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Marine EnviRonment and Security for
the European Area - Integrated Project

Upgraded met.no and OC-UCY oil spill fate forecast systems

Deliverable D12.3.4 incorporating D12.3.1 and D12.3.3

Ref: MERSEA WP12-METNO-STR-001

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1. INTRODUCTION

This report addresses MERSEA Deliverable D12.3.4 of Task 12.3.

TASK 12.3: Oil spill fate prediction

D12.3.4 Report on upgraded met.no and OC-UCY oil spill fate forecast systems…………..Mo 40

The existing oil spill forecast services at the three partners participating in MERSEA TASK 12.3 – the Norwegian Meteorological Institute (met.no), MeteoFrance (MF) and the Oceanographic Centre, University of Cyprus (OC-UCY) – have all undergone significant developments in order to accommodate ocean forcing data from the MERSEA Forecast TEPs. For MF, these developments are documented in the deliverable report D12.3.2 (WP12-MF-STR-01-1A). For met.no and OC-UCY, these developments are documented in this report. With reference to the revised work plan for WP12 (DIP3), this report incorporates the two previously planned deliverable reports D12.3.1 and D12.3.3.

The primary aim of upgrading these oil spill forecast systems is to facilitate demonstrations of the potential benefit of MERSEA ocean forcing data in such applications to key users. Among the potential benefits from MERSEA are: improved ocean current forecasts from assimilating operational models, improved lateral boundary conditions for nesting local hydrodynamic models, global coverage, choice of several ocean forecasts for European waters. The oil spill forecasting developments described in this report reflect the need to demonstrate these aspects of the MERSEA data provision.

Demonstration exercises are planned for the latter phase of the MERSEA project. Documentation of those demonstrations will address both sensitivity of the oil spill forecasts to ocean forcing data and validation of the oil spill drift forecasts.

2. UPGRADING THE MET.NO OIL SPILL FATE FORECASTING SYSTEM

2.1. Overview of the met.no oil spill fate forecast system

This section summarizes the features of the *pre-existing* system in order to establish the context for the upgrades performed for MERSEA. For a broader overview of met.no's drift modelling systems, see *Hackett et al. (2006)*.

2.1.1. Oil spill model OD3D

The met.no oil spill fate model system OD3D calculates the drift and chemical evolution of surface and sub-surface oil in the guise of a number of "superparticles," each of which represents a certain amount of oil or its by-products. It is started by a request and returns a prognosis in the form of a time series of characteristics for each superparticle. The model has been developed in cooperation with SINTEF (Trondheim, Norway), who are experts in oil weathering processes. It is documented by *Wettre et al. (2001)*.

OD3D is fully three-dimensional and includes a novel seeding routine for deep sources (DeepBlow) developed by SINTEF. The fate of the oil spill depends on the oil characteristics, on ocean currents, temperature and salinity, on atmospheric winds and on wave height and Stoke's drift. At present, 64 oil types are included in the data base of detailed oil characteristics.

2.1.2. Forcing data

In normal operations the model is driven by real-time (or archived) data from met.no's operational models for the atmosphere, ocean circulation and waves. These models cover the northeast Atlantic, North Sea, Nordic Seas and part of the Arctic Ocean. Forecast length is +60 hours. Forcing data for the last 7 days are maintained in a rolling archive in GRIB format for immediate access. For each request for a prognosis, a continuous forecast run of the model is performed up to the requested length or up to the end of the available forecast data.

2.1.3. Users, output and user interface

The main users of the met.no oil spill fate forecast service are the Norwegian Coastal Authority (KV), who have the national responsibility for marine oil spill response, and the Norwegian Clean Seas Association of Offshore Operators (NOFO), who represent the interests of the offshore industry in the Norwegian sector.

Output from OD3D consists of two types of data:

1. data for each individual superparticle, which are essentially the model prognostic variables supplemented by some user-specified derived variables;

2. bulk information on the state of the oil spill as a whole, which includes aggregate quantities calculated from the superparticle data, e.g., total amount evaporated.

An earlier user-specific output format from the model has been replaced by more generic binary and ascii formats, in connection with national and EU projects (not MERSEA). User-specific output requirements are met through post-processing filters acting on the basic output files.

As a normal procedure, users contact a duty forecaster at met.no and request an oil spill forecast. By contract with KV, met.no returns a prognosis in agreed format within 30 minutes. In the case of KV/NOFO, data files are delivered in a format compatible with their proprietary visualisation tools. Met.no maintains a backup visualisation facility that may be employed by the duty forecaster on request or as needed.

2.2. Upgrades to the system

This section describes the developments made to the met.no oil spill fate forecast system to accommodate MERSEA ocean forcing data.

At the start of MERSEA, the oil spill forecast model system consisted of a self-contained program code written in Fortran 77. All input/output routines were hardwired to the internal formats and data structures at met.no. Alongside the oil spill service, there were also emergency services for drifting surface objects, used primarily for search and rescue support, and for ship drift, both of which used independently developed program codes. Acknowledging the similarities in the input/output requirements of these models, it was clear that all three could be consolidated into a single drift forecasting system, where main difference lies in the characteristics of the drifting object or substance. Implementing this upgrade requires modularizing each of the codes in a similar manner: an input module obtains the required input parameters for a simulation; a forcing pre-processor module takes care of organizing forcing data into the right form; the simulation model runs according to the forcing data; the output module facilitates delivery of the simulation results in the required form. The upgraded system is schematized in Figure 2-1. The work done in MERSEA is concerned primarily with the input module, where development of the forcing pre-processor is the main task.

For the OD3D model, the first step was to separate the oil drift and chemistry into a separate module. The main part of this code was rewritten in C in order to allow easier interfacing to the input/output modules and user interface. On the other hand, the physical and chemical parts were retained in Fortran to facilitate code maintenance in cooperation with SINTEF.

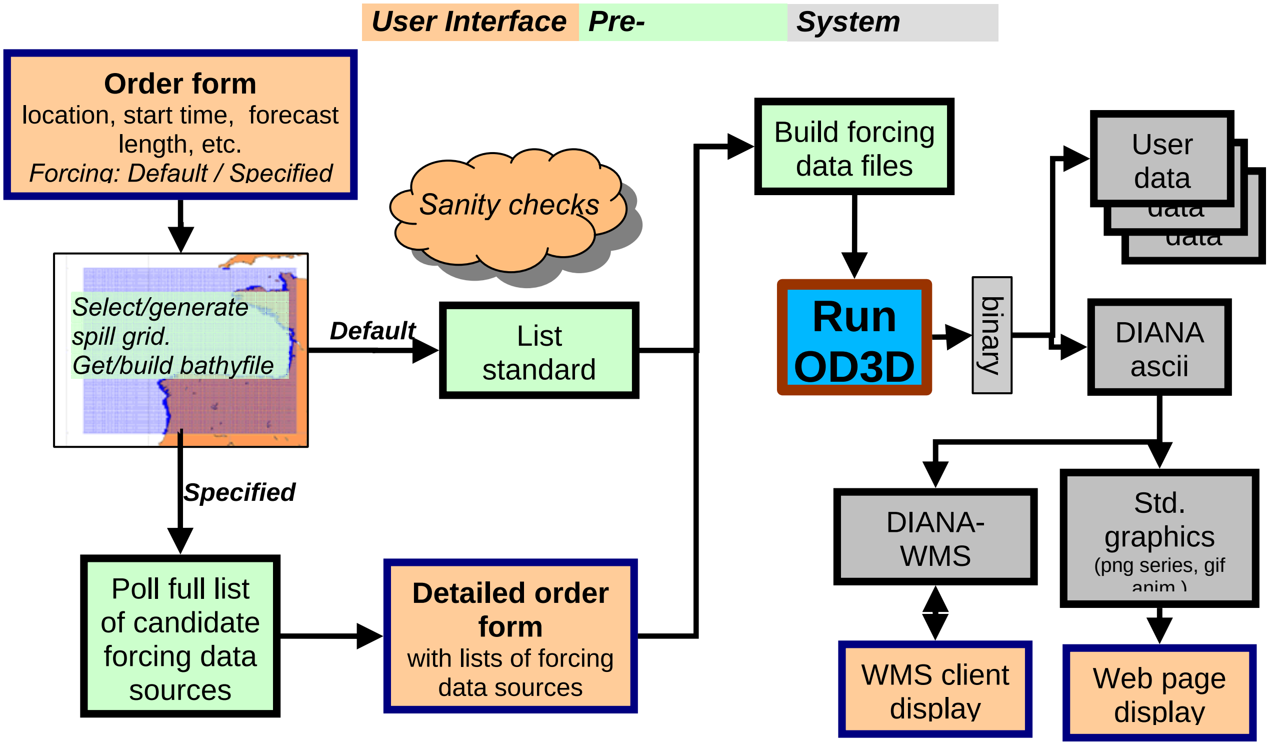


Figure 2-1: met.no oil spill fate forecast system schematic. The oil spill model OD3D is shown in blue. All processes upstream of **Run OD3D** *constitute the input module, while those downstream belong to the output module. Note that the oil spill fate model OD3D can be interchanged with drift models for floating objects (including ships). DIANA (DIgital ANAlysis) is the met.no visualization tool (see http://met.no/diana).*

2.2.1. Forcing pre-processor

The purpose of the forcing pre-processor is to access a range of candidate forcing data sets and prepare them for ingestion in the OD3D model. Forecast data produced at met.no are used for the Norwegian national oil spill forecast service provided to KV/NOFO that covers the region shown in Figure 2-2. In addition, data from MERSEA providers may be accessed in order to allow the user to perform simulations in new areas (potentially global) as well as make alternative simulations in Norwegian interest waters by using overlapping forcing data sets.

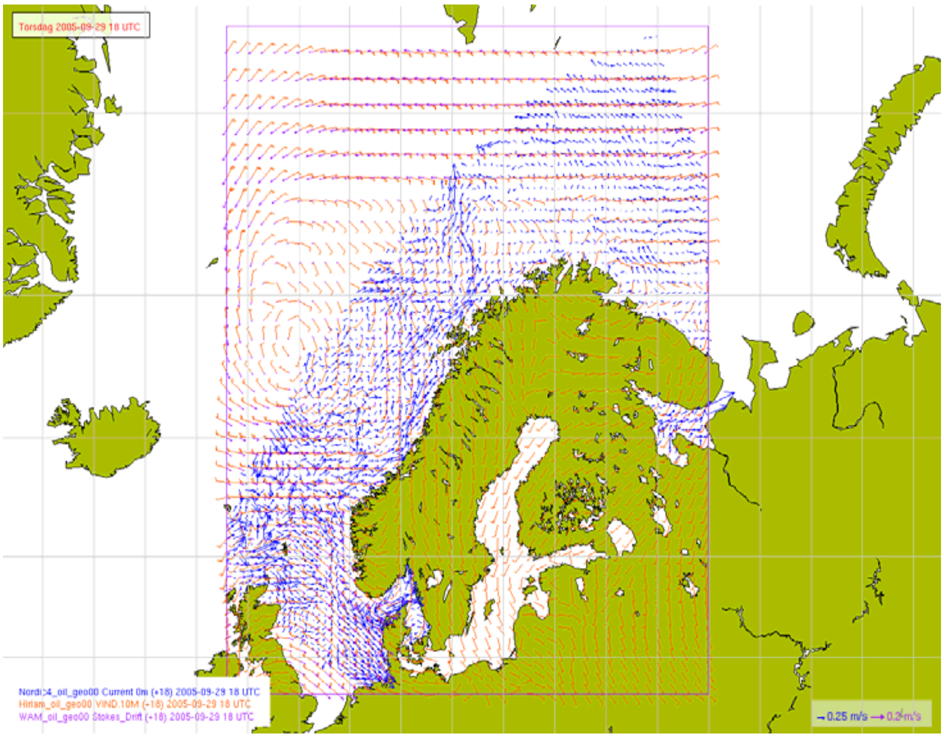


Figure 2-2: Map of the area for which met.no provides oil spill fate forecasts to the Norwegian Coastal Administration (KV), which is the national oil spill response agency. The square area shows the forcing data maintained in readiness for the forecast service. These consist of data from met.no's operational forecast models for the atmosphere, waves and ocean, and include the most recent forecast plus data for the previous seven days.

In terms of the overall system architecture shown in Figure 2-1, the forcing pre-processor consists of the green items. It must locate the requested simulation in space and time and determine which of the available forcing data sets may be used. To do so, it must maintain prioritized lists of topographic data bases and forecast data providers that are sequentially checked for the requested coverage. The candidate data sets currently used are summarized in Table 2-1. Of particular interest here are the ocean data sets and how they are accessed (see also Figure 2-4).

Data type	Source / model	Access	Characteristics
Topography Mean water depth	met.no	met.no database	N. Atlantic – Arctic Oceans 4 km resolution Composite of several databases GRIB format
	GEBCO	met.no database	Global 2' resolution GRIB format
Atmosphere 10 m wind	met.no HIRLAM	met.no database	N. Atlantic – European Arctic 20 km resolution Forecast to +60 hrs, twice daily update 7-day rolling archive GRIB format

	ECMWF	met.no database	Global 0.25° resolution Forecast to +240 hrs, daily update Fetched daily by dedicated link GRIB format
Wave Stokes drift velocity significant wave height mean period	met.no WAM	met.no database	N. Atlantic – European Arctic 10 km resolution Forecast to +60 hrs, twice daily update 7-day rolling archive GRIB format
	ECMWF	met.no database	Global 0.25° resolution Forecast to +240 hrs, daily update Fetched daily by dedicated link GRIB format
Ocean current velocity temperature salinity [3D fields]	met.no MIPOM	met.no database	North and Nordic Seas 4 km resolution Boundary forcing: climatology + tides Forecast to +60 hrs, twice daily update 7-day rolling archive GRIB format
	met.no MIPOM + FOAM	met.no database	North Sea 4 km resolution Boundary forcing: FOAM 1/9° + tides Forecast to +120 hrs, daily update met.no binary format
	MERSEA N. Atlantic FOAM – MetO	met.no database	N. Atlantic – European Arctic 1/9° resolution Forecast to +120 hrs, daily update Used mainly for nesting to MIPOM Fetched daily by ftp GRIB format
	MERSEA Arctic – NERSC	met.no database	N. Atlantic – Arctic Oceans 14 km resolution Forecast to minimum +72 hrs, weekly update Used mainly for nesting to MIPOM Fetched weekly by ftp netCDF format
	MERSEA Arctic – NERSC	OPeNDAP	N. Atlantic – Arctic Oceans 14 km resolution Forecast to minimum +72 hrs, weekly update Fetched on demand netCDF format
	MERSEA Med - INGV	OPeNDAP	Mediterranean Sea 0.0625° resolution Forecast to +240 hrs, daily update Fetched on demand netCDF format
	MERSEA Global – Mercator	OPeNDAP	Global 0.25° resolution Forecast to minimum +240 hrs, weekly update Fetched on demand netCDF format

	MERSEA Global climatology FOAM – MetO	met.no database	Global 1.0° resolution Monthly mean fields netCDF format

Table 2-1: Summary of candidate forcing data sets for the met.no oil spill fate forecast system. Note that Access *refers to how the oil spill forecast system accesses the data.*

The pre-processor discriminates between two areas: 1) within Norwegian national interest waters, and 2) outside those waters. For each area, there is a default forcing data set selected from the prioritized lists. Priority is generally given to data from models with the highest resolution, but other criteria may also be applied. For Norwegian waters, the default data set is identical to the data described in Section 2.1.2, i.e., the rolling archives of met.no forecasts. For other waters, the default data set consists of ECMWF global atmosphere and wave data, together with MERSEA global ocean data (Mercator).

As a fallback solution, i.e., when operational data are for some reason inaccessible, climatological data are used. Climatological data may also be used to extend the forecast beyond the range of the operational data.

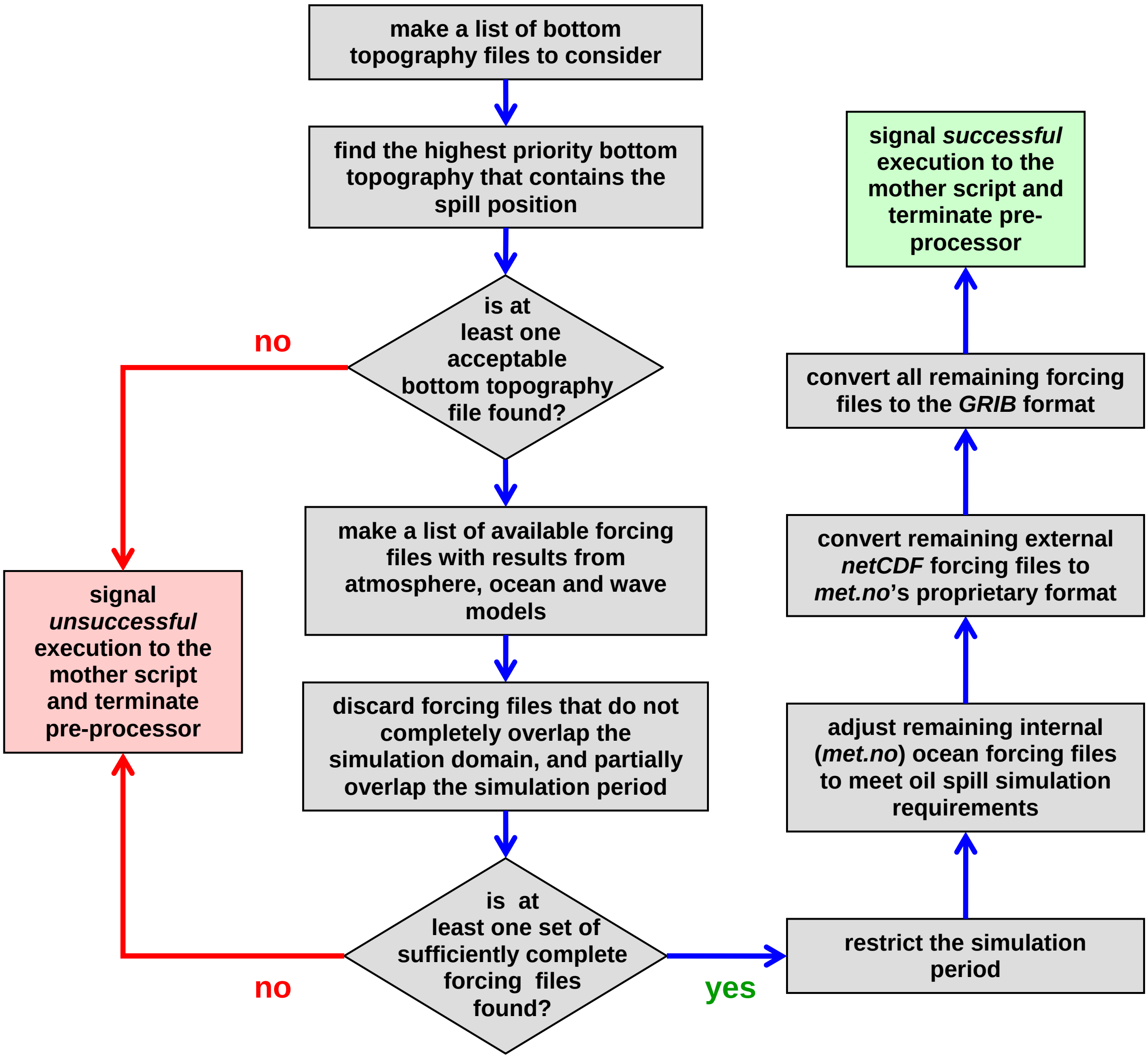


Figure 2-3: Forcing data pre-processor flowchart. The pre-processor produces a set of GRIB files with results from atmosphere, ocean and wave models that cover the requested spill simulation in time and space. The flow chart is a somewhat simplified illustration of how available forcing files with bottom topography data and model results are prepared for the oil spill simulation:

Currently, two types of access to MERSEA operational ocean data are being tested: regular delivery by ftp from MetOffice FOAM and NERSC TOPAZ, and on-demand access to the MERSEA Forecast TEPs' OPeNDAP servers (cf. Figure 2-4). The regular delivery method has the advantage of being quickly accessible and allowing nested operational models at met.no. The disadvantages are storage requirements and fixed geographical coverage.

The MERSEA Forecast TEPs offer a range of data from shelf to global scales with a fairly consistent method of access. The TEPs can be queried to determine what data are available at any time, and the data fetch can be limited to just what is needed. The main disadvantage of the TEP OPeNDAP service is that the data products placed there are not optimal for many oil spill applications (e.g., only daily means). Also, the MERSEA OPeNDAP servers are not organized in a completely similar manner, making access by automated scripts somewhat tedious.

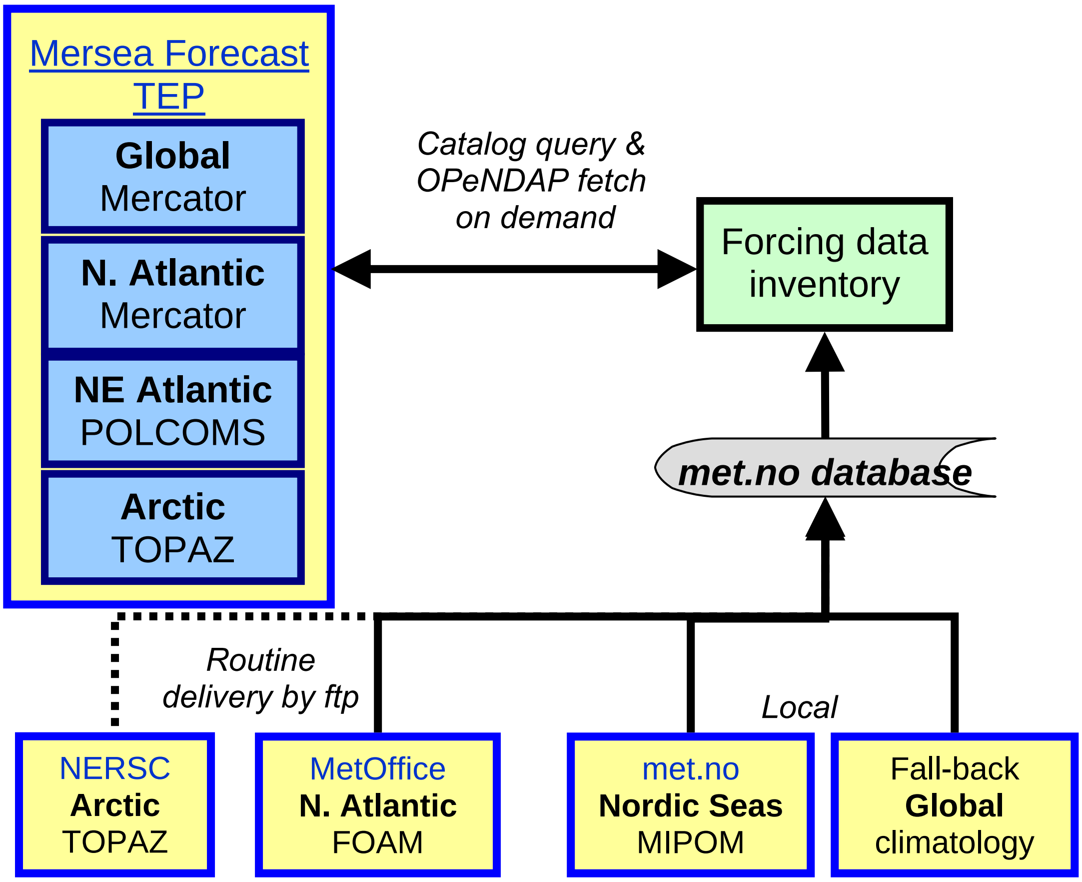


Figure 2-4: Schematic of how the forcing pre-processor accesses various prognostic ocean data sets. At the bottom are data that are either static or routinely updated and stored for use at met.no. The global climatology is obtained from the MetOffice FOAM. Two MERSEA providers deliver agreed data by ftp on a routine basis: NERSC and Met Office. Other MERSEA data sets are accessed on an on-demand basis via queries to THREDDS catalogs and retrieval from OPeNDAP servers. For a given oil spill location, a prioritized inventory list is built from the stored data and by querying candidate Forecast TEPs.

2.2.2. Model developments

2.2.2.1. Moving source and coupling oil drift and ship drift models

The ability to forecast the fate of oil spilled from a moving ship was recommended by users, motivated not least by the “Prestige” accident. Work to facilitate a moving oil source and, thereafter, coupling to the met.no ship drift forecast model was supported in part by the MERSEA project.

The first step in this work was to implement a moving source facility in the OD3D code. The extension from fixed to evolving source position is straightforward.

Next, the input module was revised to accept a specified source trajectory. This is implemented as a list of positions and times (waypoints), along with corresponding oil source flow rates. The location and amount of oil spilled at each model time step is then determined by linear interpolation.

Then, the user interface was upgraded to facilitate specification of the moving source by the user. This was done by allowing the user to enter multiple source specifications, i.e., the position, time and flow rate, in the order form.

Finally, coupling to the ship drift model was implemented by using a series of positions from a ship drift model simulation as the multiple source specifications. The user specifies a previously run ship drift simulation and supplies additional information on the oil flow rate.

See the following Section 2.2.3 and Figure 2-5 for more information on the user interface changes required.

In connection with this coupling, it was found expedient to reduce the time step of the model from 60 minutes to 15 minutes.

2.2.3. User interface

The manual request described above has been supplemented by an interactive web interface, with support from MERSEA and other national and EU projects. It includes an order form, simulation status information, delivery of results and a simple graphical display. The portal for this web service is subject to user control so that simulations ordered by different users are kept separate. Using this service, privileged users can initiate simulations at any time, independent of personal contact with a forecaster, using a standard web browser, and receive results in agreed form within a few minutes.

A screen shot of the web portal menu is shown in Figure 2-5. Note that the oil spill forecast service may, for certain users, be collocated with similar services for drifting objects and ship drift.

The order form, shown in Figure 2-5 at right, is in two parts: a basic form consisting of just the most important input parameters (according to users) and an advanced options form which gives full access to all input parameters. In the advanced options, the user may specify forcing data sets; otherwise default data sets are used (see Section 2.2.1). A series of time intervals with varying oil source flow rates may be specified. Coupling to the ship drift model (see Section 2.2.2) is implemented through an access button.

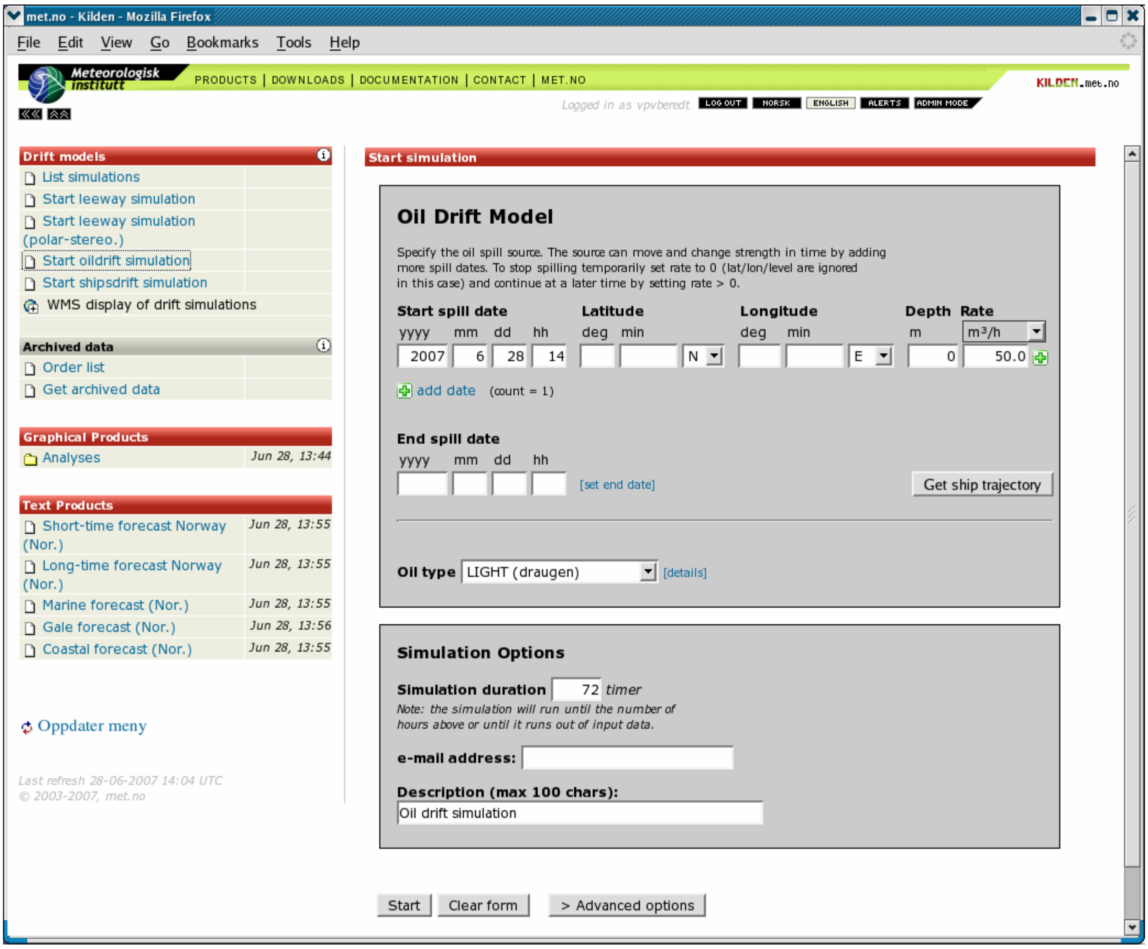


Figure 2-5: Screen shot of the met.no drift simulation portal, featuring user menu and oil drift simulation order form. At left is the user-specific menu; for this particular user access is given to simulations of oil spill drift, drifting objects (leeway model) and ship drift, as well as weather analyses and some text weather forecast products. At right is the basic oil drift simulation order form, which offers only the minimum information needed to run a simulation; all other input parameters are set to default values. Note the button for accessing a previously run ship drift simulation to specify the moving source trajectory. An Advanced options form, allowing detailed specification of the input parameters, is available via a button at the bottom.

Once the user has started a simulation, he/she may monitor the status of the simulation and access various information and results files, as shown in Figure 2-6.

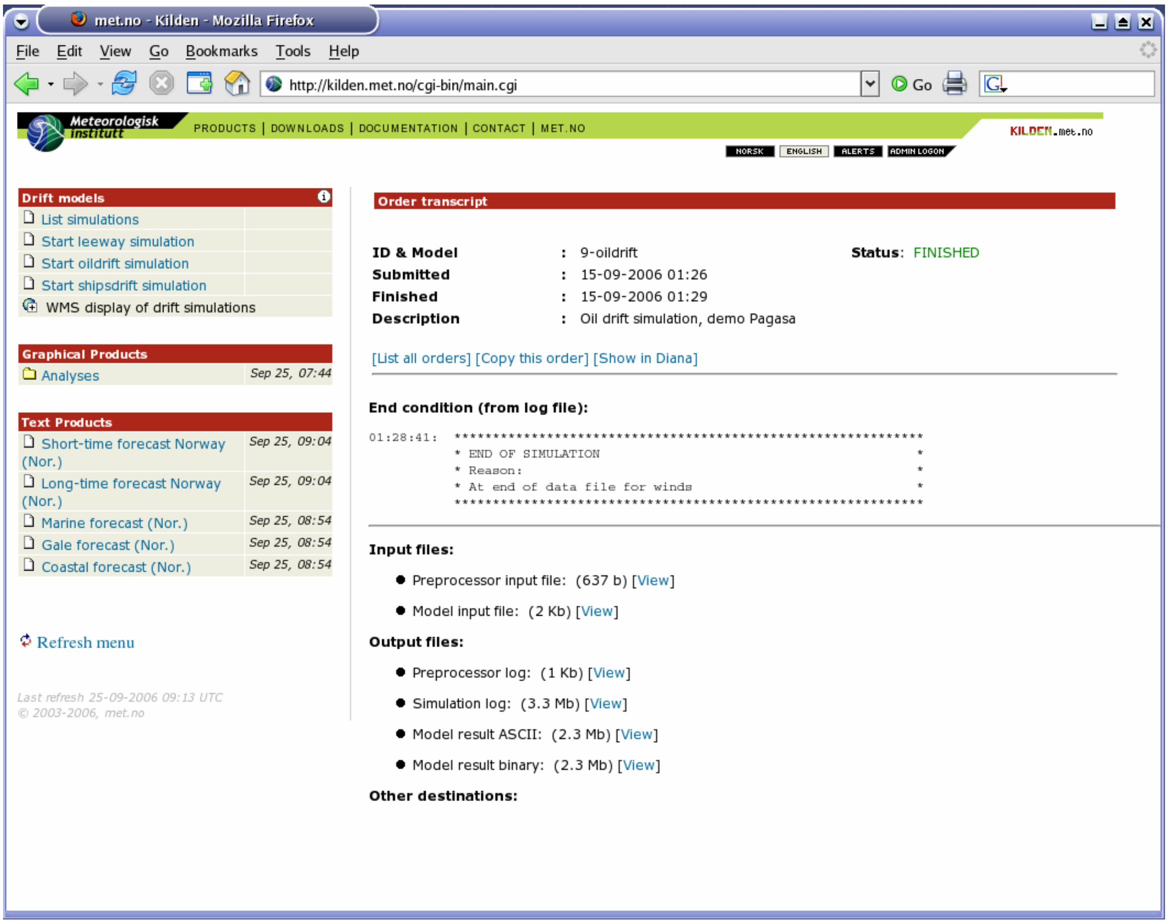


Figure 2-6: Screen shot of the met.no drift simulation portal, featuring simulation status page, at right. Note the online access to input, log and result files.

Visualization of the simulation results is implemented in an embedded WMS (Web Mapping Service) client (Figure 2-7). This service is meant to serve as an easily available backup visualization for KV/NOFO and as a simple display for other users. Using the standard WMS facilities the user may overlay any available layer resources listed in the menu. The latest forecast fields for winds and currents are also available for overlaying.

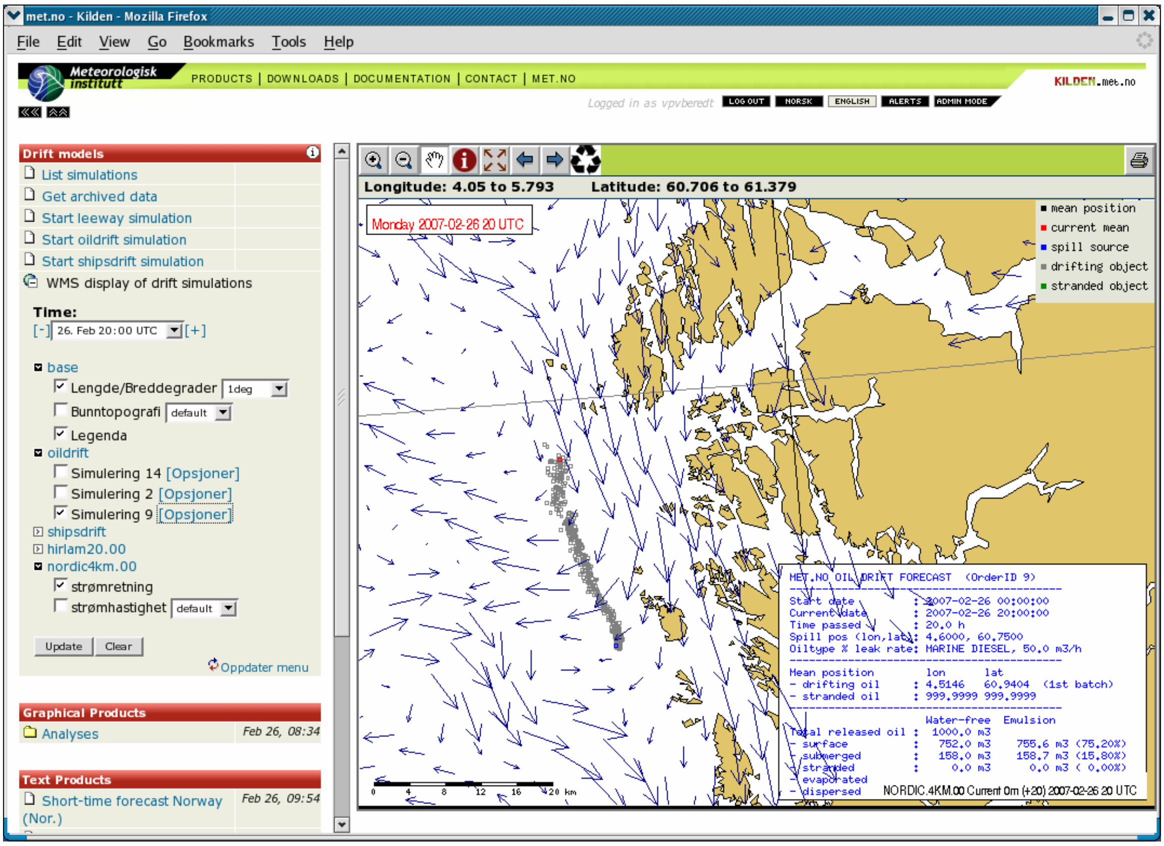


Figure 2-7: Screen shot of the met.no drift simulation portal, featuring the embedded WMS client for visualization of the results. Menu at left includes layer selection and time control. The WMS client includes basic features for zooming, panning, paging and reloading. The superparticle and bulk spill information are as requested by KV/NOFO. In this particular shot, the superparticle positions and surface current vectors are overlaid a map layer.

2.3. Sensitivity of oil spill forecasts to MERSEA ocean data

This section describes the impact of using MERSEA ocean forcing data compared with prior practices.

Currently, only limited testing of the impact of MERSEA ocean forcing data has been performed. The main comparison will be made in connection with the user demonstration exercises in the fall of 2007.

A few preliminary comparative tests of the oil spill service have been carried out using ocean forcing data from the met.no North Sea model with climatological boundary conditions and with nesting data from MERSEA North Atlantic (FOAM 1/9 deg). All other forcing and input parameters were identical. In this case, the differences in the oil spill evolution were quite small. This is a direct consequence of the small differences in the currents, which indicates that, in this area, the surface currents are dominated by tides and local winds.

3. UPGRADING THE OC-UCY OIL SPILL FORECASTING SYSTEM

3.1. Overview of the OC-UCY oil spill forecast system

The OC-UCY oil spill model system, known as MEDSLIK, predicts the transport, fate and weathering of oil spill. MEDSLIK incorporates evaporation, emulsification, viscosity changes, dispersion in water column and adhesion to coast. MEDSLIK in its pre-operational mode was first developed in 1997 (Lardner et. al., 1998) to assist the objectives of the "Sub-regional Contingency Plan for Preparedness and Response to Major Marine Pollution Incidents in the Mediterranean", between Cyprus, Egypt and Israel, which has been prepared with the assistance of REMPEC, under a contract between the IMO for REMPEC and the EU- LIFE program, as a contribution to the implementation of the Emergency Protocol to Barcelona Convention.

MEDSLIK is a user-friendly 3-dimensional oil spill model that has subsequently been applied to several sub-regions of the Mediterranean, such as in the Levantine (Zodiatis et. al. 2005) using the CYCOFOS products, in Adriatic Sea (Glyptou et. al., 2005) using the ADRICOSM products, the Malta coastal sea areas using the ROSARIO products and in the whole Mediterranean Sea using the MFS products, the later application as a contribution to the MERSEA-IP project. Moreover, MEDSLIK has been applied in other regions of the planet, as for example in Taiwan.

MEDSLIK consists of four major modules:

1) a setup module for input of the desirable model domain and model parameters,

2) a visual interface for input of the spill data, the ocean and atmospheric data

3) a run module that performs the simulation, and

4) a visual interface for viewing and animate the output data.

OC-UCY participates in several EU project, such as MERSEA-1, MFSTEP, MERSEA-IP, ECOOP, in applying operationally the MEDSLIK oil spill model, in order to demonstrate to the end users the benefit from having an operational ocean forecasting system in place. Particularly, these operational applications are of useful to the agencies in charge to respond in cases of major oil spill incidents in the Mediterranean and elsewhere. MEDSLIK has been used successfully during the Lebanese oil spill incident, in summer 2006, following a request from several local and European agencies.

3.1.1. MEDSLIK general description

The MEDSLIK oil spill is modelled using a Monte Carlo method, in which the pollutant is divided into a large number of Lagrangian parcels of equal size. At each time step, for each parcel is given a convective and a diffusive displacement. The oil is considered to consist of a light evaporative component and a heavy non evaporative component. The emulsification is also simulated, and the viscosity changes of the oil are computed according to the amounts of emulsification and evaporation of the oil. The MEDSLIK algorithms are based on an earlier version of the OILPOL model (Al Rabeh et al. 1995) that used successfully for oil predictions during the Gulf war in 1991.

In MEDSLIK the transport of the surface slick is governed by both water currents and by direct wind forcing. The diffusion of the slick is modelled by a random walk (Monte Carlo) model.

Oil may be dispersed into the water column by wave action (Mackay et. al. 1979; Buist, 1979), while the dispersed oil is moved by currents only. Mechanical spreading of the initial slick is included (Fay, 1969,1971). The fate processes included in MEDSLIK, i.e. the evaporation of the lighter oil fractions (Mackay and Paterson, (1980), mixing into the water column by wave action (Mackay et. al. 1979; Buist, 1979), emulsification (Mackay and Leinonen, 1977; Mackay et. al., 1979), beaching on the coast and absorption depending on the coastal type (Shen et. al., 1987; Torgrimson, 1980).

Other major features of MEDSLIK:

- The model includes a built-in database from REMPEC of physical properties of over 220 oil types that are the most common in the Mediterranean.
- The model allows switching, while running, from coarse to high resolution ocean forecasting data, when the oil slick passes from a coarse to a higher resolution model domain.
- The model allows spill predictions to be corrected by subsequent slick observations.
- The effect of the deployed of oil slick booms can be examined.
- Simultaneous oil spills whose slicks merge can be modelled together.
- The model includes a simple GIS system to allow information on coastal and open sea resources.

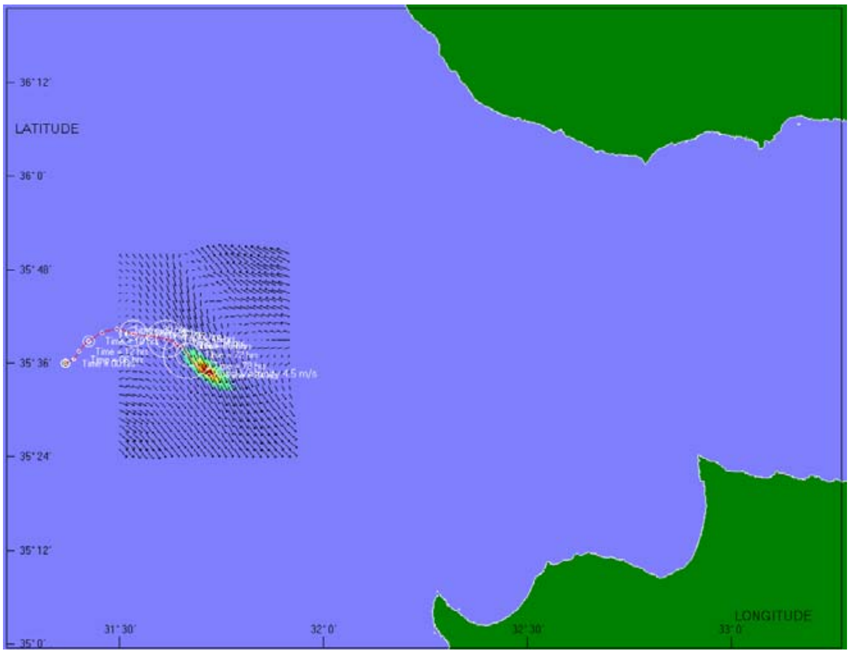


Figure 3-1: The MEDSLIK oil spill and trajectory model allows to switch, while is running, from coarse to high resolution ocean forecasting data, when the oil slick or floating object passes from a coarse (MFS) to higher resolution (CYCOFOS) model domain.

3.1.2 Forcing data

MEDSLIK is driven by NRT or archived data from OC-UCY's operational forecasting models, i.e. of the CYCOFOS system, for ocean circulation and temperature and wind data from SKIRON or ECMWF atmospheric forecasting systems. The CYCOFOS ocean model covers the NE Levantine basin with currents and temperature forecasting data for 5 and 10 days, while the SKIRON covers the whole Mediterranean with high frequency wind forecasts for 5 days and 10 days with ECMWF. Moreover, MEDSLIK can use the MFS ocean data for the entire Mediterranean. The MEDSLIK forcing data in ASCII format, are available through the CYCOFOS web page for immediate access. Also MEDSLIK is capable to driven by the CYCOFOS or MFS NetCDF data files.

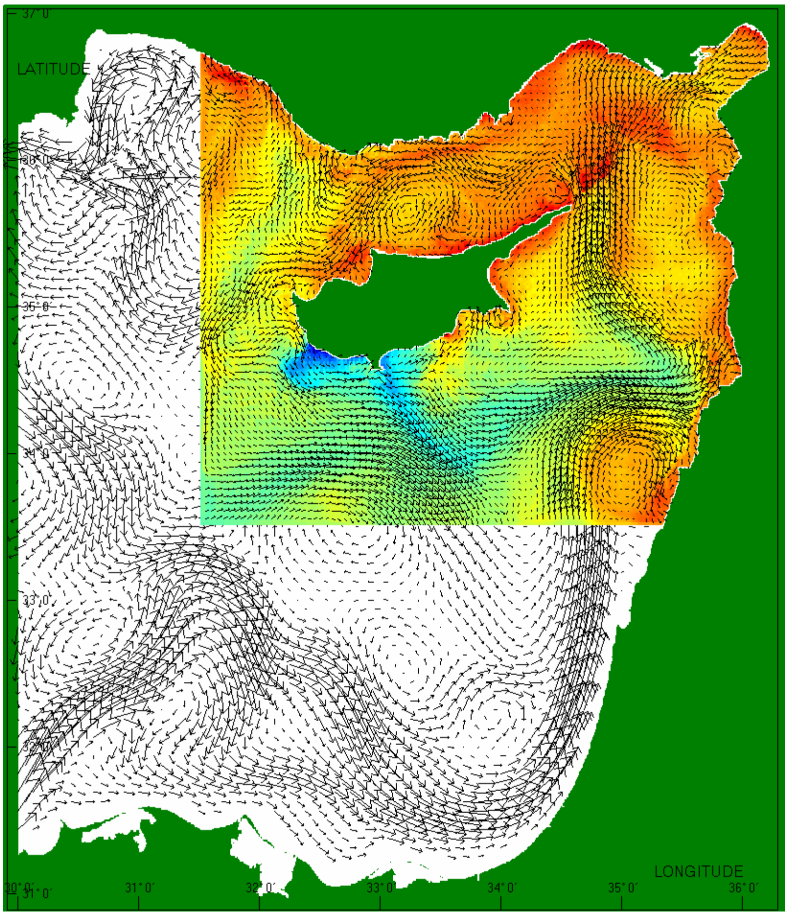


Figure 3-2: Map of the areas for which OC-UCY provides oil spill forecasts to the Cyprus Department of Fisheries and Merchant Shipping, which are the national oil spill response agencies, as well to other EU response and decision agencies. The coloured area shows the CYCOFOS ocean data, as well those of MFS in the rest part of the Eastern Mediterranean Levantine Basin, maintained in readiness for oil spill modelling applications, as a contribution to MERSEA-IP.

3.1.3. Users, output and user interface

The main users of the OC-UCY oil spill forecast service are the Cyprus Departments of Fisheries and Merchant Shipping, who have the national responsibility for marine oil spill response, as well the REMPEC/IMO/UNESCO, who has the responsibility to assist the Mediterranean countries in the preparedness to respond in oil spill incidents. Moreover, additional users for the MEDSLIK trajectory model are the Cyprus Search and Rescue Center.

Output from MEDSLIK consists of:

1. data for the particle, which are essentially the model prognostic variables;

2. information on the state of the oil spill, which includes the total amount evaporated, total amount on the coast, total amount on the sea surface, total amount in the water column.

The MEDSLIK output files are in ASCII formats.

The MEDSLIK has a user friendly interface, so can be used directly by the end-users. However, in serious oil spill incidents, usually there are direct requests from the major and other users to OC-UCY for oil spill forecasts. The OC-UCY have a dedicated person 24 hours on call, in case of an emergency request. The MEDSLIK output files are visualised by the MEDSLIK output visualisation module.

3.2. Upgrades to the system

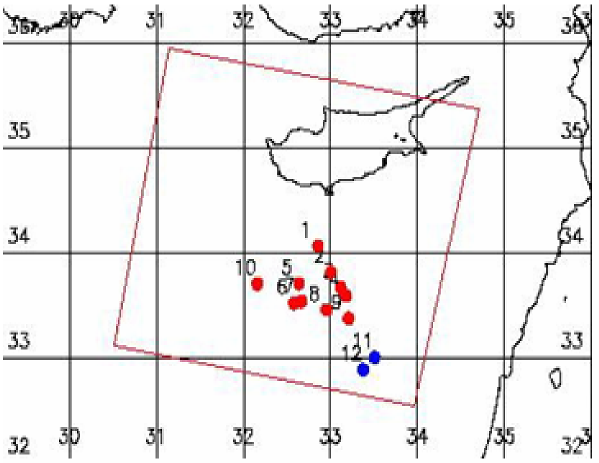
At the start of MERSEA-IP project the used version of MEDSLIK was forced with the CYCOFOS forecasting data covering the Levantine basin. Since then, MEDSLIK has been upgraded to use the MFS forecasting data for the entire Mediterranean as well. MFS is one of the regional forecasting systems of the MERSEA IP. Alongside the oil spill module, there was also developed a model for drifting surface objects, used primarily for search and rescue support. Acknowledging the similarities in the input/output requirements and the same format of the forcing data for both models, it was clear that these models could be consolidated into a single forecasting system, where main difference lies in the characteristics of the drifting object or substance. Implementing this upgrade requires modularizing each of the model in a similar manner: an input module obtains the required input parameters for a simulation; the simulation models runs according to the same forcing data format; the output module facilitates delivery of the simulation results in a similar form.

3.2.1 Model developments

3.2.1.1. Moving or drifting oil spill source

The ability to forecast the fate of oil spilled from a moving or drifting vessel was motivated after revealing from MODIS and SAR images the illegal oil slicks released along the track of some ships, as well by the Directive 2005/35/European Commission on illegal marine pollution from ships.

MEDSLIK's recent development on the above issue include the upgrade of the model's input module, in order to facilitate the input of the several, up to 20 moving or drifting oil spill sources, providing for each new source information about the new position, time, flow rate.



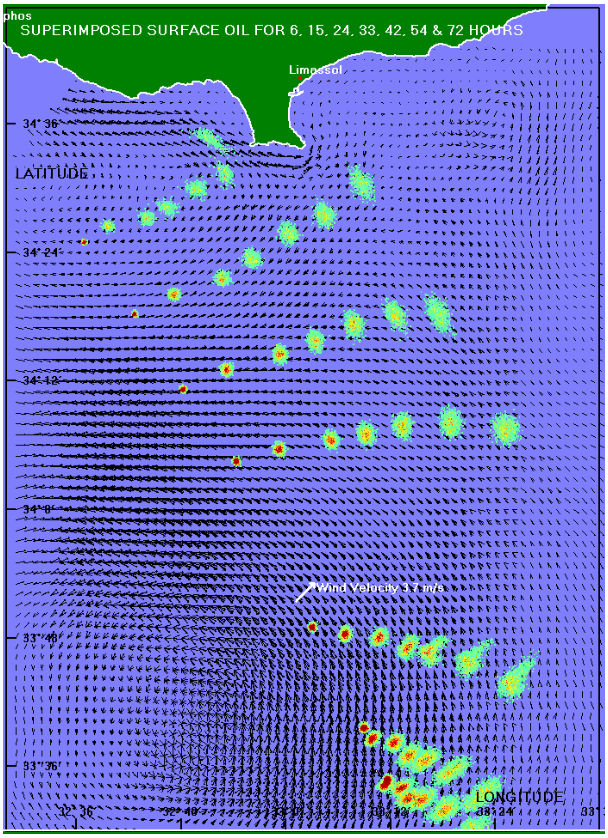


Figure 3-3: . On the 18th June 2007, OC-UCY has received an emergency request from the Cyprus Department of Merchant Shipping to run the MEDSLIK oil spill model, after a warning report from EMSA. EMSA has reported several possibly illegal oil discharges south of Cyprus, covering a distance of about 100 km, from a vessel, which moved from the south to the north direction (see the map with the EMSA reported possibly oil spill positions).

The recent-new developments of MEDSLIK for oil spills predictions from a moving vessel, was made possible to get an overview of the dispersed oil slicks along the track of the vessel, using the MERSEA-IP data (MFS and CYCOFOS).

Despite the detection of the oil slicks from SAR and MODIS, the in-time EMSA warning report and the near real time MEDSLIK oil spill predictions, the aerial survey of the northern part of the reported area, shown no any oil slick in the area.

However, the above incident shown in best practice the effectiveness response of various agencies, including that of the MERSEA-IP contribution on oil spill predictions in the Eastern Mediterranean Levantine Basin.

3.3. Sensitivity of oil spill forecasts to MERSEA ocean data

MEDSLIK use the MERSEA-IP ocean data, particularly those of MFS in any part of the Mediterranean Sea. Moreover, the CYCOFOS ocean forecasting model is nested hierarchically with the MFS.

During the Lebanese oil spill incident in July and August 2006, which is considered the major oil spill incident in the Eastern Mediterranean so far, the OC-UCY was tasked by several local and European agencies (Lardner et.al., 2006, Zodiatis et.al. 2007) to provide predictions of the oil that was spilled from the Jeih power plant in Lebanon.

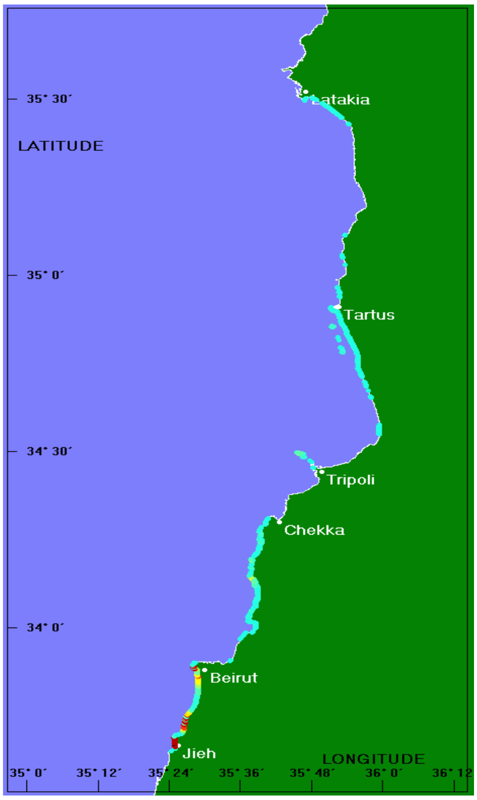
The results of the MEDSLIK oil spill predictions were confirmed by local observations of the Lebanese Ministry of Environment and from MODIS and SAR images, (www.mersea.eu.org).

The MEDSLIK results were used later to draw the International Action plan for the clean up operations of the oil from the Lebanese coast (Experts working group for Lebanon, 2006). The success of the MEDSLIK oil spill predictions during the Lebanese oil spill incident in 2006, was made possible because of the good quality of the MERSEA-IP (MFS/CYCOFOS) ocean forecast and of the SKIRON winds.

Comparison of oil spill predictions, using MERSEA-IP data and trajectories from surface drifters, designed to mimic the oil spill movement, will be carried out during September -October 2007 in the Eastern Mediterranean Levantine Basin by OC-UCY in cooperation with the MERSEA-IP partners.

Figure 3-4: Predicted amounts of oil permanently stuck on the Lebanese coast by MEDSLIK using the MERSEA-IP data, after 30 days from the oil incident. Heaviest deposits are near Jieh and South Beirut. Lighter deposits as far north as Latakia.

The results of the MEDSLIK predictions, regarding the affected coastal areas, were confirmed by local observations from the Lebanese Ministry of Environment.



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