Mediterranean Decision Support System for Marine Safety dedicated to oil slicks predictions, MEDESS4MS and PREMARPOL projects

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MAREMED Project Conference,
October 9 2012, Larnaca

Outline

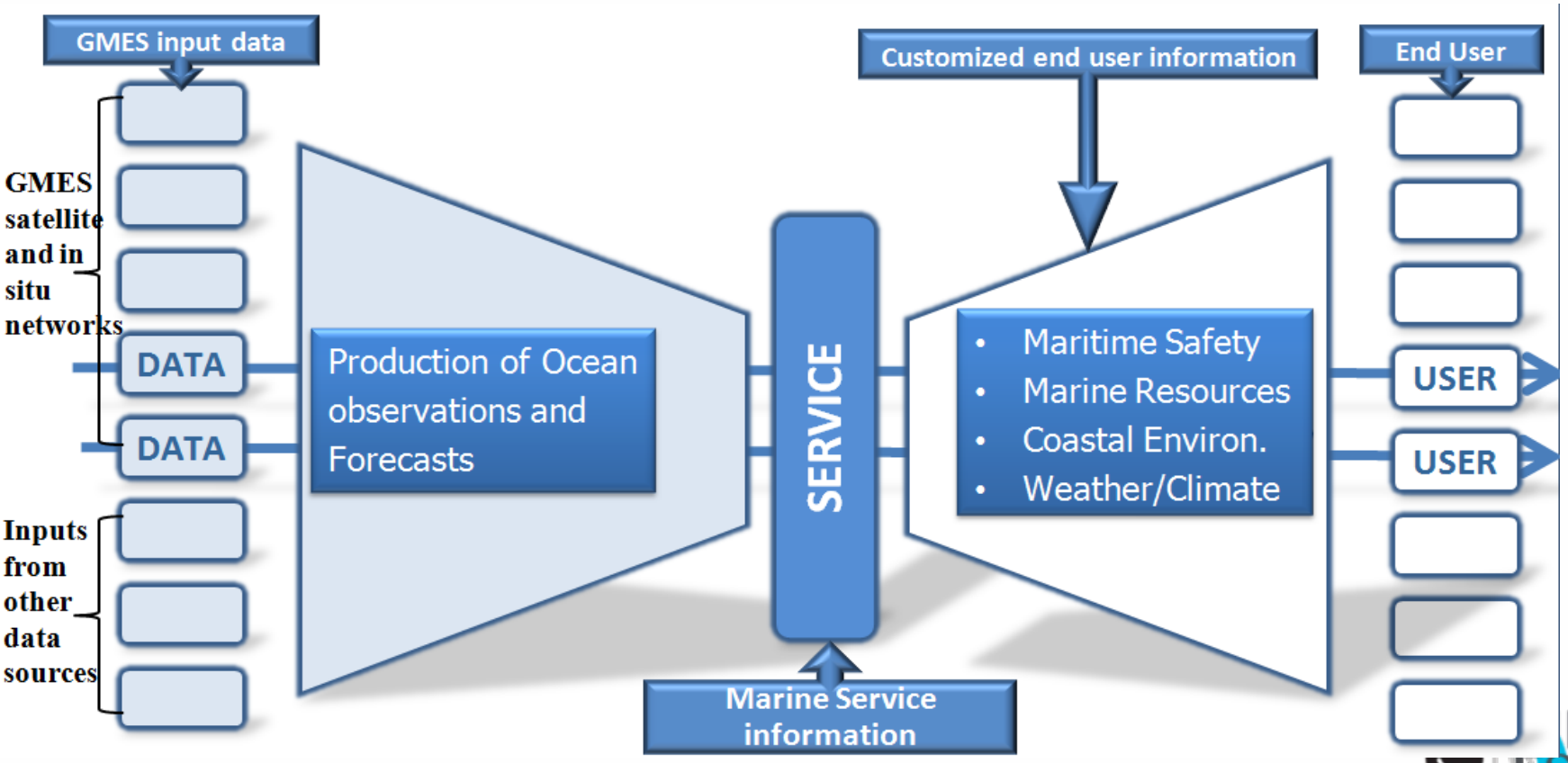
- GMES – Global Monitoring for Environment and Security
- Motivation / need for Oil Spills predictions
- MEDESS4MS project
  - Objectives
  - Role in operational oil spill response
  - MEDESS4MS service solution
- PREMARPOL project
- MEDSLIK Oil Spill Model
  - Description
  - Characteristics
  - Features
- Conclusion

GMES Marine Core Services

General aims of the Ocean component of GMES:

a) Produce regular and systematic information on the state of the oceans (analyses & forecasts), global and European Seas

b) The products should be observational and model data, in RT



GMES ocean component : MyOCEAN forecasting system

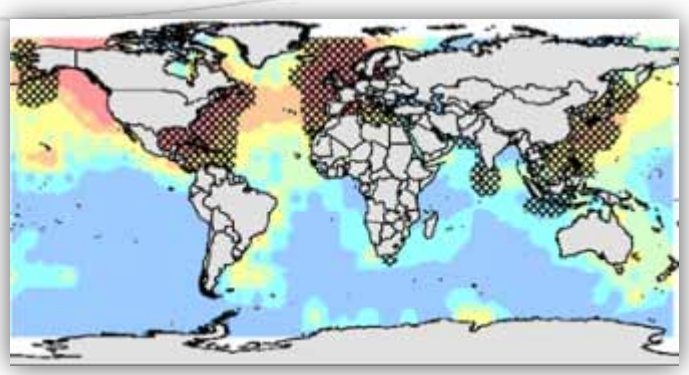
Provide models and observations:

- currents
- temperature
- salinity
- sea level

Motivation for Oil Spill Predictions

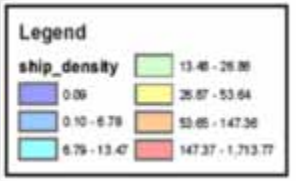
One of the permanent risks from an incident in the Mediterranean, is associated with the heavy traffic of maritime transport and with the coastal and offshore installations related to oil industry.

Such a dense activity, imposes on the coastal countries the need for preparing an operational response in cases of major incident.



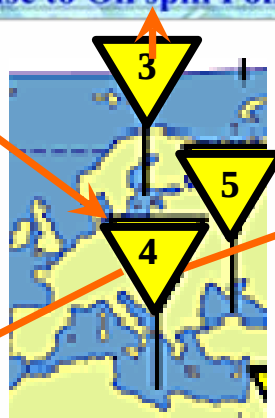
Map with ship accidents: more than 4 ships per

Ship density:



Regional Emergency Centres for Response to Oil spill Pollution

An incident like this may occur



Response to oil incident: booms deployment

Response to an oil incident: oil combating vessel

The recommended procedure for responding to oil spill incidents includes the application of oil spill models.

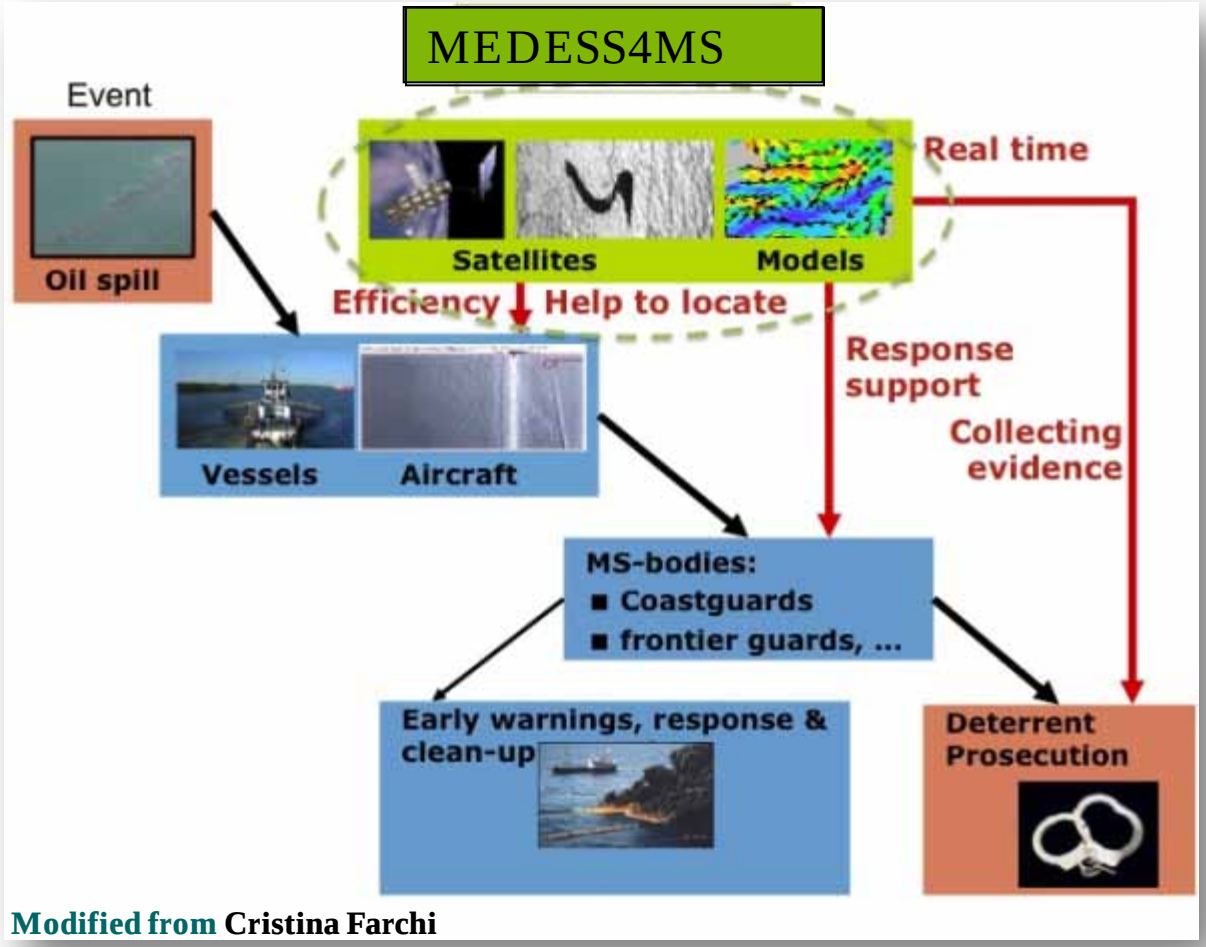
The catastrophe

Motivation for Oil Spill Predictions

- The success of response to oil spill incidents depends on the prediction of the movement and weathering of the oil spill or moving of the floating object. Such predictions may be obtained through the application of oil spill and floating objects models to forecast:
  - Where the oil spill will move
  - How soon it will get there
  - Which resources are threatened
  - What will it look like when it arrives

- The oil spill predictions need to be operational for effective support of the response agencies using an integrated multi-model oil spill prediction system and the GMES forecasting met-ocean data.

As from REMPEC, the agencies need an integrated service…



Modified from **Cristina Farchi**

to strengthen the national/regional response chain for accidental spills and deliberate discharges from ships.

MEDESS4MS Project

Mediterranean Decision Support System 4 Marine Safety

- Dedicated to maritime risks prevention and strengthening of maritime safety related to oil spill pollution in the Mediterranean.

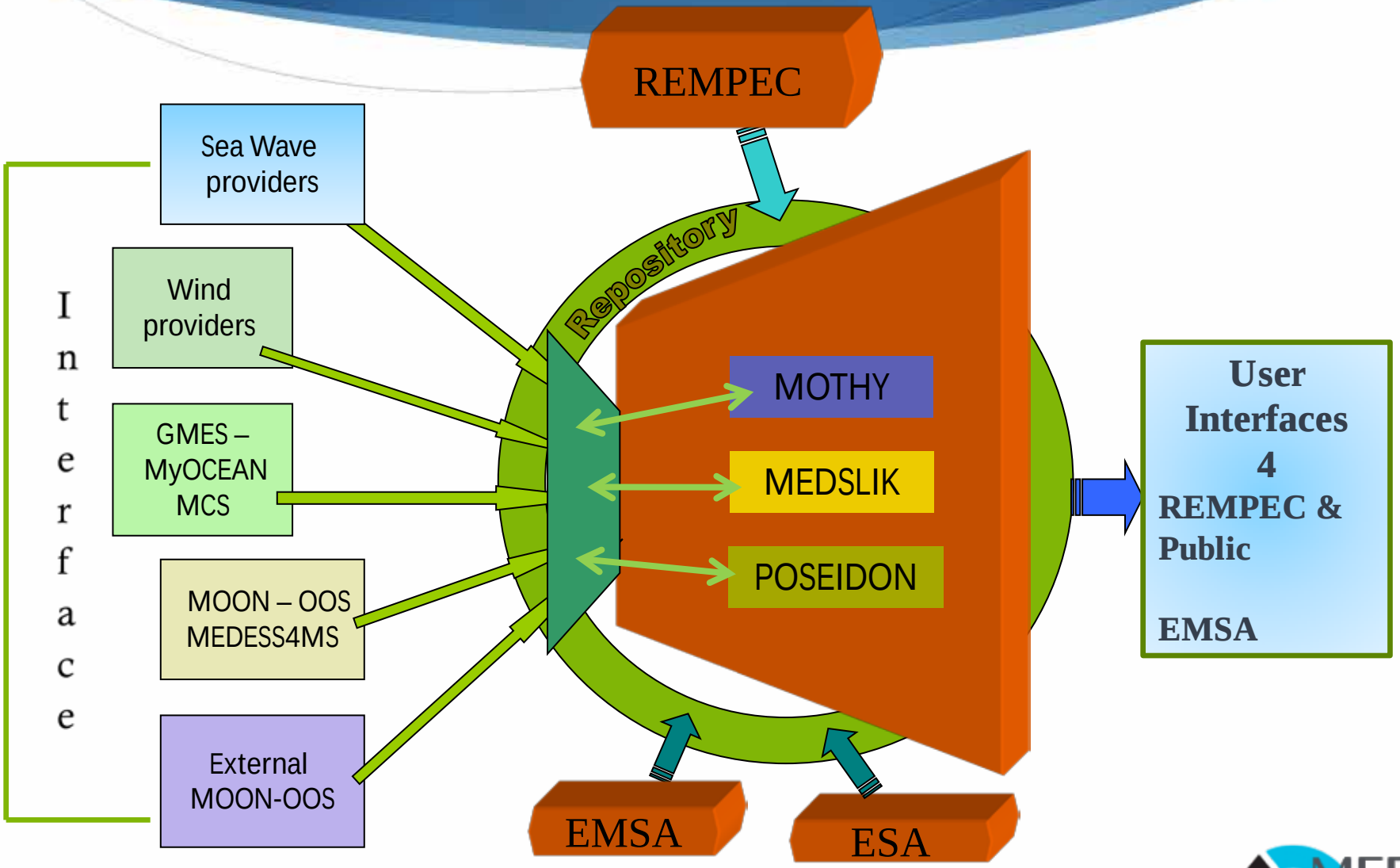
- General objective: Delivery of an integrated, operational, multi-model oil spill prediction service in the Mediterranean
  - connected to existing monitoring platforms (REMPEC, EMSA-CSN, AIS)
  - using the well established oil spill modeling systems
  - using data from the GMES Marine Core Service & the national ocean forecasting systems.

Particular Objectives

MEDESS4MS will establish a downstream service including:

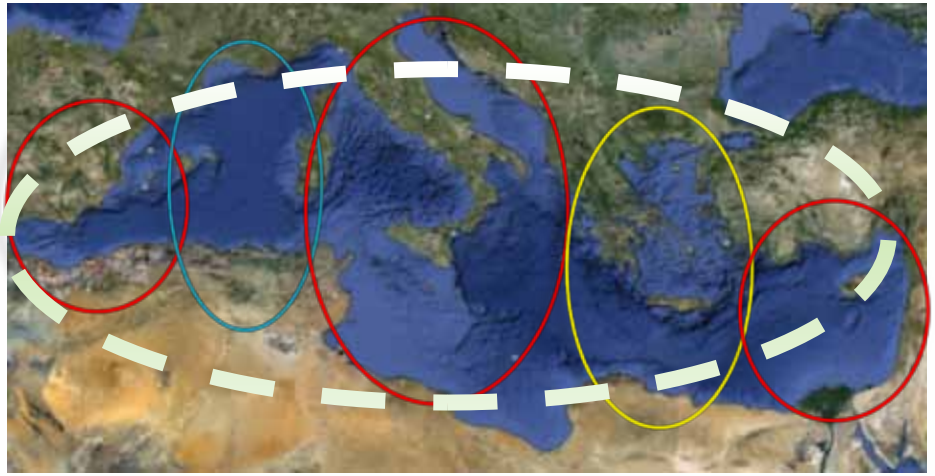
- Exploitation of the GMES MCS products and of the national ocean forecasting systems
- Design and implementation of a unique Web portal access point for end-users with different UI (for REMPEC, EMSA and generic users)
- Training on the MEDESS4MS service
  - key end-users and the generic users
  - non-EU countries responsible agencies, as defined by REMPEC for the Mediterranean and the MS responsible agencies, as defined by EMSA
- Development of concepts and plans for economic business models for extending the user base of the downstream service i.e. its implementation to other EU regions, such as the Black Sea.

MEDESS4MS Service Solution



MEDESS4MS solution

MEDESS4MS will build upon the demo implementations carried out in the frame of EC projects (MFSTEP, MERSEA, ECOOP, MARCOAST, MyOCEAN), by maturing the pre-cursor services provided to individual MS response agencies, to an integrated structured service delivery for all the countries in the Mediterranean, and to major key end-users, such as REMPEC and EMSA.



Geographical deployment of the MEDESS4MS subsystems:
Red - MEDSLIK **Blue- MOTHY** **Yellow - POSEIDON**

The geographical area of the service will cover the Mediterranean, based on the sound expertise of the MEDESS4MS MOON and response agencies partners in their areas of responsibility.

MEDESS4MS solution

MEDESS4MS provides solution to all 11 of EMSA's requirements.

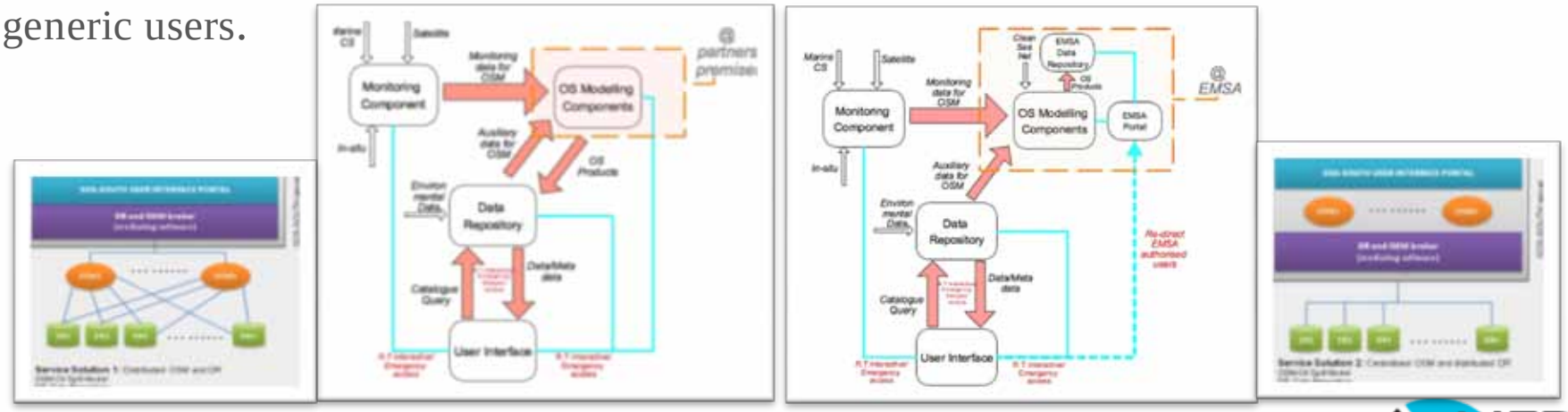
- **MEDESS4MS will provide 3 services scenarios:**

  1) RT oil spill forecasting by authorized users;

  2) Delayed mode by authorized users;

  3) Oil Spill Decision Support System, for selection of management strategies.

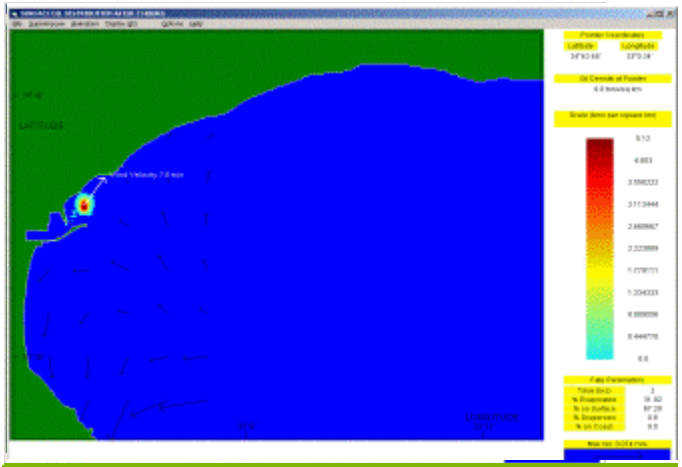
MEDESS4MS service scenario 1 examines two different User Interfaces, one better suited to the EMSA requirements (including automatic mode) and another to REMPEC and generic users.



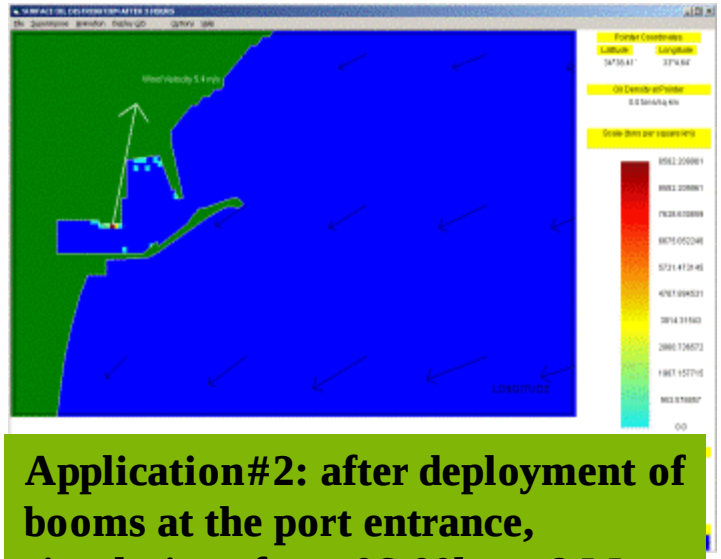
PREMARPOL objectives

- To deploy a network of dedicated sensors in 3 ports in Cyprus and 4 ports in Greece to monitor in NRT various pollution parameters
- To provide the tool for predictions of the dispersion of pollutants for supporting the efficient planning of combating.
- To provide the impact and risk assessment scenario for different types of pollution in the ports under monitoring and suggest prevention measurements.

Example of application of oil spill MEDSLIK model



Application#3: after escape of the small portion of the oil spill through the port entrance, simulations from 08:00h on 10 May to 11:00h on 11 May 2004

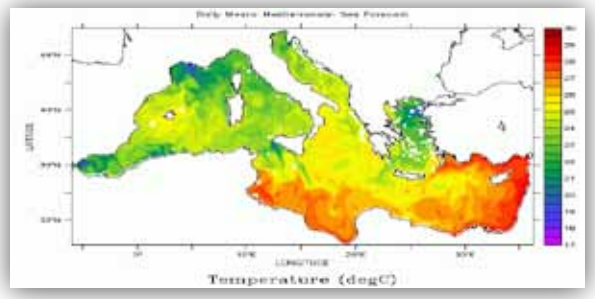


Application#2: after deployment of booms at the port entrance, simulations from 06:00h on 8 May to 11:00h on 11 May 2004

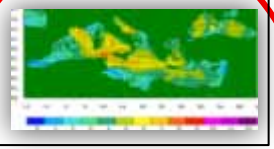
Downscaled ocean forecasts

Oil spill dispersion forecast

MFS



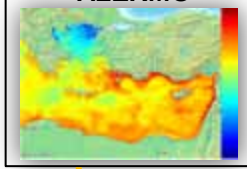
SKIRON



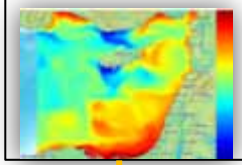
CYCOFOS – WAVE FORECAST

LEV-DESS Decision Support System: Pre-Cursor to the MEDESS4MS and PREMARPOL oil spill prediction

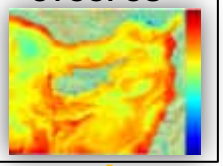
ALERMO



CYCOFOS - LEV

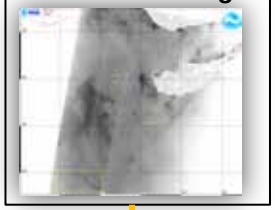


CYCOFOS



DOWNSTREAM FORCING

ESA ASAR image



ONLINE OUTPUTS

Sat	Sun	Mon	Tue	Wed	Thu	Fri
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

MEDSLIK

Request from response agencies, REMPEC, EMSA.

MED ESS 4MS

MEDSLIK Oil Spill Model

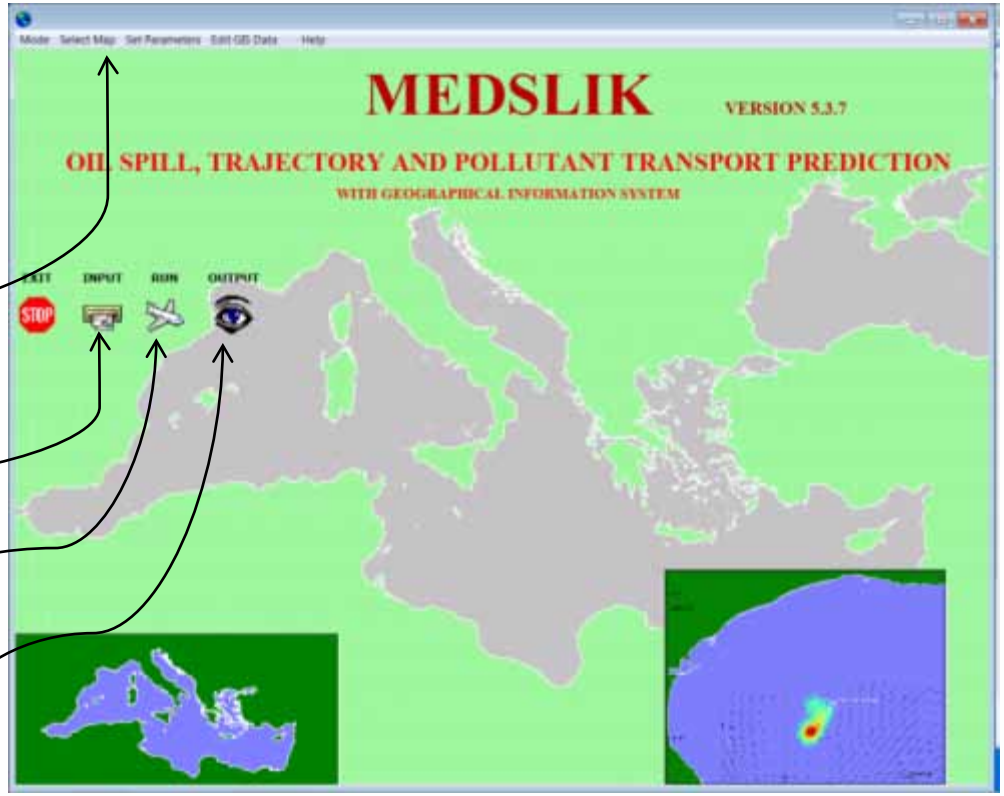
- MEDSLIK 3D model is successfully used by agencies throughout the Mediterranean for preparedness and real oil spill and search and rescue incidents.
- Currently used in Cyprus, Malta, Spain, Italy, Israel, Algeria, etc
  - Pre-operationally used in the Black and Baltic Seas
- Coupled with EMSA CSN and ESA ASAR imageries
  - For 24th forward and backward predictions
  - for supporting the response agencies to implement the EU Directive 2005/35 to identify the ships carrying out illegal oil spills
- Predicts the transport, diffusion and spreading of an oil spill
- Incorporates the use of forecasts of currents and wind data from GMES MyOCEAN MCS and the associated downscaled ocean forecasting systems
- Uses wind forecasts from SKIRON weather forecasting system

MEDSLIK

- MEDSLIK incorporates the fate processes of evaporation, emulsification, viscosity changes, dispersion in water column and coastal impact and adhesion.

Four modules of the MEDSLIK application :

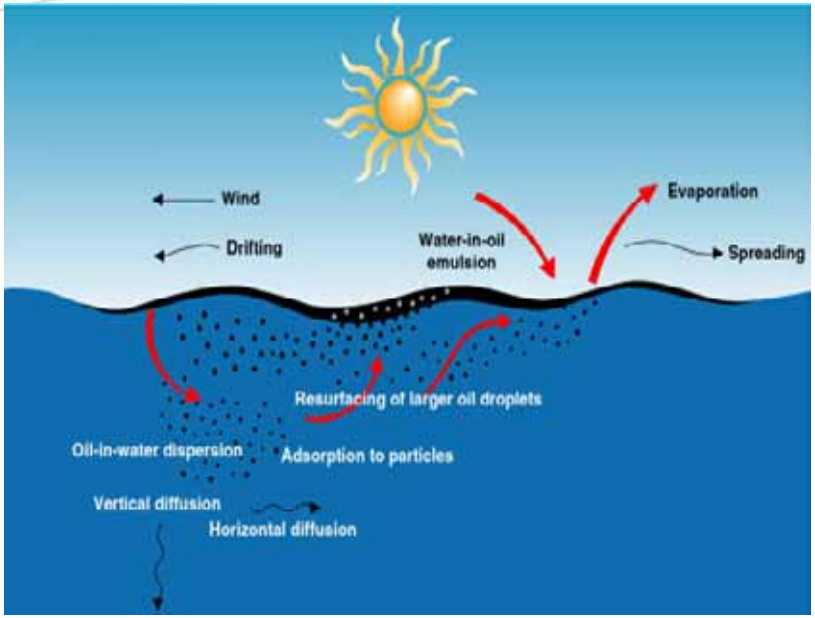
- Setup module for model domain and model parameters
- Visual interface for input the spill data
- Run module that performs the simulations
- Visual interface for viewing the output results.



MEDSLIK general description

- The oil spill is modelled using a Monte Carlo method. The spill is divided into a large number (up to 500,000) of Lagrangian parcels of equal size. At each time step, each parcel is given a convective and a diffusive displacement.

- The lighter components of the oil evaporate at a rate dependent on water temperature and wind speed. Emulsification of the residual component is simulated, and the viscosity changes of the oil are computed according to the amounts of emulsification and evaporation of the oil.



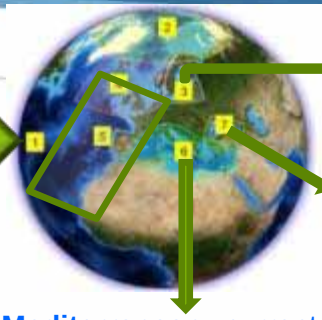
The Mackay et. al. schematic model of fate processes (evaporation, dispersion and emulsification)

In surface spills the evaporation of volatile oil components is a fast process and takes place in a period of hours.

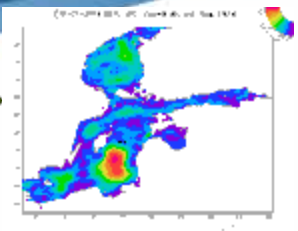
Emulsification is the process of the formation of water-in-oil emulsion, often called “chocolate mousse”

Ocean data forcing for MEDSLIK oil spill and floating objects predictions

MEDSLIK has been adapted to use the ocean products from MyOCEAN regional forecasting systems, those of the Med, Black and Baltic seas.



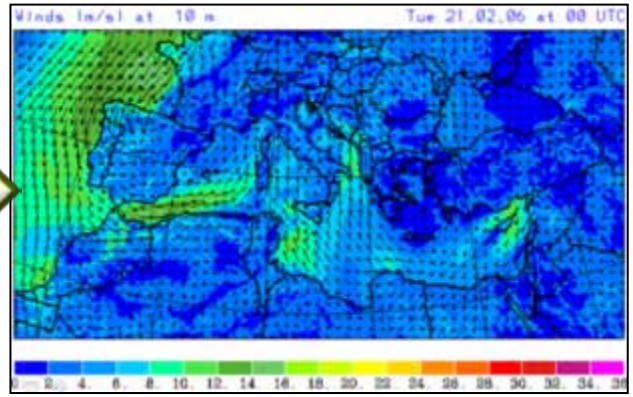
Baltic Sea: currents, temperature



Black Sea: currents, temperature

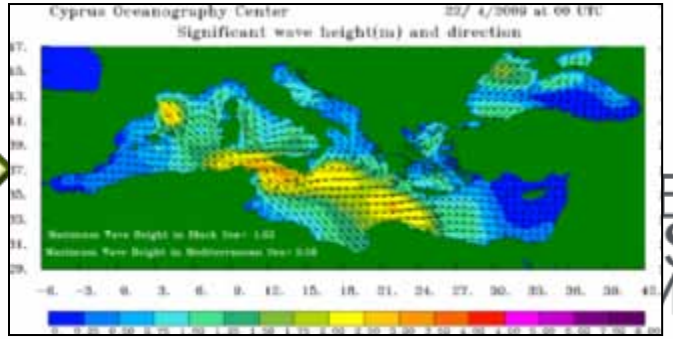
Mediterranean : currents, temperature,

The SKIRON hourly forecast winds for the Med and Black seas are used in MEDSLIK. The ECMWF and UK met office winds may also be used to cover other European areas.



In addition, MEDSLIK has been adapted to use the sub-regional and coastal forecasting system of MyOcean and MOON

MEDSLIK uses also the CYCOFOS waves forecasts for estimating the influence of waves to the oil drift; i.e. *Stoke's* drift in the Med and Black seas.



Major features of MEDSLIK

The model allows to switch from coarse to high resolution forecasting data, when the slick passes from a coarse to a higher resolution domain.

The model allows assimilation of slick and drifters observations to correct the predictions, if is needed.

Allows to locate the slick source at any given water depth.

The effect of deployment of oil booms can be examined.

Simultaneous oil spills or floating objects from moving or drifting ships can be modelled together.

Backtracking to identify the source of slicks or floating objects.

Includes a simple GIS to allow information on resources.

Integration with AIS-Automatic Identification of Ships

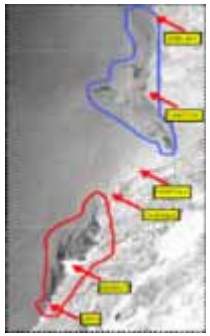
Conclusion a:

- CYCOFOS/MEDSLIK is one of the sub-regional Downscaled MCS and Marine Safety Downstream Systems in the Mediterranean that made use of the GMES MyOCEAN products.
- The CYCOFOS/MEDSLIK system is successfully used by several agencies throughout the Mediterranean for preparedness and real oil spill and search and rescue response. The CYCOFOS/MEDSLIK implementation during the Lebanon oil pollution crisis, in summer 2006, demonstrates the benefit of having an operational ocean forecasting system in place.

MEDSLIK

MODIS

SAR

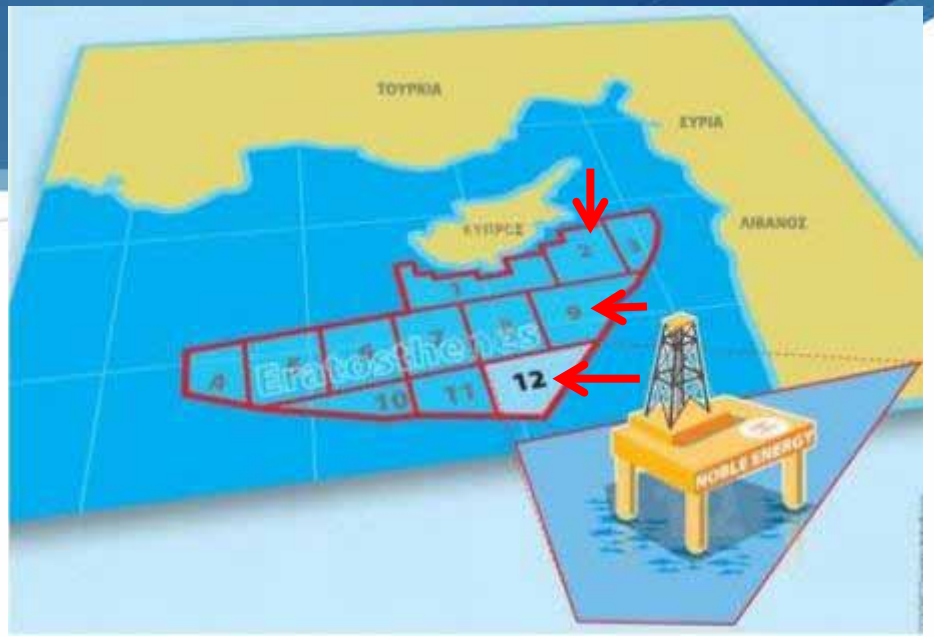


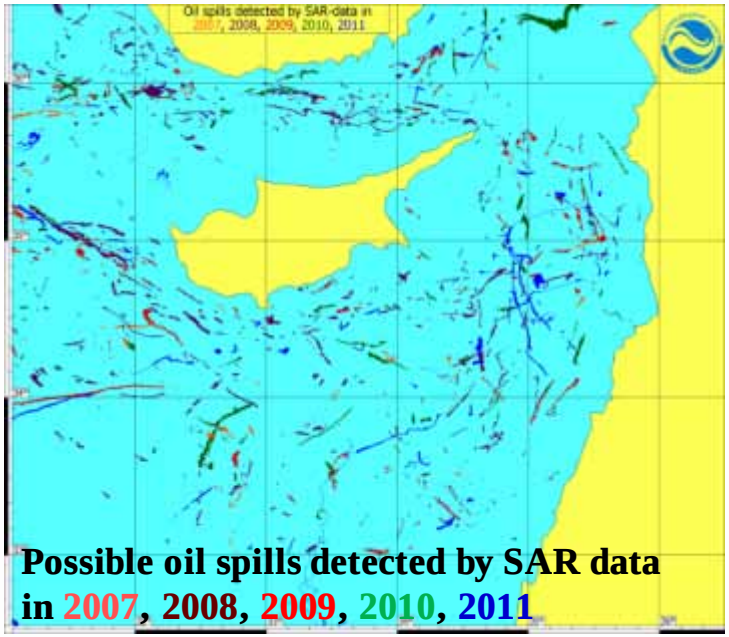
UN map

- The CYCOFOS/MEDSLIK implementation nowadays made possible to assist the response agencies in the implementation of the EU Directive 2005/35.

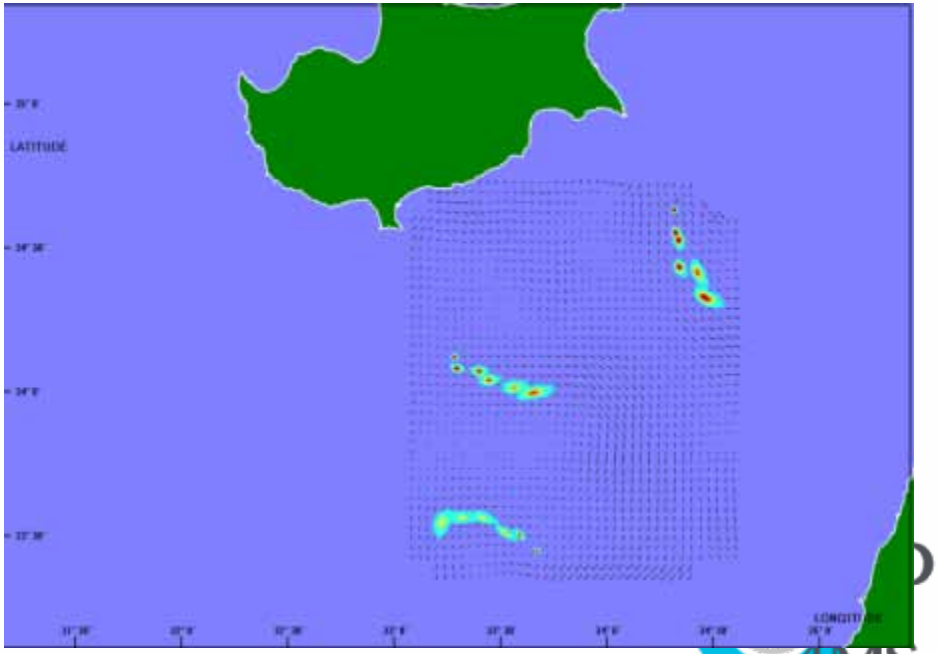
Conclusion b:

The role of the CYCOFOS/MEDSLIK system becomes important for assisting the response agencies, in view of the hydrocarbon exploration in the EEZ of Cyprus and of the neighboring countries.

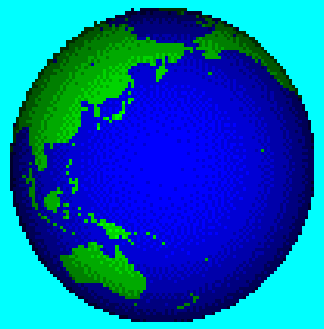




Possible oil spills detected by SAR data in 2007, 2008, 2009, 2010, 2011



Risk map assessment from hypothetical oil spills from platforms 2,9,12: oil spill predictions for 18–21/5/12



Thank you for your attention