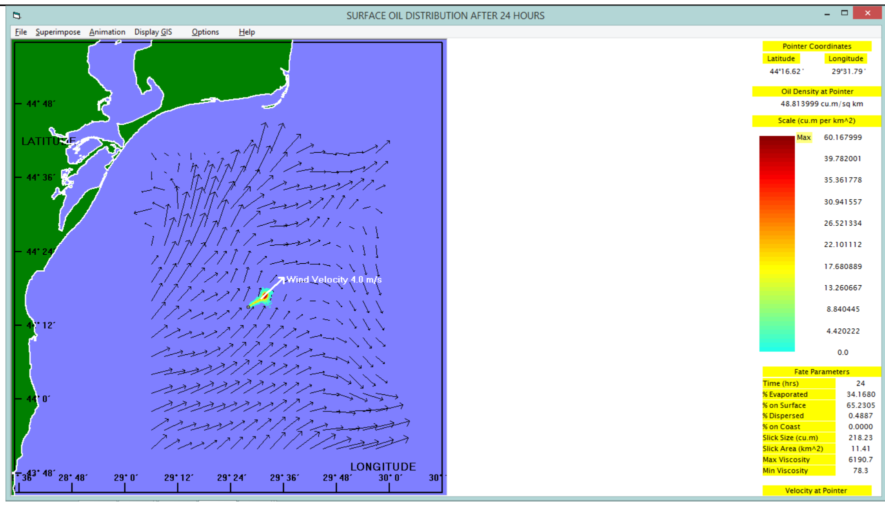

Figure 2: Surface currents **<u>(black arrows)</u>** and wind **<u>(white arrow)</u>**, at 08:15 CET 11/05/2016. Position of the incident is highlighted with the dot.

<u>Oil spill after 48 hours</u> (12/05/2016 08:15 CET, figure 3)

The surface currents are North-East, while the wind is South-West with intensity around 4.2 m/s.

The oil spill 48 hours after the incident was at sea surface 63.12% of the total released during the 2 days. The oil transport following the direction of winds and of the sea currents, without any impact at the coastal zone. The evaporated oil constitutes the 34.75% of the total oil spilled.

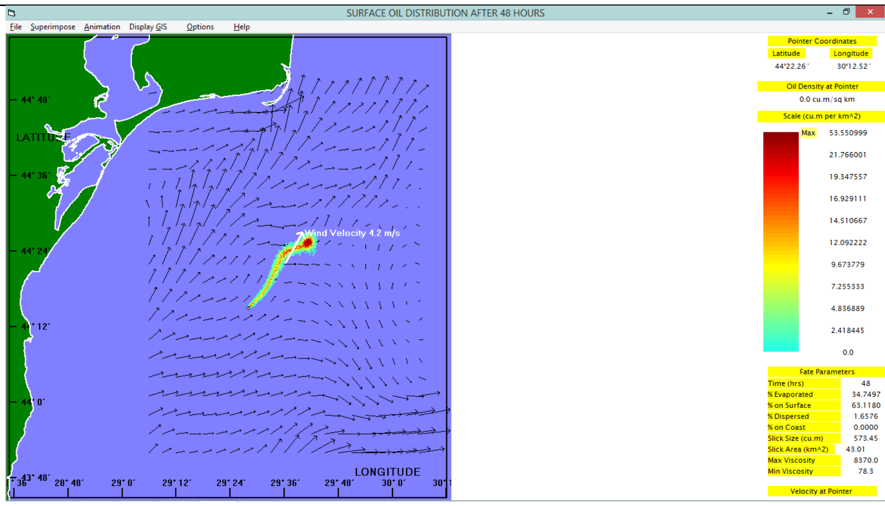

Figure 3: Position of the oil slick at 08:00 of 06/10/2015, oil concentration is given in units of m3/km^2. Surface currents **<u>(black arrows)</u>** and wind **<u>(white arrow)</u>**.

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Oil spill after 72 hours (13/05/2016 08:15 CET, figure 4)
The sea surface currents in the area of incident are Northerly, while the wind is South-East with intensity as high as 7.6 m/s.
The oil spill 72 hours after the reported incident was at sea surface 59.512% of the total released oil. The oil transport following the direction of winds and of the sea currents, without any impact at the coastal zone. The evaporated oil Constitutes the 35.3% of the total oil spilled.
The oil spill has been transported far away from the location of the incident, one day after the oil release from the pipeline has been stopped.

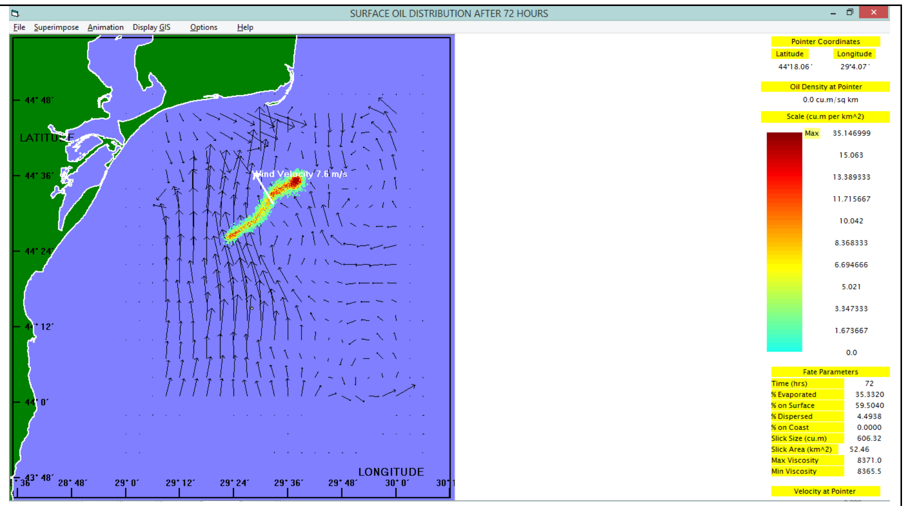

Figure 4: Position of the oil slick at 08:15 on 13/05/2016, oil concentration is given in units of m3/km^2.

Oil spill after 72 hours (13/05/2016 08:15 CET, figure 5)

The dispersion of the oil in the water column constitutes only the 4.5% of the total oil released and follows the general direction of the sea surface oil transport, i.e. to the North-East.
Despite the fact that the source of the oil spill located at the seabed, the amount of the dispersed oil In the water column

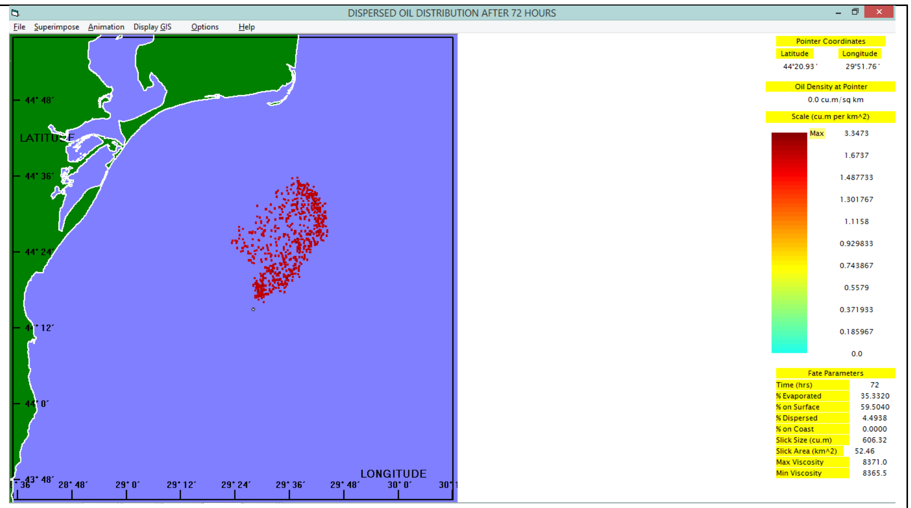

Figure 5: Position of the dispersed oil within the water column at 08:15 on 13/05/2016, oil concentration is given in units of m3/km^2. Location of the source is indicated as a small circle.

constitutes a small fraction 4.5%. This is due mainly to the fact that the location of the subsurface source of the oil spill was at shallow water, i.e. at 50 m and the oil rise the surface very quickly. Moreover, the weak subsurface sea currents at the area of the oil spill source case an insignificant diversion of the oil plume from the vertical axis (Figure 6) to the North-East, as the dominant sea currents.

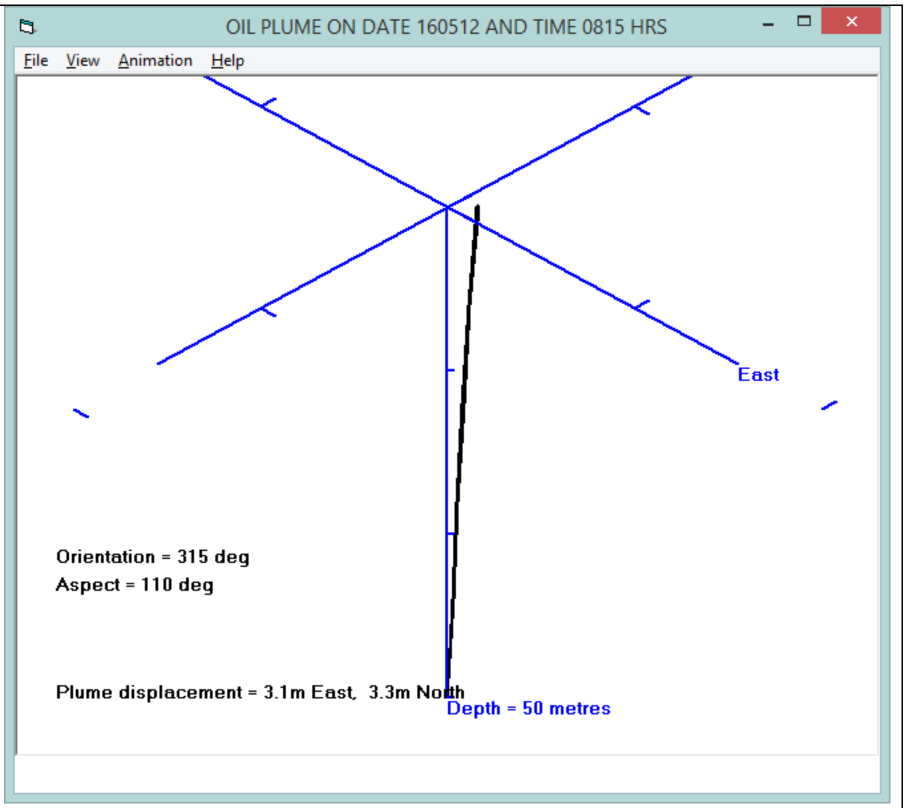

Figure 6. The plume of the oil spill from the depth of 50 m (where the blowout of the pipeline was located) up to the sea surface, at 08:15 on 12/05/2016, i.e. after 2 days from the reported incident. This plot constitutes the last hour of the oil released from the pipeline.

Oil Fate Parameters:

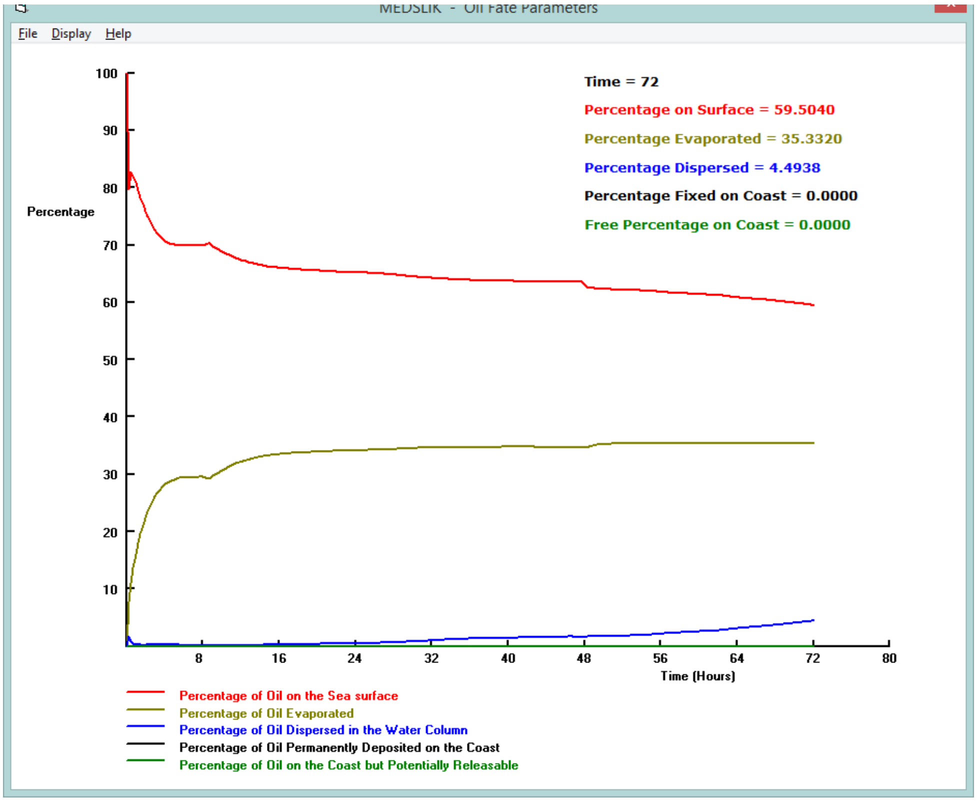

Fig. 7: **Oil Fate parameters, evolution in time**: oil spill at sea surface, oil evaporated, dispersed in the water column.

Expected impact of simulated oil spill on environmental and human activity

Level of potential impact of the oil slick simulated on environmental and human activity can be evaluated basing on:

- Bathymetry
- Coastal and seabed geomorphology
- Environmental resources and fish stock
- Transport routes
- European protected areas

A brief overview of this information on north-western Black Sea shelf presented below is based on a literature survey conducted by the experts in the frame work of BlackSea Checkpoint.

Bathymetry and coastal and seabed geomorphology
The oil slick was generated in the area of potential geohazards including submarine earthquakes, slope instabilities, and coastline erosion (Fig.8).

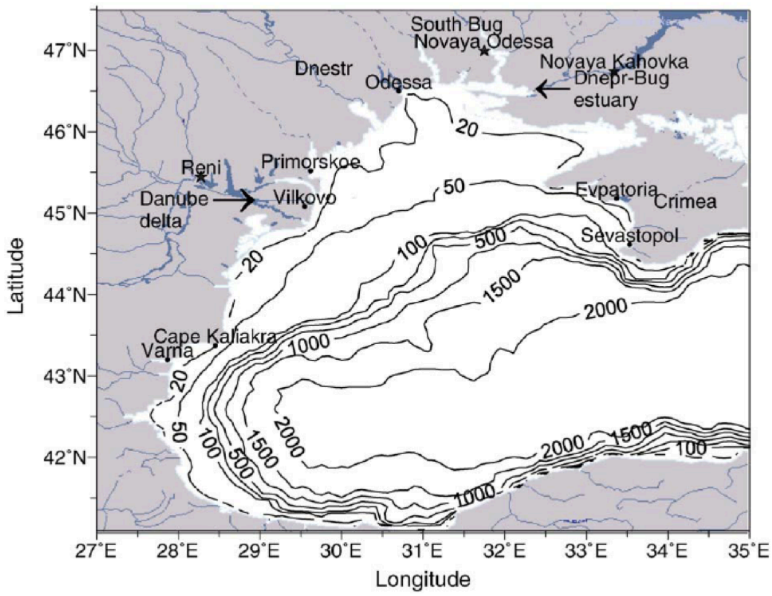

Figure 8. Bathymetry (m) of the western Black Sea and major rivers. (Yankovsky et al, 2004)

The Danube Delta shows a significant shoreline retreat, up to 20m/year (Fig. 9).

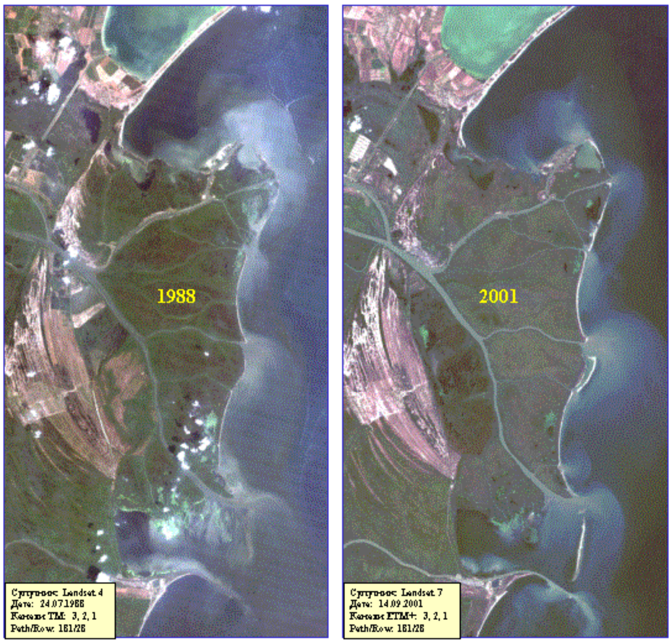

Figure 9. Evolution of the Danube Delta coastline.

Additionally, in the vicinity of spill drift area, the Dnepr paleo-delta area is situated, which indicates the major faults and methane seep locations in the northwesternBlack Sea (Fig. 10).

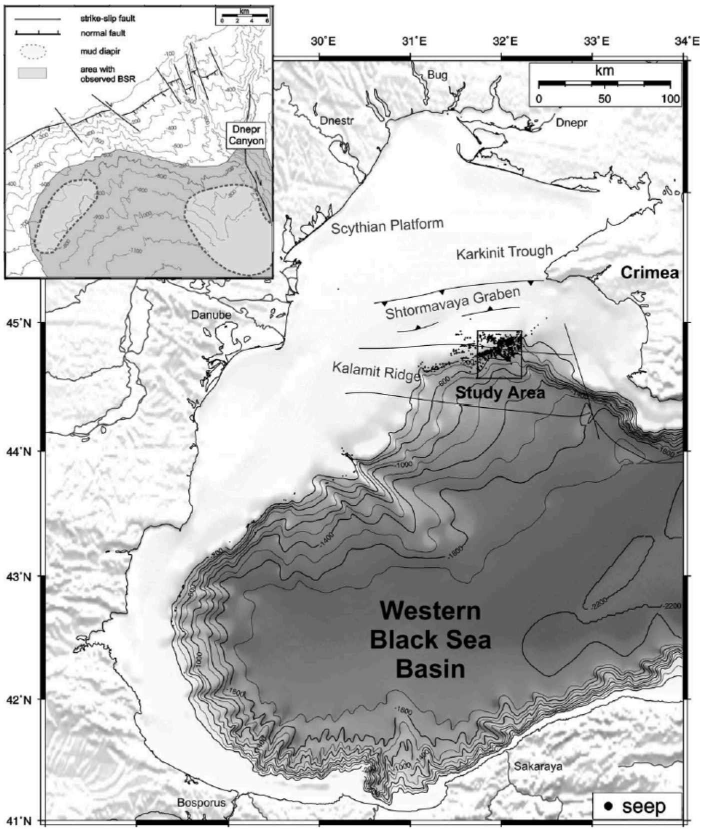

Figure 10. Location map of the Dnepr Canyon area with indication of deep structures, major faults and methane seep locations in the northwestern Black Sea (Naudts et al, 2006)

Environmental resources and fish stock

The area of potential oil slick impact exhibits high planktonic primary production rates, clearly reflecting meso- and eutrophic feature of these waters. The major primary producers are usually *Skeletonemacostatum, Chaetoceroscurvisetus, Peridiniumtrochoideum, Exuviaellacordata and Prorocentrummicans*. An example of spring coccolithophores bloom is presented in Fig. 11.

Figure 11. Spring coccolithophores bloom in the area of potential spill impact (May 11, 2002) (http://visibleearth.nasa.gov/view.php?id=59032).

The area of potential oil slick impact coincides with of turbot (*Scophthalmusmaeoticus*), which is one of the most valuable commercial species in the Black Sea (Fig.12).

Figure 12. Turbot spawning and feeding areas (Black Sea Environmental Programme (BSEP).

Although there is not sound evidence of direct hazardous impact of such a volume oil spills on the unique Black Sea chemocline and biodiversity hotspots, long lasted cumulative effect is highly expected.

Transport routes
Traffic density map in Fig. 13 demonstrates the most congested routes of Odessa (Ukraine)-Bosporus and Constanta (Romania)-Bosporus.

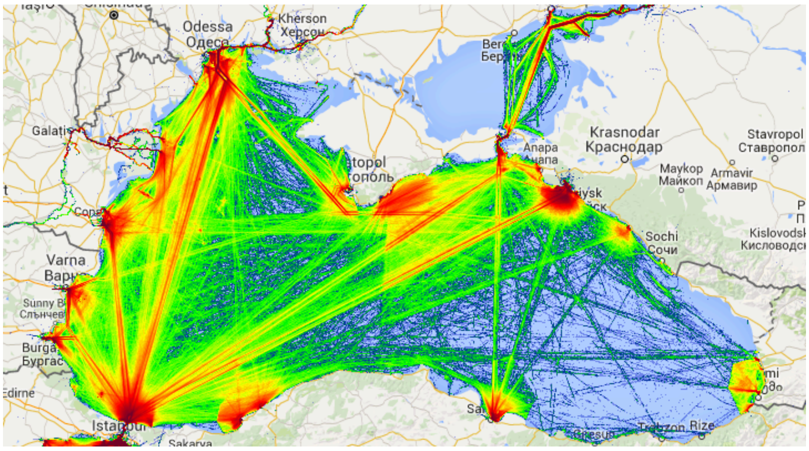

Figure 13. Ship traffic density, 2014 (https://www.marinetraffic.com)

Simulated oil spill could potentially contribute to total operational oil contamination of the basin (Fig. 14).

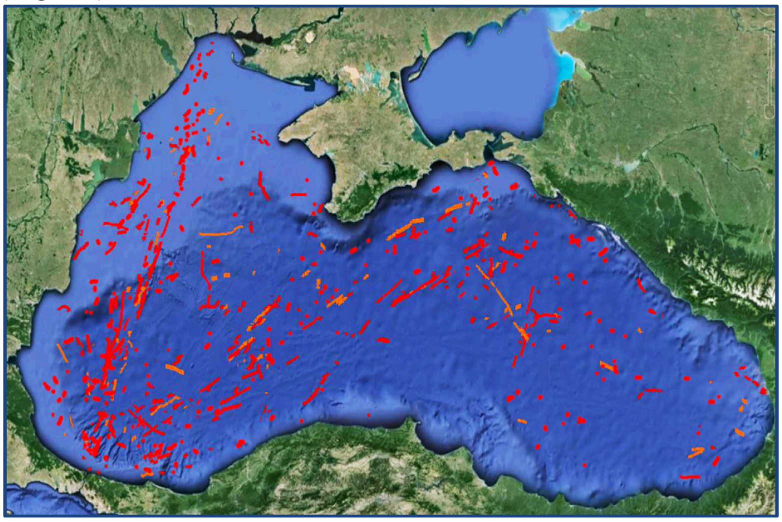
Figure 14. Map of oil spills on the Black Sea surface revealed from satellite radar imagery over 2009-2011 (Mityagina and Lavrova, 2015).

European protected areas

Natura 2000 Viewer indicates the coastal area of potential oil slick impact as Habitats Directive Sites and Bird Directive Sites (Fig.15).

Figure 15. Screenshot of Natura 2000 Viewer zoomed in the area of potential soil slick impact. (http://natura2000.eea.europa.eu/#).