

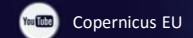
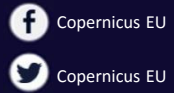


# Coastal pollution

## Copernicus for Coastal Zone Management



Space





- Operational forecast of oil spill drift (examples: Witoil, MEDESS, Poseidon)



- Hazard mapping for operational oil spills



- Plastic debris drift modeling





User  
Uptake

## C M E M S Med - M F C data

- Ocean currents (hourly forecasts, daily analyses) for calculation of the **oil spill** and **plastic transport**
- Sea surface temperature (hourly forecasts, daily analyses) for calculation of the oil weathering
- Mediterranean Sea physics as boundary conditions for nesting a high-resolution model (Adriatic Forecasting System AFS)



User  
Uptake

# Data: how to download the product

Online catalogue on <http://marine.copernicus.eu/services-portfolio/access-to-products/>

Select the area  
of interest and  
the parameter

### ONLINE CATALOGUE

#### YOUR SEARCH

NEW SEARCH

**AREA**

- All areas
- Global Ocean (0)
- Arctic Ocean (0)
- Baltic Sea (0)
- European North-West Shelf Seas (0)
- Iberia-Biscay-Ireland Regional Seas (0)
- Mediterranean Sea (4)
- Black Sea (0)

**PARAMETER**

- All parameters
- Ocean Temperature (4)
- Ocean Salinity (4)
- Ocean Currents (4)
- Sea Ice (0)
- Sea Level (4)
- Winds (0)
- Ocean Optics (0)

### COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE

Providing PRODUCTS and SERVICES for all marine applications

Search terms  OK

ABOUT US | BENEFITS | NEWS | SCIENCE & LEARNING | TRAINING | SERVICES PORTFOLIO | SHORT-CUT TO SERVICES

Home > Services portfolio > Access to products

#### ONLINE CATALOGUE

CATALOGUE PDF FIRST VISIT? MY CART 0

Found 1 product matching your criteria.

KEYWORD SEARCH  SEARCH

#### MEDITERRANEAN SEA PHYSICS ANALYSIS AND FORECAST

MEDSEA\_ANALYSIS\_FORECAST\_PHYS\_006\_01

Numerical-model, Currents, Temperature, Salinity, Sea-level, Forecast, Near-real-time, Mediterranean-sea

The physical component of the Mediterranean Forecasting System (Med-currents) is a coupled hydrodynamic-wave model implemented over the whole Mediterranean Basin. The model horizontal grid resolution is 1/16° (ca. 6-7 km) and has 72 unevenly spaced vertical levels. The hydrodynamics are supplied by the Nucleus for European Modelling of the Ocean (NEMO) while the wave component is provided by WaveWatch-III. The model solutions are corrected by the variational assimilation (based on a 3DVAR scheme) of temperature and salinity vertical profiles and along track satellite Sea Level Anomaly observations.

MORE INFO ADD TO CART

# Data: how to download the product



User Uptake

Download the product with the user interface

**ONLINE CATALOGUE** CATALOGUE PDF FIRST VISIT! MY CART 1 LOGOUT

### MEDITERRANEAN SEA PHYSICS ANALYSIS AND FORECAST

Metadata provided by CEMES  
Credits: Copernicus Marine Service

BACK TO SEARCH

ADD TO CART

VIEW PRODUCT

**DOWNLOAD PRODUCT**

**INFORMATION** PDF XML **DOCUMENTATION** **SERVICES**

PRODUCT IDENTIFIER: MEDSEA\_ANALYSIS\_FORECAST\_PHYS\_006\_001

OVERVIEW

The physical component of the Mediterranean Forecasting System (Med-forecast) is a coupled hydrodynamic-wave model implemented over the whole Mediterranean Basin. The model horizontal grid resolution is 1/16° (ca. 6.7 km) and has 72 unevenly spaced vertical levels. The hydrodynamics are supplied by the Nucleus for European Modelling of the Ocean (NEMO) while the wave component is provided by WaveWatch-III. The model solutions are corrected by the variational assimilation (based on a 3DVAR scheme) of temperature and salinity vertical profiles and along track satellite Sea Level Anomaly observations.

**FULL OVERVIEW**

**VARIABLES**

- northward\_sea\_water\_velocity
- eastward\_sea\_water\_velocity
- surface\_eastward\_sea\_water\_velocity\_produced\_by\_sea\_surface\_waves
- surface\_northward\_sea\_water\_velocity\_produced\_by\_sea\_surface\_waves
- ocean\_mixed\_layer\_thickness
- sea\_water\_salinity
- sea\_surface\_height\_above\_sea\_level
- sea\_water\_potential\_temperature
- sea\_water\_temperature

**GEOGRAPHICAL COVERAGE**

45.9375 Areas: mediterranean-sea

-15 36.25

30 1875

**SPATIAL RESOLUTION** 0.06 degree

**VERTICAL COVERAGE** from -5500.0m to 0.0m (CRS=EPSG:5714)

**TEMPORAL RESOLUTION** Daily mean, Hourly mean

**TEMPORAL COVERAGE** from 2013-01-01T00:00:00Z still going

**UPDATE FREQUENCY** daily

**PRODUCTION UNIT** MED-INGV-BOLDGNA-IT

**DATA ACCESS** BACK TO SEARCH

MY CART

MEDSEA\_ANALYSIS\_FORECAST\_PHYS\_006\_001

**Dataset Selected**

- CMEMS\_V02-MED-INGV-CUR-AN-FC-D
- CMEMS\_V02-MED-INGV-CUR-AN-FC-H
- CMEMS\_V02-MED-INGV-MLD-AN-FC-D
- CMEMS\_V02-MED-INGV-MLD-AN-FC-H
- CMEMS\_V02-MED-INGV-SAL-AN-FC-D
- CMEMS\_V02-MED-INGV-SAL-AN-FC-H
- CMEMS\_V02-MED-INGV-SSH-AN-FC-D
- CMEMS\_V02-MED-INGV-SSH-AN-FC-H
- CMEMS\_V02-MED-INGV-TEM-AN-FC-D
- CMEMS\_V02-MED-INGV-TEM-AN-FC-H

**Dataset Filters**

**GEOGRAPHICAL AREA** (Default = Product region)

Mediterranean Sea

**TIME RANGE** (Default = Last date available)

START DATE: 2016-09-24 11:30:00 ± END DATE: 2016-09-24 11:30:00 ±

**DEPTH** (Default = Surface depth)

START DEPTH: 1.4722 ± END DEPTH: 1.4722 ±

**VARIABLES** (Default = All variables) [Uncheck All]

DOWNLOAD	NAME	DESCRIPTION	STANDARD NAME	UNITS
<input checked="" type="checkbox"/>	sowavnu	Wave Number	sea_water_wavenu_mber	m-1
<input checked="" type="checkbox"/>	somesty	V-Stokes drift velocity at surface	surface_northward_sea_water_velocity_produced_by_sea_surface_waves	ms
<input checked="" type="checkbox"/>	vomecrty	meridional current	northward_sea_water_velocity	ms
<input checked="" type="checkbox"/>	sozostdx	U-Stokes drift velocity at surface	surface_eastward_sea_water_velocity_produced_by_sea_surface_waves	ms
<input checked="" type="checkbox"/>	vozoctx	zonal current	eastward_sea_water_velocity	ms

**DOWNLOAD**



```
CMEMS_V02-MED-INGV-CUR-AN-FC-D
CMEMS_V02-MED-INGV-CUR-AN-FC-H
CMEMS_V02-MED-INGV-MLD-AN-FC-D
CMEMS_V02-MED-INGV-MLD-AN-FC-H
CMEMS_V02-MED-INGV-SAL-AN-FC-D
CMEMS_V02-MED-INGV-SAL-AN-FC-H
CMEMS_V02-MED-INGV-SSH-AN-FC-D
CMEMS_V02-MED-INGV-SSH-AN-FC-H
CMEMS_V02-MED-INGV-TEM-AN-FC-D
CMEMS_V02-MED-INGV-TEM-AN-FC-H
```



User Uptake

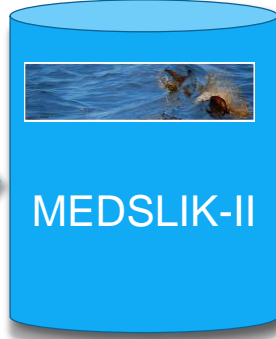
# Operational forecast of oil spill: methodology



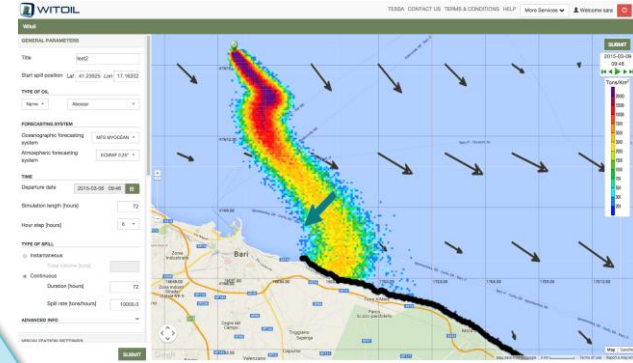
Ocean currents hourly forecasts, daily analyses  $1/16^\circ \times 1/16^\circ$  horizontal resolution



Atmospheric wind 6 hrs - 12, 5 km



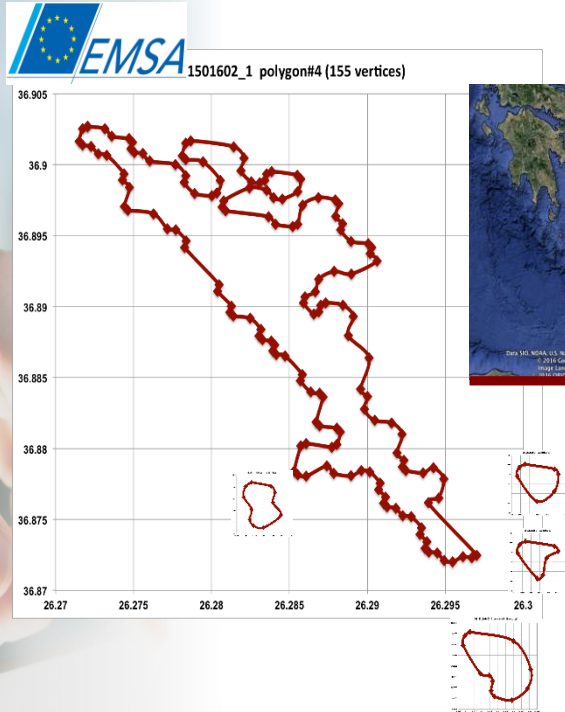
Oil Spill forecast





User  
Uptake

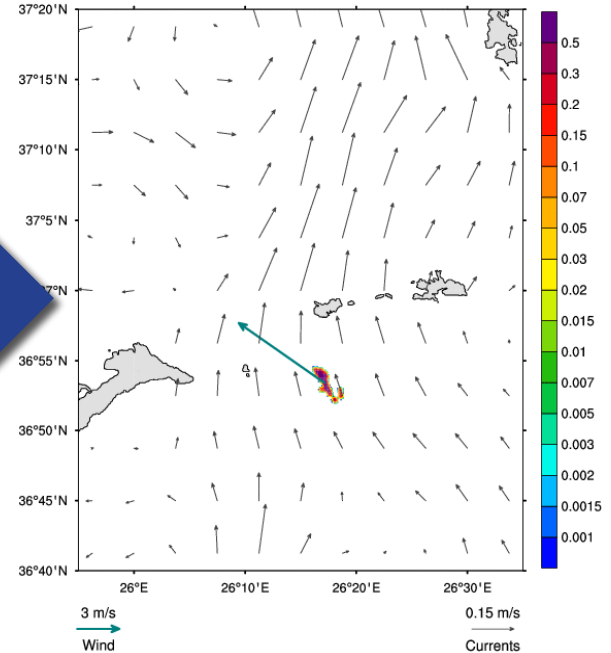
# Operational forecast of oil spill drift: demonstration



5-Polygon Oil  
Spill  
in the Aegean  
Sea  
20-01-2016  
04:20

Northward  
transport  
led to  
the oil  
contamina-  
tion of  
Kinaros  
Island  
coastline  
(Greece)

Surface oil concentration, ton/km<sup>2</sup>  
20/01/2016 04:20 UTC +0001 hours

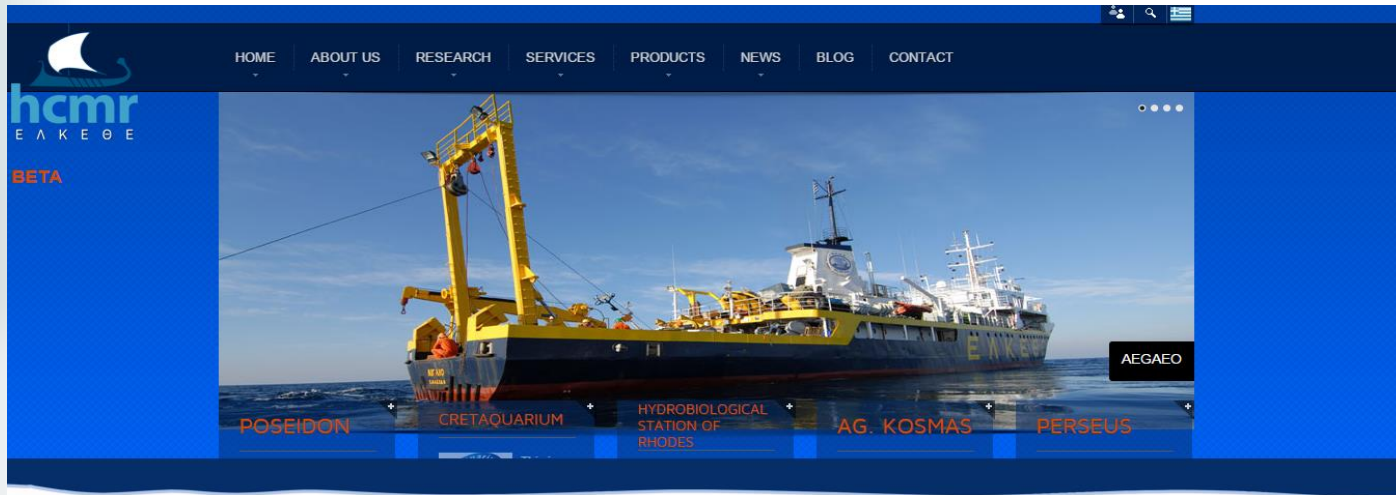






User  
Uptake

# Hellenic Centre for Marine Research HCMR - [www.hcmr.gr](http://www.hcmr.gr)



## HELLENIC CENTRE FOR MARINE RESEARCH

Institutes: [Oceanography](#) | [Marine Biological Resources & Inland Waters](#) | [Marine Biology and Genetics & Aquaculture](#)

HCMR is the main research and advisory body for marine environment, fisheries and aquaculture in Greece.





User Uptake

# Hellenic Centre for Marine Research HCMR - www.hcmr.gr



Monitoring, Forecasting and Information System for the Greek Seas

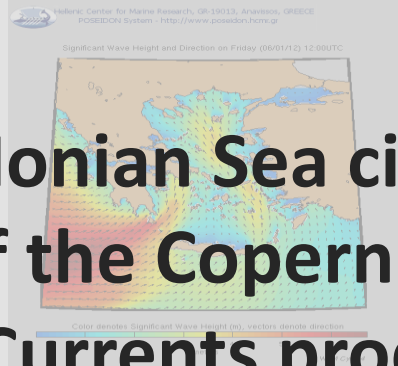
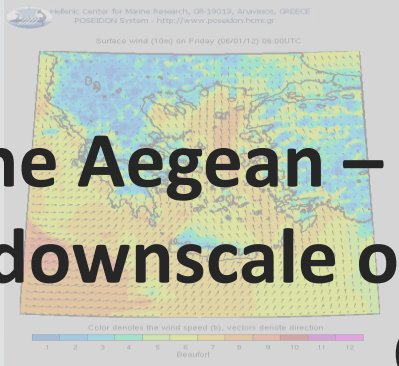


### Poseidon products

- On line data
- Weather Forecast
- Sea State Forecast
- Sailing Forecast
- Sea Level Forecast
- Ocean Forecast
- Ecosystem Forecast
- Forecasting Models

### Poseidon services

- Live Access Server
- Oil Spill Drifts
- Data Base
- FerryBox
- Previous forecasts
- Satellite Images
- HF Remote Sensing
- POSEIDON mobile



### PoseidonDataBase

HELLENIC CENTRE FOR MARINE RESEARCH - POSEIDON SYSTEM

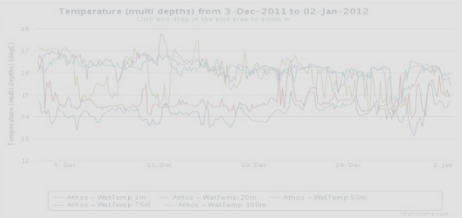
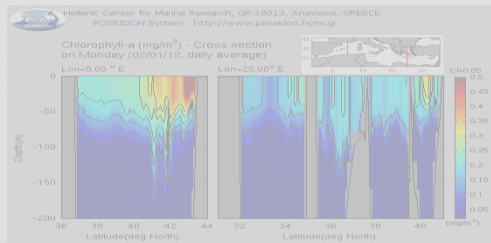
Login

Username: \_\_\_\_\_

Password: \_\_\_\_\_

© 2010-2011 Hellenic Center for Marine Research - Poseidon Team  
Design and development by A. G. Chantziropoulos

# The Aegean – Ionian Sea circulation model is a downscale of the Copernicus CMEMS MED-Currents product



### Poseidon LAS

HELLENIC CENTRE FOR MARINE RESEARCH - POSEIDON SYSTEM

Latitude range: 32.0 - 40.0  
Longitude range: 22.0 - 28.0

Time: 12/14/2011 00:00

SEA SURFACE HEIGHT (cm)



# A Greek operational example: Poseidon Oil Drift Application

## Online Oil Drift Forecasting System

Hellenic Center for Marine Research - Poseidon System

### Login

Username:

Password:

**Submit**



© 2010 Hellenic Center for Marine Research - Poseidon Teams  
Designed by A. G. Chalkopoulos

### The user submits a scenario:

- 'Event' position
- Date, time
- Simulation time
- Initial volume of the pollutant (if it is known)
- Evacuation time (if it is known)

The user receives email notification when the simulation is completed (average pending time 5 – 7 min).

The user can see and download the results:

Geographical position of each particle

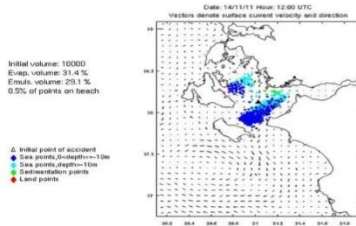
- Depth
- Percentage of evaporation, emulsification volume, beached and bottom particles.

## Results for the Oil Spill Modeling Application

Information about the oil spill event

[Download KM...](#)

**Date:** 10/1/11  
**Time (UTC):** 00:00  
**Initial Position:** 21.0278 E 38.1210 N  
**Duration of integration (Hrs):** 168 (7 days)  
**Evacuation time (Hrs):** Instant  
**Output graphic every (Hrs):** 12



14/1/11 Hour: 12:00 UTC [Animation](#)

All the graphical outputs with a summary text are available in .zip file.  
Click here to download the .zip file (size: 482.19 KB)

### About

The POSEIDON Oil Spill fate and trajectory model is based on PARCEL model (Pollani et al. 2003) which is able to simulate not only the drift of the oil but also the chemical transformations under the specific environmental conditions. more...

### Links

Poseidon System  
Hellenic Center for Marine Research  
Ecoop project  
Roses project  
MarCoast network

## Request for the Oil Spill Modeling Application

How to submit your request:

- Select the area of the oil spill event, either by dragging and dropping the pin into the desired position on the map or by filling manually the relevant fields of Latitude/Longitude (in this latter case you may click the "Set pin here" to move the pin into the relevant location)
- Select the date and time of the oil spill accident, the duration of oil spill model integration in hours and the frequency of the graphic output results.
- You can optionally provide the following information for the model run: The total oil volume that has been dispersed into the sea (Default value: 10000m<sup>3</sup>) and the evacuation time in hours, i.e. the time frame where all the amount of oil will be dispersed into the sea (Default value: 0= instant evacuation).
- Provide a valid e-mail address and press submit.



Initial point of the accident:

Latitude \*   
 Longitude \*   
 Combo box:   
[Set Pin Here](#)

Date of the accident \*   
 Time of the accident \*  UTC  
 Duration of integration (in hrs) \*   
 Output graph every \*  hours  
 Oil volume (m<sup>3</sup>) (if you know)   
 Evacuation time (in Hrs)

Your e-mail

**Submit** **Reset**

\* Required fields

### About

The POSEIDON Oil Spill fate and trajectory model is based on PARCEL model (Pollani et al. 2003) which is able to simulate not only the drift of the oil but also the chemical transformations under the specific environmental conditions. more...

### Links

Poseidon System  
Hellenic Center for Marine Research  
Ecoop project  
Roses project  
MarCoast network



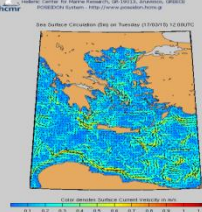


# POSEIDON Operational Oil-spill Model

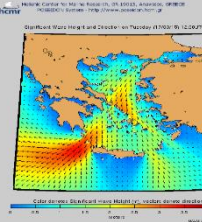
User Uptake

Downscaled from Copernicus CMEMS

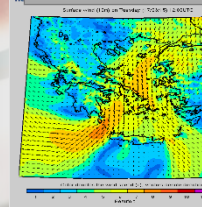
Hydrodynamic forecasts Based on POM



Wave forecast WAM Cycle 4



Weather forecast Based on ETA



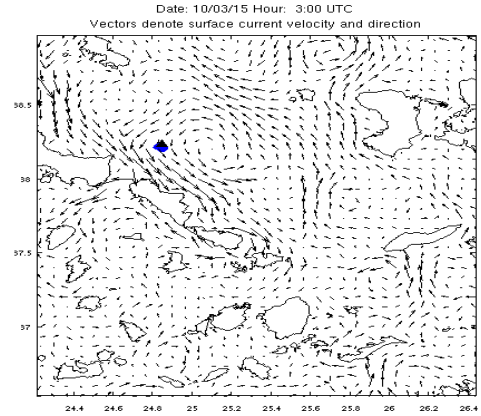
Oil Spill Model

- 3-D numerical model which simulates
- the pollutant transport
- weathering (evaporation, emulsification, sedimentation, beaching)
- oil slick represented as “parcels” with time dependent chemical and physical characteristics



Initial volume: 10000  
 Evap. volume: 15.4 %  
 Emuls. volume: 2.8 %  
 0.0% of points on beach

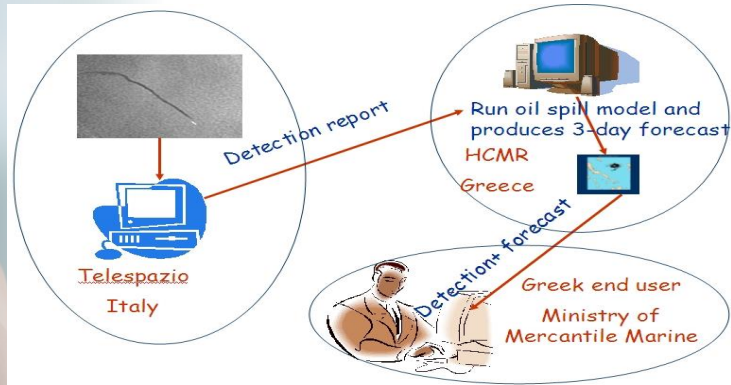
- ▲ Initial point of accident
- ◆ Sea points, 0<depth<=10m
- Sea points, depth>10m
- Sedimentation points
- ◆ Land points





User  
Uptake

# POSEIDON Oil Spill Model performance in near real time



Between 2006 and 2008

**132** ENVISAT images over Aegean were analyzed

**155** Oil spills were detected – Relevant forecasts were delivered

## Registered End users

- Hellenic Ministry of Mercantile Marine  
Marine Environment Protection Division (MEPD)
- Joint Rescue Notification Center (JRCC)



User  
Uptake

# Hazard mapping for operational oil spills: methodology

The oil hazard mapping methodology uses the following assumptions:

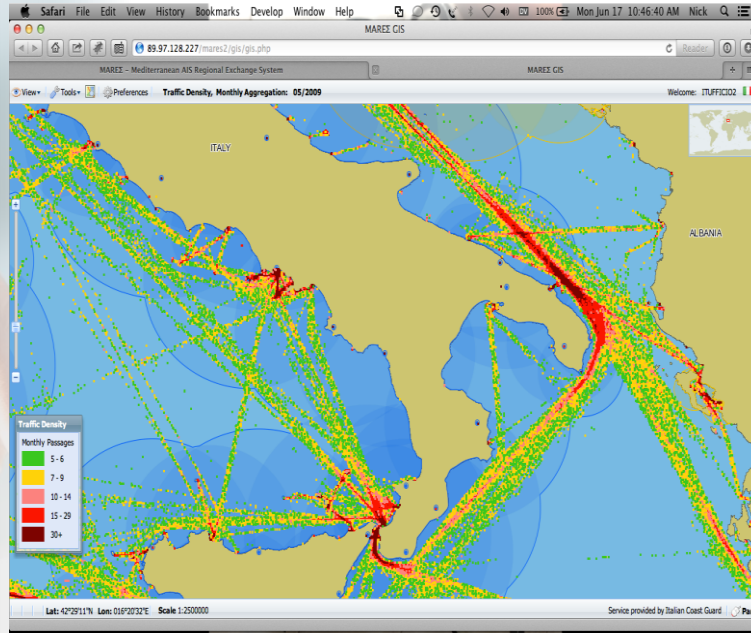
1. the traffic density distribution and the amount of oil operationally spilled is representative of the present state and will not vary significantly in the future
2. the oil spill simulations, performed using the past daily meteo- oceanographic conditions from 2009 to 2013, sampled relevant possible meteo-oceanographic conditions.



User  
Uptake

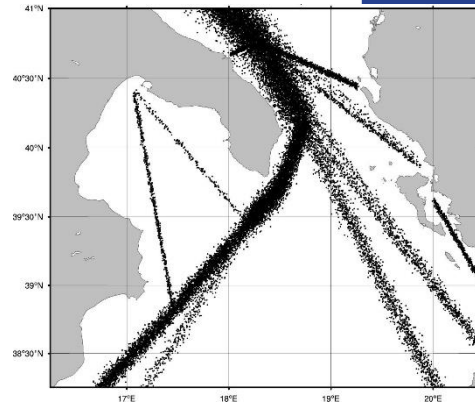
# Hazard mapping for operational oil spills: methodology - the traffic density distribution

*Digitizing the ship traffic maps provided by the Italian Coast Guard*



Monthly Ship Traffic Maps provided by ITCG

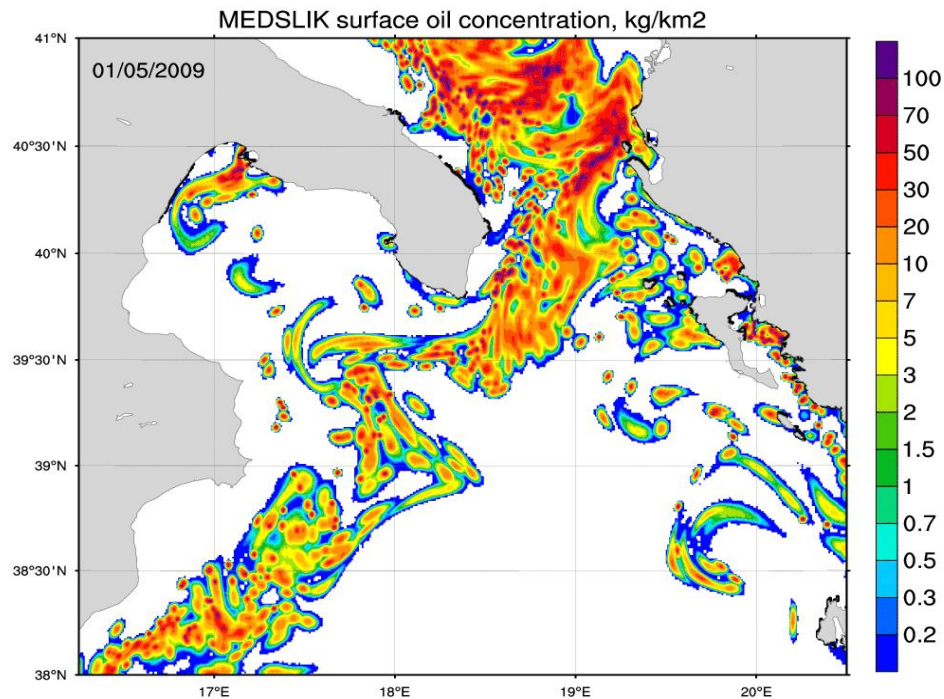
Spill list  
1.000.000  
spills/month





User  
Uptake

# Hazard mapping for operational oil spills: methodology - the oil spill simulations



Hourly Surface Oil Concentration  $C_{\text{HOURLY}}(x,y)$  Maps





User  
Uptake

# Hazard maps for operational oil spills: demonstration

Marine Pollution Bulletin 90 (2015) 259–272

Contents lists available at ScienceDirect

**Marine Pollution Bulletin**

Journal homepage: [www.elsevier.com/locate/marpolbul](http://www.elsevier.com/locate/marpolbul)

**Oil spill hazard from dispersal of oil along shipping lanes in the Southern Adriatic and Northern Ionian Seas**

S. Liubartseva<sup>a,\*</sup>, M. De Dominicis<sup>b</sup>, P. Oddo<sup>b</sup>, G. Coppini<sup>c</sup>, N. Pinardi<sup>d</sup>, N. Greggio<sup>e</sup>

<sup>a</sup>Centro EuroMediteraneo sul Cambiamento Climatico, Bologna, Italy  
<sup>b</sup>Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy  
<sup>c</sup>Centro EuroMediteraneo sul Cambiamento Climatico, Lecce, Italy  
<sup>d</sup>Department of Physics and Astronomy, University of Bologna, Italy  
<sup>e</sup>Italian Coast Guard Headquarters, Ministry of Infrastructure and Transport, Rome, Italy

**ARTICLE INFO**

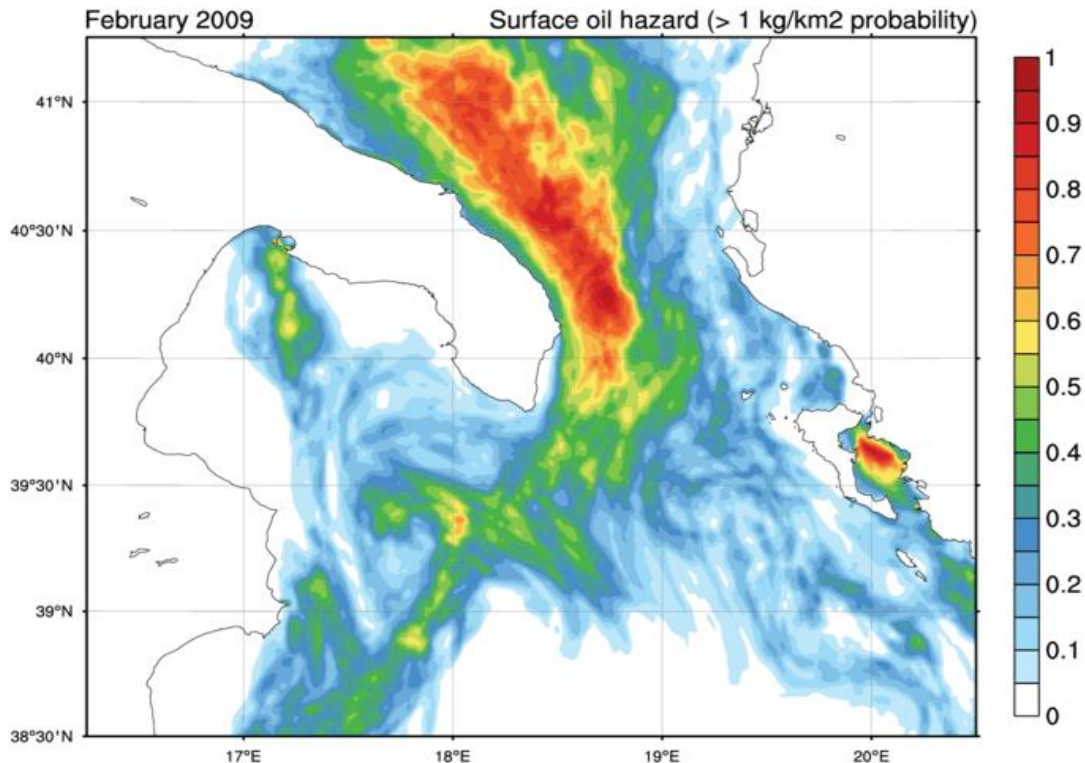
**ABSTRACT**

**Article history:**  
Available online 14 November 2014

**Keywords:**  
Oil spill modelling  
Hazard mapping  
Operational oil pollution  
Southern Adriatic and Northern Ionian Seas

An assessment of hazard stemming from operational oil ship discharges in the Southern Adriatic and Northern Ionian (SANI) Seas is presented. The methodology integrates ship traffic data, the fate and transport oil spill model MESSLICH, coupled with the Mediterranean Forecasting System (MFS) ocean currents, sea surface temperature analyses and ECMWF surface winds. Monthly and climatological hazard maps were calculated for February 2009 through April 2013. Monthly hazard distributions of oil show that the zones of highest sea surface hazard are located in the southwestern Adriatic Sea and eastern Ionian Sea. Distinctive “hot spots” appear in front of the Taranto Port and the sea area between Corfu Island and the Greek coastlines. Reached oil hazard maps indicate the highest values in the Taranto Port area, on the eastern Greek coastline, as well as in the Bari Port area and near British Port area.

© 2014 Elsevier Ltd. All rights reserved.



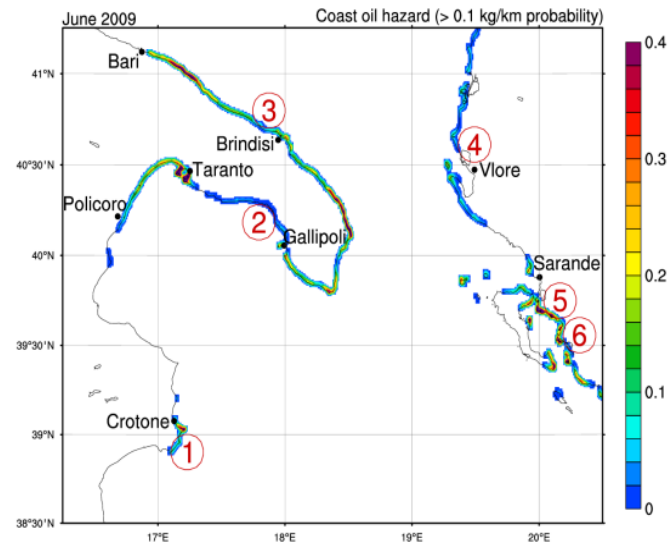
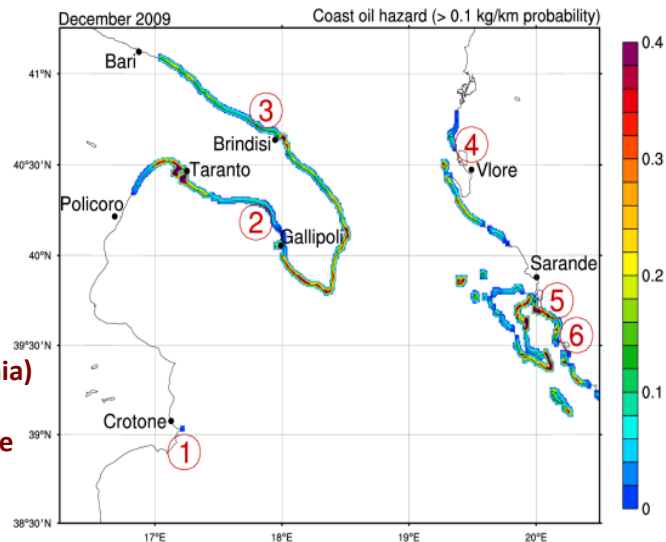


User  
Uptake

# Hazard maps for operational oil spills: demonstration

## *At risk of chronic oil pollution: Marine Protected Areas*

- (1) Capo Rizzuto MPA (Italy)
- (2) Porto Cesareo MPA (Italy)
- (3) Torre Guaceto MPA (Italy)
- (4) Vjose-Narte Landscape Protected Site (Albania)
- (5) Butrinti National Park (Albania)
- (6) Kalama Delta Natural Reserve (Greece)

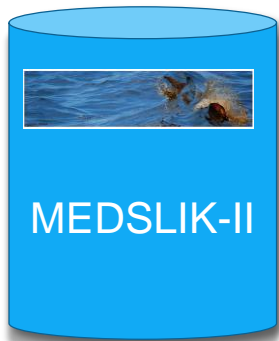


# Plastic debris drift modeling: methodology

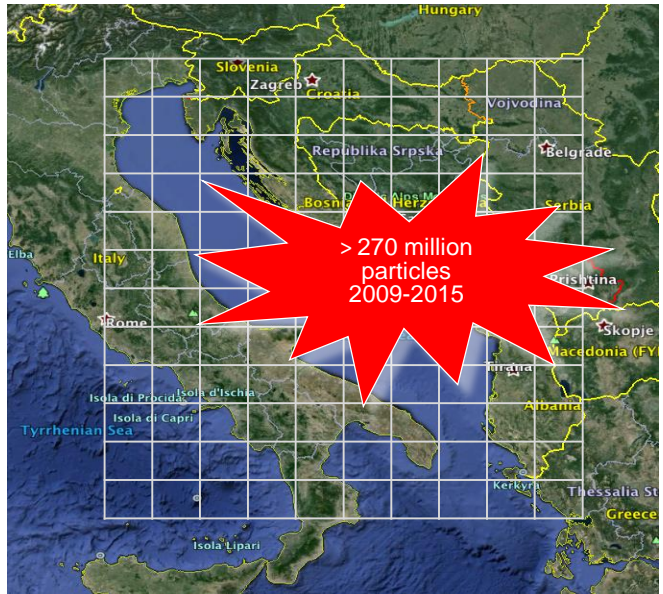


User  
Uptake

AFS daily  
2.2 x  
2.2 km



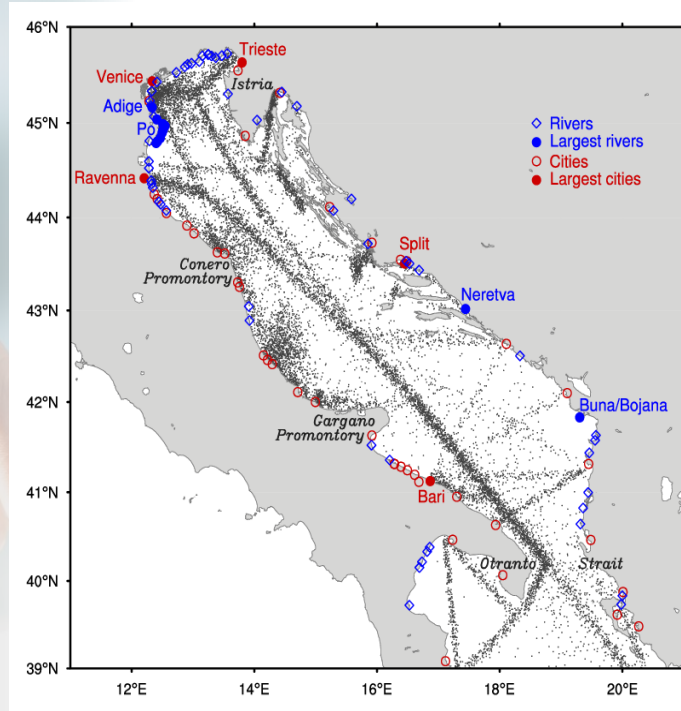
**ECMWF**  
6 hrs  
25 x 25 km





User  
Uptake

# Plastic debris drift modeling: methodology



## Identification of plastics' sources

**10 000 ton/year of plastics  
goes  
into the Adriatic Sea:**

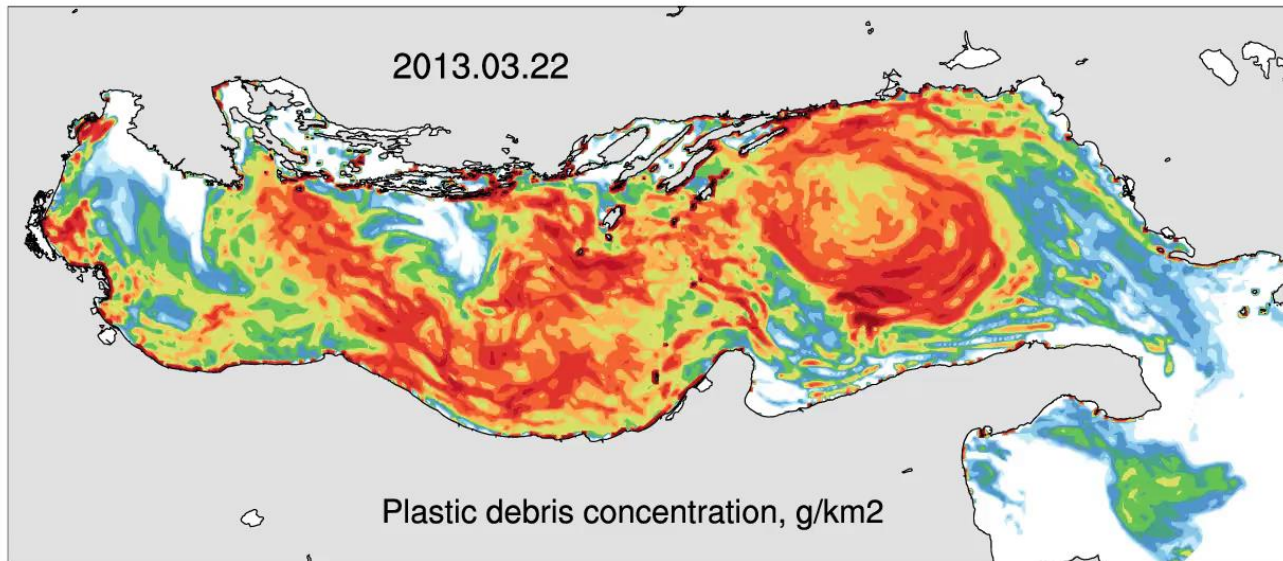
**40% - from river  
discharges  
40% - from coastal  
population  
20% - from shipping lanes**



User  
Uptake

# Plastic drift in the Adriatic Sea: demonstration

[http://plastics.cmcc.it/files/DFG\\_suppl.mov](http://plastics.cmcc.it/files/DFG_suppl.mov)

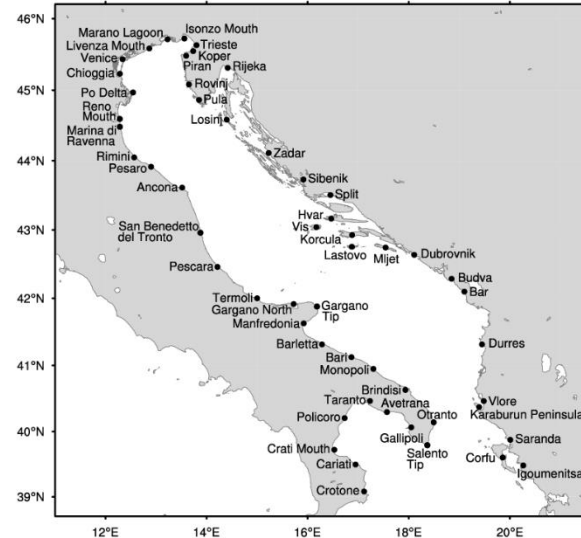
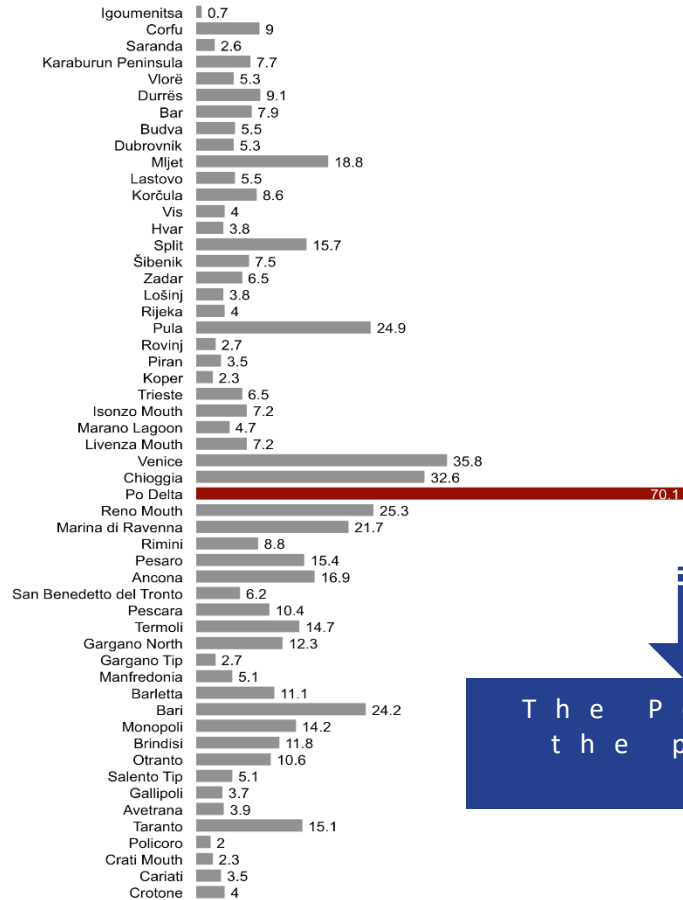




User  
Uptake

# Plastic debris drift modeling: demonstration

## *Plastics' fluxes onto the coastline*



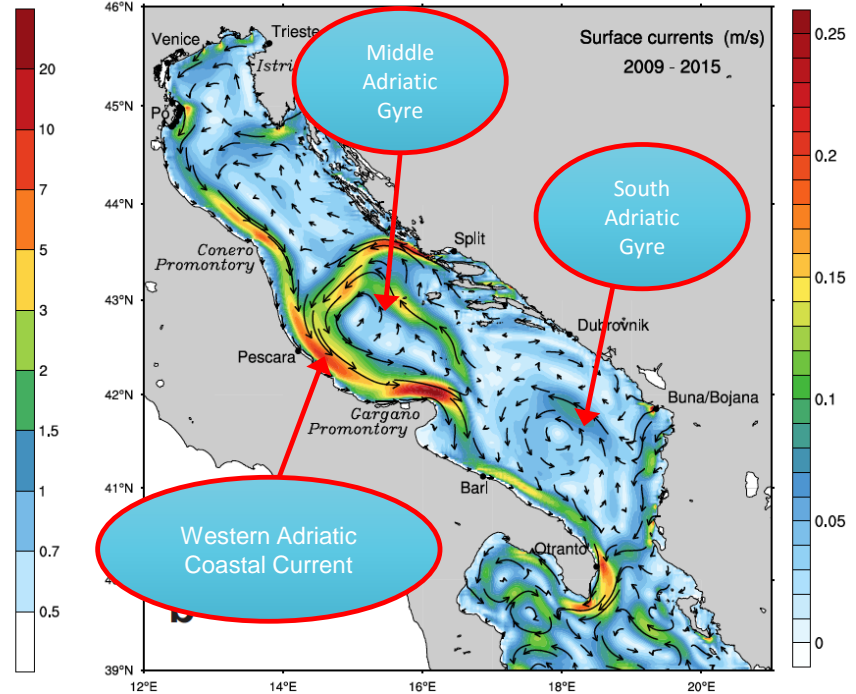
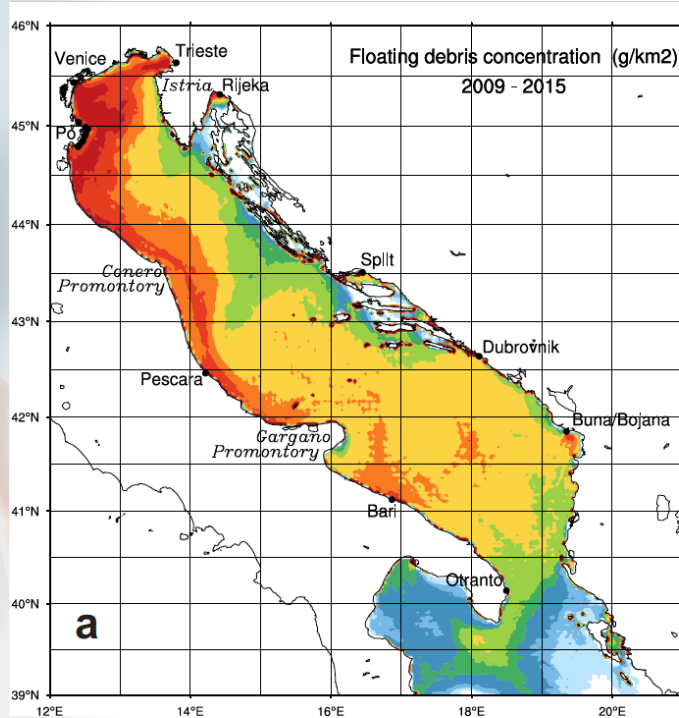
The Po Delta coastline receives  
the plastics' flux maximum of  
70.1 kg/(km·day)



User  
Uptake

# Plastic debris drift modeling: demonstration

## Connection between plastic concentration and ocean currents





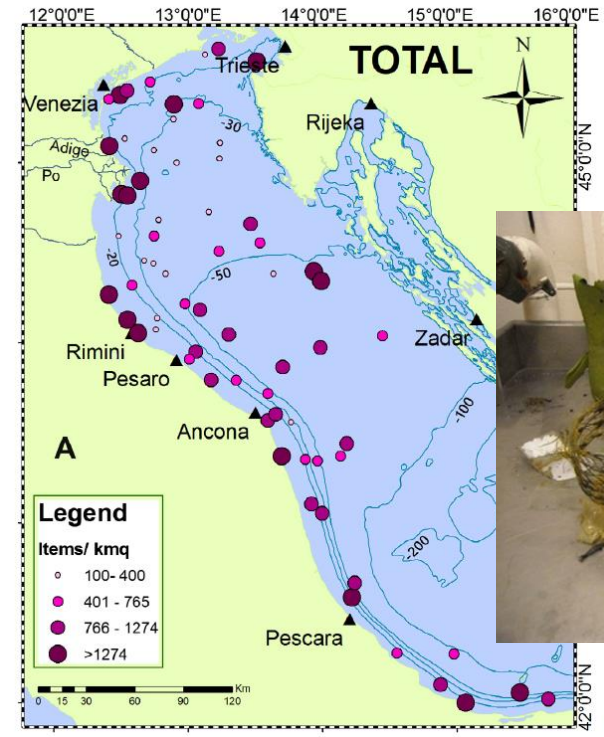




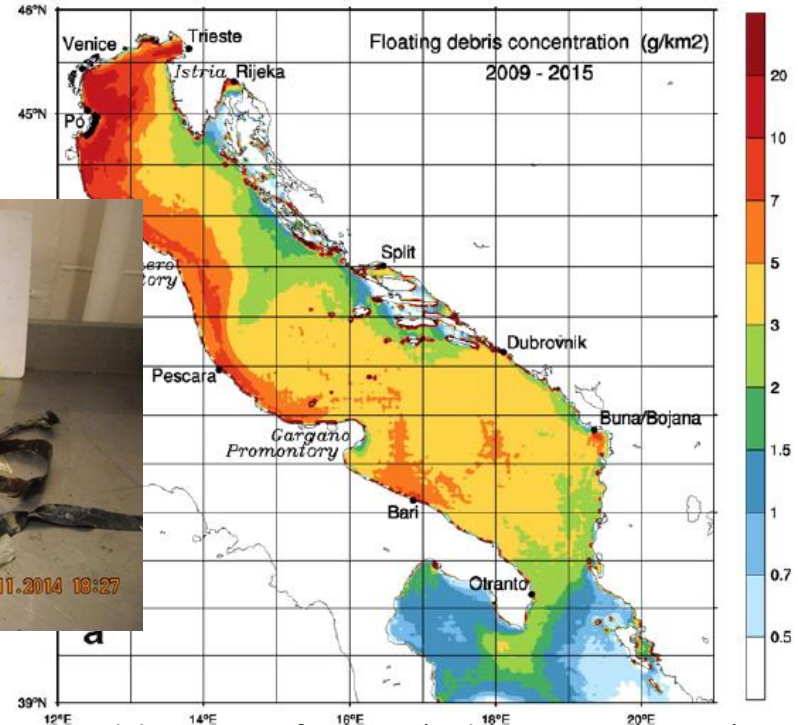
User  
Uptake

# Plastic debris drift modeling: demonstration

## Comparison with the field measurements



*In situ*: Benthic litter map (Pasquini et al., 2016)



Modeling: Sea surface map (Liubartseva et al., 2016)