IMDIS 2016

International Conference on Marine Data and Information Systems
Gdansk (Poland) 11-13 October 2016

Web interface for the Oil Spill prediction software

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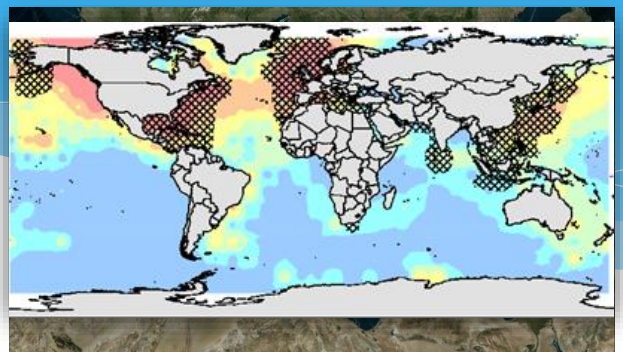
Motivation for Supporting Marine Safety

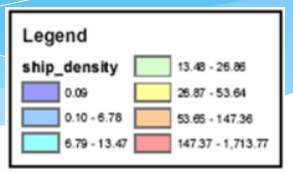
One of the permanent risk from an incident at sea, is associated with the **traffic of maritime transport** and with the operation of coastal and **offshore** installations related to **oil and gas industry**.

Such an dense activity imposes on the countries the need to response in cases of major incidents. Med and Black seas constitute a significant % (more than 15%) of the world maritime navigation.



Map with ship accidents: more than 4 ships per

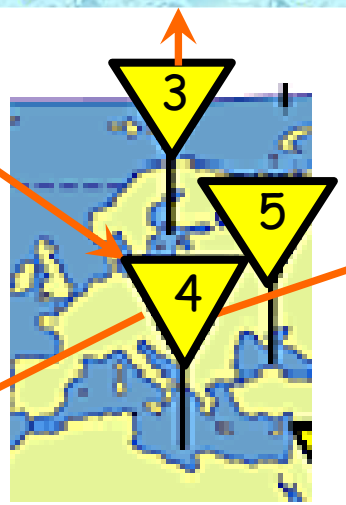
Ship density:



Regional Emergency Centres for Response to oil spill pollution

An incident like this may occur

Response to an oil incident: oil combating vessel



The Contingency Plans require the application of oil spill models

Response to oil incident: booms deployment

The catastrophe

Motivation for Supporting Marine Safety

The success of response to oil spill incidents depends at first on the operational prediction of the movement and weathering of the oil spills. Such predictions may be obtained through the application of oil spill models to forecast:

- Where the oil spill will move
- How soon it will get there
- Which resources are threatened
- What will be its state when it arrives

The first 3 questions are the more critical for effective support of the response agencies and **depend completely on reliable sea currents, winds, waves data.**

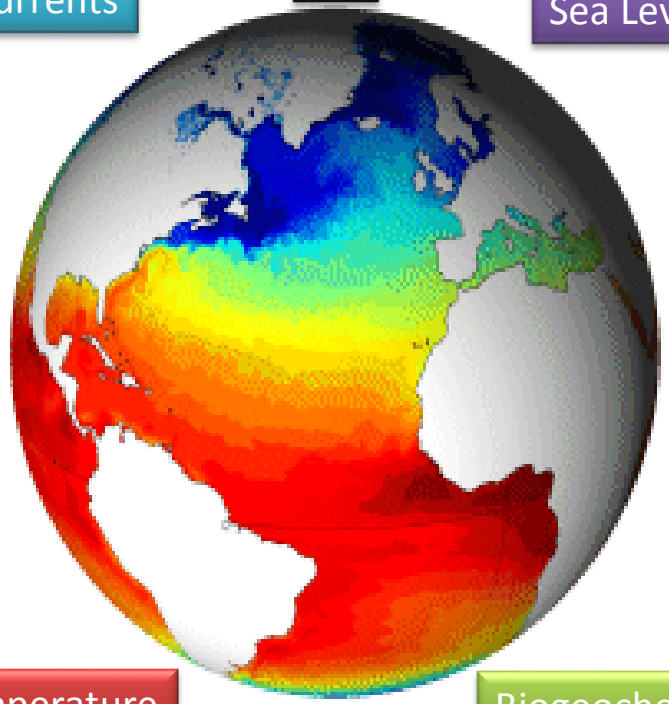
For the 4th question a reliable fate algorithm is required.

CMEMS provides a dynamic 3D vision of the Ocean

Currents

Ice

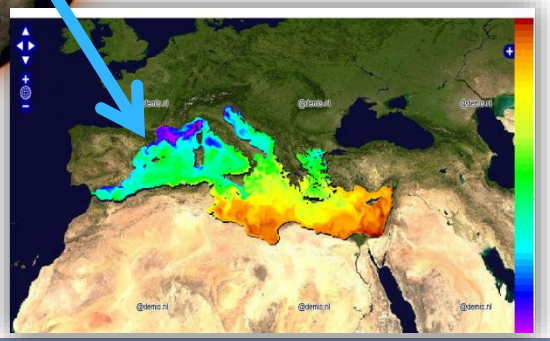
Sea Level



Temperature

Biogeochemical

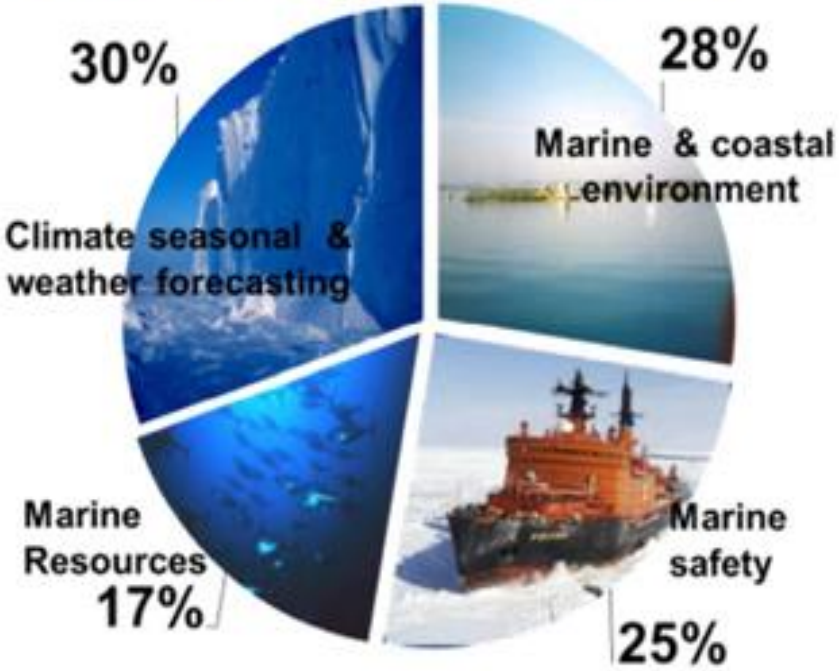
Salinity



- ✓ **ANYWHERE** (Global + 6 Regional Seas)
- ✓ **FROM THE TOP TO THE BOTTOM**
- ✓ **AT ANY TIME** (past, present, future)
- ✓ **REAL TIME or PAST PERIOD**

CMEMS areas of benefits:

- to support the MS decision makers in the Marine Environment and Security fields
- to foster user applications related to:

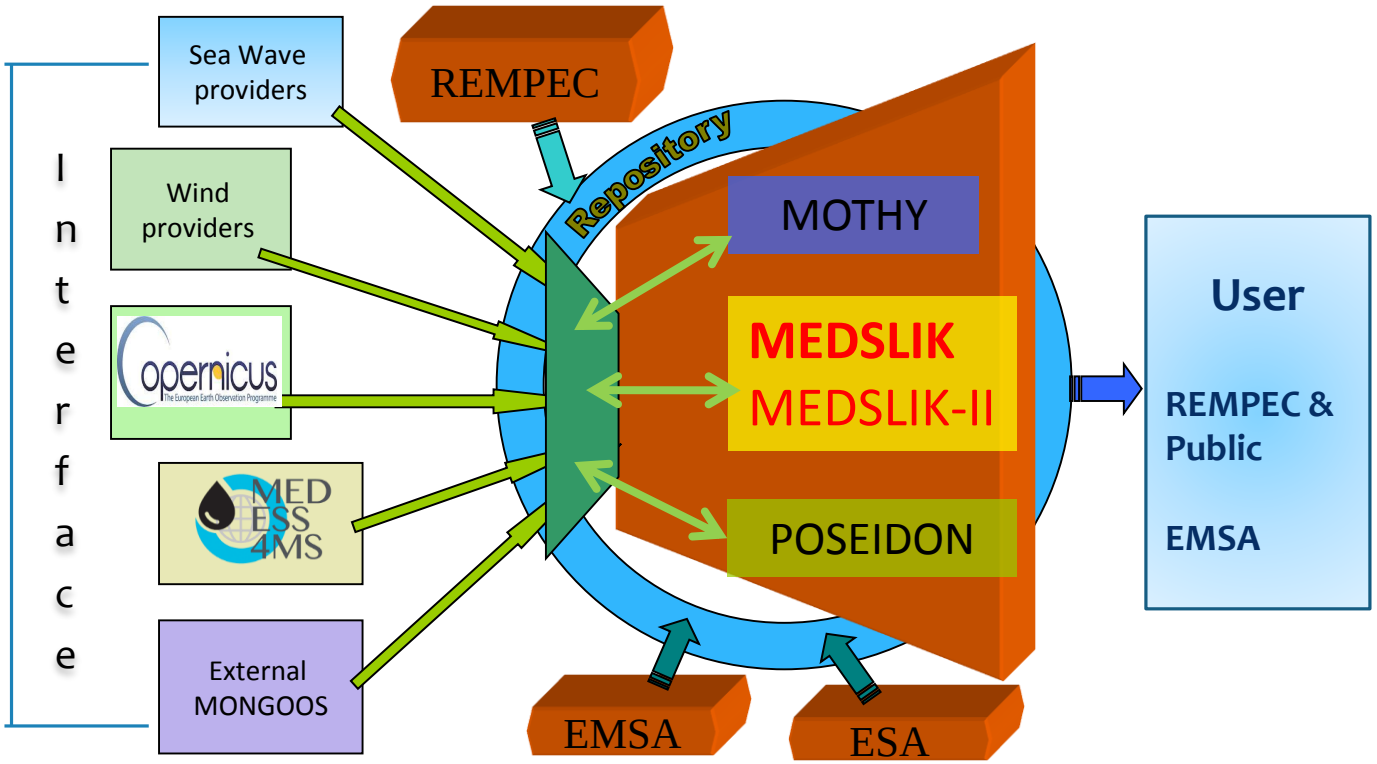


Moreover, CMEMS products are useful for:

- reinforcing safety at sea (offshore operations, search & rescue)
- combating oil spills,
- monitoring water quality,
- assessing environmental impact,
- climate change scenarios,
- protecting living marine resources,
- renewable energy (thermal, wave)
- predicting coastal erosion, etc

MEDESS - 4MS

- provides an integrated operational multi model oil spill prediction service in the entire region, connected to existing monitoring platforms (EMSA-CSN, REMPEC), using well established oil spill modeling systems and met-ocean data from the Copernicus services and the MS ocean forecasting systems.

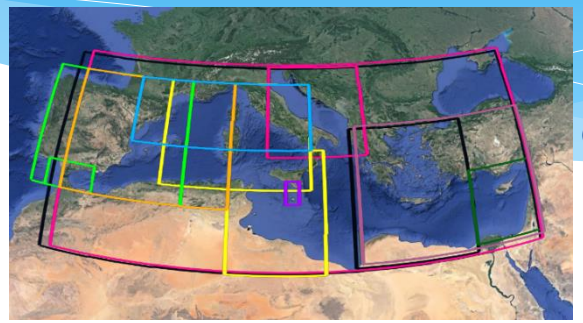


MEDESS-4MS forcing data for the oil spill predictions

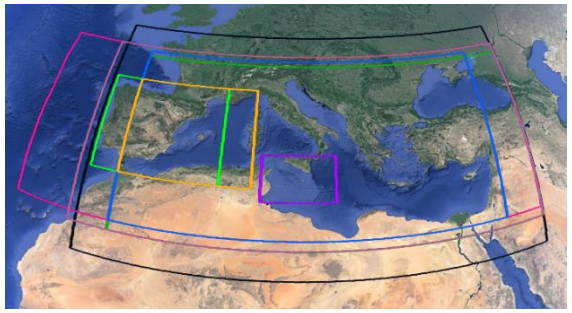
Coupling with a variety of environmetal data

The MEDESS-4MS oil spill models coupled with the met-ocean data from the Copernicus, the downloaded MS ocean forecasting systems and the oil slick data from platforms such as EMSA-CSN, REMPEC, MS VTMIS, HF-radars and AIS data.

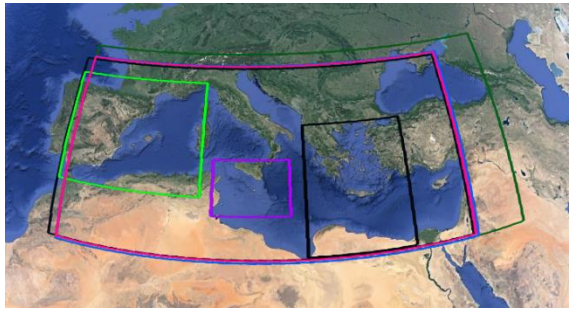
- **9** different Mediterranean institutions and centers are providing met-ocean forecasting data in real time.
- **28** different forecasting data sets are available RT.



MEDESS-4MS ocean forecasting systems (14)



MEDESS-4MS meteo forecasting systems (7)



MEDESS-4MS sea state forecasting systems (7)

Harmonization of data for oil spill modeling predictions

MEDESS-4MS system connect **3** well established oil spill models with **28** different met-ocean forecasting systems.

Common specifications for all the modules of the system:

Oil spill models:

- Common input/output files

Atmospheric/Marine forecasting data:

- Common specifications for file naming
- Common naming of all the parameters
- Common format of the provided files
- Common protocols for data exchange
- Common rolling archive for keeping history of the results

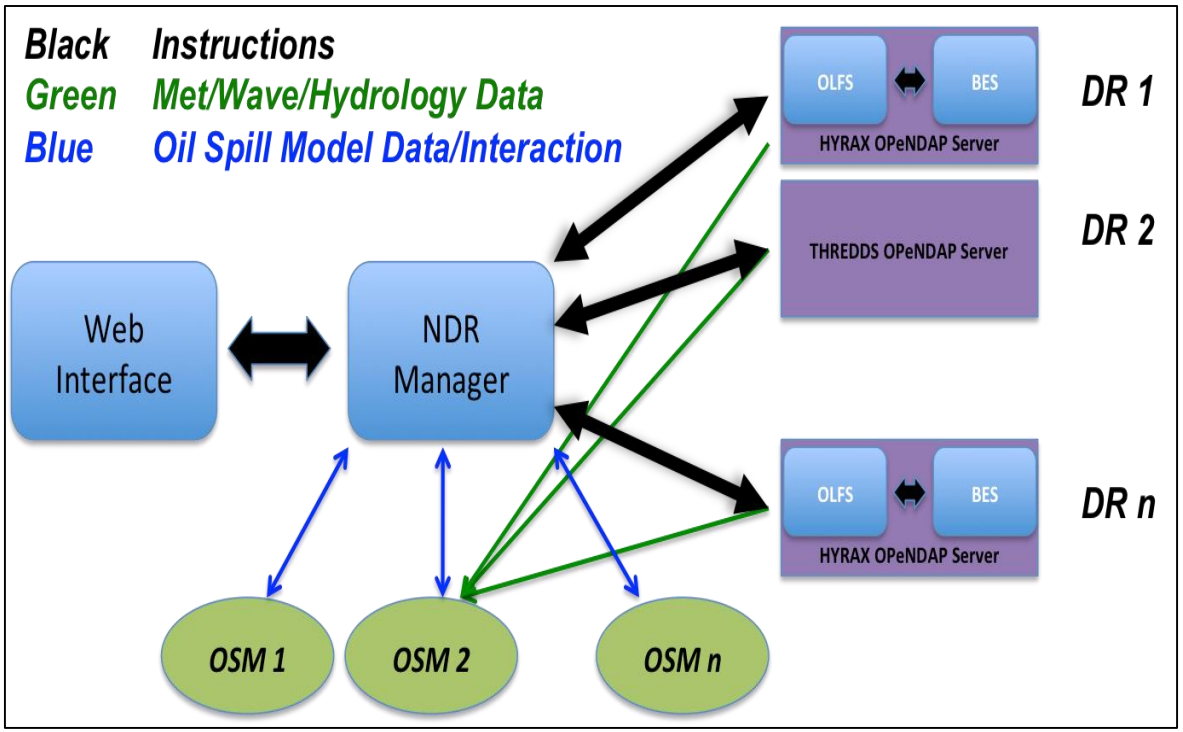
The homogenized data flow is carried by the **NDR**, connecting all the available operational met-ocean forcing in the Mediterranean, on a daily base.

Network Data Repository - NDR

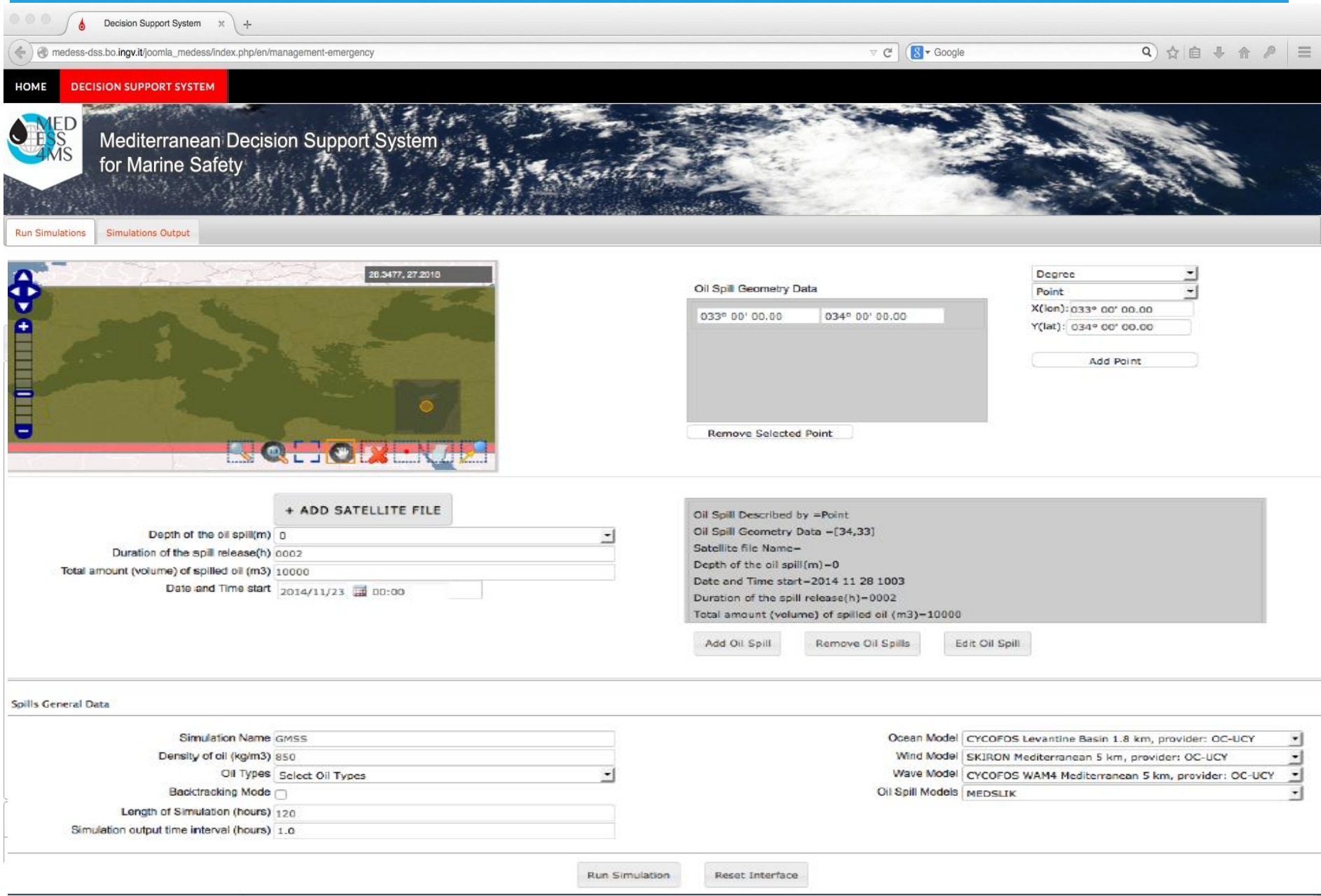
The NDR main function is the integration of the oil spill models with the different oceanographic data providers.

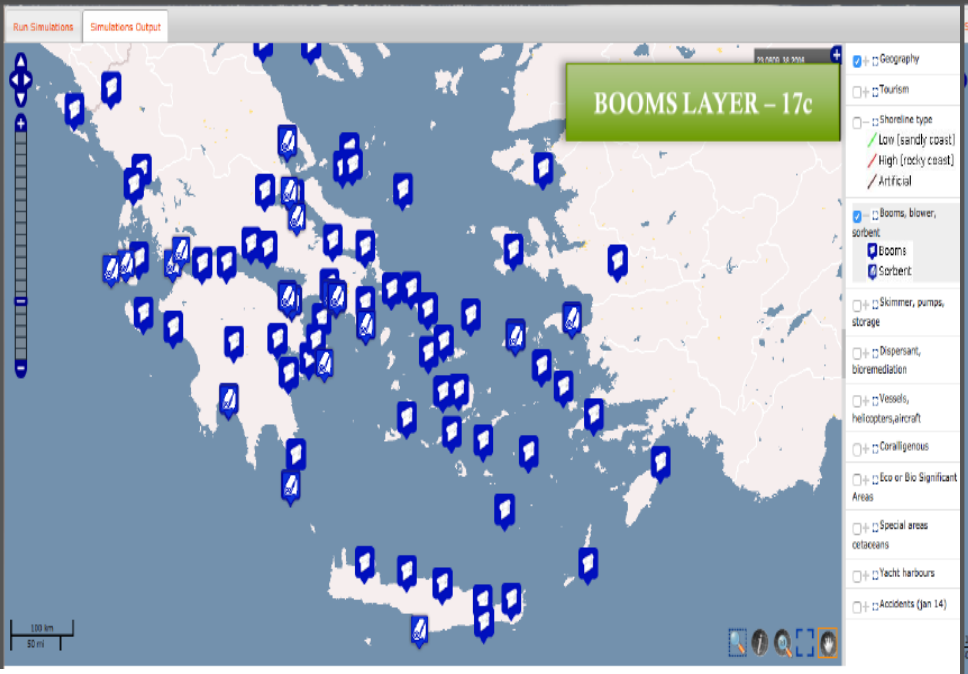
Its secondary function is to catalogue the different oil spill events for historical needs, and

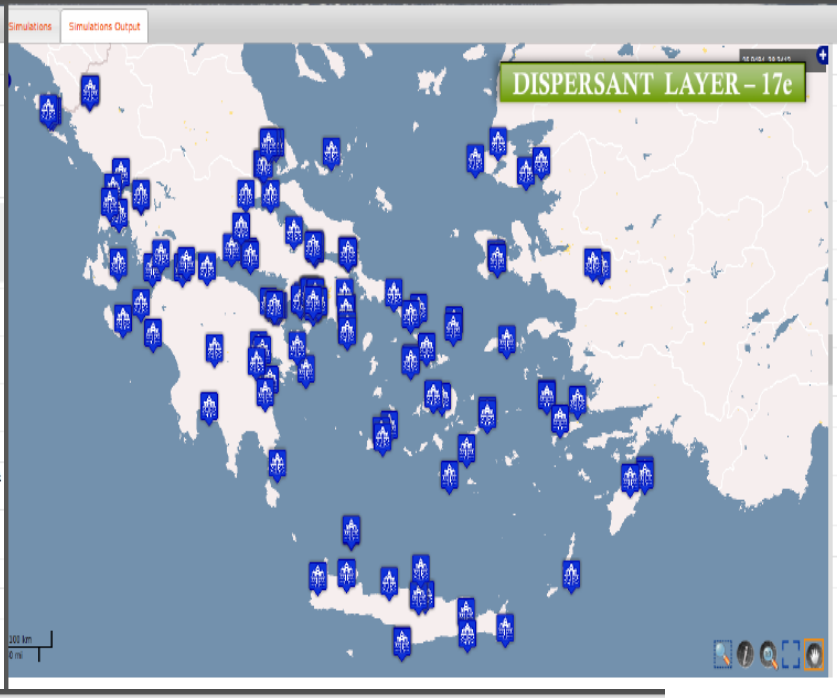
third function its interaction with the User Interface.

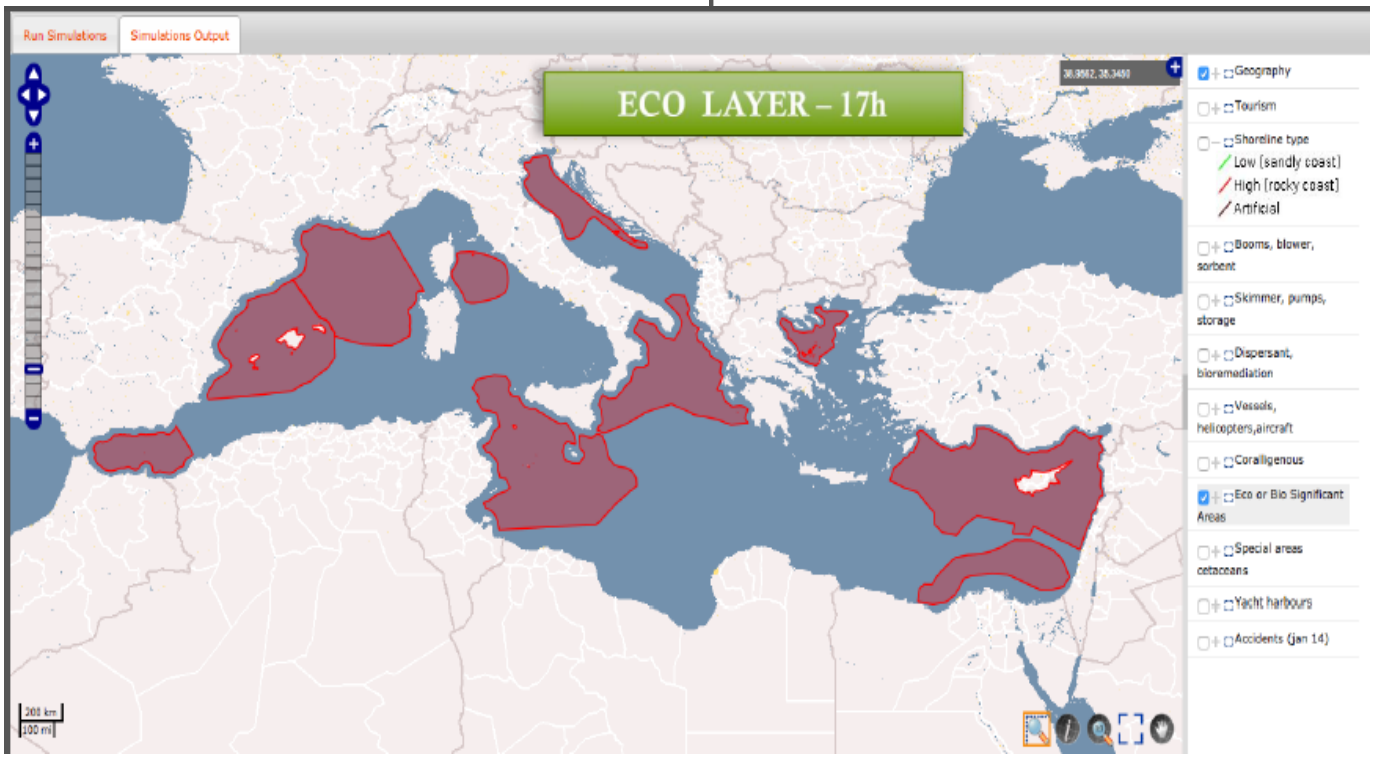


User Interface




Run Simulations
Simulations Output
BOOMS LAYER – 17c
Geography
Tourism
Shoreline type
Low (sandy coast)
High (rocky coast)
Artificial
Booms, blower, sorbent
Booms
Sorbent
Skimmer, pumps, storage
Dispersant, bioremediation
Vessels, helicopters,aircraft
Coralligenous
Eco or Bio Significant Areas
Special areas cetaceans
Yacht harbours
Accidents (jan 14)


Simulations
Simulations Output
DISPERSANT LAYER – 17e
Geography
Tourism
Shoreline type
Low (sandy coast)
High (rocky coast)
Artificial
Booms, blower, sorbent
Skimmer, pumps, storage
Dispersant, bioremediation
Vessels, helicopters,aircraft
Coralligenous
Eco or Bio Significant Areas
Special areas cetaceans
Yacht harbours
Accidents (jan 14)

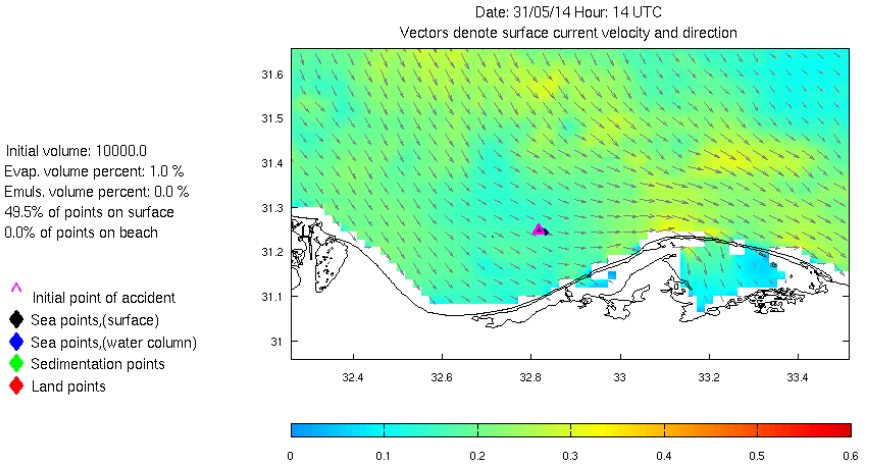

Run Simulations
Simulations Output
ECO LAYER – 17h
Geography
Tourism
Shoreline type
Low (sandy coast)
High (rocky coast)
Artificial
Booms, blower, sorbent
Skimmer, pumps, storage
Dispersant, bioremediation
Vessels, helicopters,aircraft
Coralligenous
Eco or Bio Significant Areas
Special areas cetaceans
Yacht harbours
Accidents (jan 14)

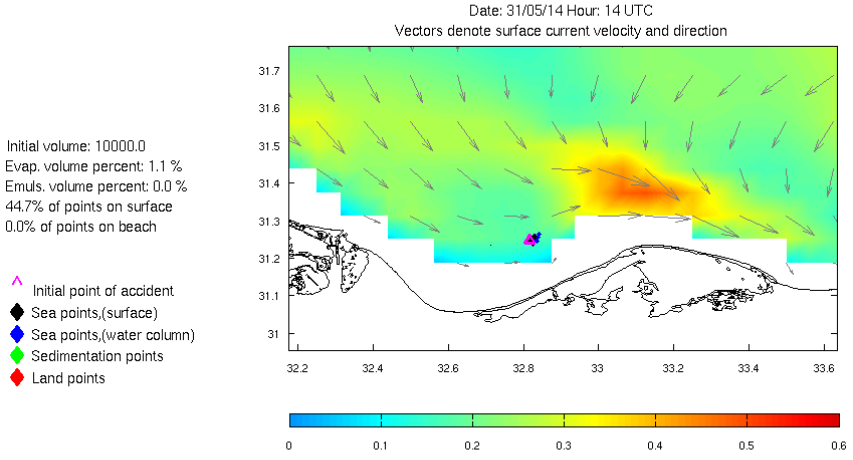
MED ESS 4MS

MEDESS-4MS
Oil spill in the Levantine Basin

Oil spill model: POSEIDON OSM
Date of event: 31/5/2014
Simulation length (hours): 148

Use of the same oil spill model with 2 different data set





OCEAN data	METEO data	WAVES data
CYCOFOS AEG LEV (2×2 km)	Skiron (5×5 km)	CYCOFOS WAM4 (5×5 km)

Higher resolution forcing data

OCEAN data	METEO data	WAVES data
MFS (6.5×6.5 km)	ECMWF (25×25 km)	INGV WWIII (6.5×6.5 km)

Lower resolution forcing data

In the Green Paper *'Marine Knowledge 2020: from seabed mapping to ocean forecasting'* (COM-2012-437) it is explained that central to the unlocking of the economic potential of Europe's marine observations is the "*concept of a European Marine Observation and Data Network (EMODnet), a network of marine organizations that would provide a single entry point for accessing and retrieving marine data derived from hundreds of databases throughout the EU. It would also deliver digital map layers of parameters derived from these primary data for entire sea basins around Europe.*"

The data are extracted from the existing EMODnet thematic portals, the Copernicus Services, the JRC Data Collection Framework for Fisheries and other initiatives existing at each sea region.

11 tasks or "challenges" were chosen to test how comprehensive and accurate the monitoring and forecasting data are at **the Med & Black** sea. These are:

- Wind farm sitting
- Marine Protected areas
- ***Oil Platforms leak***
- Climate
- Coasts
- Fisheries management
- Fisheries impact
- Eutrophication
- River inputs
- Bathymetry
- Alien species

Objectives for oil spill predictions

- Produce oil spill predictions in the Med & Black sea, connected to existing oil spill monitoring platforms (EMSA-CSN) using the established MEDSLIK oil spill modeling system and the environmental data from Copernicus Marine Service, ECMWF or other met services and from the EMODnet portal data.
- Deliver within 24 hours from the time of receipt of the oil platform leakage information, *a **Bulletin*** containing information about the oil spill trajectory and the statistical probability that coastal habitats and coastal activities will be impacted by the oil spill. The ***Bulletin*** will contain the evolution of the surface, subsurface and on coast oil concentration for the next 72 hours.

The online-MEDSLIK system allows authenticated users to use the main MEDSLIK functionality via an interactive user friendly web application without the need of installing any software locally.

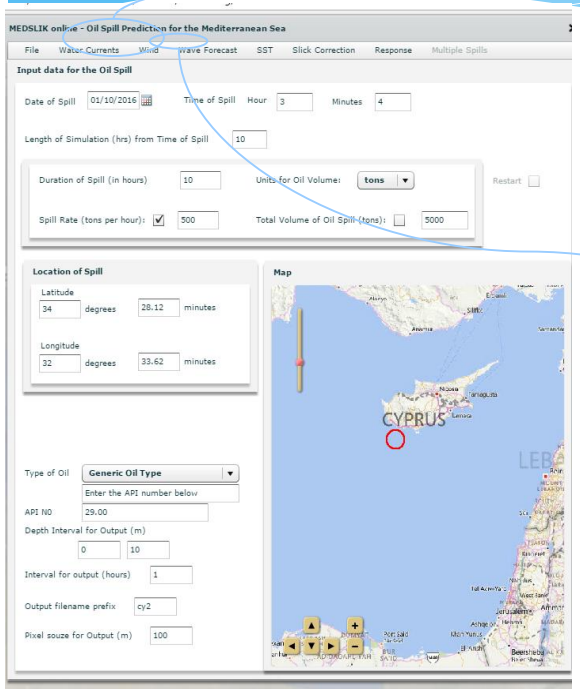
The application consists of 3 main interfaces:

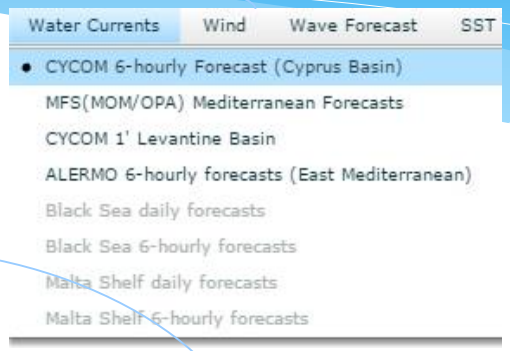
- Input
- Simulation
- Visualization results

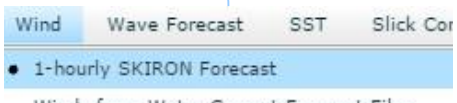
A number of different technologies, such as FLEX, PHP, and modestmaps API for mapping and visualization were used in developing the web-based application.

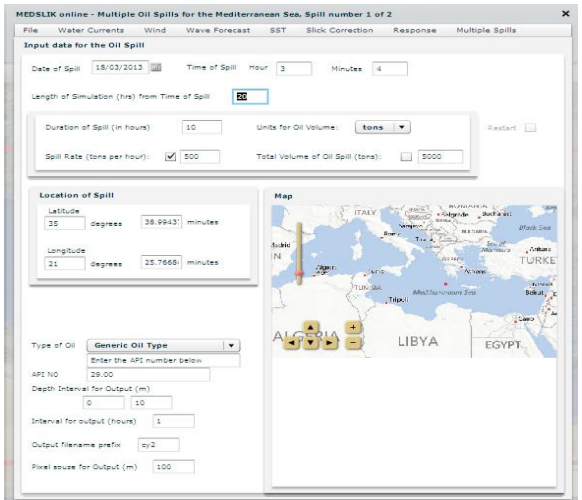
Oil spill prediction results from the MEDSLIK module are presented to the users through a rich web application in a geographical context.

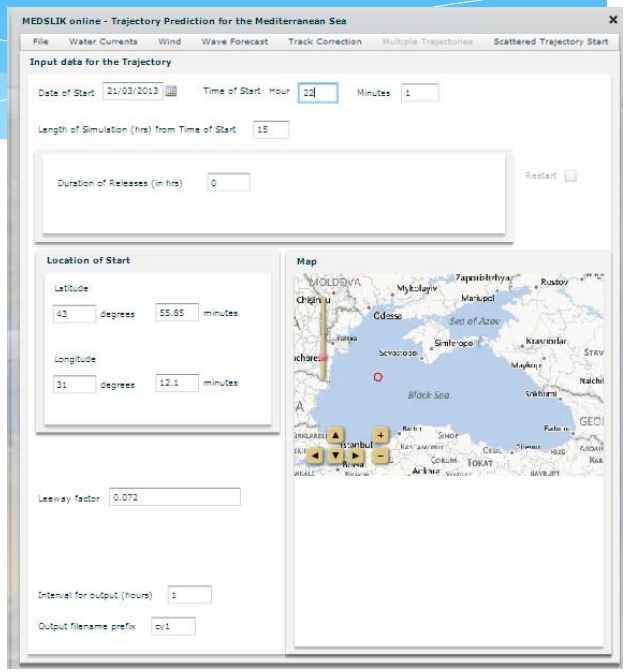
The online input interface was developed to be similar to the MEDSLIK desktop interface. Provides the input of all the necessary oil spill modelling parameters.



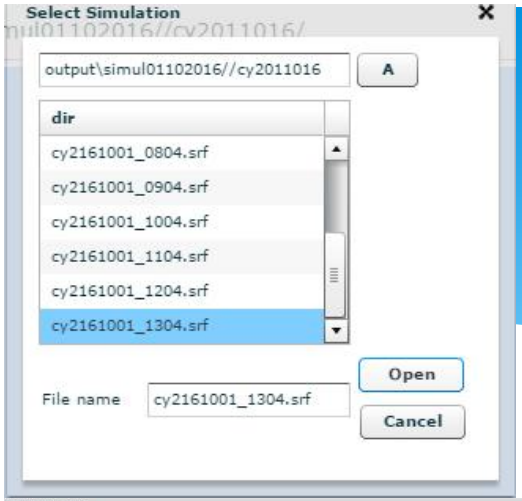






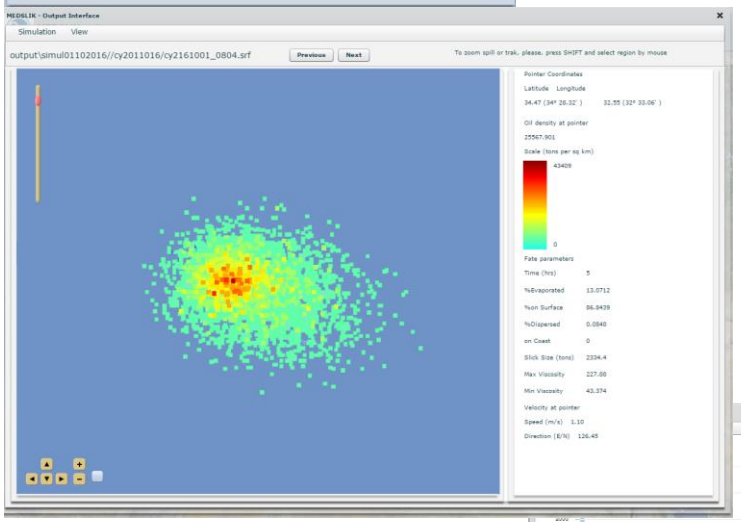


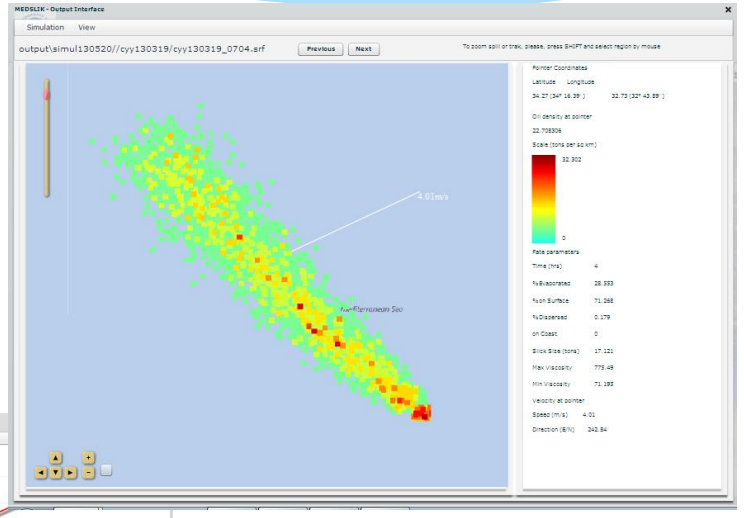
Oil spill input interface

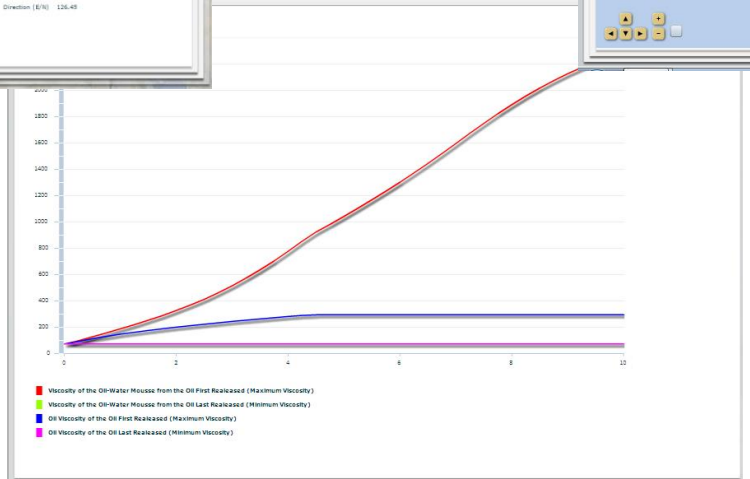


-Similar the output web MEDSLIK interface:

- select case of simulation
- select type of parameter
-Select type of visualization

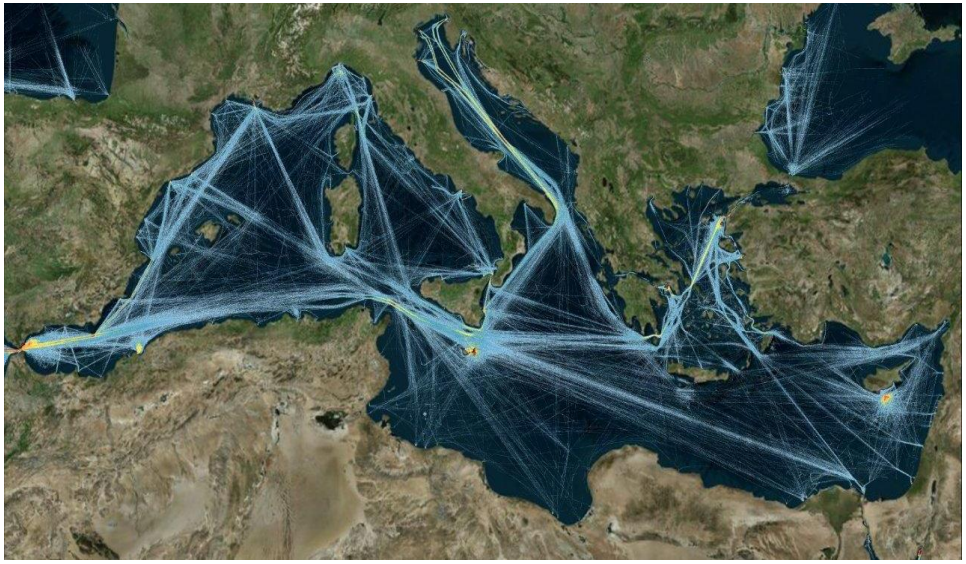


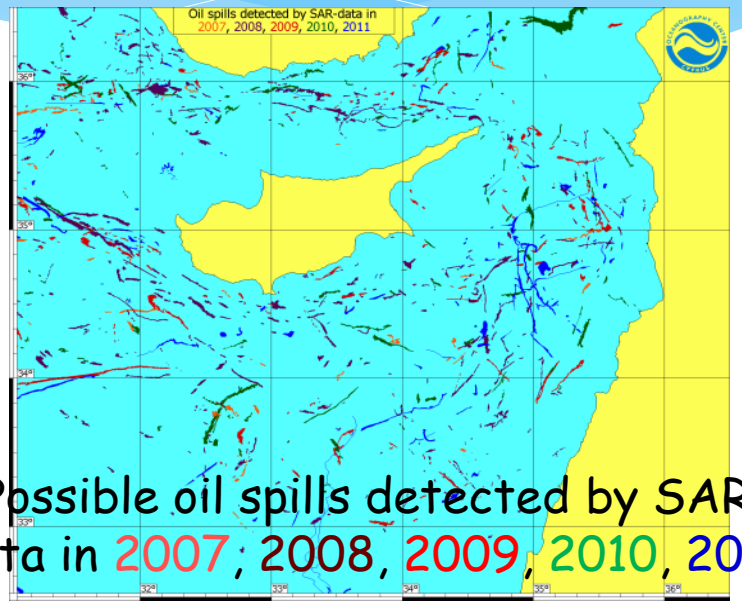




Instead of Conclusion

The web interface of MEDSLIK oil spill model continues to provide predictions for **EMODnet MedSea and Black sea check points**, in order to assist the EU agencies, in view of the increase of the ship traffic due to the oil and gas transfer and the enlargement of the Suez Canal.





Possible oil spills detected by SAR data in 2007, 2008, 2009, 2010, 2011

ZODIATIS G., et. al. (2016). The Mediterranean Decision Support System for Marine Safety dedicated to oil slicks predictions. *Deep Sea Research* II, doi : 10.1016/j.dsr2.2016.07.014.

ZODIATIS G., Lardner R., Solovyov,D., Panayidou X.,De Dominicis M. (2012). Predictions for oil slicks detected from satellite images using MyOcean forecasting data, *Ocean Science*, Vol. 8, 1105-1115.

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