REGIONAL MARINE POLLUTION EMERGENCY
RESPONSE CENTRE FOR THE MEDITERRANEAN SEA
(REMPEC)

MEDITERRANEAN ACTION PLAN

NATIONAL TRAINING COURSE ON MEDSLIK OIL SPILL DRIFTING MODEL version 5.1.2

Lattakia, Syria, 4-5 June 2007

R E P O R T

JUNE 2007

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INTRODUCTION

1. A national training course for Syria on MEDSLIK oil spill drifting model version 5.1.2 was held in Lattakia, Syria, between 4 and 5 June 2007. The National Training Course was organized as part of the on-going programme of REMPEC's activities aimed at assisting the national authorities of the Mediterranean coastal States to develop their national systems for preparedness for and response to accidental marine pollution. It was financed by the funds allocated for this purpose in the Centre's budget.

2. The training course represents the follow up of previous activities organized by REMPEC in Syria within the framework of a LIFE project financed by the LIFE Third Countries mechanism of the EU. One of the activities carried out during the project consisted in adapting and modifying as necessary a previous version of the MEDSLIK oil prediction model for use in Syrian waters. The Syrian authorities were also provided with copies of the program and Syrian personnel were trained in the use of the model.

3. The aim of the present training course was to provide the Syrian Authorities with the new version of the MEDSLIK model (version 5.1.2), which had been recently developed at the University of Cyprus by adding several new features to the previous version.

ORGANIZATION OF THE TRAINING COURSE

4. The Ministry of Local Administration and Environment and the Ministry of Transport of the Syrian Arab Republic, being the REMPEC's National Focal Points, were responsible for the selection and invitation of the participants. The Syrian administration's responsibilities also included making necessary logistic arrangements. The arrangements were excellently co-ordinated by Mr. Shaka Alsoleman, from the General Commission for Environmental Affairs of the Ministry of Local Administration and Environment of Syria.

5. The training course was held in a conference room at the General Directorate of Ports in Lattakia.

6. REMPEC covered the cost of consultancy (air ticket and rDSA), as well as the provision of lunches and coffee breaks for the participants. The Centre covered also the travel expenses for participants coming from the Environmental Directorate in Tartous and the Marine Pollution Combating Centre in Banias (near Tartous) and a rDSA for one participant coming from the Ministry of Local Administration and Environment in Damascus.

7. REMPEC acted as the official point of contact with the national authorities and liaised with them on the dates and venue of the training course. REMPEC prepared the training course programme, which was approved by the Syrian authorities.

8. Ms. Cristina Farchi, Programme Officer, was in charge of the organization and of ensuring the smooth running of the training course.

9. The training course was conducted in English language.

10. The majority of participants who attended the national training course came from the Marine Pollution Combating Centre in Banias (General Directorate of Ports), others were coming from the General Directorate of Ports in Lattakia, two participants were from the Environmental Directorate in Tartous, whilst only one participant came from the Ministry of Local Administration and Environment in Damascus. A total of 10 participants attended the course. The list of participants is given in **Annex I.**

PROCEEDINGS OF THE TRAINING COURSE

11. The objective of the training course was, in addition to providing the participants with the basic knowledge on the use of oil spill drifting models in responding to accidental marine pollution, to train personnel responsible for oil pollution response on the new version of MEDSLIK which included several new features with respect to the older version.

12. With the aim of achieving these objectives, REMPEC provided the Syrian Authorities with the training course programme, which comprised a general introductory lecture on meteocean forecasts and oil spill drifting models, and a series of technical lectures on the new features of MEDSLIK. Moreover, the program of MEDSLIK was installed on the PCs which were rendered available to the participants. A copy of the training course programme in English is reproduced in **Annex II**.

13. In her opening address Ms. Cristina Farchi, Programme Officer of REMPEC, briefly referred to previous related activities organized by REMPEC in Syria, recalling the training course on MEDSLIK carried out in 2003 within the LIFE project financed by the EU. The lectures were given by Dr. Robin Lardner, who developed the MEDSLIK oil spill drifting model in collaboration with the University of Cyprus. The introductory power point presentation is attached in **Annex III.**

14. In order to ensure the smooth running of the training course, each computer was shared by two participants, while the PC of the lecturer was connected to an overhead projector which facilitated the participants in learning the basic features of MEDSLIK.

15. The technical lectures were carried out through examples given by the lecturer and exercises carried out by the participants. After each example shown by the lecturer, a similar exercise was carried out by the participants on their own PC. Hard copies of both examples and exercises were distributed to the participants.

16. Due to the short time available and to the busy agenda it was not possible to go through all the examples as planned, whereas an exercise on each different topic was carried out. However it was highlighted that all the examples are included and explained in detail in the User Manual of MEDSLIK which comes with the program installation.

17. Each participant was provided with a CD-ROM containing the MEDSLIK program and the related forecast files which are necessary to run the model.

18. Before closing the training course, Ms. Cristina Farchi thanked all the attendees for their contribution and presented participants with numbered Certificates, which had been prepared by REMPEC. A copy of the specimen of the Certificate is given in **Annex IV.**

19. Mr. Dayoub, Head of Marine Pollution Unit of the General Directorate of Ports, Ministry of Transport, thanked REMPEC, the lecturer and the training group for their involvement and wished this training course to be followed by other similar seminars / training courses.

20. The training course was closed on 5 June 2007 at 13.30.

EVALUATION OF THE TRAINING COURSE

21. The training course was aimed at operational personnel in the field of marine pollution preparedness and response. To a large extent the participants were coming from the sector expected, although there was only one representative from the Ministry of Local Administration and Environment of Syria.

22. The participants have shown interest during the entire course and expressed their appreciation for the work carried out during the 2 days training; however, some difficulties were encountered since many participants were not fluent in English.

23. All the topics reported in the training course programme were presented and explained by the lecturer. However, the effectiveness of the course would have been enhanced if an additional day of training was dedicated to practicing the new features of the model.

CONCLUSIONS AND RECOMMENDATIONS

24. The training course was highly appreciated and all participants expressed their interest on the topics which were presented. The audience was well selected as all attendees were involved in the field of marine pollution preparedness and response. However, none of the participants were familiar with the previous version of MEDSLIK, as most of the people who attended the course in 2003 had left their posts and/or had moved to another field.

25. Thanks to the availability of PCs on which the participants could carry out the various exercises by themselves, an active participation was shown during the whole course. From the questions and the results of the exercises, it appears that the information was well understood by the trainees and suited to their needs.

26. Time constraints did not allow the lecturer to give all the examples related to the different issues thus it would be highly recommended to consider an additional training day for future training activities on MEDSLIK oil spill drifting model. This would enable participants to practice more on the use of the program and to better assimilate the new topics. Finally, the course demonstrated that a provided simultaneous interpretation from English into Arabic language would be very helpful for future training activities in Syria.

Annex I

LIST OF PARTICIPANTS

Mr. Khattar Sara — **Certificate No. 2597**
E.I.A.
Environmental Directorate
Tartous
Maten-Alsahel
Tel: +963 043 321916
Fax: +963 043 321917
Mobile: +963 933490337

Mr. Ali Dayoub — **Certificate No. 2598**
Head of Marine Anti Pollution Department
General Directorate of Ports
Al Gazair
Lattakia
Tel: +963 041 473876
Fax: +963 041 475805
Mobile: +963 933738625
E-mail: danco@net.sy

Mr. Mahmoud Saleh — **Certificate No. 2599**
E.I.A.
Environmental Directorate
Tartous
Tel: +963 043 321916
Fax: +963 043 321917

Mr. Adel Habib — **Certificate No. 2600**
Programmer
Environmental Directorate
Lattakia
Tel: +963 041 213185
Mobile: +963 955752372

Mr. Wael Jdied — **Certificate No. 2601**
Deputy of Environmental Directorate
Environmental Directorate
Aljlaa Street
Lattakia
Tel: +963 041214751
Fax: +963 041211189

Mr. Shaka Alsoleman **Certificate No. 2602**
General Commission for Environmental Affairs
Ministry of Local Administration and Environment
Almzraa Street
Damascus
Tel: +963 011 44677774
Fax: +963 011 4443729

Mobile: +963 933583314
E-mail: shaka@mail.sy;
shakaalsoleman@yahoo.com

Mr. Waseem Saeed **Certificate No. 2603**
Chemical Engineer
Marine Pollution Combating Centre
General Directorate of Ports
Lattakia
Tel: +963 043 723336
Fax: +963 041 472597
Mobile: +963 944935737

Mr. Sameer Tenzakli **Certificate No. 2604**
Marine Pollution Combating Centre
General Directorate of Ports
Lattakia
Tel: +963 043 723336
Fax: +963 041 472597
Mobile: +963 955345948

Mr. Thaier Ali **Certificate No. 2605**
Engineer
Marine Pollution Combating Centre
General Directorate of Ports
Lattakia
Tel: +963 041 812608
Fax: +963 041 475805
Mobile: +963 988410430
Mail: saccali@gmail.com

Mr. Hussein Shahadeh **Certificate No. 2606**
Engineer
Marine Pollution Combating Centre
General Directorate of Ports
Lattakia
Tel: +963 041 473333
Fax: +963 041 475805
Mobile: +963 944747628
Mail: danco@net.sy

Annex II

PROGRAMME

Monday 4 June

9.00 — *Installation of the program on computers (Presence of participants is not required)*

9.30 — Opening

9.40 — General overview and introduction to the course. Main features of oil spill modelling with particular reference to MEDSLIK

11.00	*Coffee break*

11.15 — Interactive 1st sessions
- entry of spill characteristics, wind and current data
- download and use of forecast data to run the model
- correction of spill forecasts by incorporation of slick observations visualization tools for spill predictions.

12.30	*Lunch*

14.00 — Cont

15.30	*Coffee break*

15.45 — Cont.

17.00	*End of day 1*

Tuesday 5 June

9.00 — Interactive 2nd sessions
- trajectory prediction and its use as a tool for oil spill response and Search & Rescue operations
- restarting a stopped simulation
- change of simulation domain
- use of oil booms within the model
- simulation of simultaneous spills
- built-in GIS

11.00	*Coffee break*

11.15 — Cont.

13.30	*Closure*

Annex III

INTRODUCTORY PRESENTATION

The Cyprus Operational Oceanography System

And

The Application MEDSLIK

Robin Lardner & George Zodiatis

Oceanography Centre

University of Cyprus

Nicosia, Cyprus

Outline

CYCOFOS-Cyprus Operational Oceanography System

✓The CYCOFOS in GMES, MERSEA and MOON

✓The CYCOFOS ocean forecasting modules

✓ The CYCOFOS observational operations

The CYCOFOS end-user module MEDSLIK

✓Details of the model for oil spill predictions

✓The ocean data to run the model

✓Example application: The Lebanese spill of July 2006

✓Detection of the oil slicks using satellite images

A complete operational oceanographic forecasting and observing system has been developed in Cyprus, and has been operational since early 2002. The system is called CYCOFOS-Cyprus Coastal Ocean Forecasting and Observing System and is a component of the European EuroGOOS and Mediterranean MOON modules. CYCOFOS is the result of several years of research activities carried out in the framework of EU research projects.

CYCOFOS at present consists of several operational modules, including:

flow, marine state and offshore waves forecasts

satellite remote sensing

coastal and offshore monitoring stations

oil spill, trajectory and pollutant predictions

All these operational modules provide NRT forecasts and observations, both to local and sub-regional end users in the Eastern Mediterranean Levantine Basin.

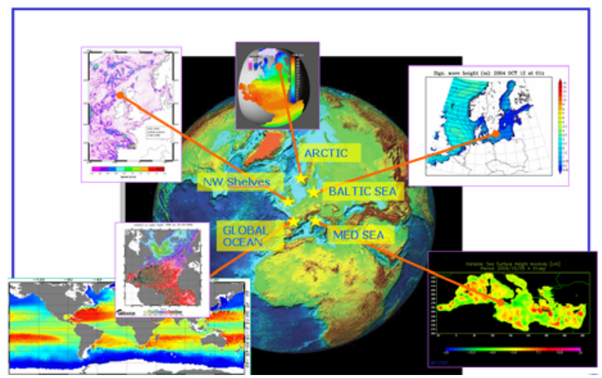
The CYCOFOS is the Cyprus contribution to MCS-Marine Core Services of the GMES -Global Monitoring for Environment and Security of the EU.

The development of the GMES MCS in Cyprus is carried out by the Oceanography Centre, within the framework of EU projects and initiatives such as:

MERSEA-Marine Environment and Security for the European Area

(MERSEA strand 1)

MERSEA aims to build the MCServices of GMES by 2008, Based on existing expertise.

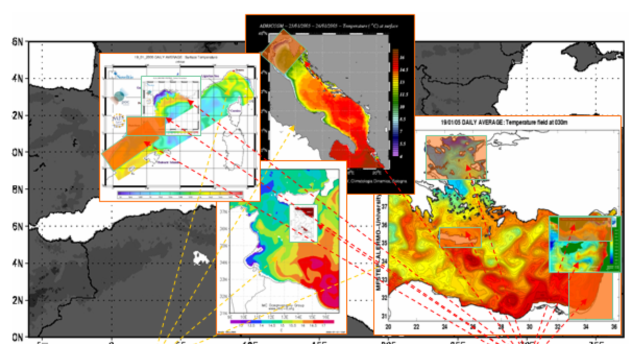


CYCOFOS
MEDSLIK

MOON-Mediterranean Operational Oceanography Network

(MFSPP, MFSTEP)

MOON main objectives to consolidate the operational modeling systems in the Med.



CYCOFOS
MEDSLIK

CYCOFOS-Cyprus Coastal Ocean Forecasting and Observing System : NRT products

At present :

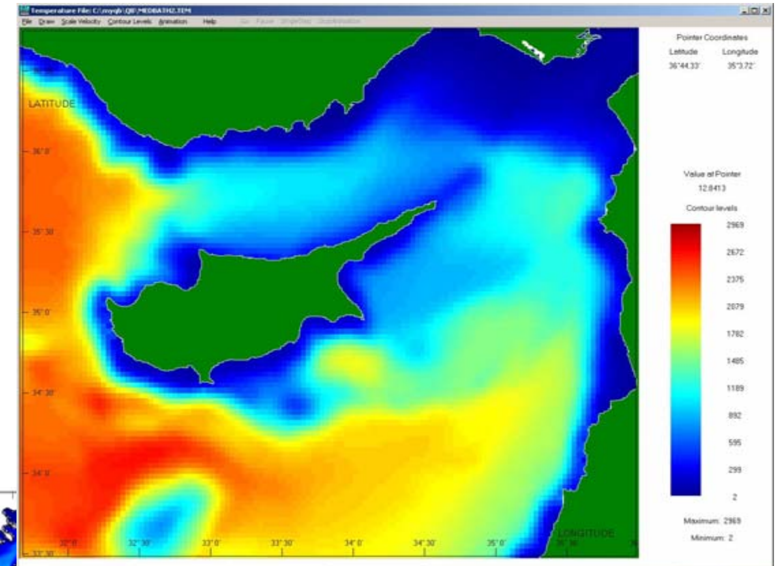
1. Currents, temperature, salinity, sea level
2. Remote sensing SST, chlorophyll-a, oil slicks
3. In-situ sea level, water temp., salinity, pressure
4. Significant wave height and direction, using SKIRON winds
5. Specific end-users applications, such as:
   oil spill, pollution dispersion and trajectory of floating objects predictions, using the CYCOFOS products

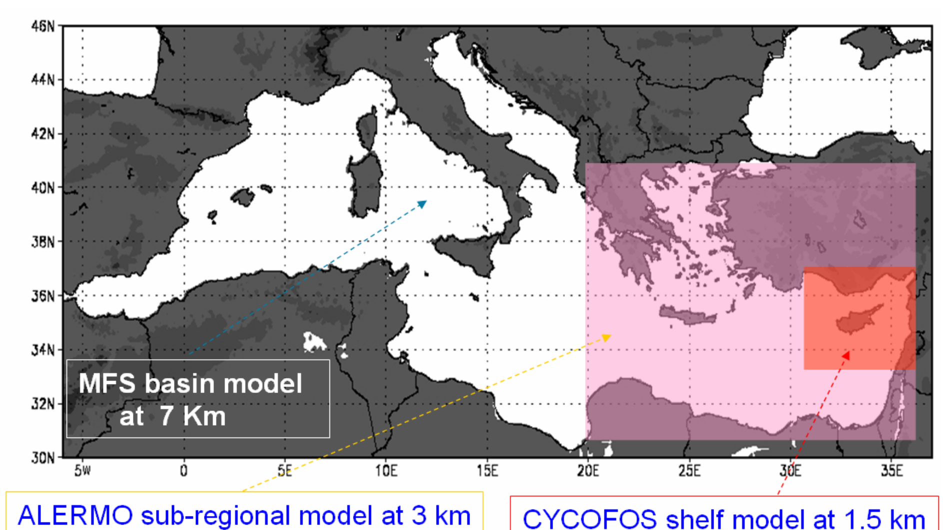
The CYCOFOS flow model

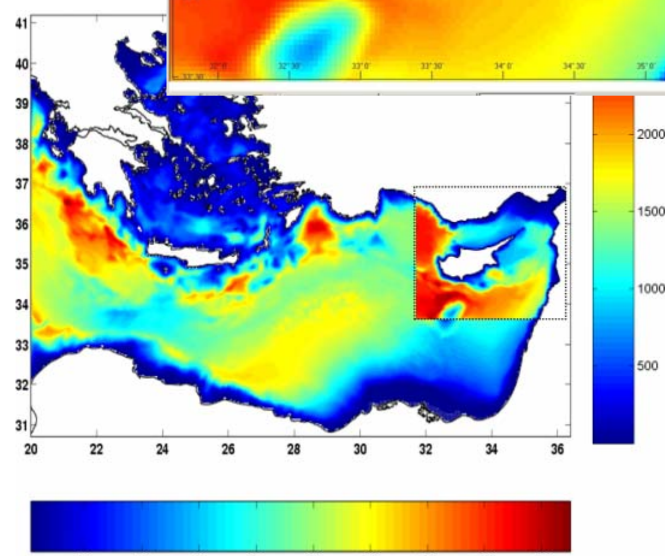
CYCOFOS use a POM version for NRT flow forecasts, with

25 sigma layers in vertical and
1.5x1.8 km grid step in horizontal

The CYCOFOS model is nested with :
MFS-OPA: daily 10 days forecasts and with
ALERMO : daily 5 days forecasts, using the SKIRON high frequency forcing.







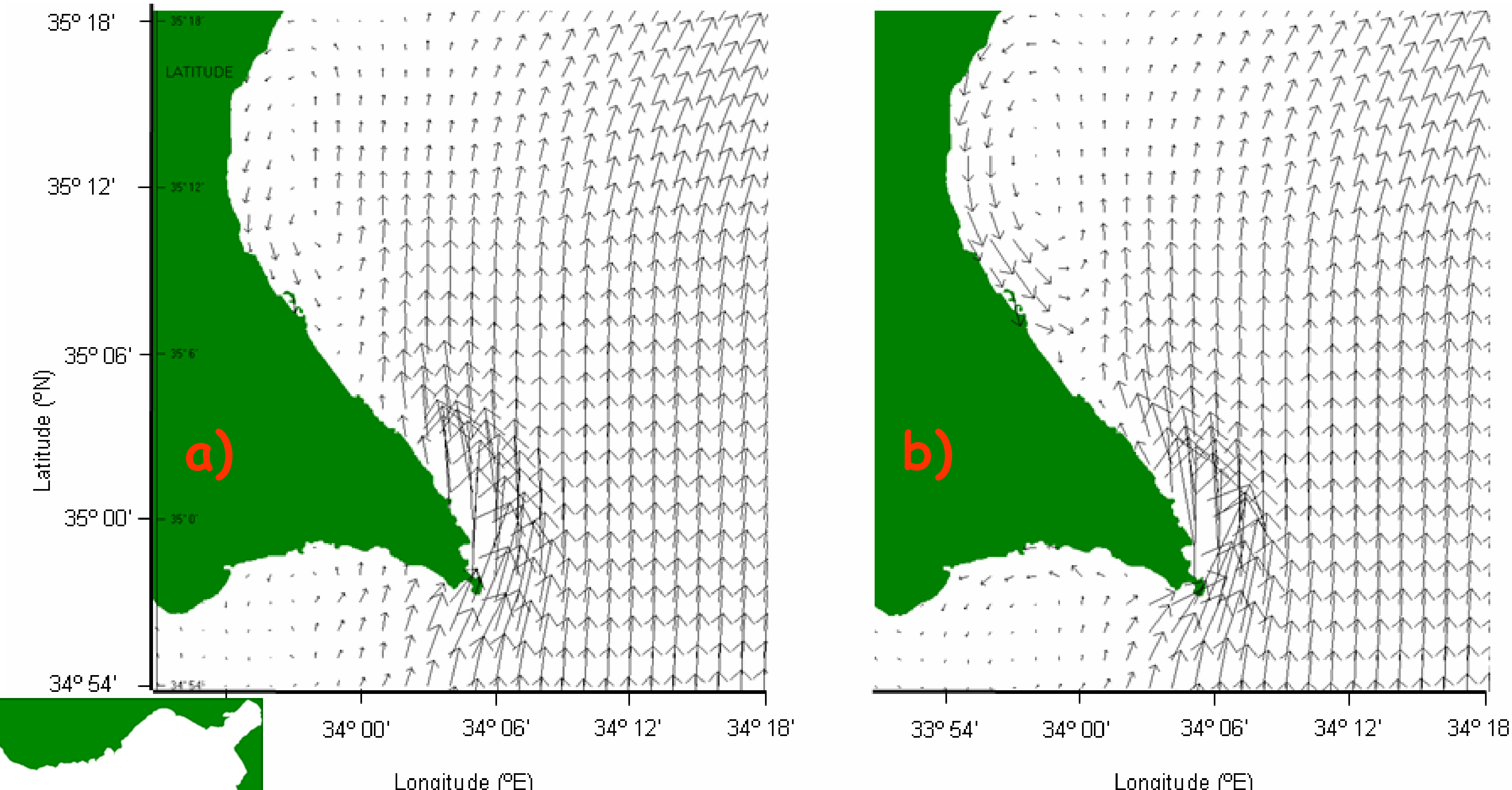
MFS-OPA basin, ALERMO intermediate and CYCOFOS coastal models domains

CYCOFOS flow model: Inputs

- for daily 10-day forecasts use:
- Surface wind stress and heat & salinity fluxes directly from MFS-OPA (based on 6 hourly ECMWF forcing).
- No surface relaxation of temperature and salinity has been applied.

- for daily 5-day forecasts use:
- **Surface wind stress and heat & salinity fluxes, determined using the bulk parametrization formulas and the SKIRON high frequency surface forcing.**
- **No surface relaxation of temperature and salinity has been applied.**

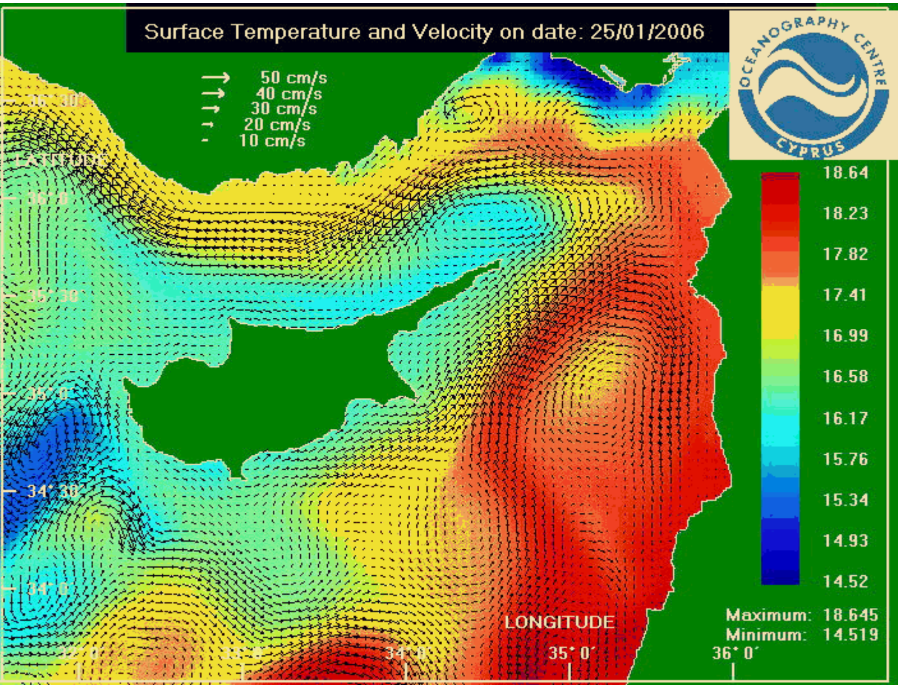
CYCOFOS flow model uses the VIFOP to improve forecast at the coastal zones



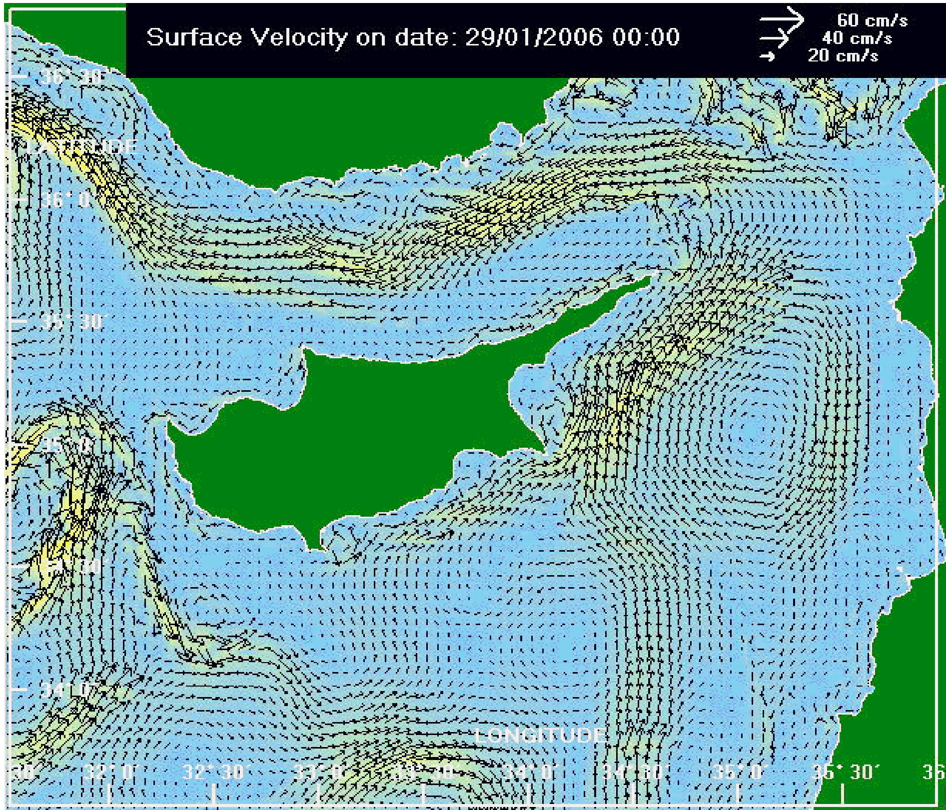
Example of the CYCOM velocity fields without (a) and with (b) the implementation of VIFOP.

The CYCOFOS flow models: example of forecasting products

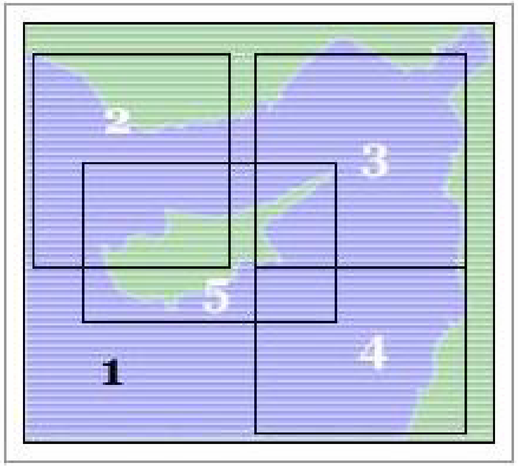
Daily fields for 10 days forecasts are produced daily

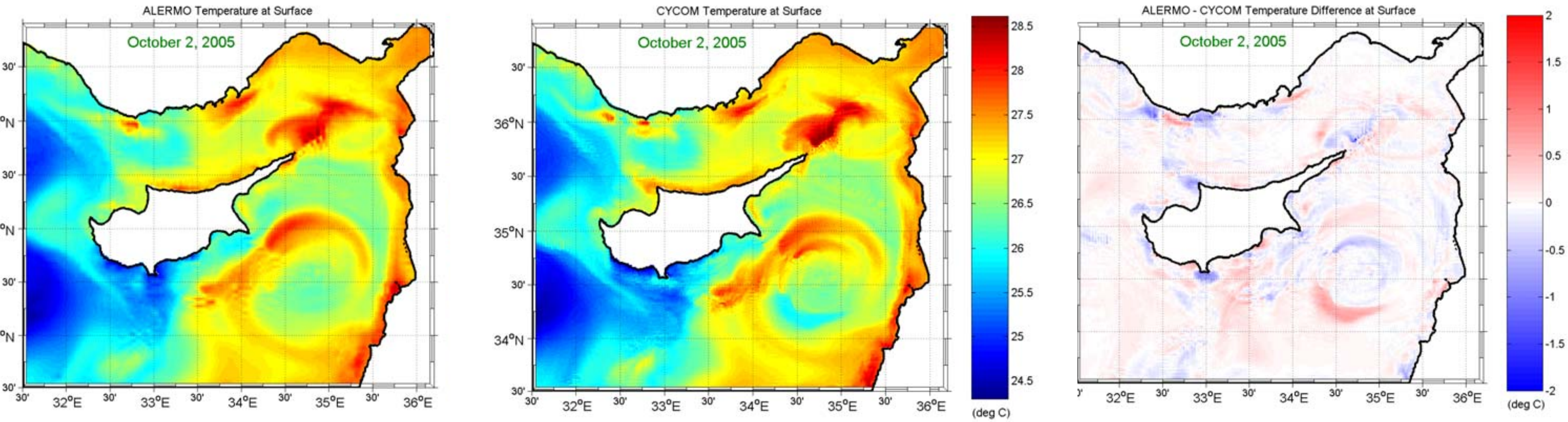


6 hourly fields for 5 days forecasts are produced daily

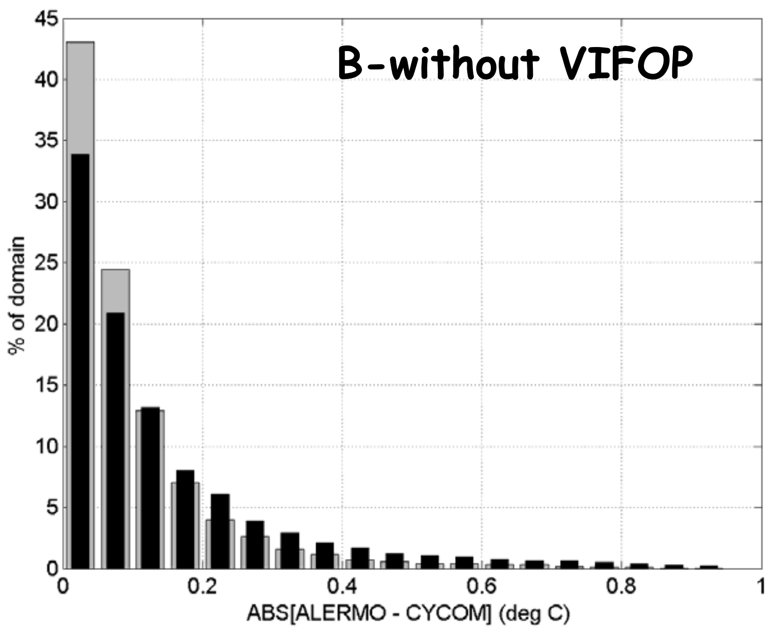


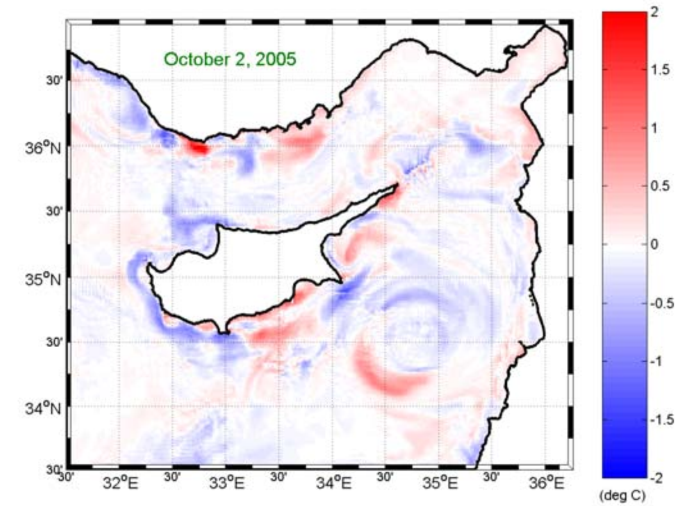
The CYCOFOS provides daily high resolution forecasts for currents, T, S, and SL, in the NW Levantine and its sub-regions.





ALERMO-CYCOM with VIFOP



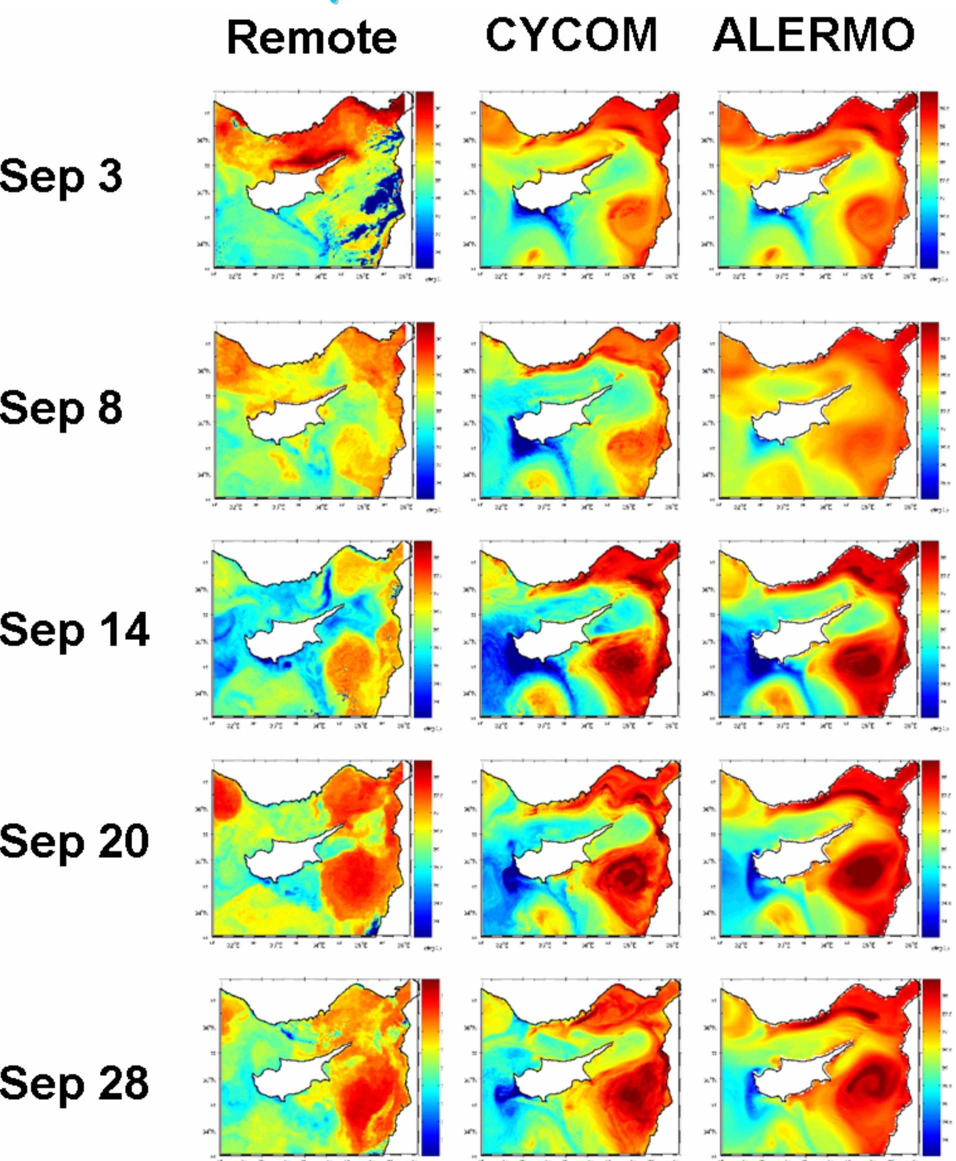


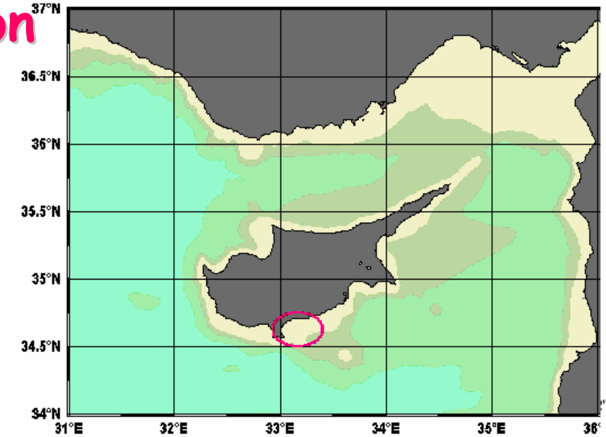
ALERMO-CYCOM without VIFOP

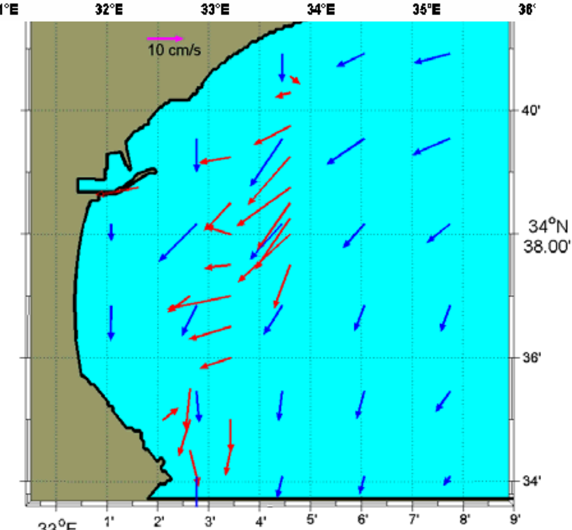
CYCOFOS flow model Validation & inter-comparison Model-Model

CYCOFOS flow model Validation & inter-comparison

Models – remote sensing SST time series for September 2004, active mode

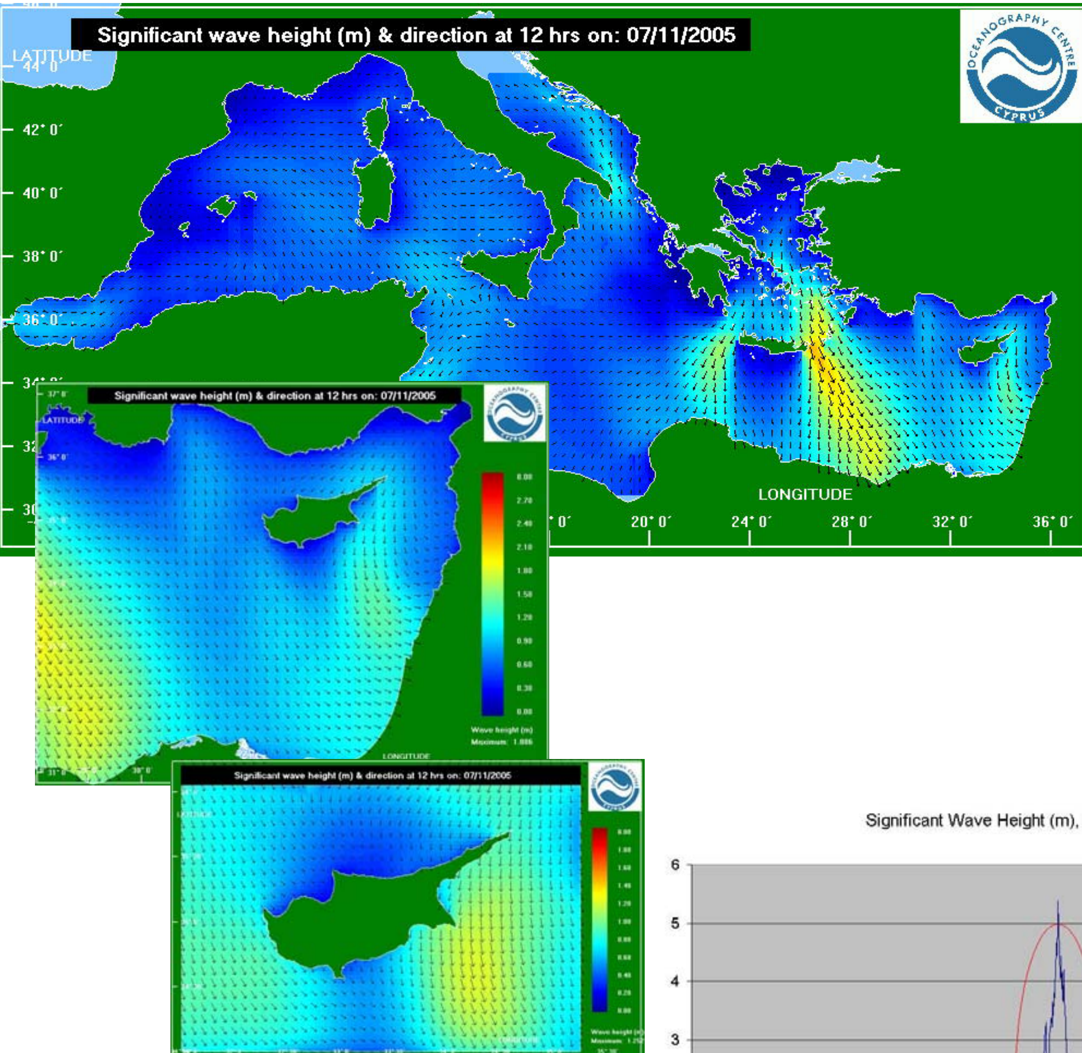


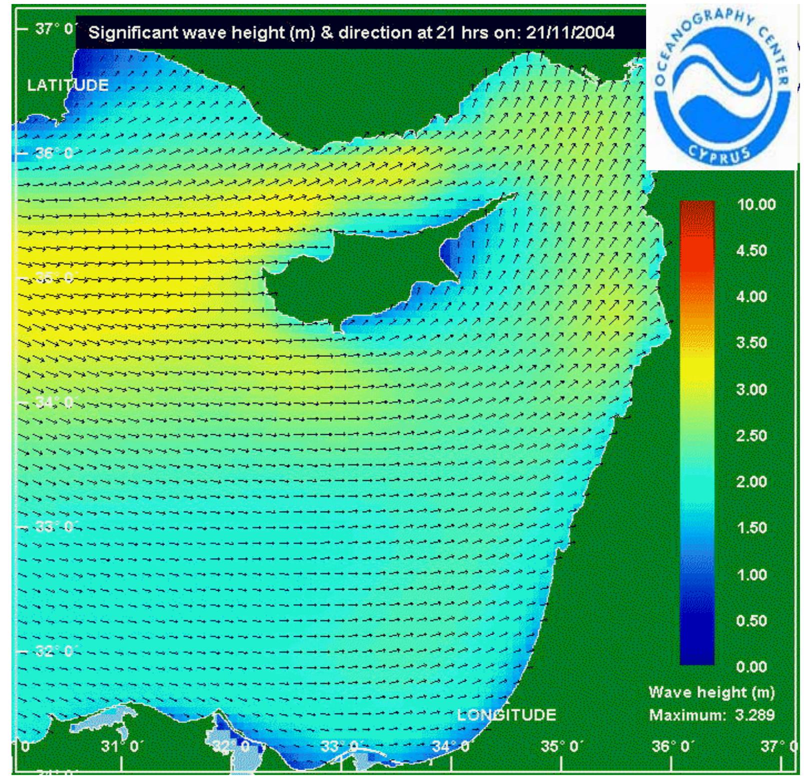




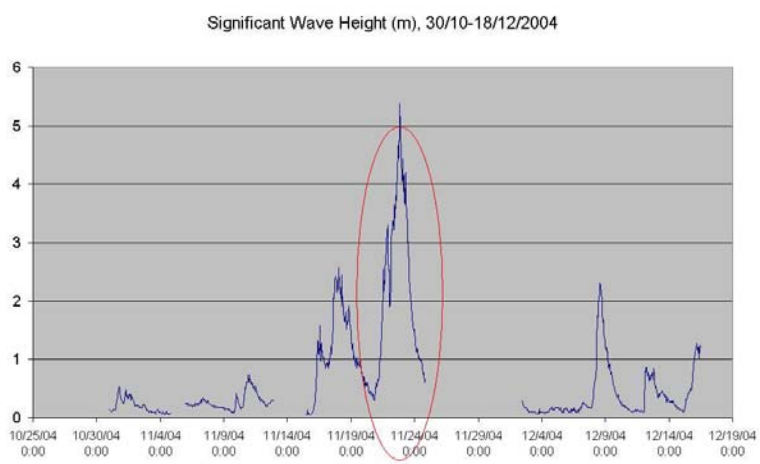
Model- in-situ-ADCP data, in the Akrotiri Bay, Cyprus, at 10 m depth. The ADCP measurements were carried out on 29 & 30 July 2004. The forecasting currents, are for the same period of the in-situ observations. The forecasting data are daily average, centered on 00:00 GMT of the 31 July 2004.

The CYCOFOS wave forecasts: example of NRT products: significant wave height (m) & direction



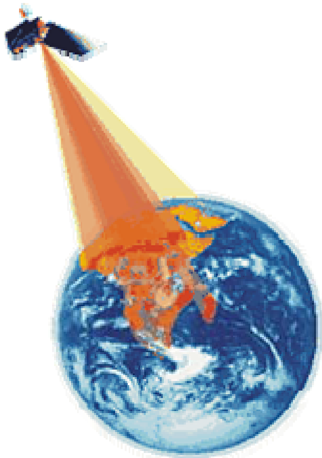


Mediterranean, Levantine and Cyprus wave models, products

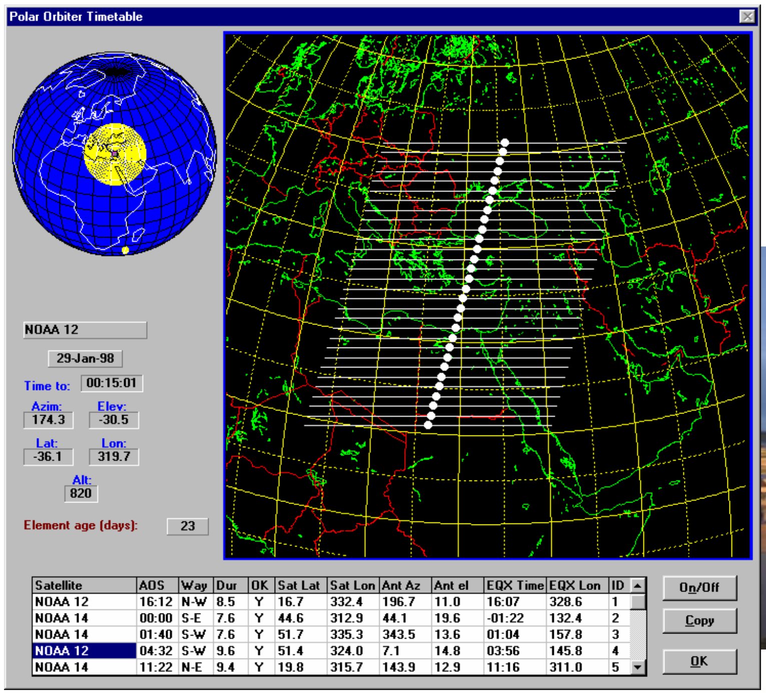


Validation example of the CYCOFOS wave forecasts during the end of November 2004, using the Hadera wave station.

The CYCOFOS Ocean Remote Sensing



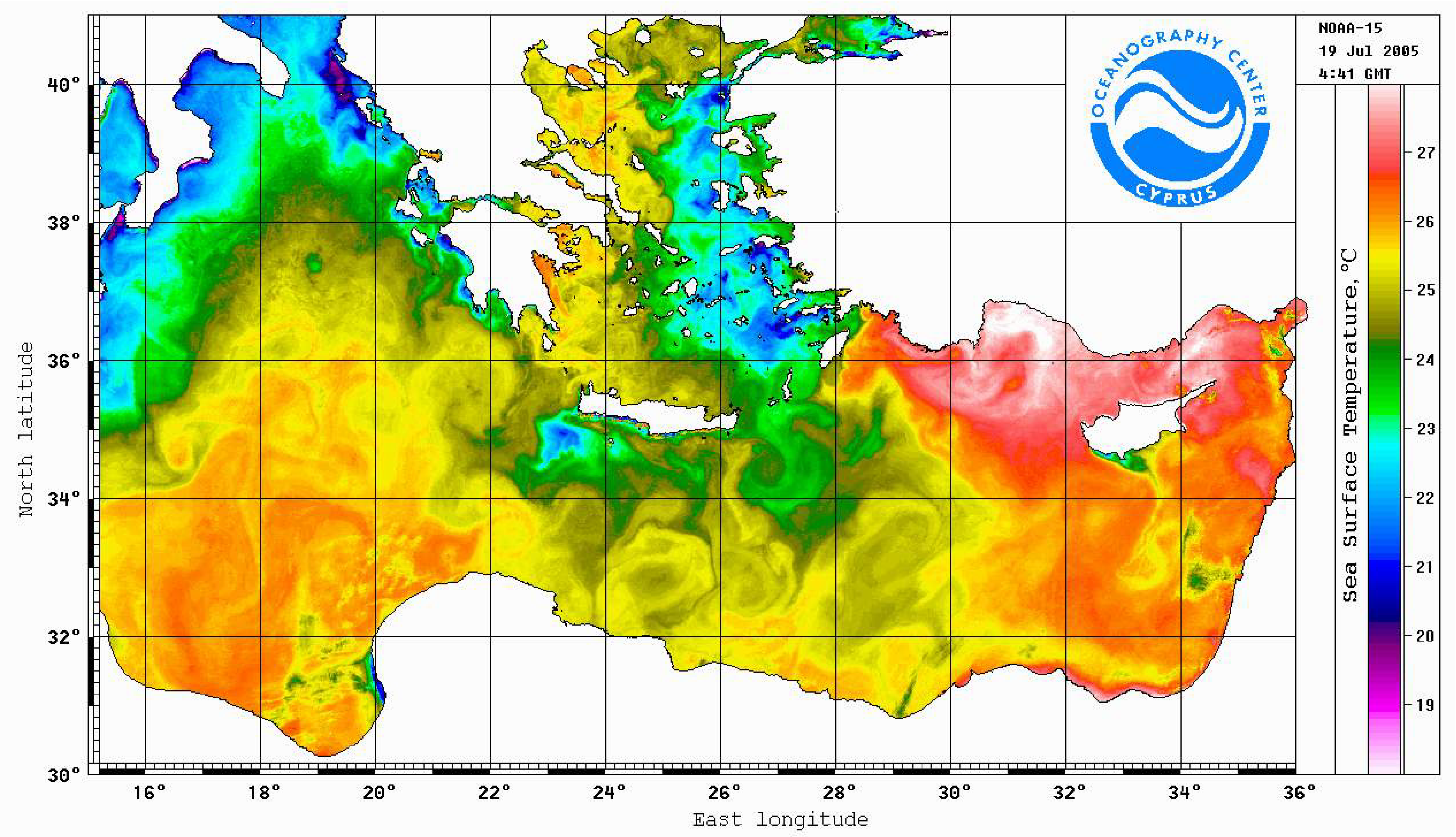
- ✓ SST images are provided daily from the CYCOFOS using the NOAA-AVHRR ground receiving station operated by CYCOFOS.



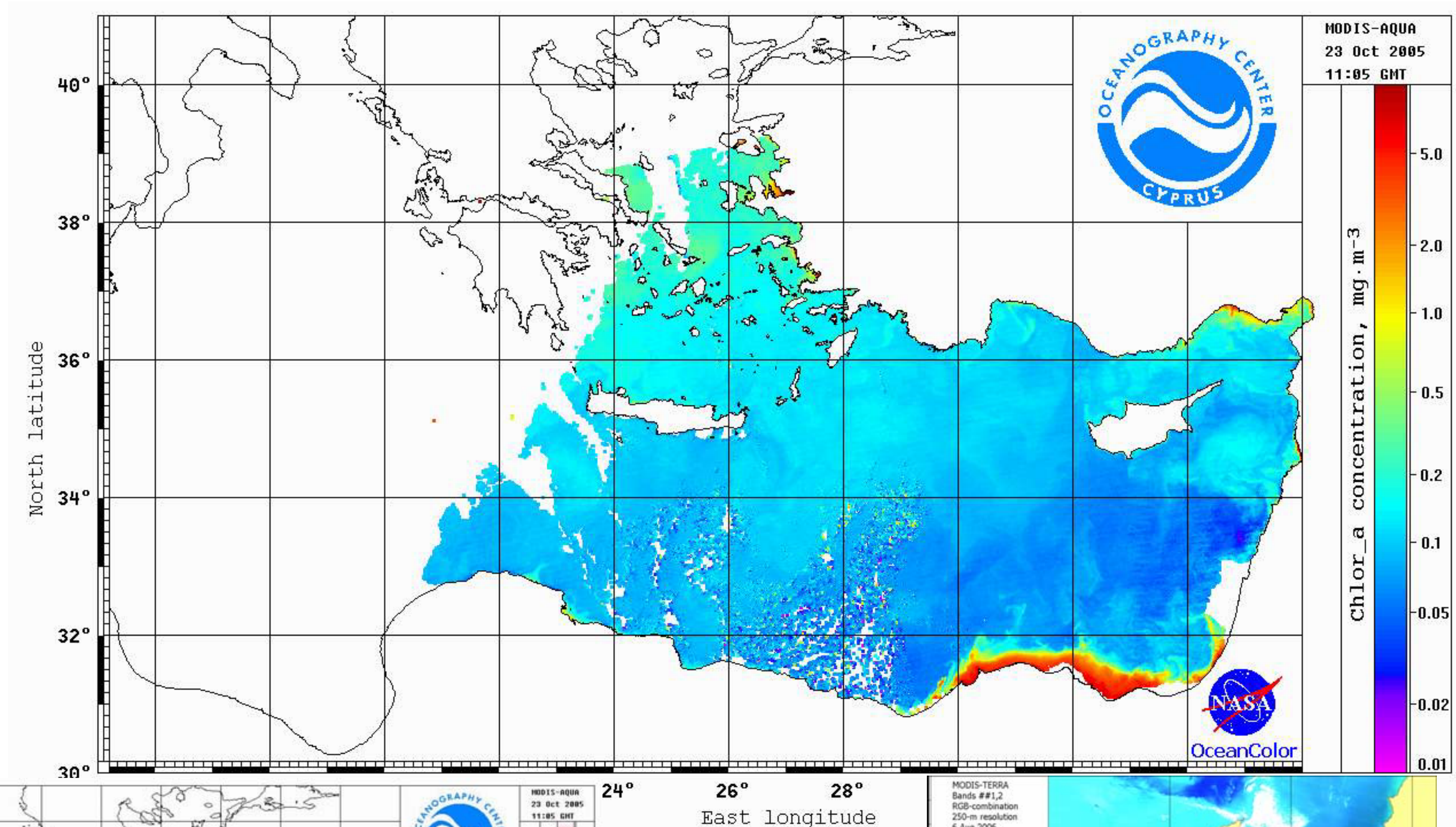
SMARTech

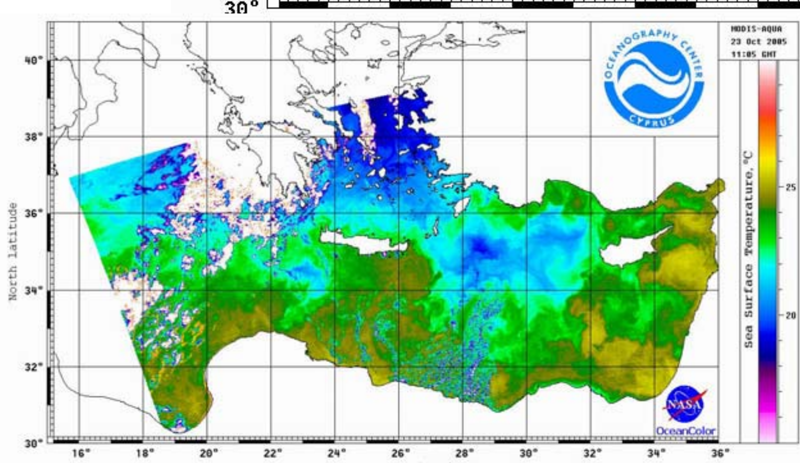
- ✓ Chlorophyll-a images provided daily from the CYCOFOS using the NASA MODIS Aqua data.
- ✓ oil slicks detection using NASA MODIS Aqua data during oil pollution crisis

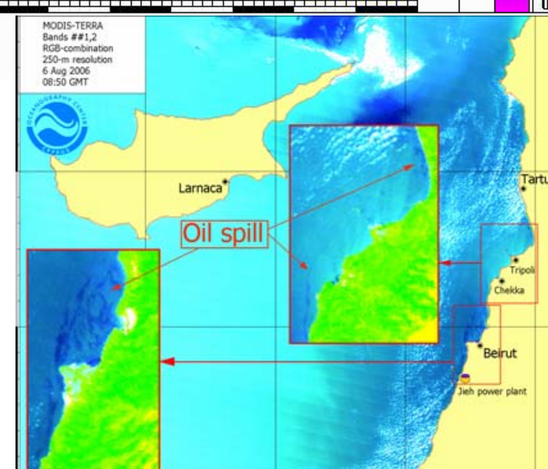
The CYCOFOS Ocean Remote sensing : example of SST images from the NOAA-AVHRR ground receiving station operated by CYCOFOS.



The CYCOFOS Ocean Remote sensing : example of Chlorophyll-a, SST, oil slicks images from NASA MODIS Aqua data.

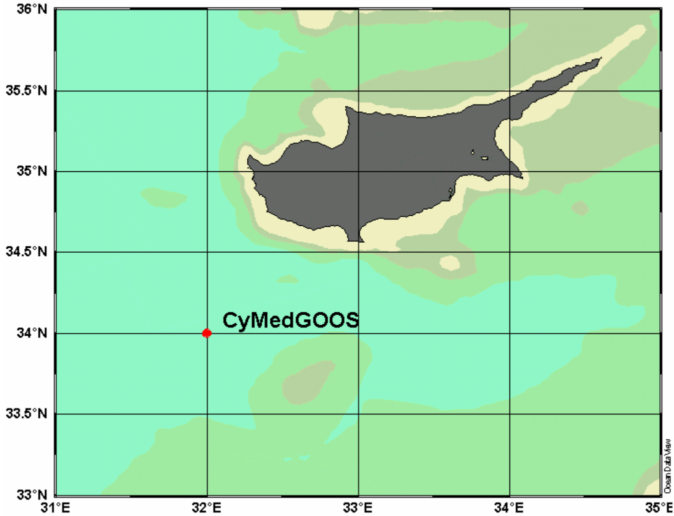


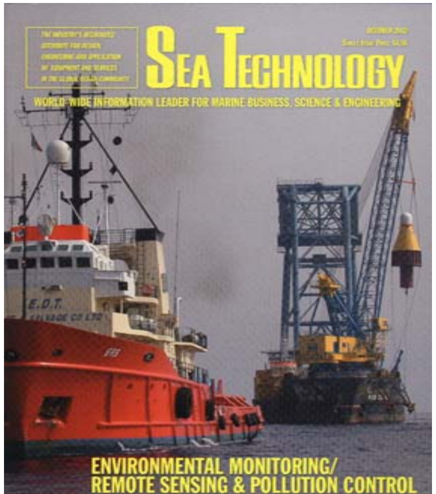


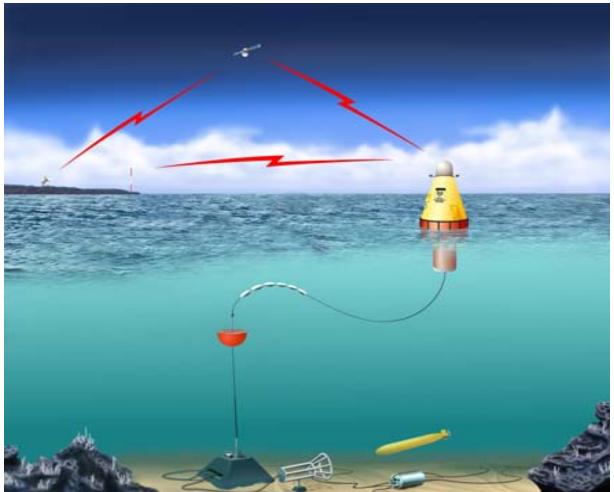


The CYCOFOS Ocean Observatory : location, network system

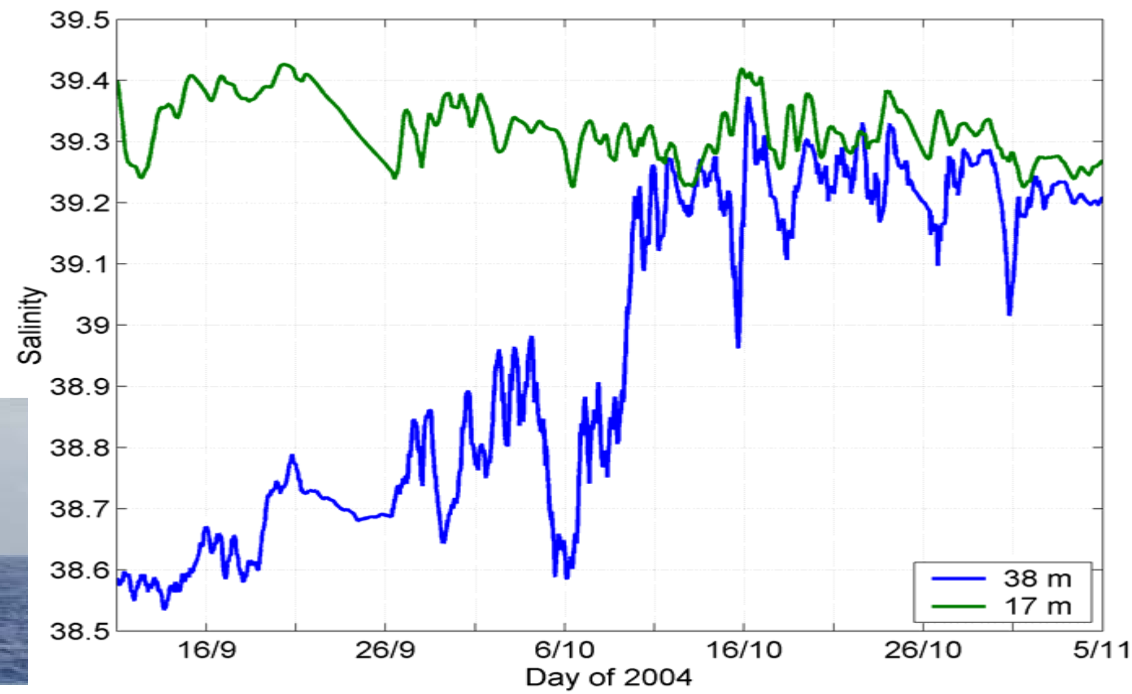
To promote the open deep sea NRT in-situ monitoring in the Levantine Basin, the CYCOFOS Ocean Observatory deployed jointly by the Cyprus Oceanography Centre, the DFMR and the Harris MCS- Maritime Communication Services, within the frame of MedGOOS

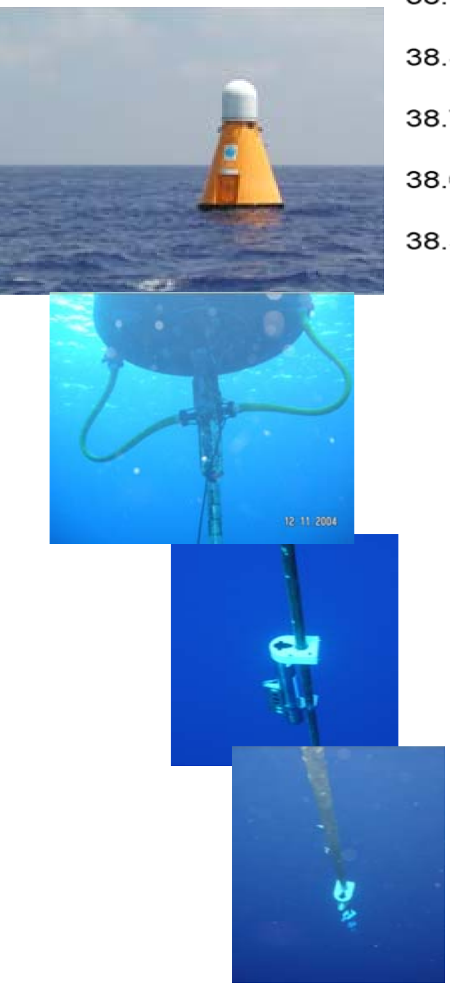


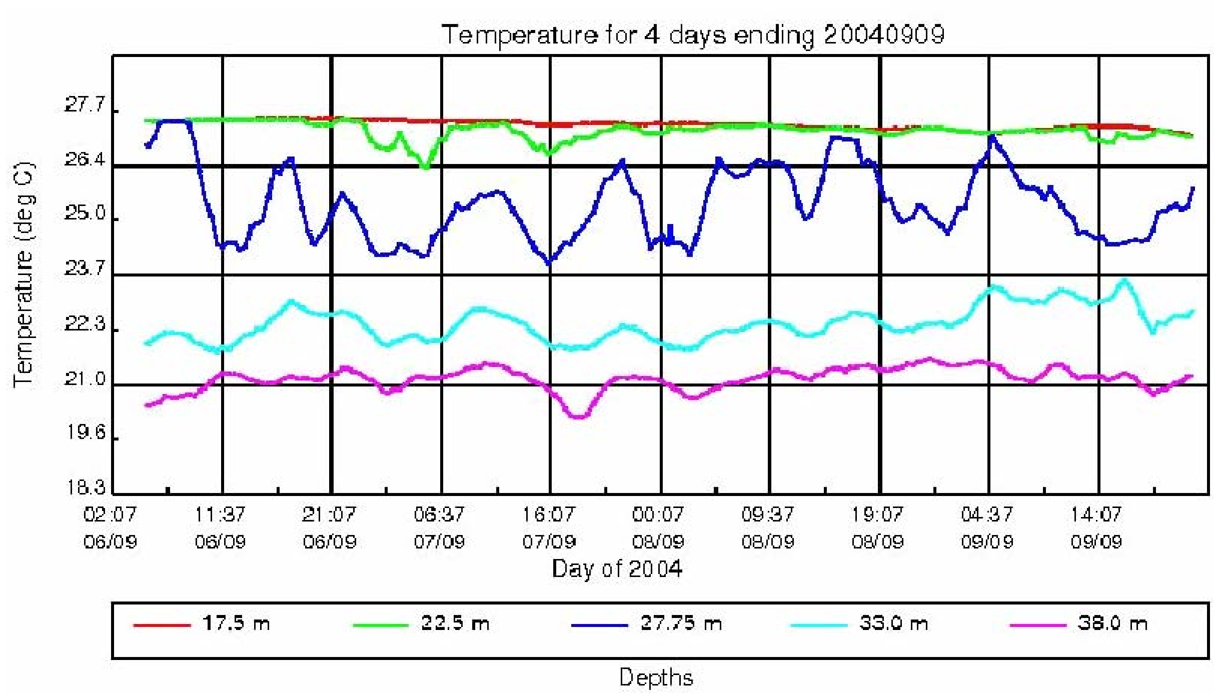




Example products of the CYCOFOS Ocean Observatory

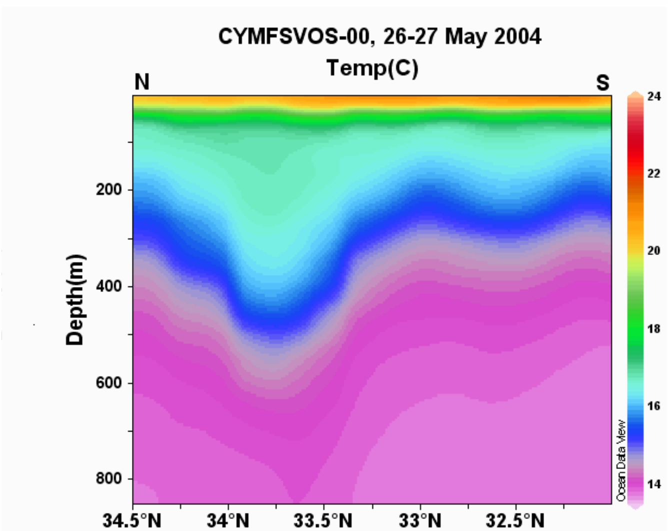


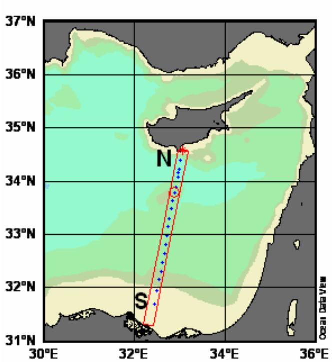


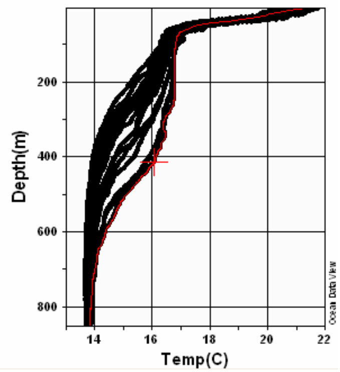


XBTs data collection and NRT transmission.

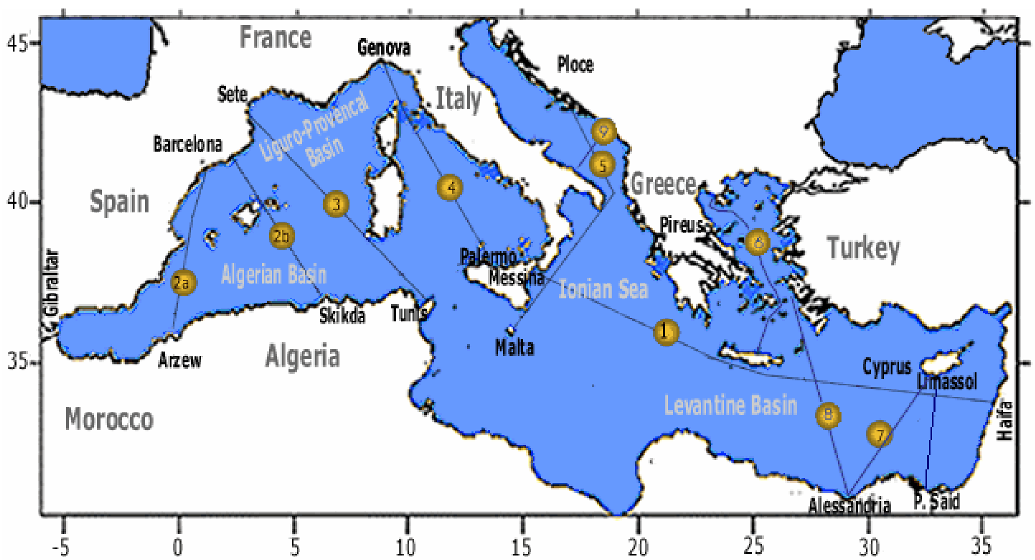
bi-weekly (1999-2000), monthly (2004-2005), periodically (2006)







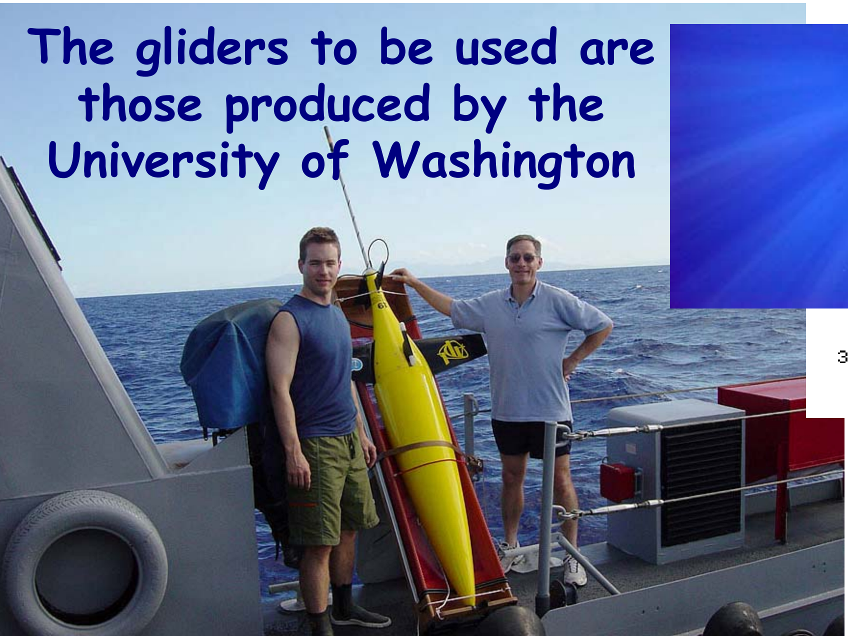
LOUIS CRUISE LINES

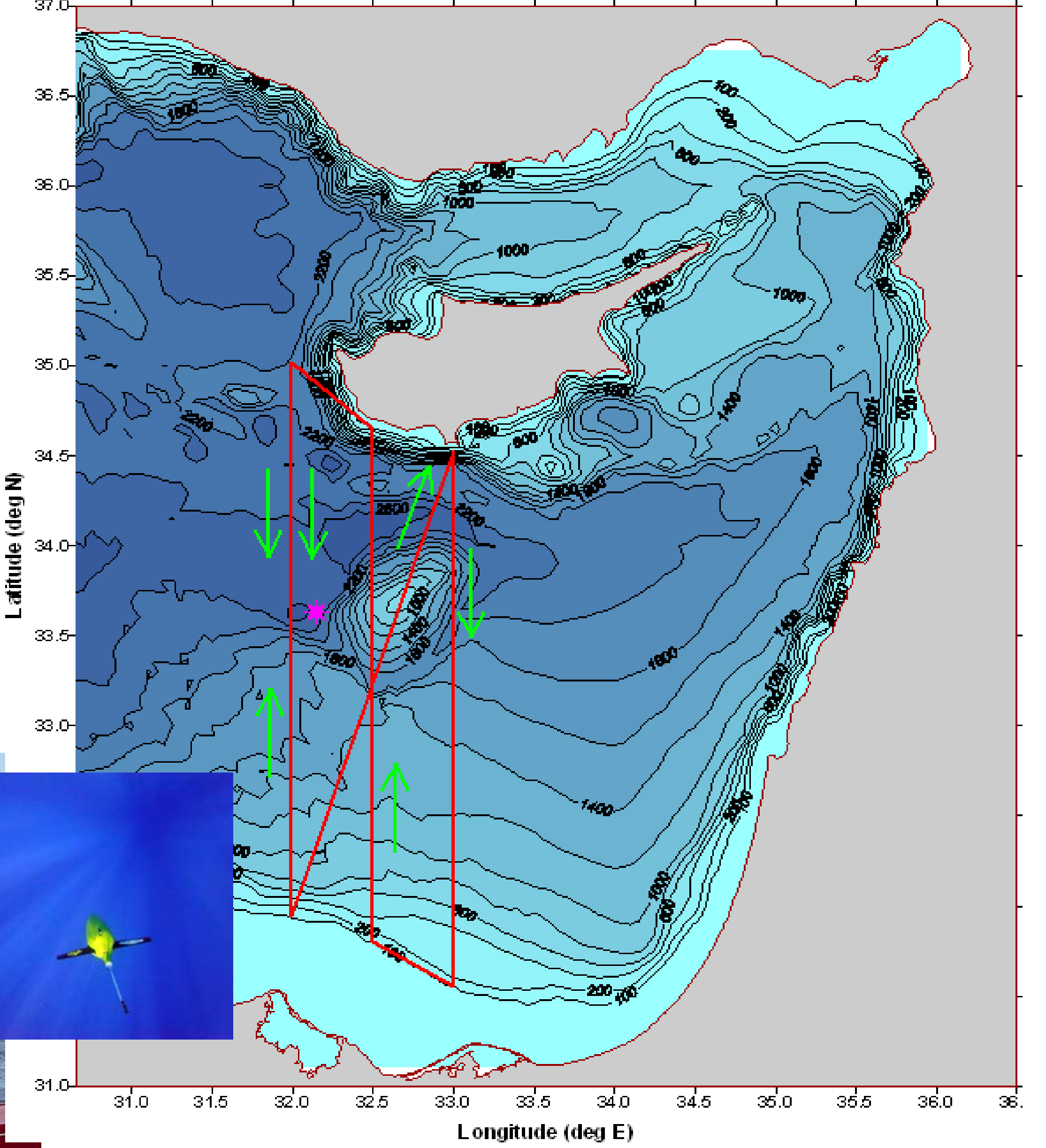


MFS VOS tracks

Forthcoming a new NRT in-situ component of CYCOFOS: gliders in the SE Levantine

The gliders to be used are those produced by the University of Washington

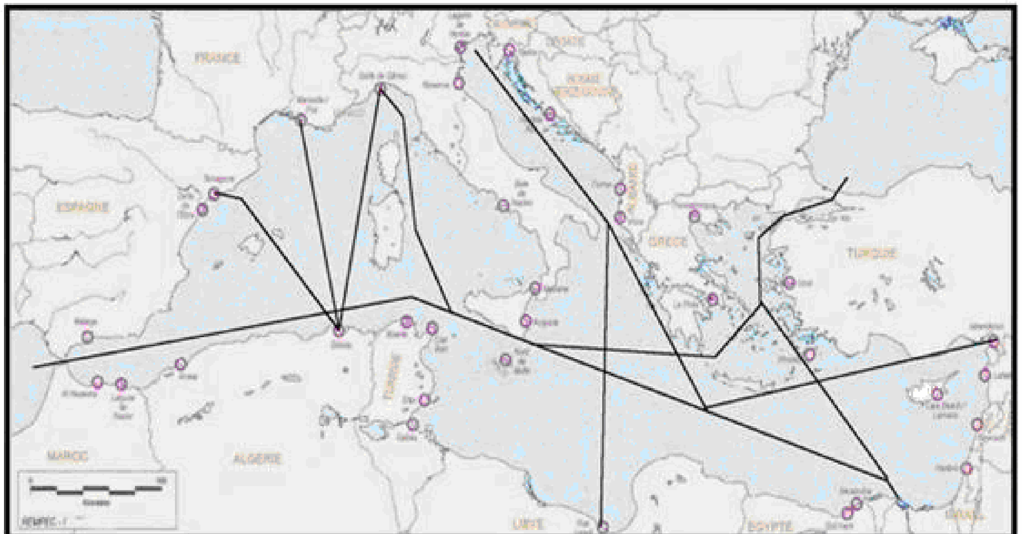




The role of operational oceanography in oil spill response

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

Such dense activities impose on the coastal countries the need to prepare an operational response in case of a major incident.

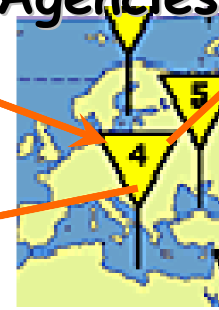


Map with oil industry related activities, that may affect the Mediterranean: tankers routes, oil loading and uploading terminals, etc.

An incident like this may occurs

Response to an oil incident: oil combating vessel

Oil spill Response Agencies



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

Response to oil incident: booms deployment

The threatened paradise

The catastrophe

Why the need for the use of Oil Spill Models

The response to an oil spill employs various measures and equipment to combat it. The success of such response depends on the prediction of the movement and the weathering of the oil. Such predictions may obtained through the application of numerical oil spill models to forecast:

Where the spill will move

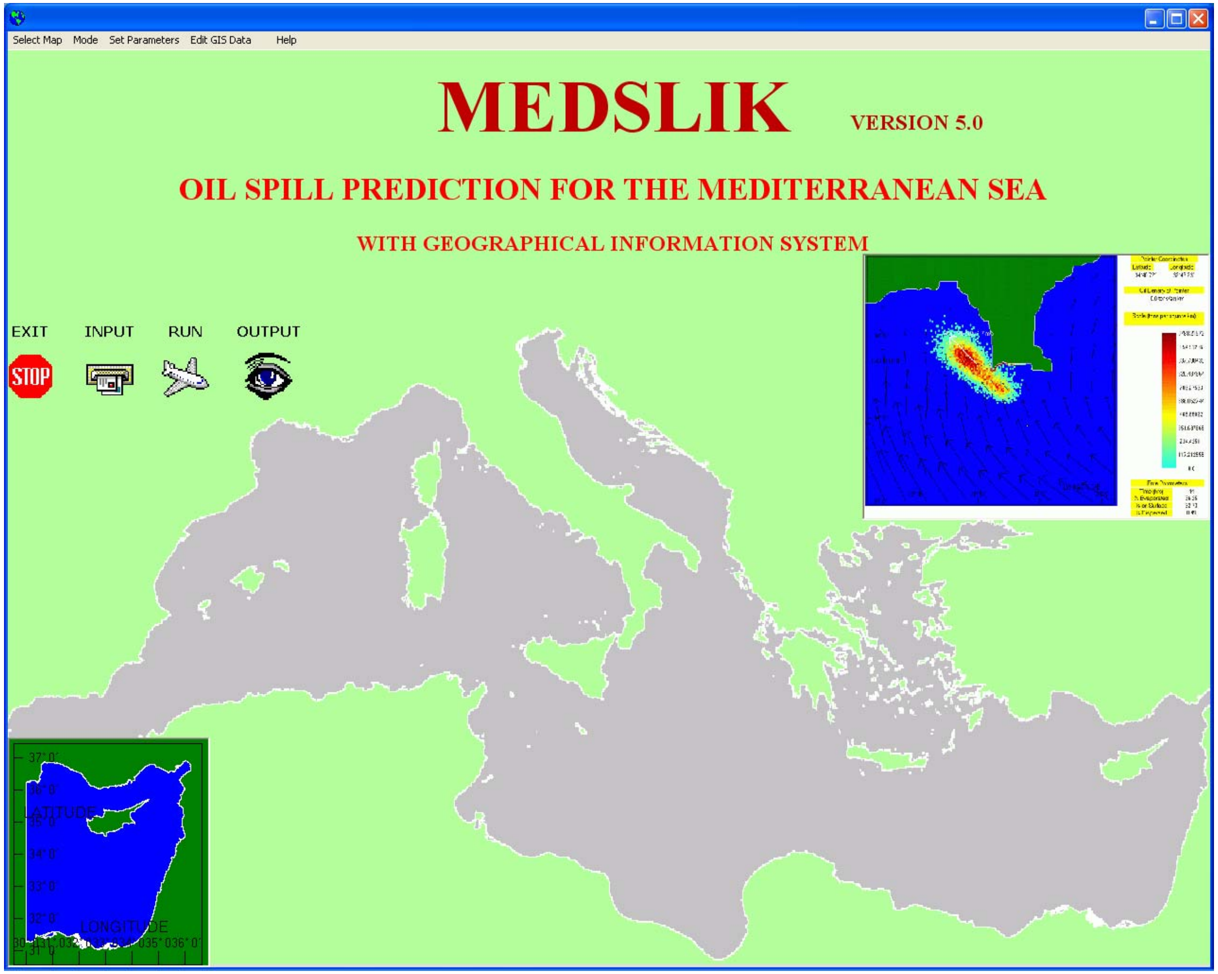
Are any resources threatened

How soon it will get there

What will it look like when it arrives

The MEDSLIK-Mediterranean oil spill model is a 3D oil spill model that predicts the transport, diffusion and spreading of oil spill.
MEDSLIK incorporates the fate processes of evaporation, emulsification, viscosity changes, dispersion into the water column and coastal impact and adhesion.
MEDSLIK is used by several institutions in the Mediterranean.

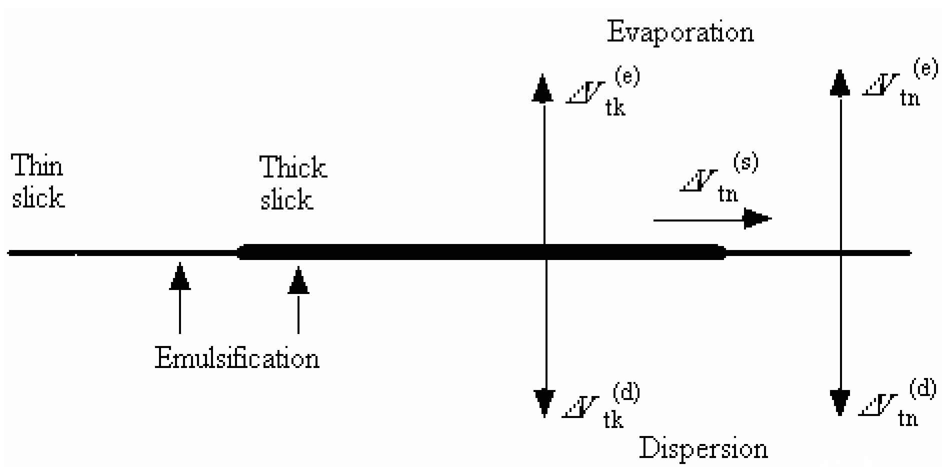
The MEDSLIK start-up screen provides the link between the **4 modules of the MEDSLIK:** a setup module for model domain and model parameters, a visual interface for input the spill data, a run module that performs the simulations, a visual interface for viewing the output results.



MEDSLIK general description

The oil spill is modelled using a Monte Carlo method. The spill is divided into a large number (up to 100,000) of Lagrangian parcels of equal size.
At each time step, each parcel is given a convective and a diffusive displacement.

The light component of the oil evaporates 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)

MEDSLIK model characteristics

- **Slick Transport**
- The transport of the surface slick is governed by both water currents and by direct wind forcing.
- 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 & Buist algorithm).
- Dispersed oil is moved by currents only.
- Mechanical spreading of the initial slick is included (modified Fay algorithm).

Fate processes included in the model

- Evaporation of the lighter oil fractions (Mackay).
- Mixing into the water column by wave action (Buist & Mackay).
- Emulsification (Mackay, Leinonen & Paterson).
- Oil viscosity changes
- Beaching on the coast and absorption depending on the coastal type (Shen, Yapa & Petroski, after Torgrimson).

The fate algorithms of the model have received extensive experimental calibration in the past.

Other features of MEDSLIK

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

The model allows spill predictions to be corrected by subsequent slick observations.

The effect of deployed of oil booms can be examined.

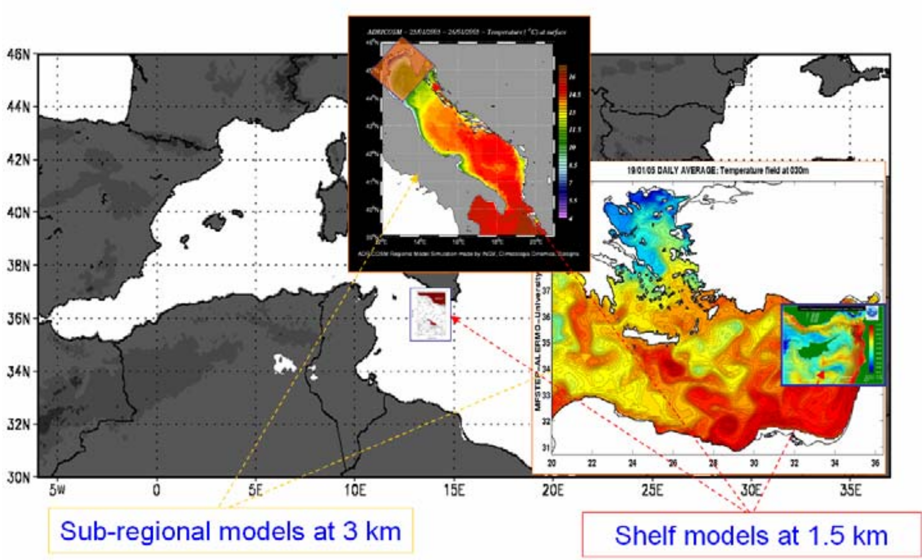
Simultaneous oil spills whose slicks merge can be modelled together.

MEDSLIK computes various fate parameters and allows them to be graphed.

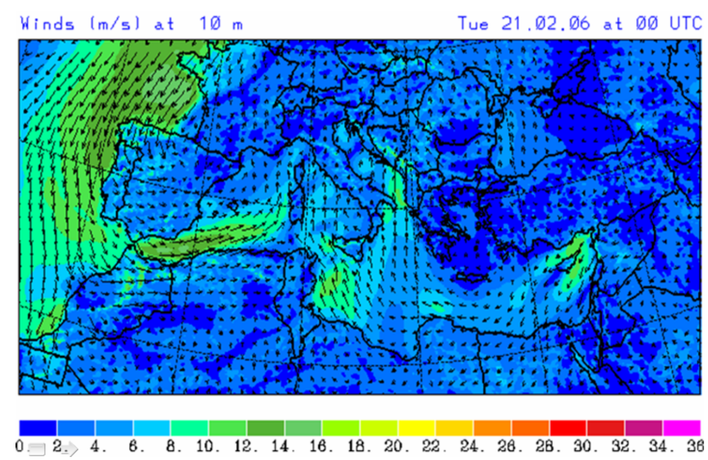
The model includes a simple GIS to allow information on coastal and open sea resources.

Ocean data for the MEDSLIK oil spill predictions

Operational ocean forecasts play an essential role in the practical use of MEDSLIK.



MEDSLIK has been adapted to use the ocean forecasting products from CYCOFOS, ADRICOSM sub-regional, ROSARIO coastal systems.
Recently CYCOFOS has been adapted to use also the MFS-OPA forecasting data in a similar way as a relocatable model.



The SKIRON hourly forecast winds for the Mediterranean are used in MEDSLIK.
The ECMWF winds used by MFS-OPA may also be used.

The Lebanese spill of July 2006

On the 13 and 15 July 2006 the oil tanks at Jieh power station, located 30 km south of Beirut and directly on the coast, were hit by bombs. About 10,000-20,000 tons of oil was spilt into the sea.

Following a request from EU,UN and other end-users, including:

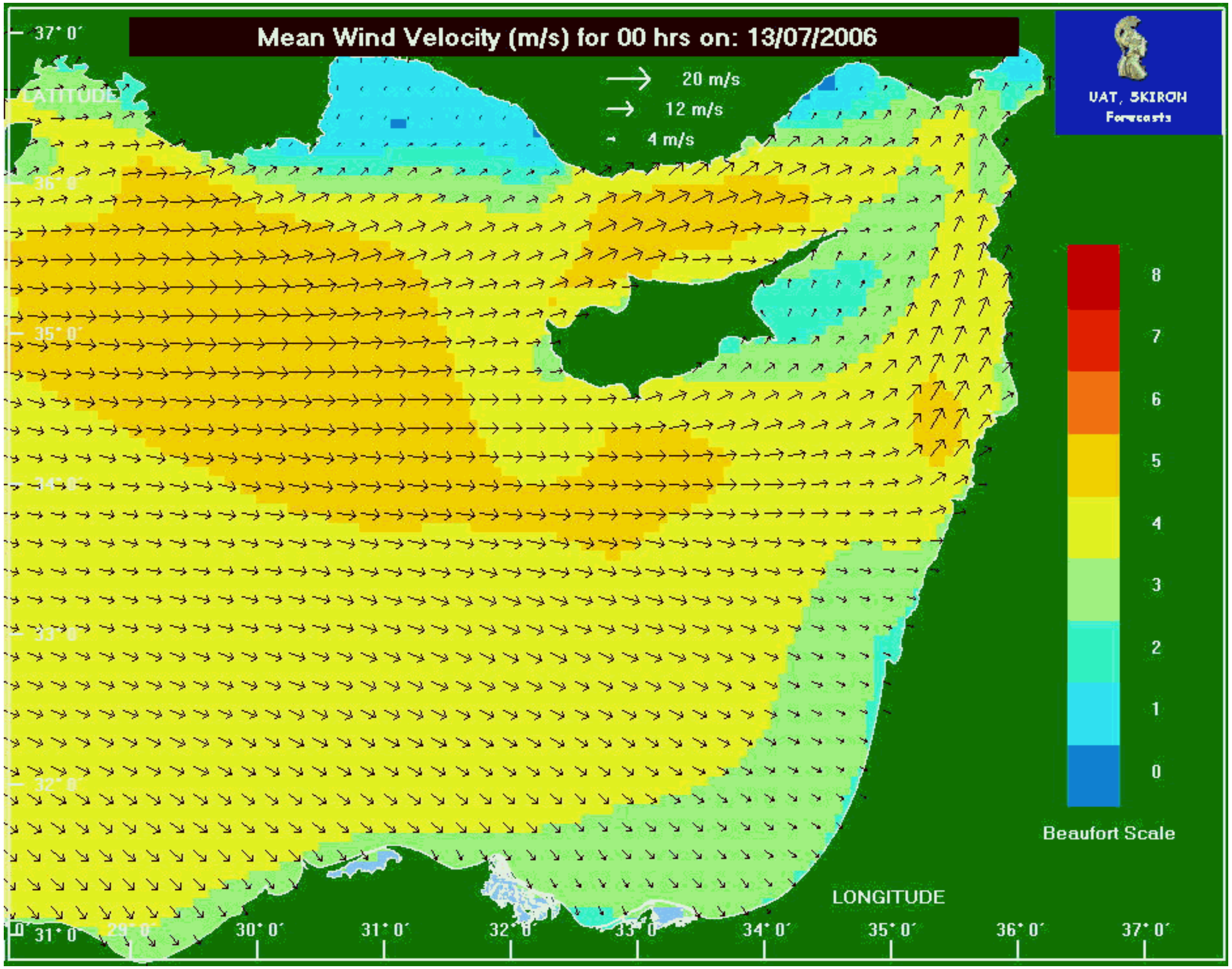
a) REMPEC-Regional Emergency Centre for Response to Oil spill Pollution in the Mediterranean,
b) the European Commission Civil Protection co-operation Mechanism, through the Cyprus Civil Protection Agency,
c) the Cyprus Ministry of Environment;

the Cyprus Oceanography Centre applied the MEDSLIK oil spill model to predict the dispersion and the movement of the oil spill in the NE Levantine Basin.

The MEDSLIK oil spill model constitutes the oil spill model of the EU MERSEA-IP for the Eastern Mediterranean. The MERSEA is aiming to establish the Marine Core services of the GMES.

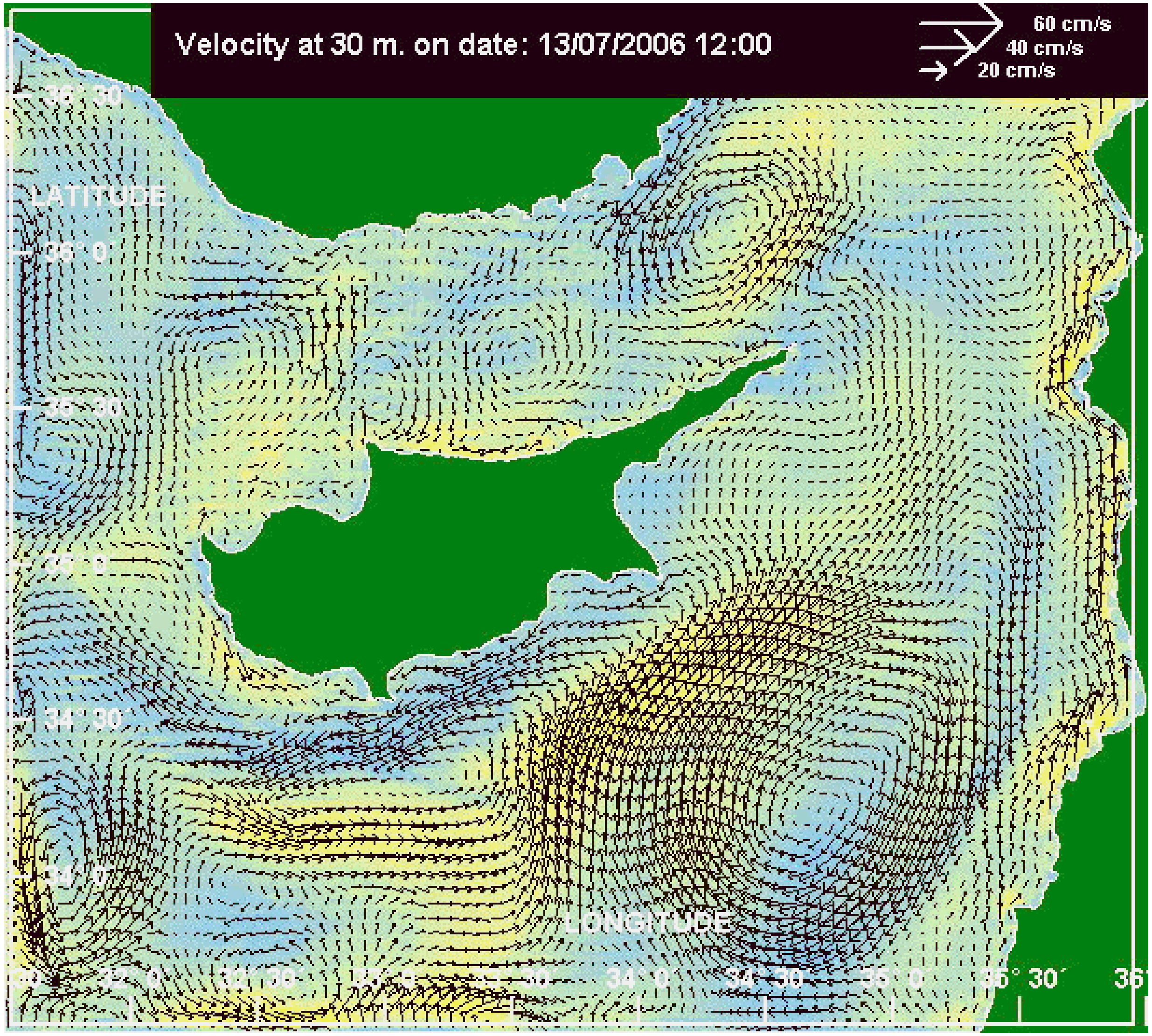
For this application, the high resolution CYCOFOS ocean forecasting products and the high frequency SKIRON wind forecasts, updated on a daily basis, were used.

Wind fields from SKIRON system, 13 July-10 August 2006



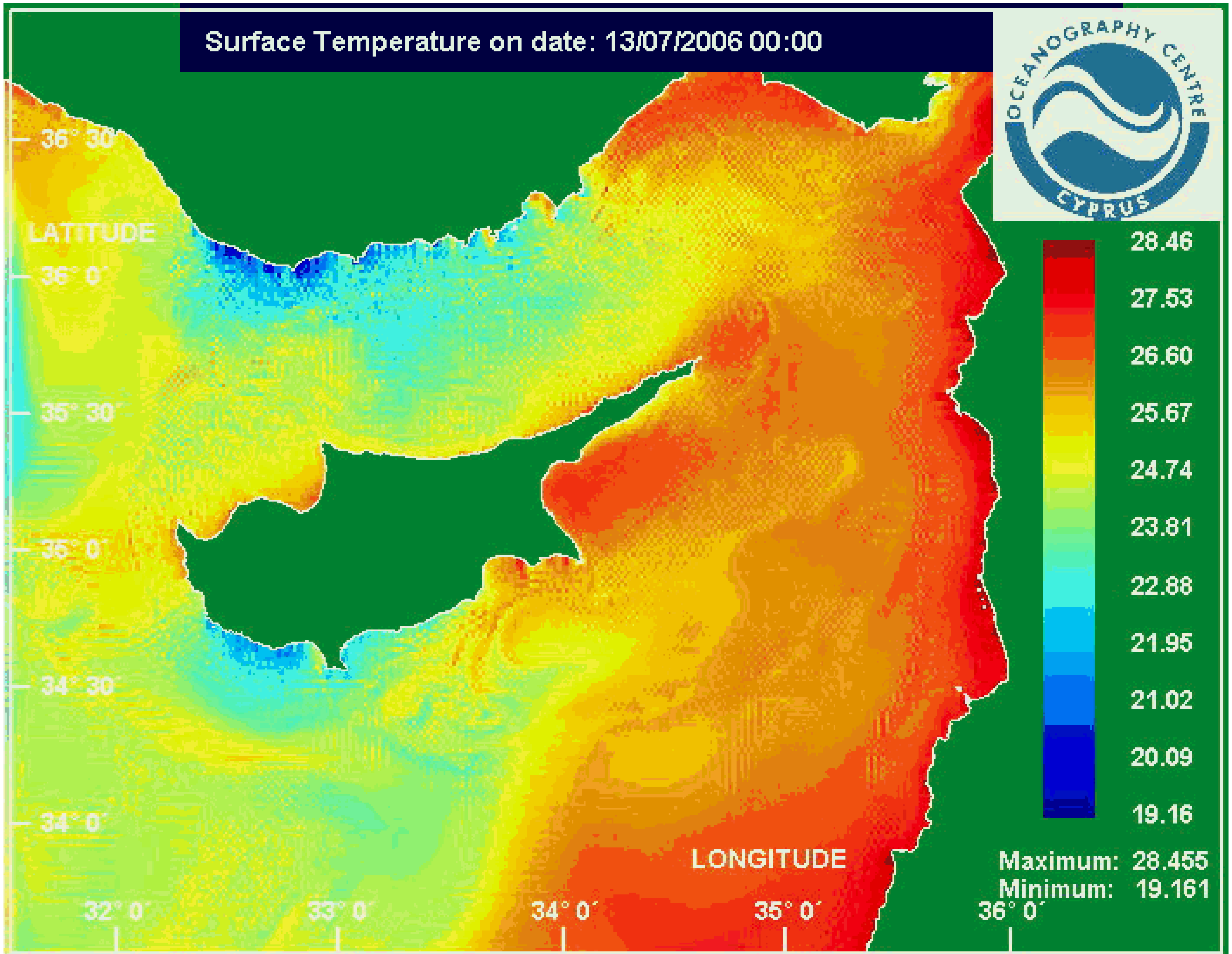
The winds during the above period between Cyprus and Lebanon and Syria are generally southwesterly with speed up to 5 beaufort.

Sea currents from CYCOFOS (Cyprus Ocean forecasting system), 13 July-11 August 2006



Along the Lebanese and Syrian coast during the above period the currents are directed northwards with velocities as high as 30 cm/s.

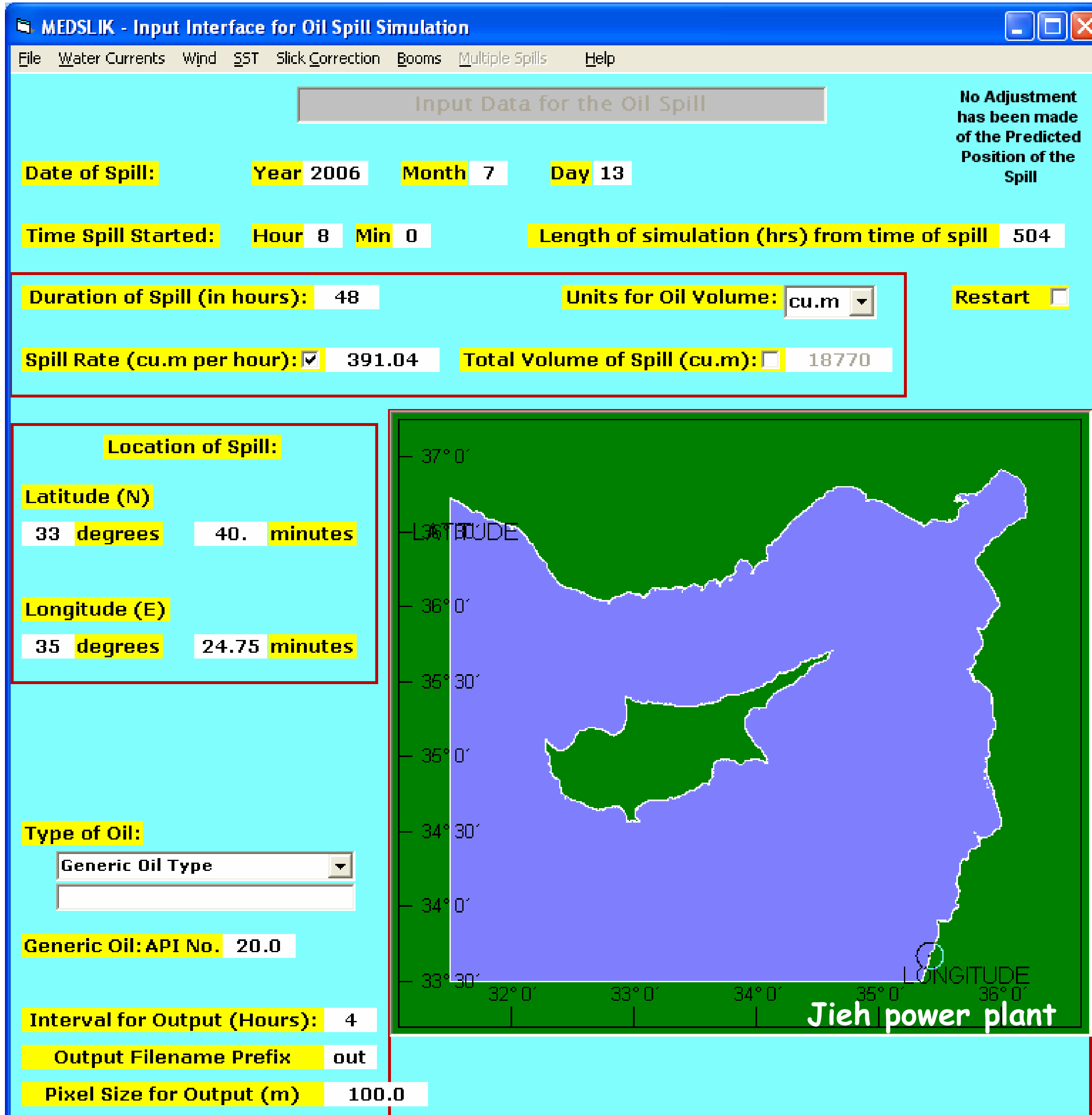
Sea Surface temperature from CYCOFOS system, 13 July-11August 2006



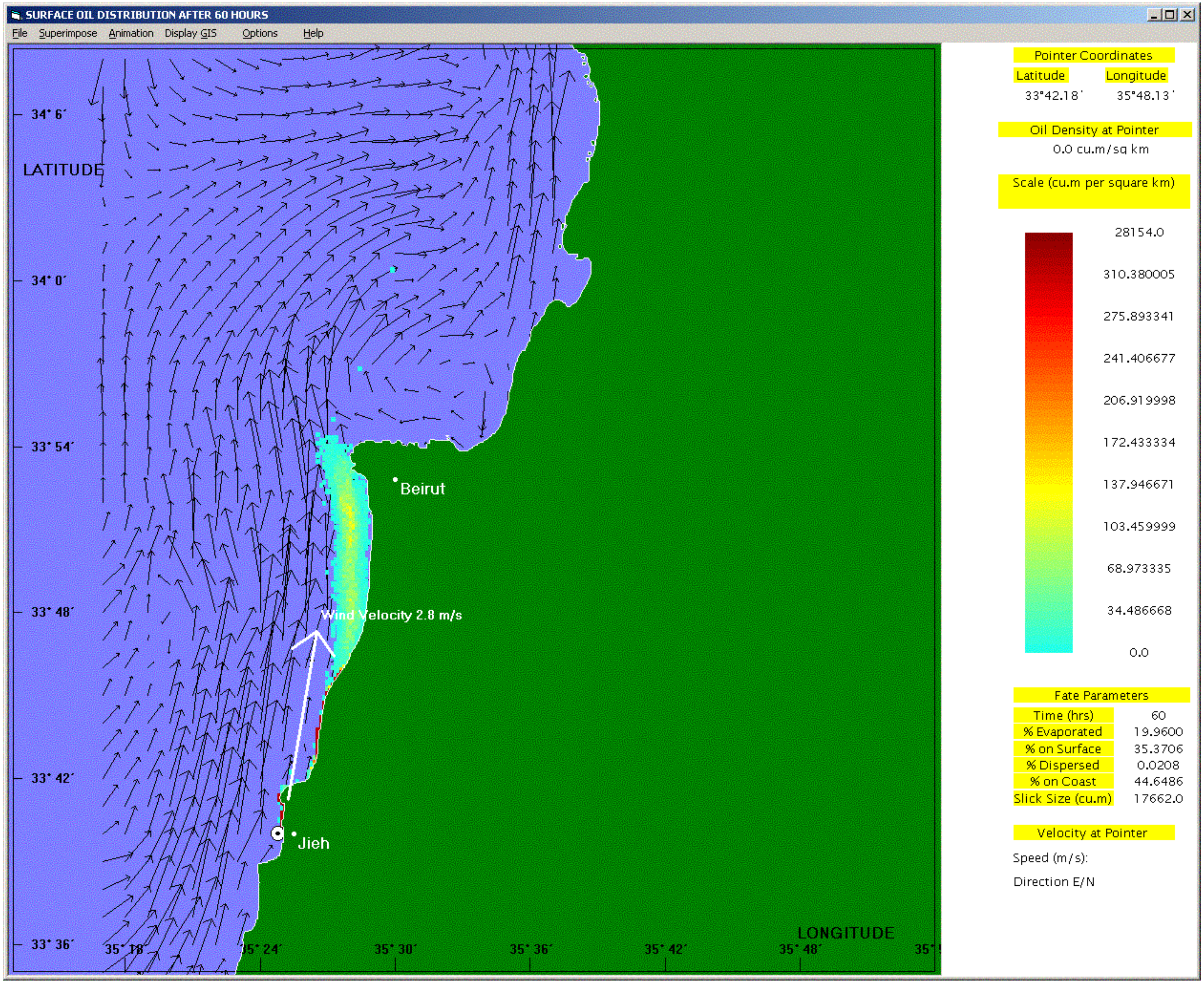
REMPEC provided the input data related to the oil pollution incident in Lebanon.

Soon after, several simulations were carried out.

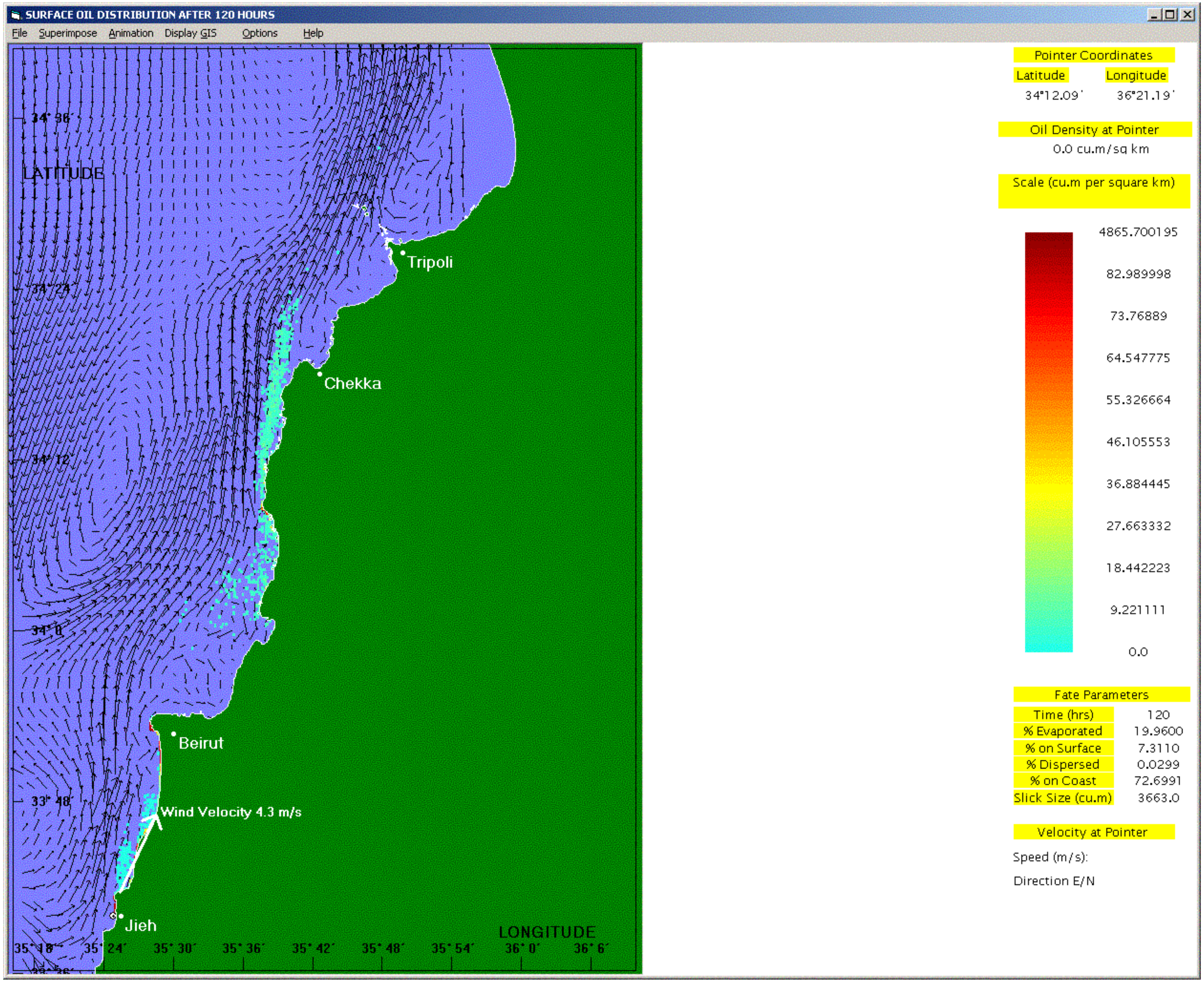
The figure shows the input for a run of 21 days from the start of the spill.



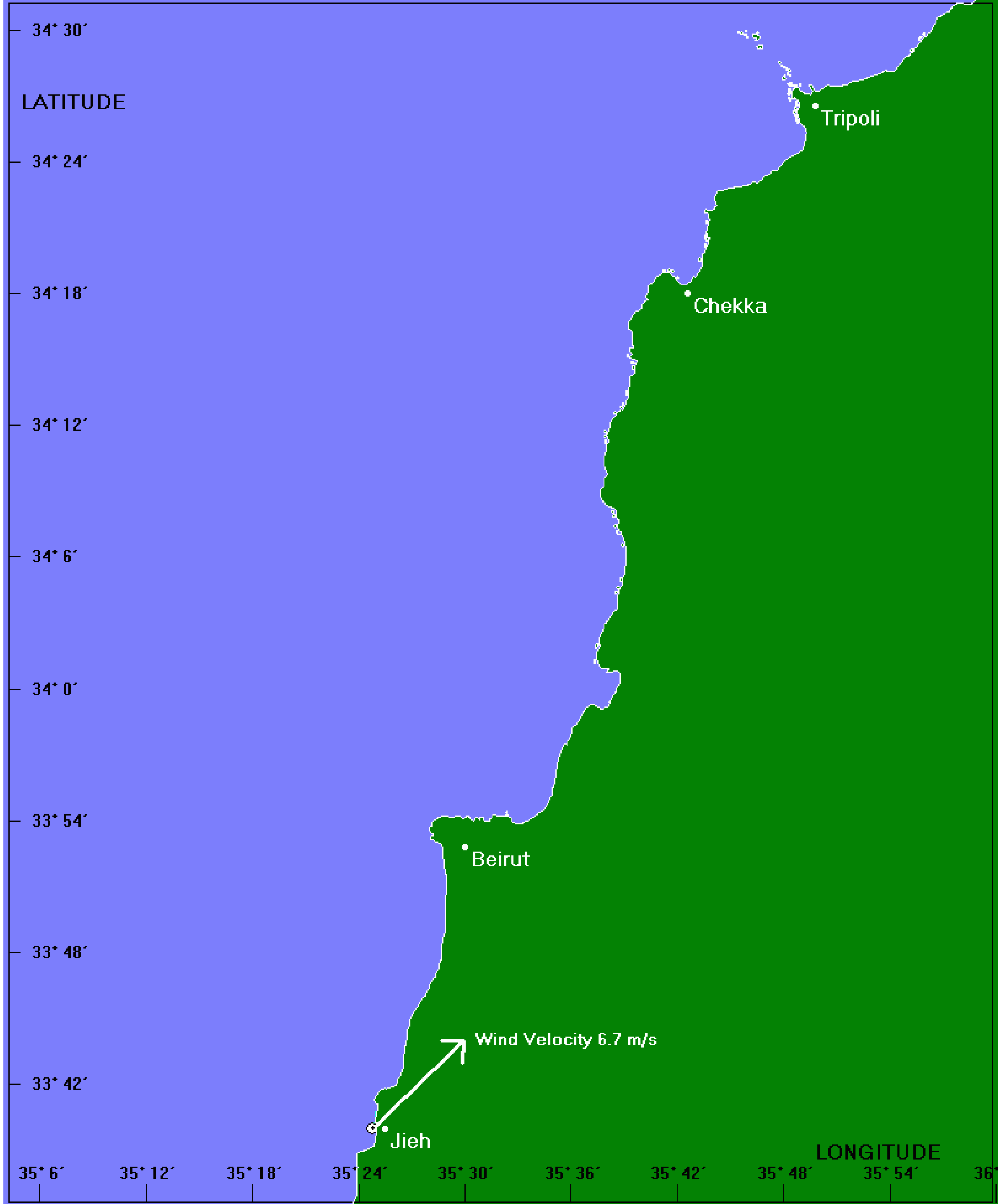
Predicted slick position after 2.5 days



Predicted slick position after 5 days



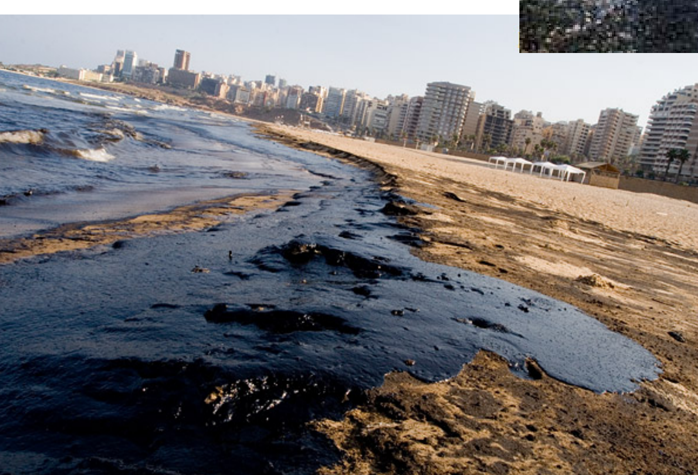
Simulation of the oil dispersion from 13 July to 12 August 2006

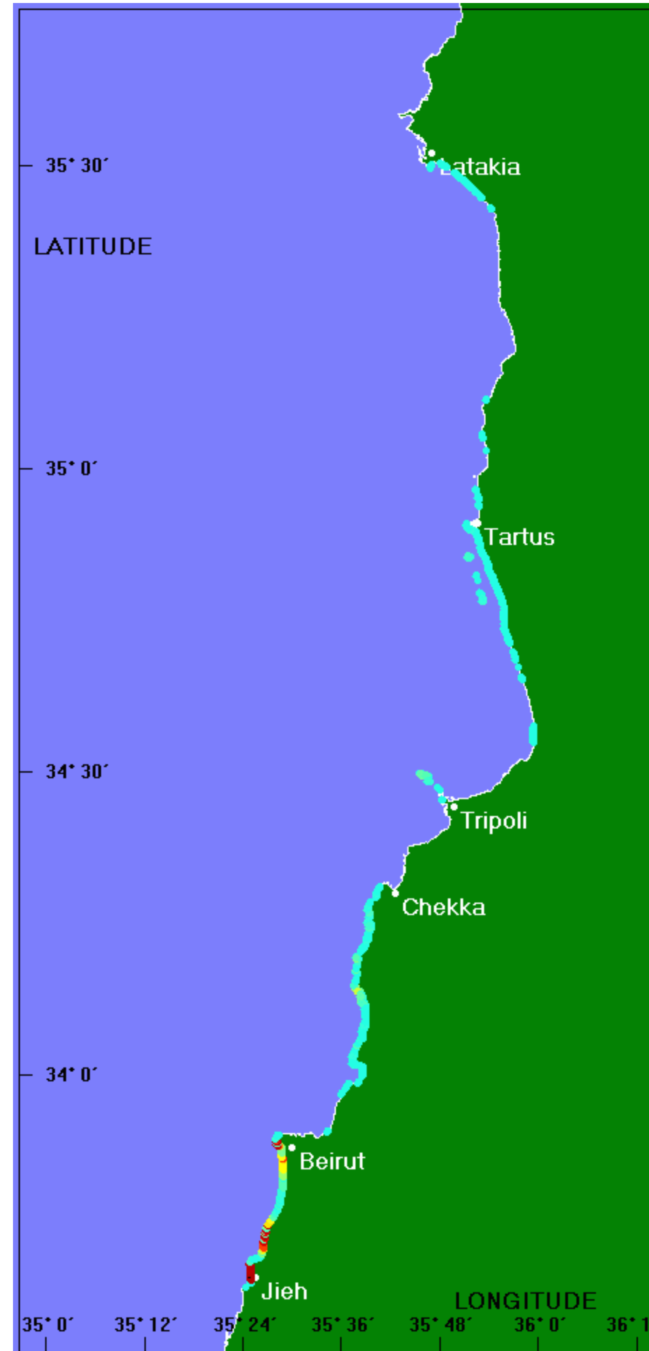


Predicted amounts of oil permanently stuck on the coast after 30 days.

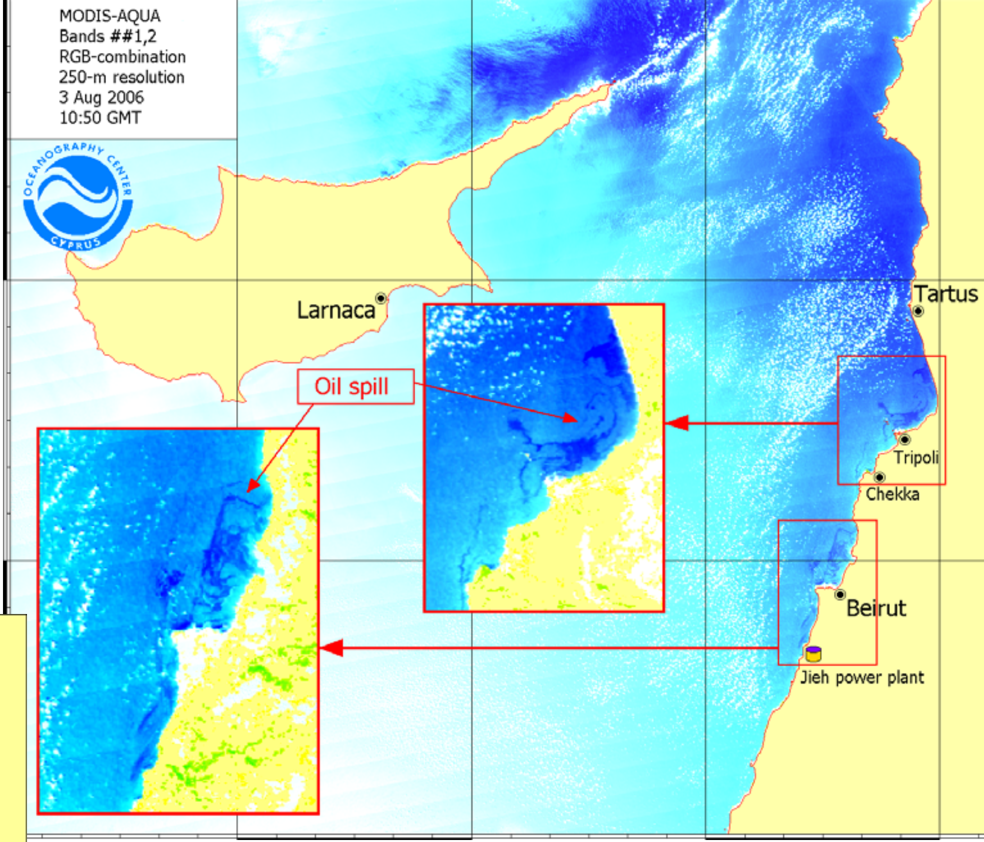
Heaviest deposits are near Jieh and South Beirut.

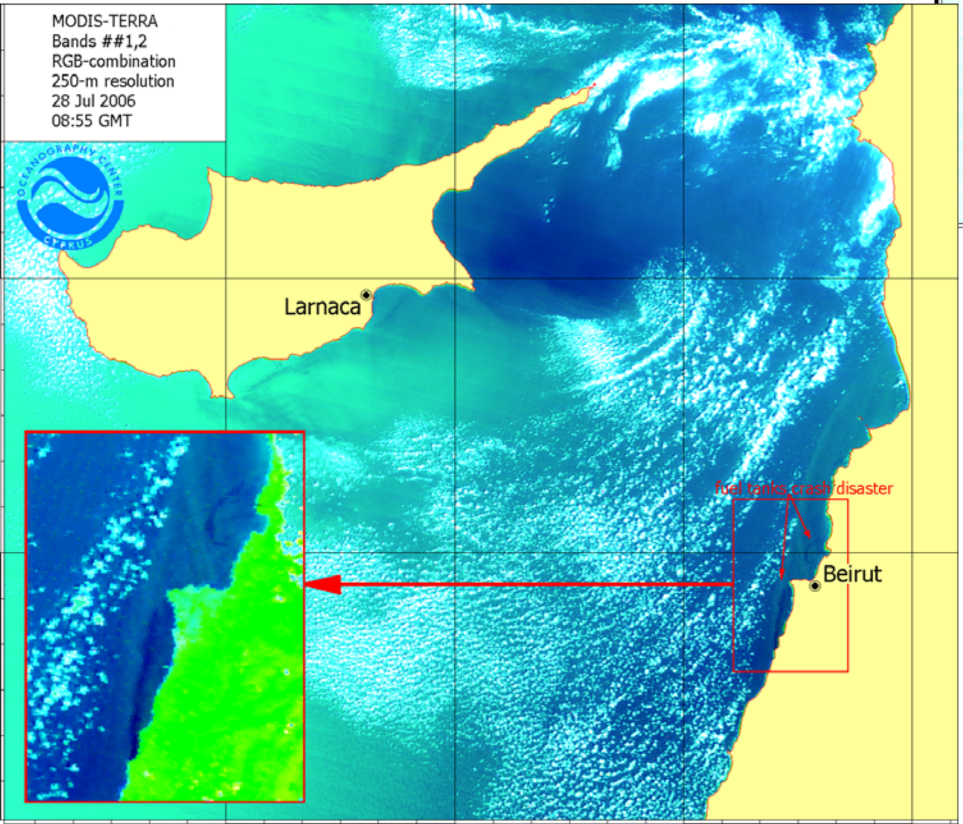
Lighter deposits as far north as Latakia.

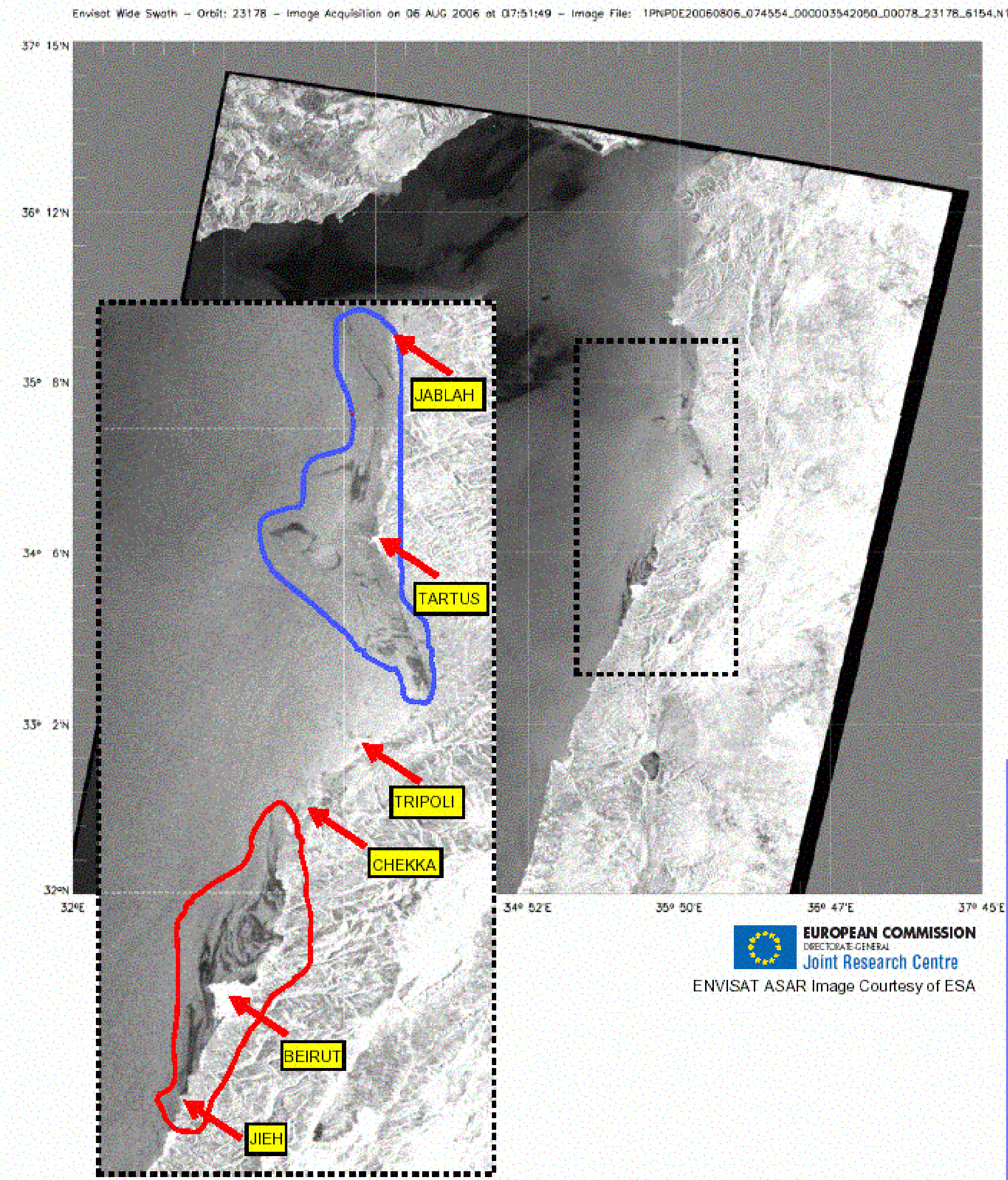




MODIS-Aqua images taken on the 28 July and 3 August, i.e. 15 and 21 days after the start of the oil pollution incident at the Jieh thermal power plant



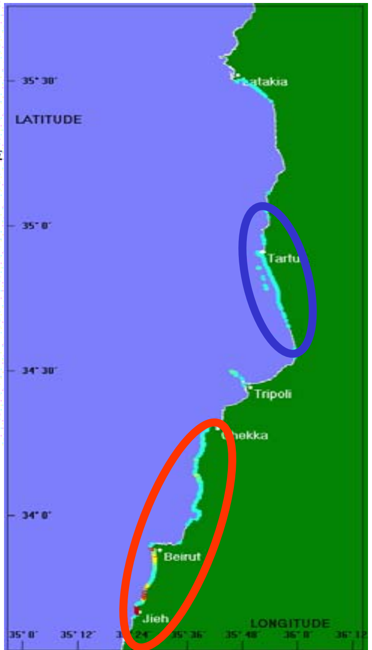




ENVISAT ASAR Image Courtesy of ESA

SAR image taken by ENVISAT on 6 August, i.e. 24 days after the start of the oil pollution discharge originated at the Jieh thermal power plant.

Significant amounts of oil slicks and oil deposition on coast extends from Jieh up to Chekka, while lower amounts extends from South of Tartus to Jablah (10 kms South of Latakia).



MEDSLIK

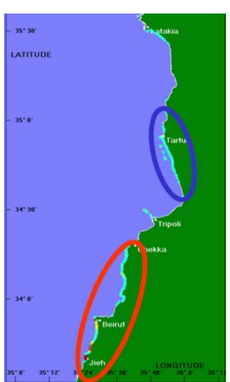
Last word

Unfortunately the Lebanon oil spill crisis, demonstrates in practice the usefulness and the benefit of having an operational oceanographic forecasting system in place.

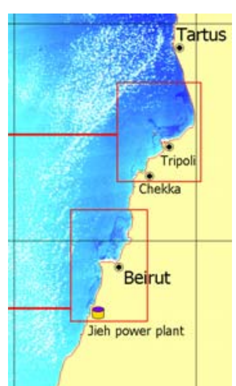
During the early period of the Lebanese oil pollution crisis, only speculations were available to the decision makers in Europe and to the media about the threat from the movement of the "black tsunami" in the Eastern Mediterranean.

The operational implementation of the MERSEA's MEDSLIK oil spill model during the Lebanese oil pollution crisis, using the MOON's CYCOFOS and SKIRON products, made possible to provide the "ground situation" to the EU and to the UN agencies and to other decision makers in the region, and to assist them to drawn up an international action plan to response to the bigger, so far oil spill pollution in the Eastern Mediterranean.

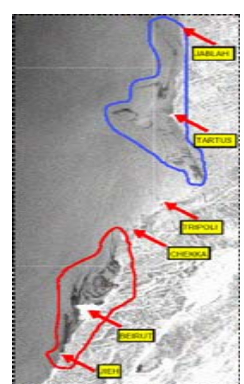
MEDSLIK



MODIS

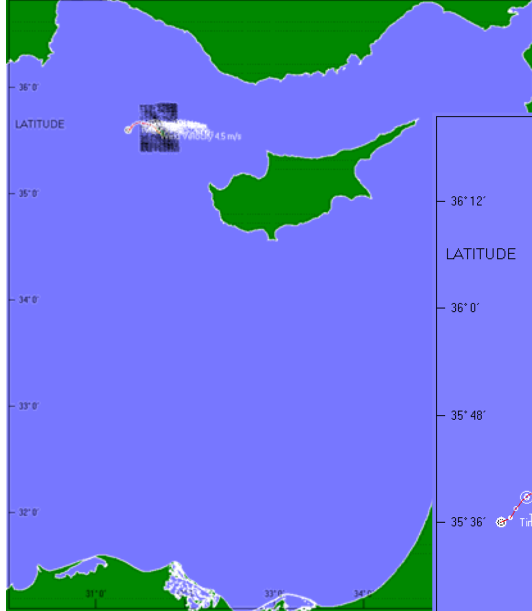


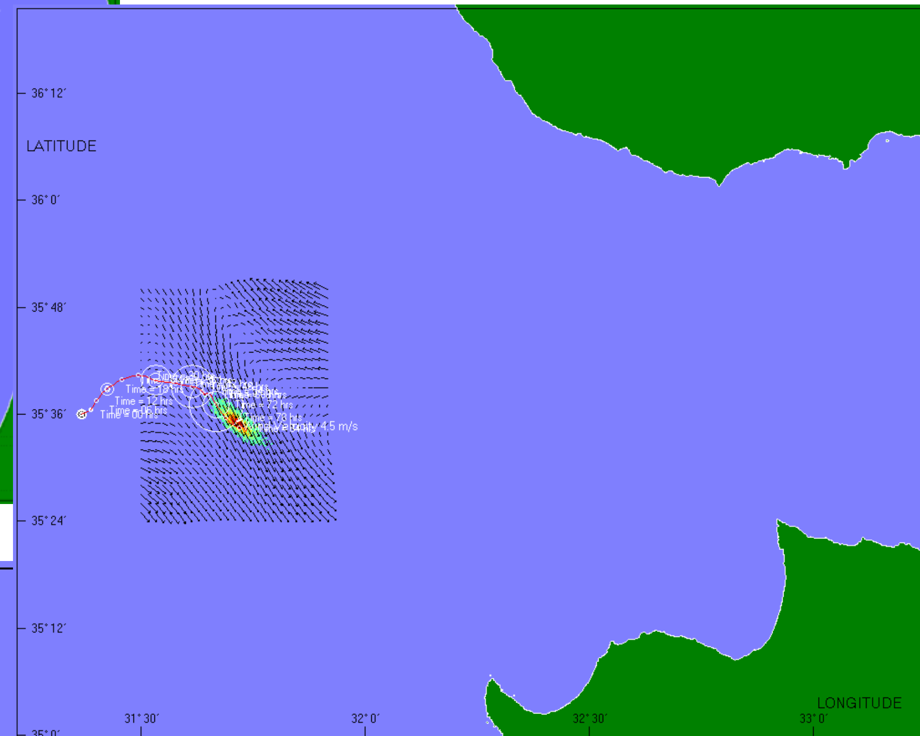
SAR

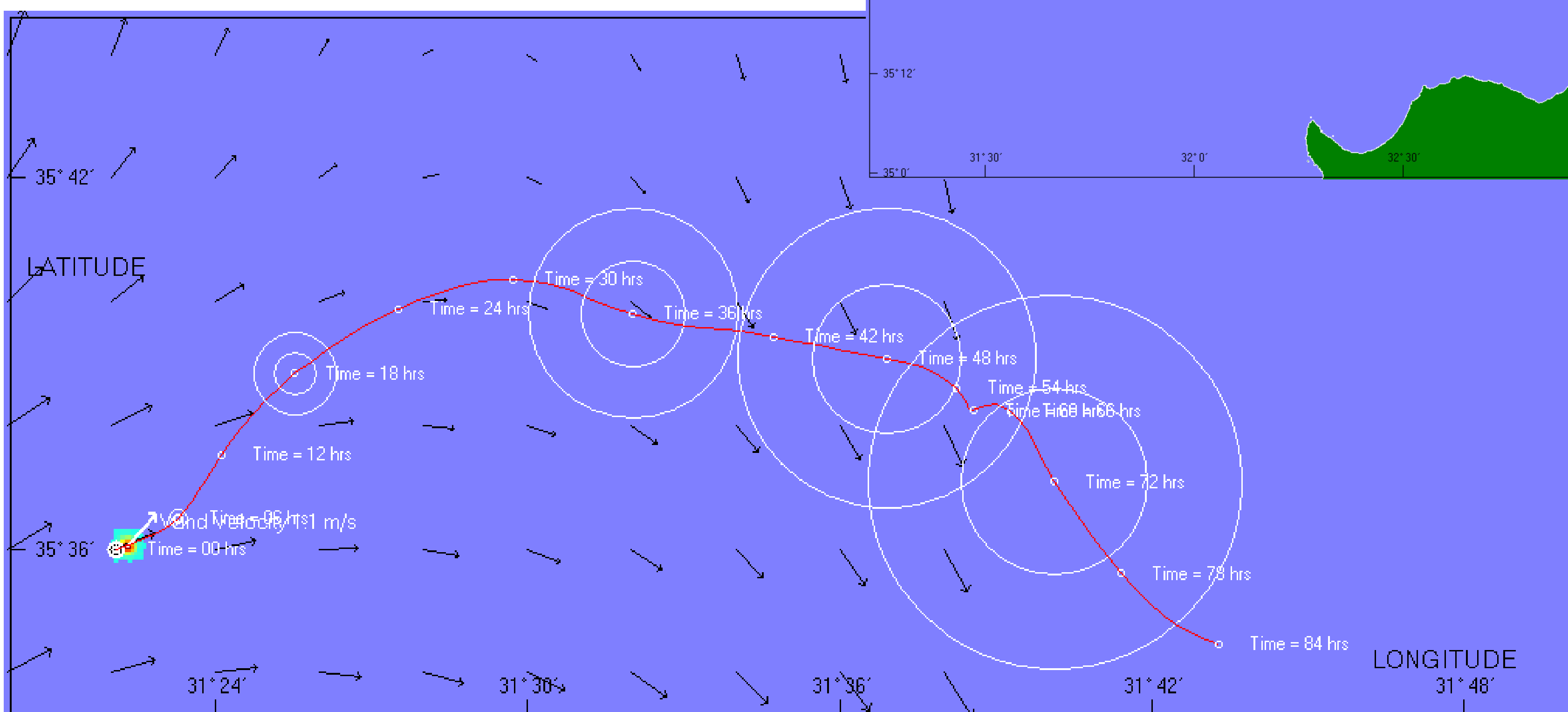


UN map

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



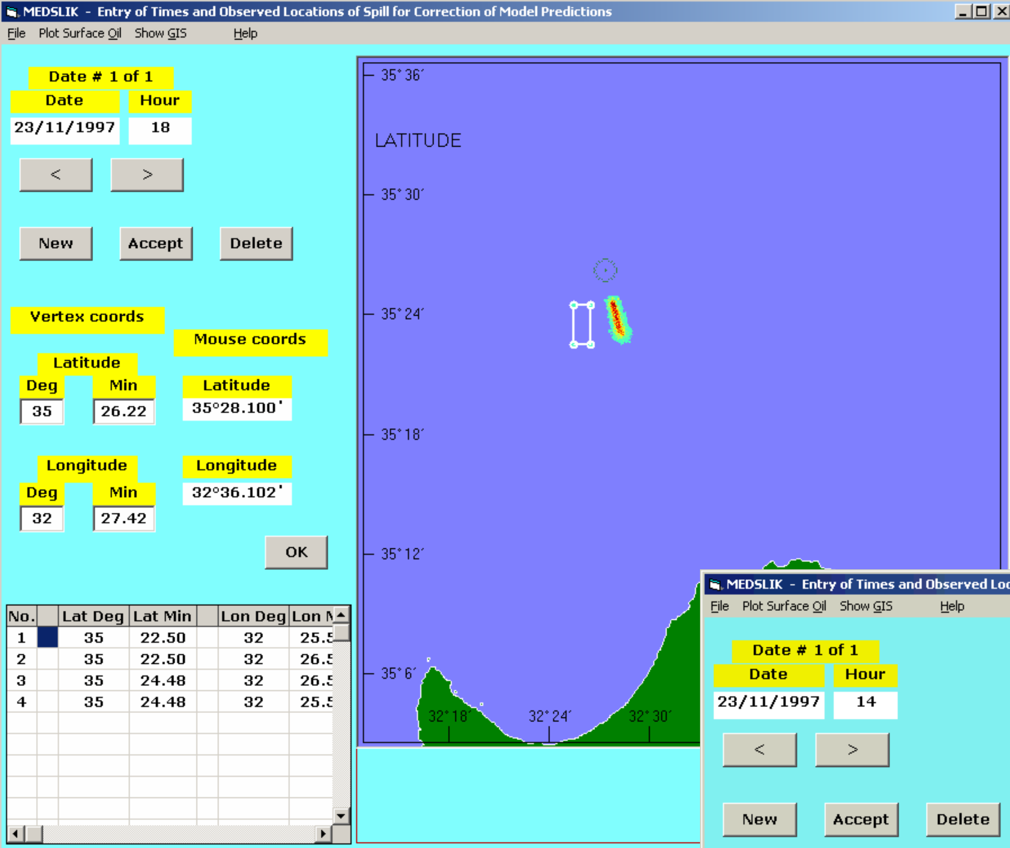


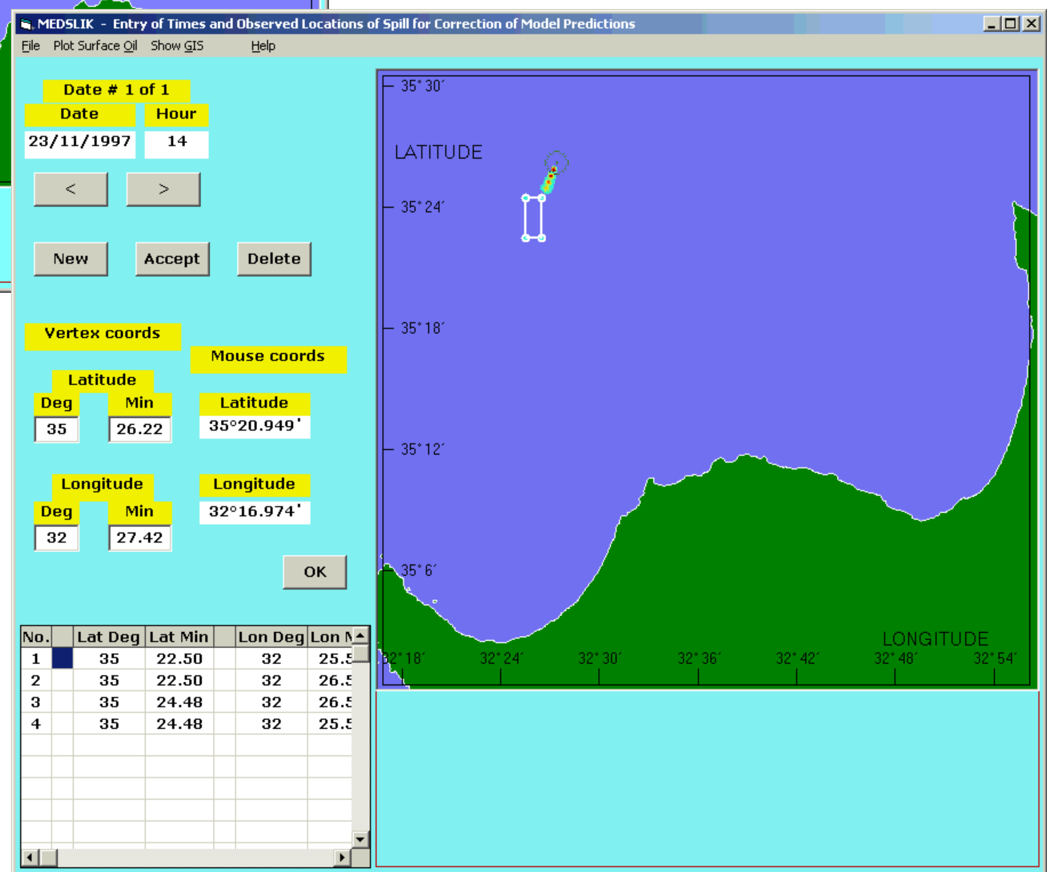


Slick Correction

The predicted slick position can be corrected on the basis of an observation of its actual position.

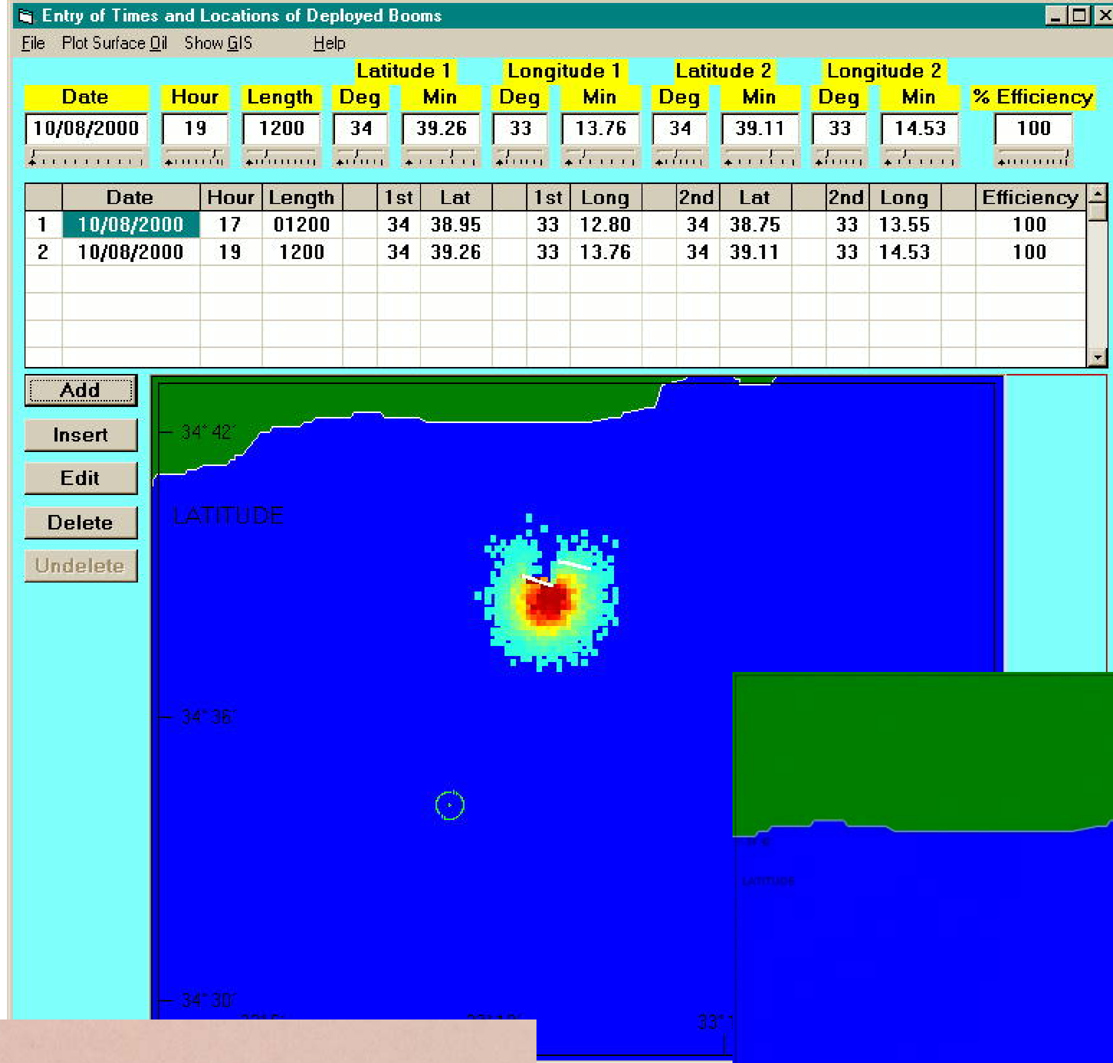
The picture on the left shows the predicted slick and the observed slick position which represented by a rectangle.

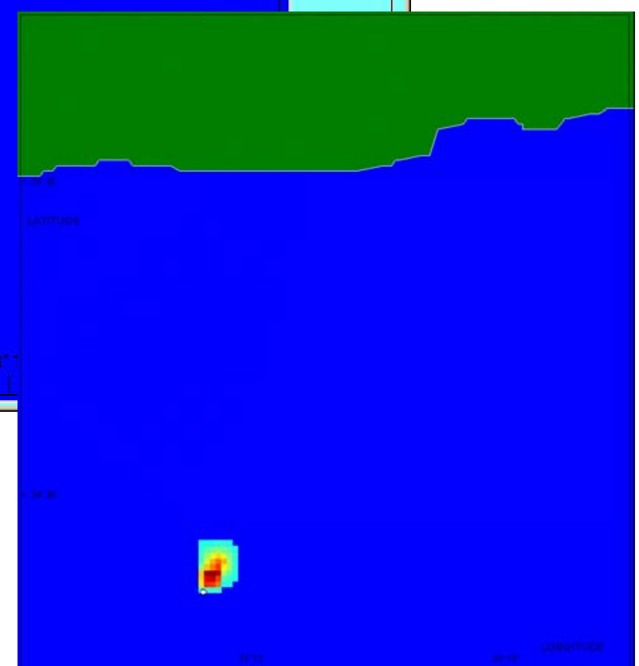




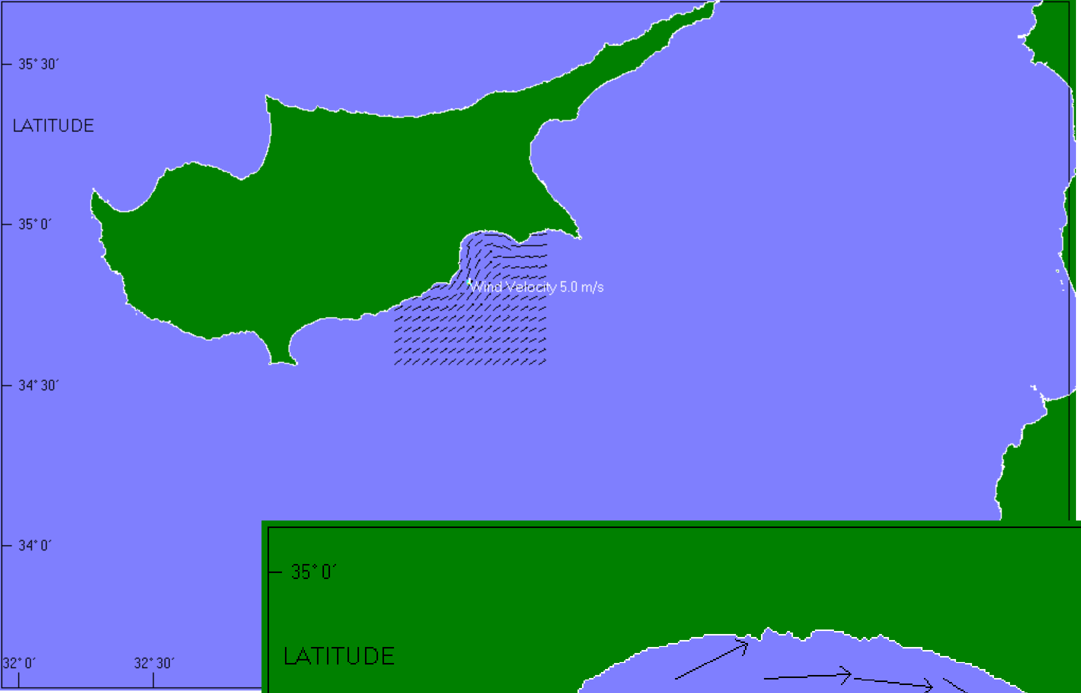
The slick prediction is adjusted to take account of the observation, as shown in the movie clip on the right.

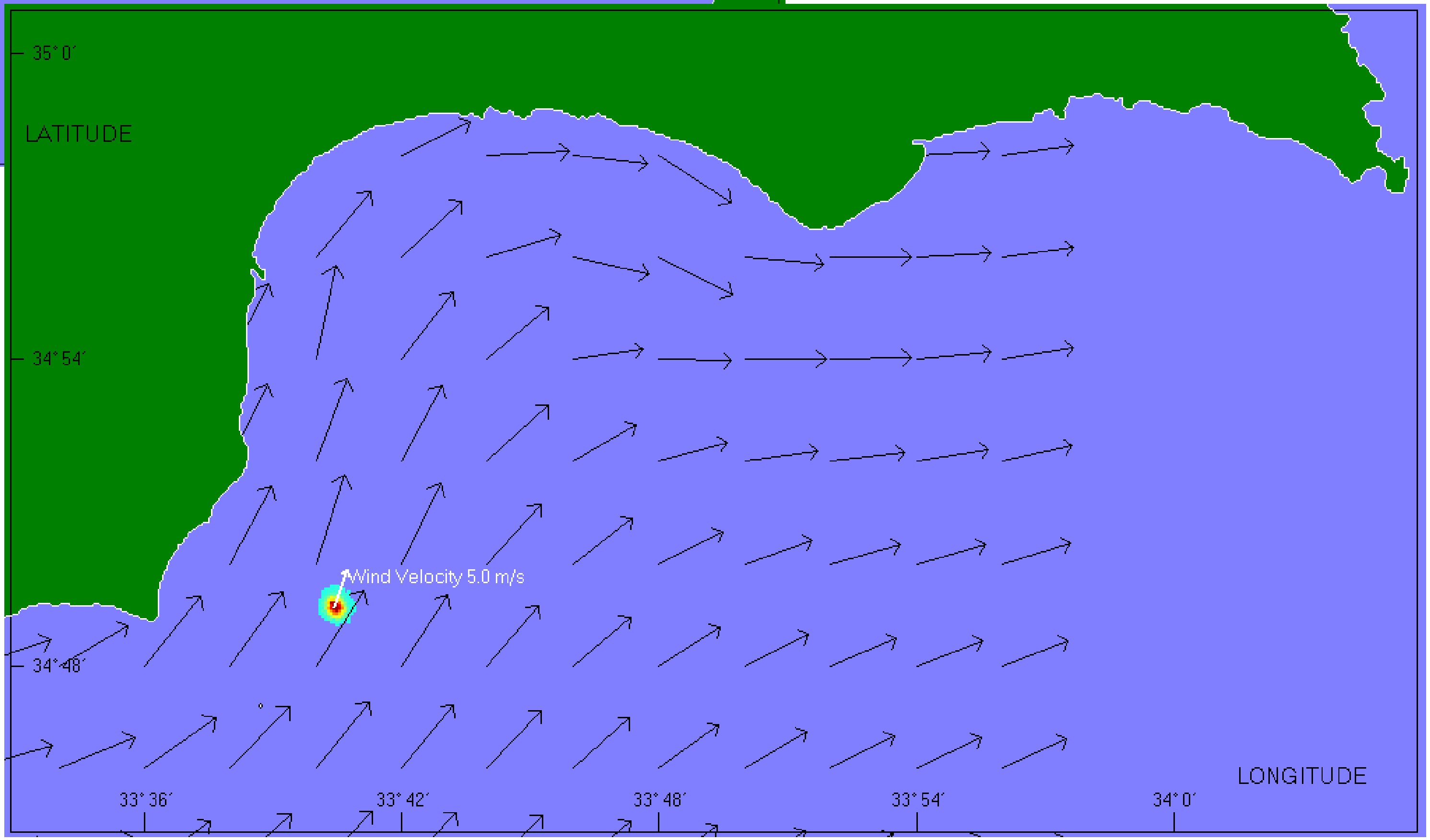
Example of **oil booms** deployment in the Cyprus coastal zone, Levantine Basin, both in MEDSLIK model & in reality.





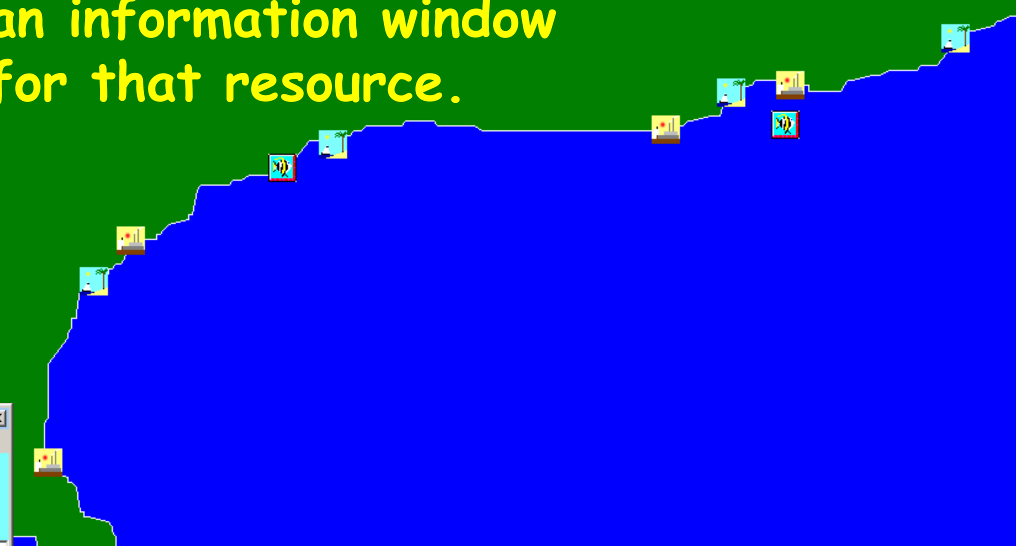
Simultaneous oil spills, whose slicks merge, can be modelled together.

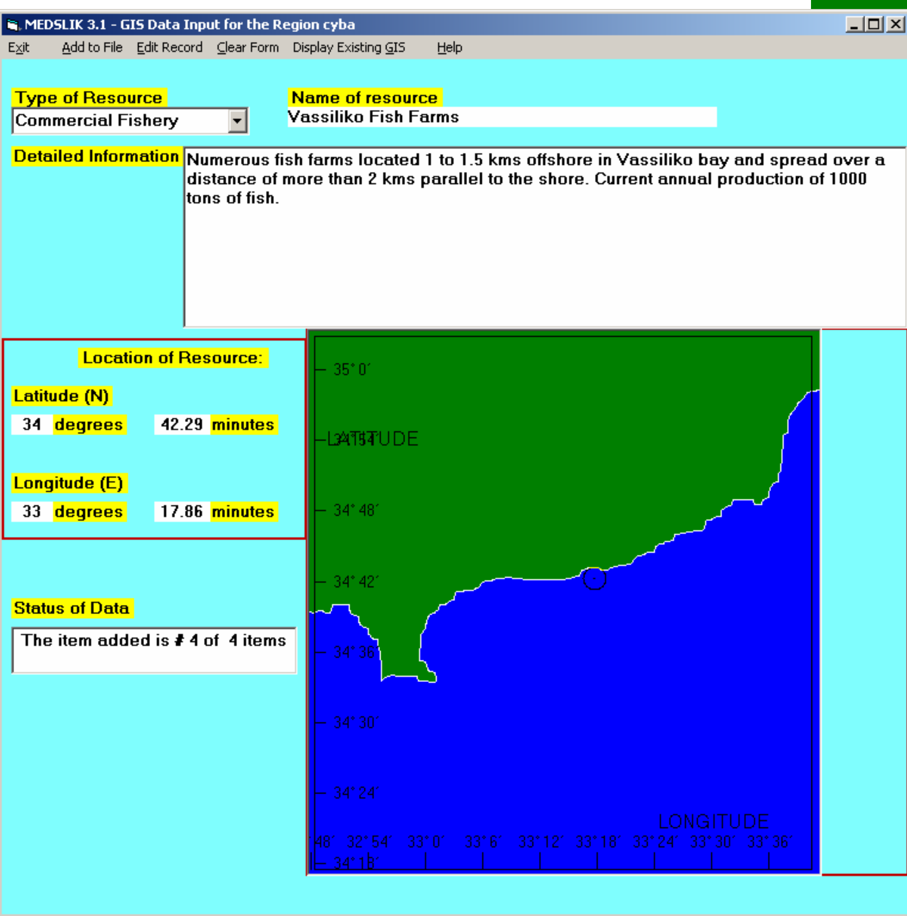


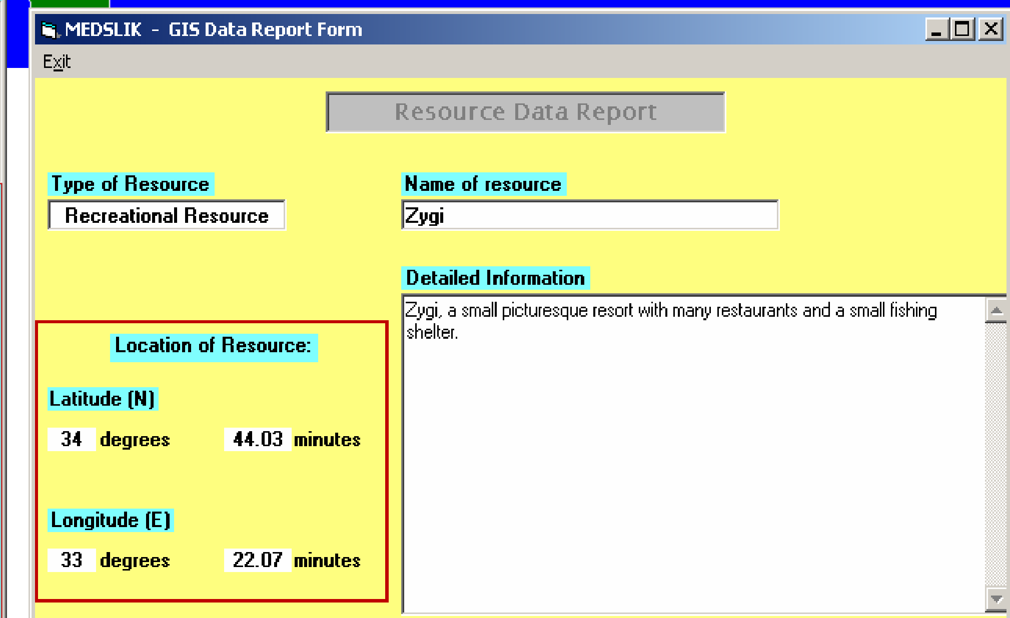


MEDSLIK includes a simple GIS that is of useful to the response agencies.
Resources are marked with an icon depending on the type of resource.

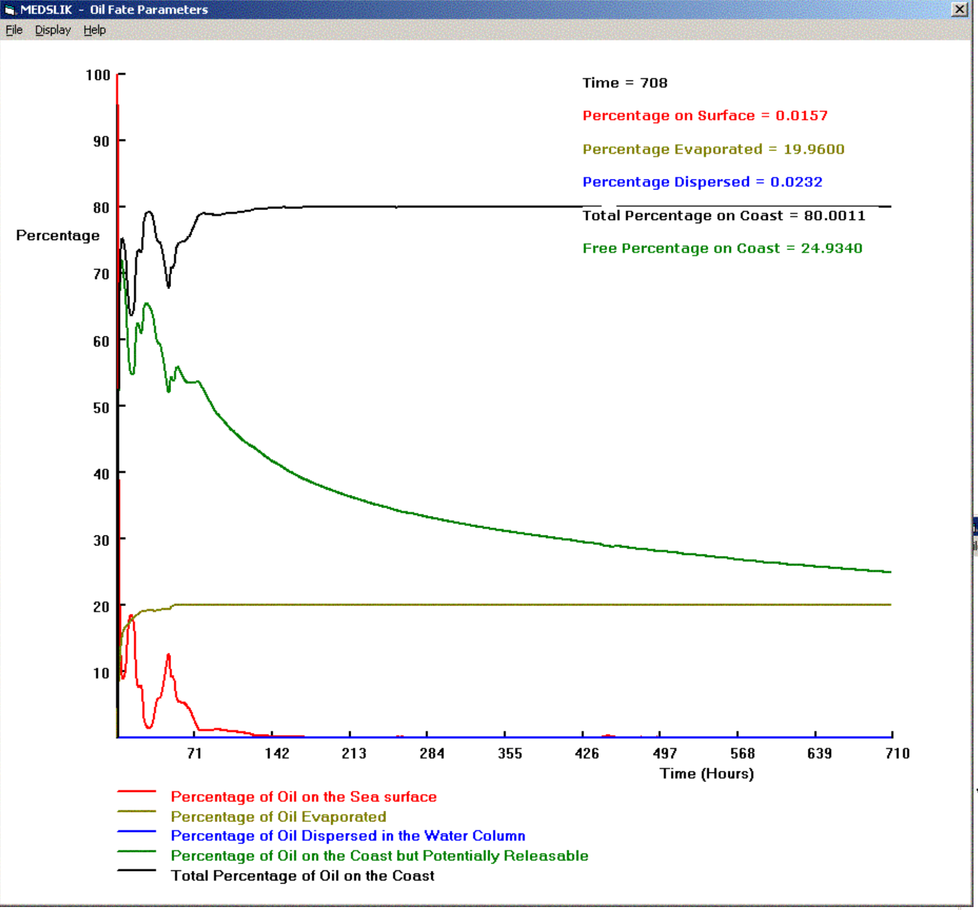
Clicking an icon brings up an information window for that resource.

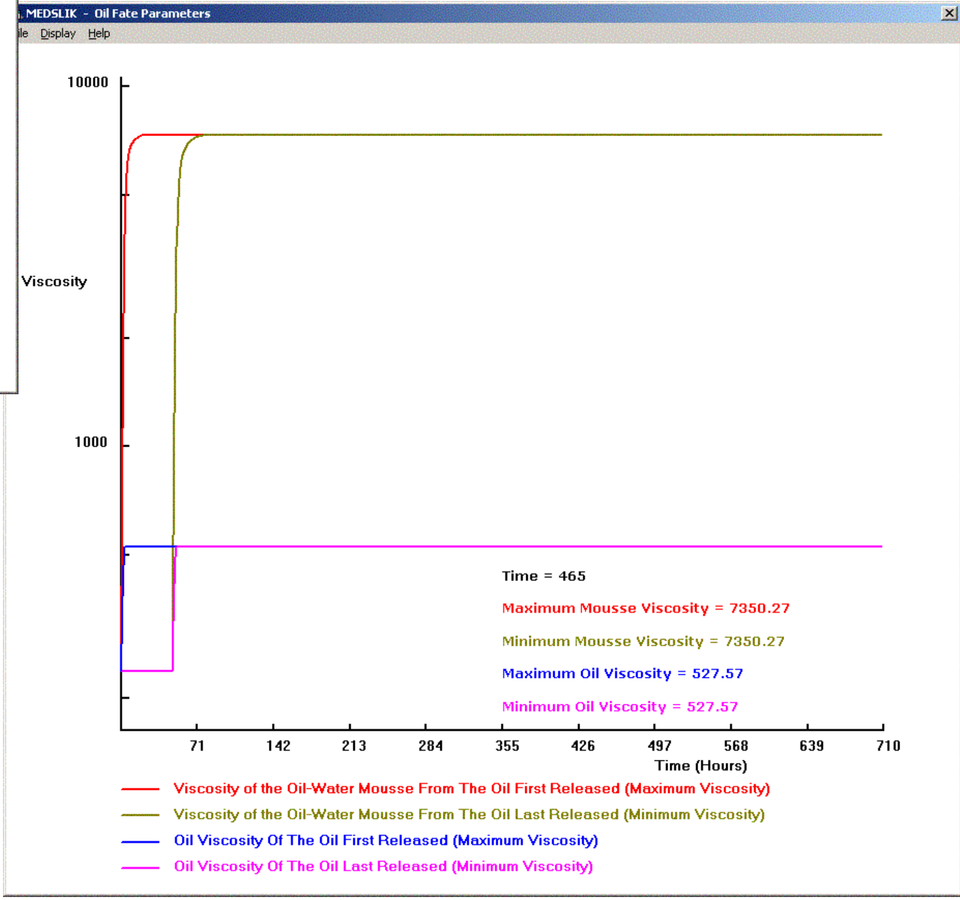






Oil fate parameters





THE END

Annex IV

<u>CERTIFICATE</u>

IMO UNEP

REGIONAL MARINE POLLUTION EMERGENCY RESPONSE CENTRE FOR THE MEDITERRANEAN SEA (REMPEC)

CERTIFICATE

No.

This is to certify that

____

has attended the

NATIONAL TRAINING COURSE ON MEDSLIK OIL SPILL FORECASTING MODEL version 5.1.2

Lattakia, Syria
4-5 June 2007

organized within the framework of the

MEDITERRANEAN ACTION PLAN

by the

REGIONAL MARINE POLLUTION EMERGENCY RESPONSE CENTRE FOR THE MEDITERRANEAN SEA (REMPEC)

in co-operation with the

GENERAL COMMISSION FOR ENVIRONMENTAL AFFAIRS
MINISTRY OF LOCAL ADMINISTRATION AND ENVIRONMENT

GENERAL DIRECTORATE OF PORTS
MINISTRY OF TRANSPORT

SYRIAN ARAB REPUBLIC

____

Mr. Frederic HEBERT
Director, REMPEC