Coastal pollution

Copernicus for Coastal Zone Management

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Space

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INTRODUCTION

User Uptake

Main responses from a multinational sample of 10 countries (n=10,106) to a qualitative question that asked individuals to state the three main marine environment matters.

Frequency of responses is illustrated by the size of the text, with pollution noted most often

reproduced from Buckley and Pinnegar (2011)

User Uptake

FACTS

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

Poseidon System — Monitoring, Forecasting and Information System for the Greek Seas

MED ESS 4MS

- Hazard mapping for operational oil spills

- Plastic debris drift modeling

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CMEMS Med-MFC data

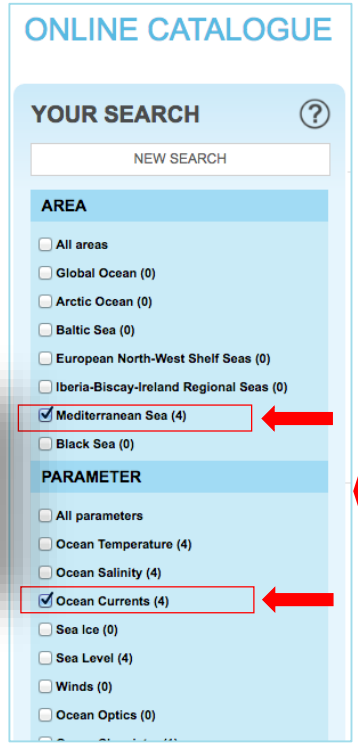
- Ocean currents (hourly forecasts, daily analyses) for calculation of the **oil spill** and **plastic transport**
- Sea surface temperature (hourly forecasts, daily analyses) for calculation of the oil weathering
- Mediterranean Sea physics as boundary conditions for nesting a high-resolution model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

Data: how to download the product

User Uptake

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

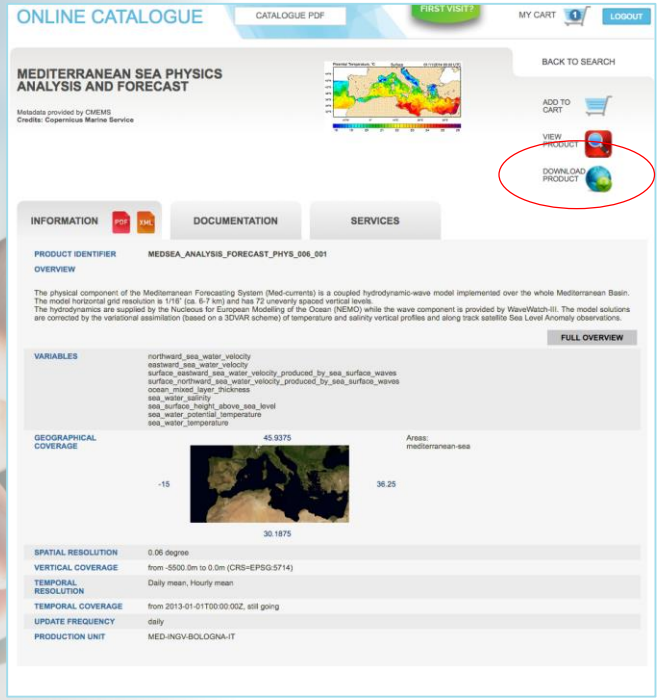
Select the area of interest and the parameter

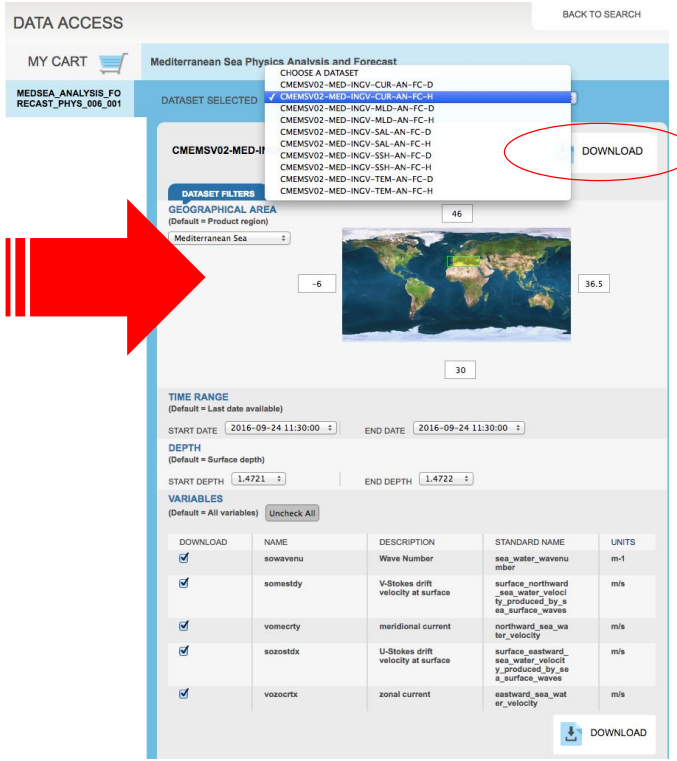


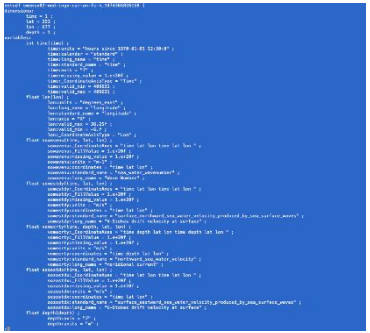
Data: how to download the product

User Uptake

Download the product with the user interface







Operational forecast of oil spill: methodology

User Uptake

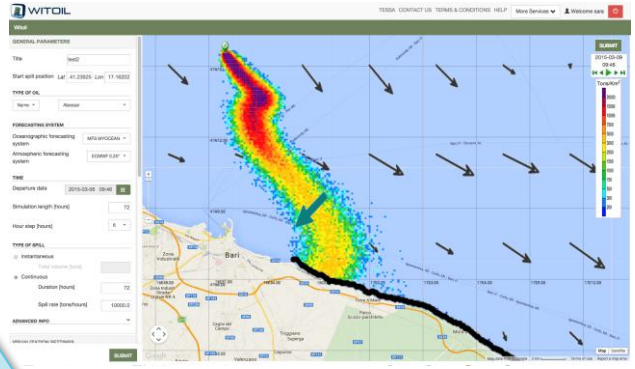
Ocean Currents hourly forecasts, daily analyses 1/16° x 1/16° horizontal resolution

ECMWF

Atmospheric wind 6 hrs - 12,5 km

MEDSLIK-II

Oil Spill forecast



MED ESS 4MS

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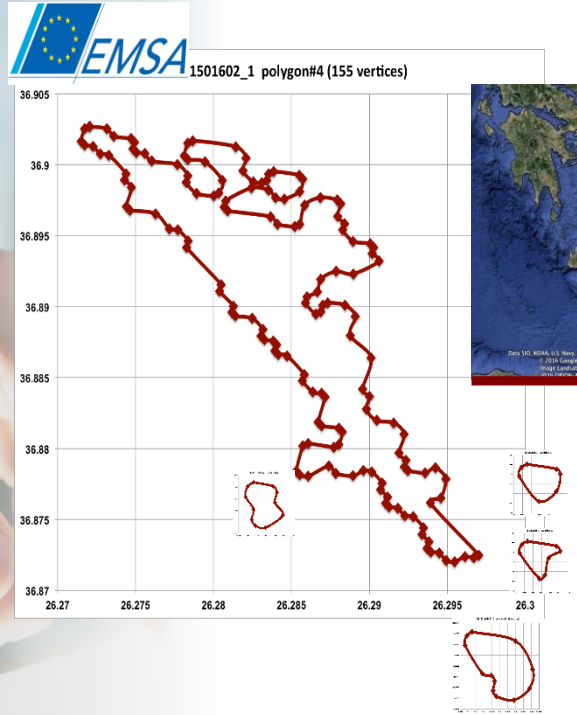
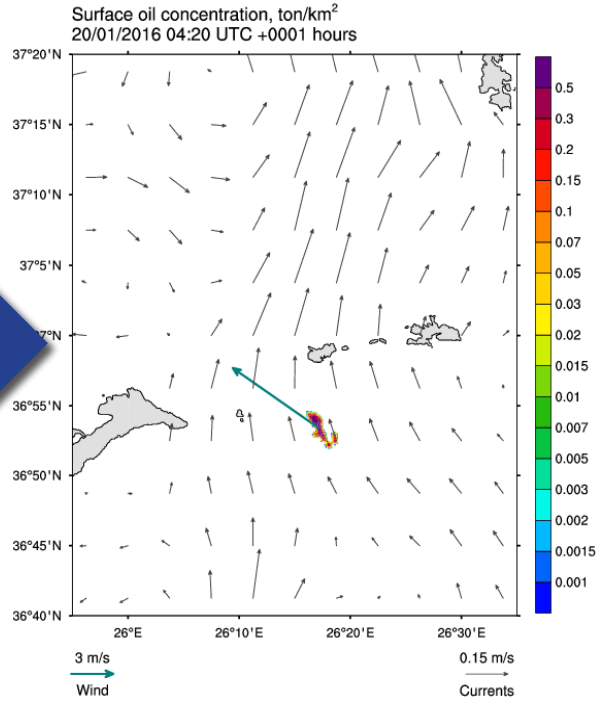
Operational forecast of oil spill drift: demonstration



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

Northward transport led to the oil contamination of Kinaros Island coastline (Greece)



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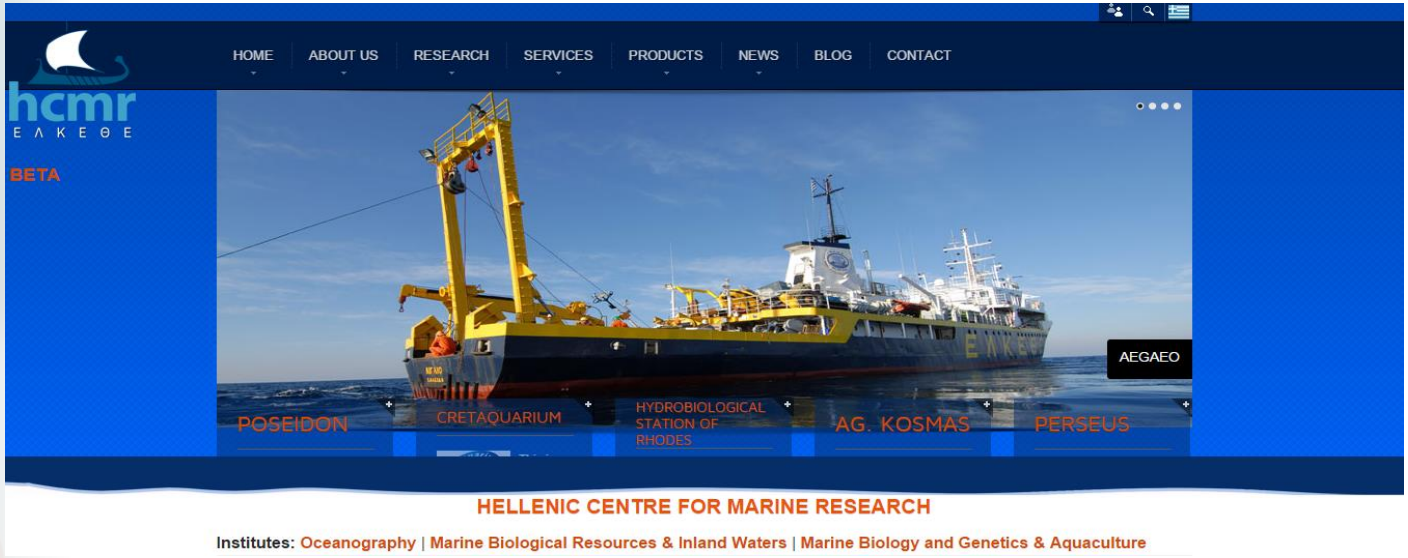
Hellenic Centre for Marine Research
HCMR - www.hcmr.gr



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

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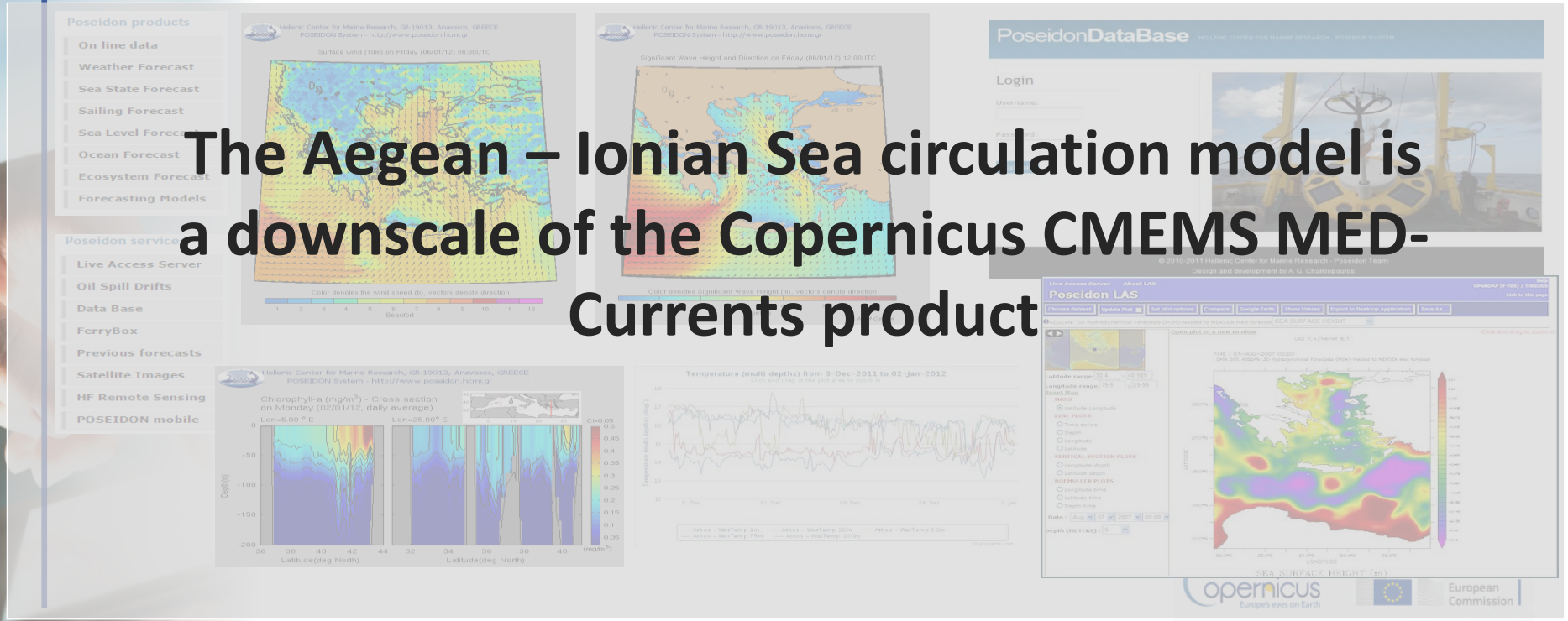
Hellenic Centre for Marine Research
HCMR - www.hcmr.gr

Poseidon System — Monitoring, Forecasting and Information System for the Greek Seas — hcmr ΕΛΚΕΘΕ

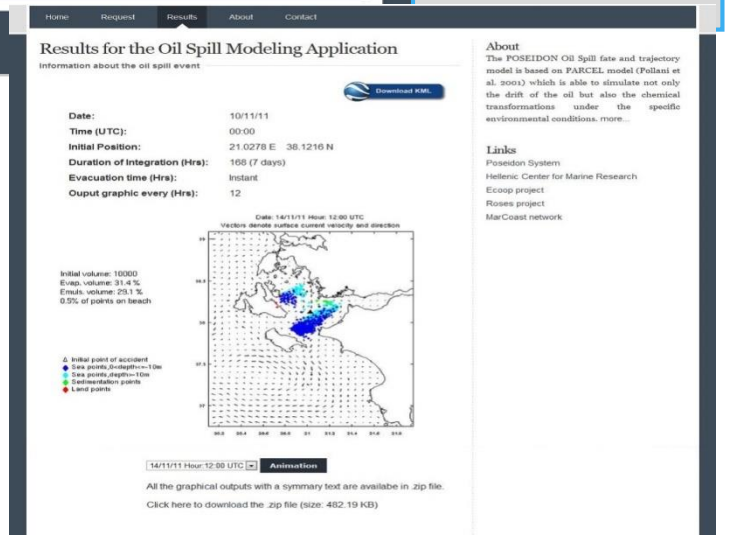
The Aegean – Ionian Sea circulation model is a downscale of the Copernicus CMEMS MED-Currents product



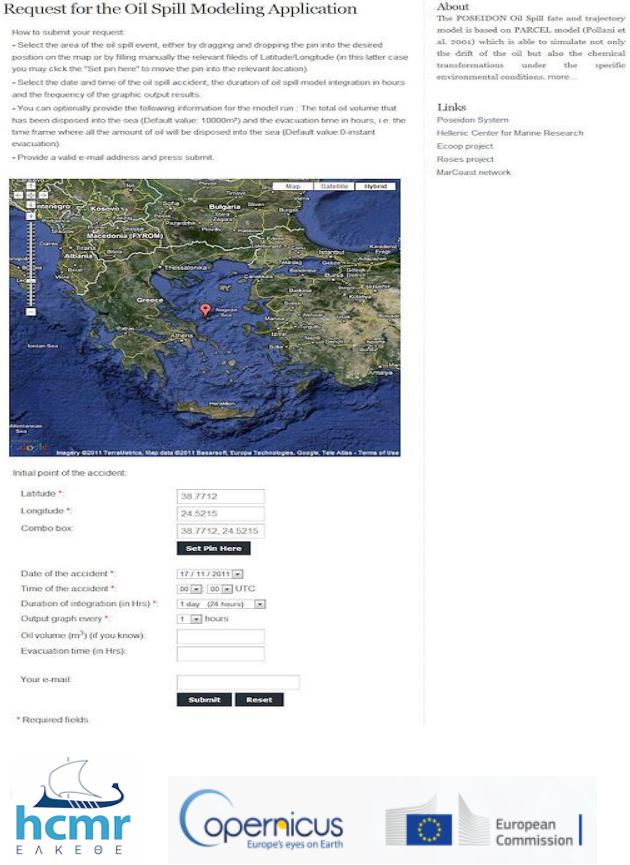
User Uptake

A Greek operational example: Poseidon Oil Drift Application

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.



POSEIDON Operational Oil-spill Model

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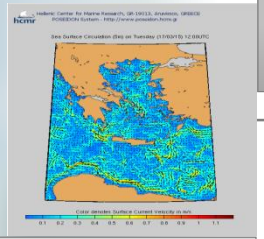
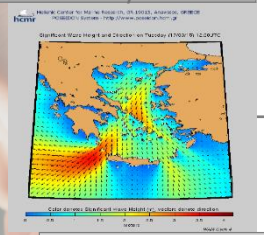
Downscaled from Copernicus CMEMS

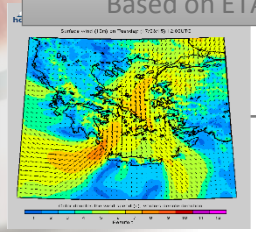
Hydrodynamic forecasts Based on POM



Wave forecast WAM Cycle 4



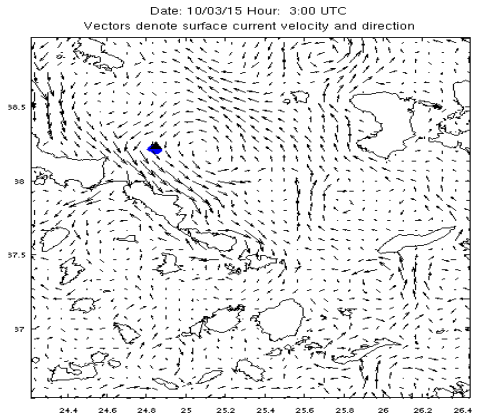
Weather forecast Based on ETA



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



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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)

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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.

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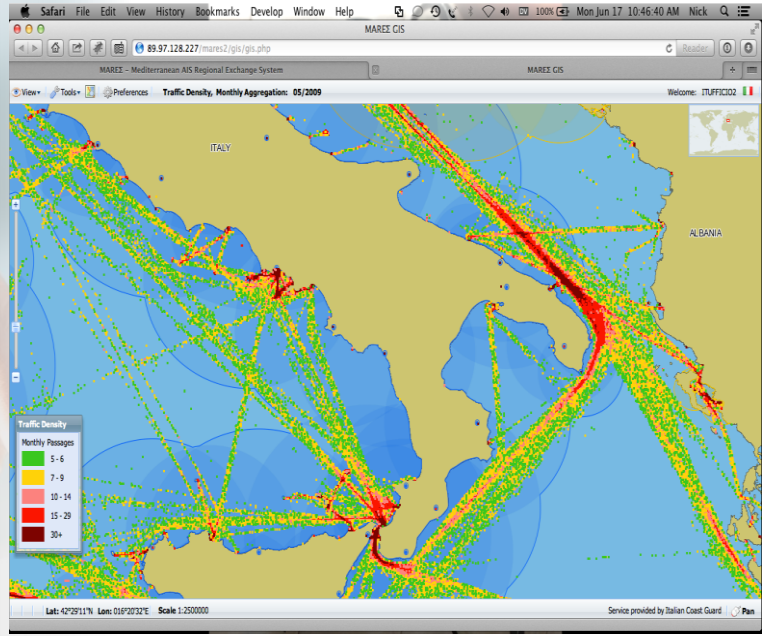
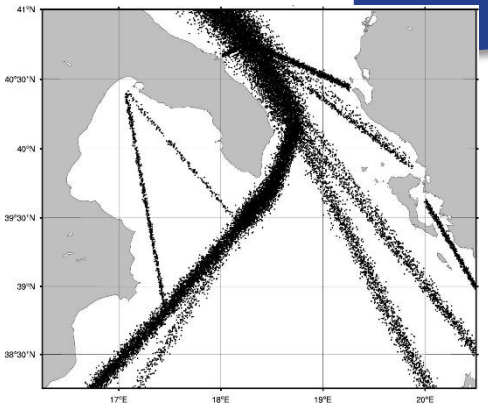
Hazard mapping for operational oil spills: methodology - the traffic density distribution

Digitizing the ship traffic maps provided by the Italian Coast Guard



Spill list 1.000.000 spills/month



Monthly Ship Traffic Maps provided by ITCG

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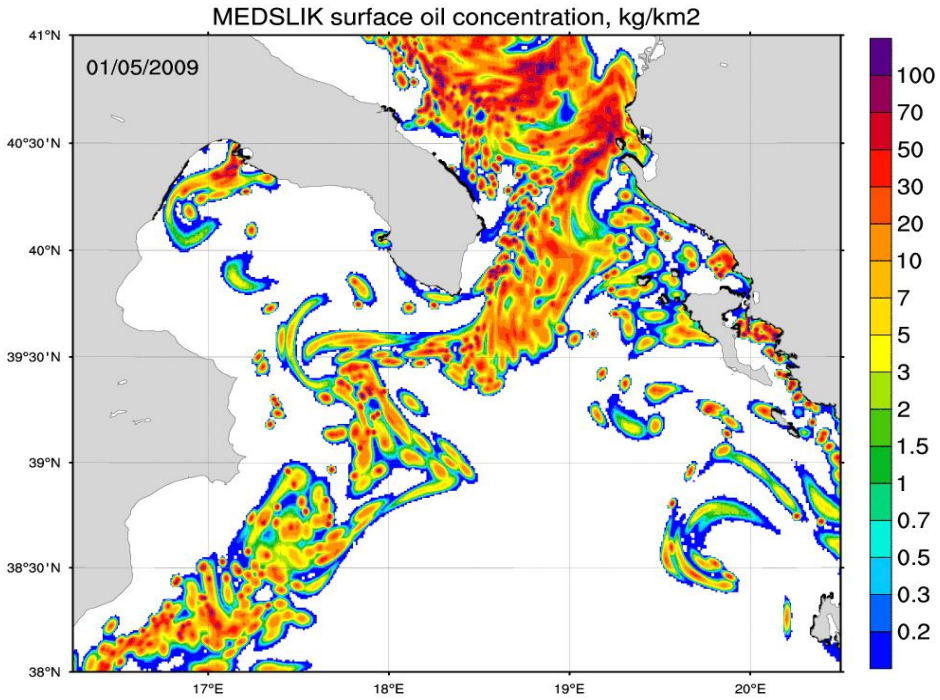
Hazard mapping for operational oil spills: methodology - the oil spill simulations



Hourly Surface Oil Concentration $C_{HOUR}(x,y)$ Maps

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Hazard maps for operational oil spills: demonstration

Marine Pollution Bulletin 90 (2015) 259–272

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Marine Pollution Bulletin

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

S. Liubartseva [a,*], M. De Dominicis [b], P. Oddo [b], G. Coppini [c], N. Pinardi [d], N. Greggio [e]

[a] Centro EuroMediterraneo sui Cambiamenti Climatici, Bologna, Italy
[b] Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy
[c] Centro EuroMediterraneo sui Cambiamenti Climatici, Lecce, Italy
[d] Department of Physics and Astronomy, University of Bologna, Italy
[e] Italian Coast Guard Headquarters, Ministry of Infrastructures and Transports, Rome, Italy

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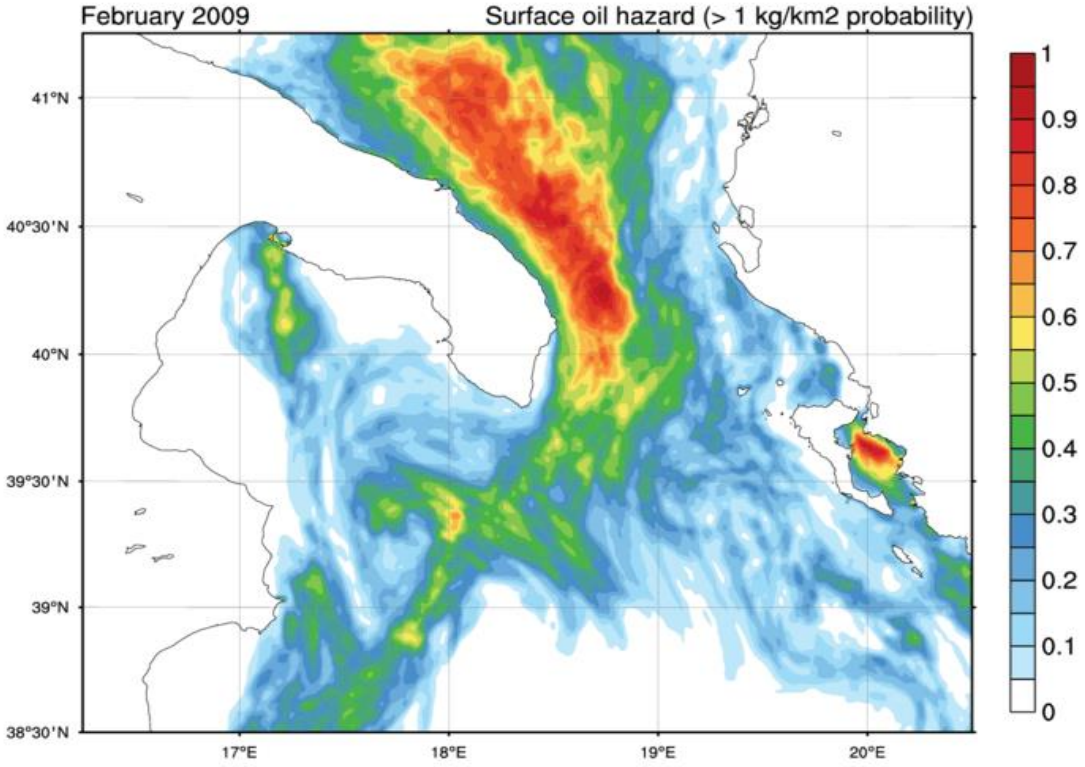
ABSTRACT

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 MEDSLIK-II, 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. Beached 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 Brindisi Port area.



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Hazard maps for operational oil spills: demonstration

At risk of chronic oil pollution: Marine Protected Areas

(1) **Capo Rizzuto MPA (Italy)**

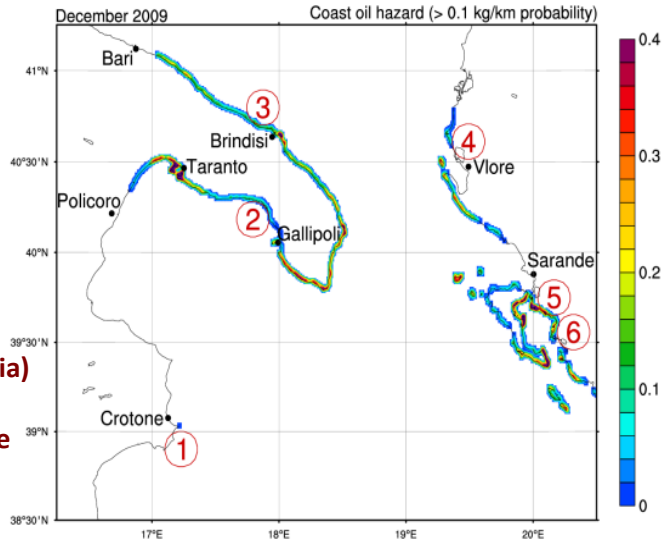
(2) **Porto Cesareo MPA (Italy)**

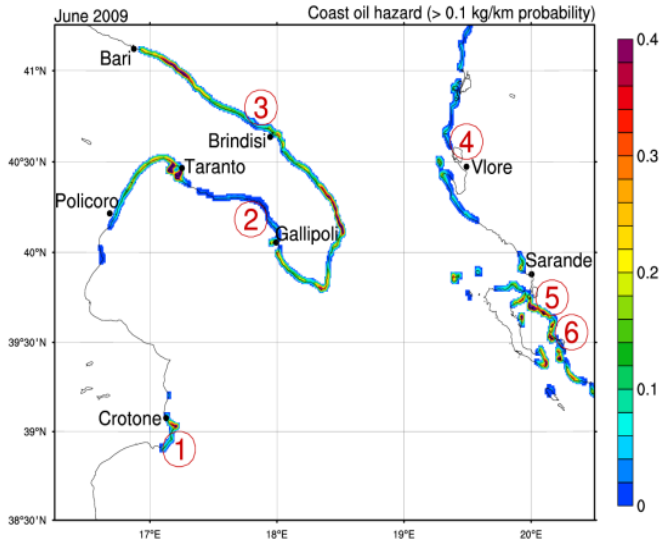
(3) **Torre Guaceto MPA (Italy)**

(4) **Vjose-Narte Landscape Protected Site (Albania)**

(5) **Butrinti National Park (Albania)**

(6) **Kalama Delta Natural Reserve (Greece)**





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Plastic debris drift modeling: methodology

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AFS daily
2.2 x
2.2 km

COPERNICUS · MARINE ENVIRONMENT MONITORING SERVICE
CMEMS
MEDITERRANEAN SEA
MFC
Contract MED-MFC
Until April 30 2018

MEDSLIK-II

ECMWF
6 hrs
25 x 25 km

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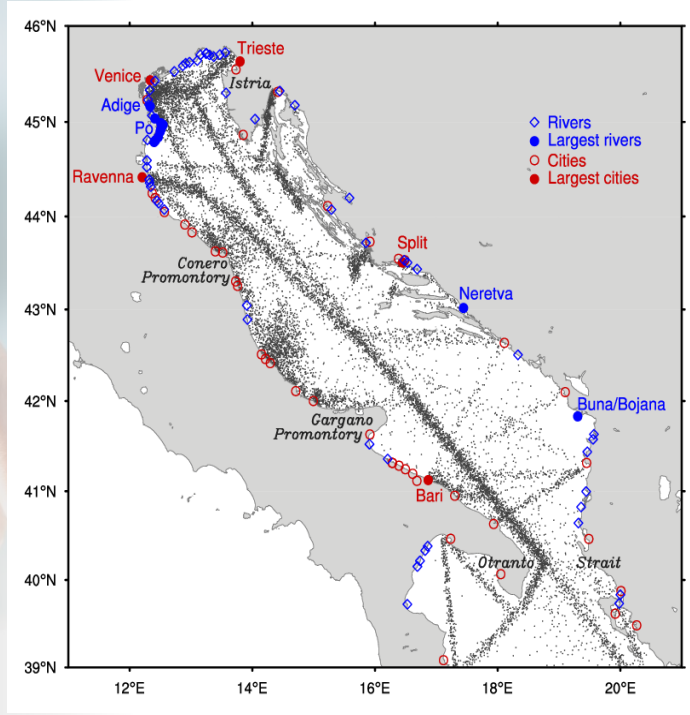
Plastic debris drift modeling: methodology

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

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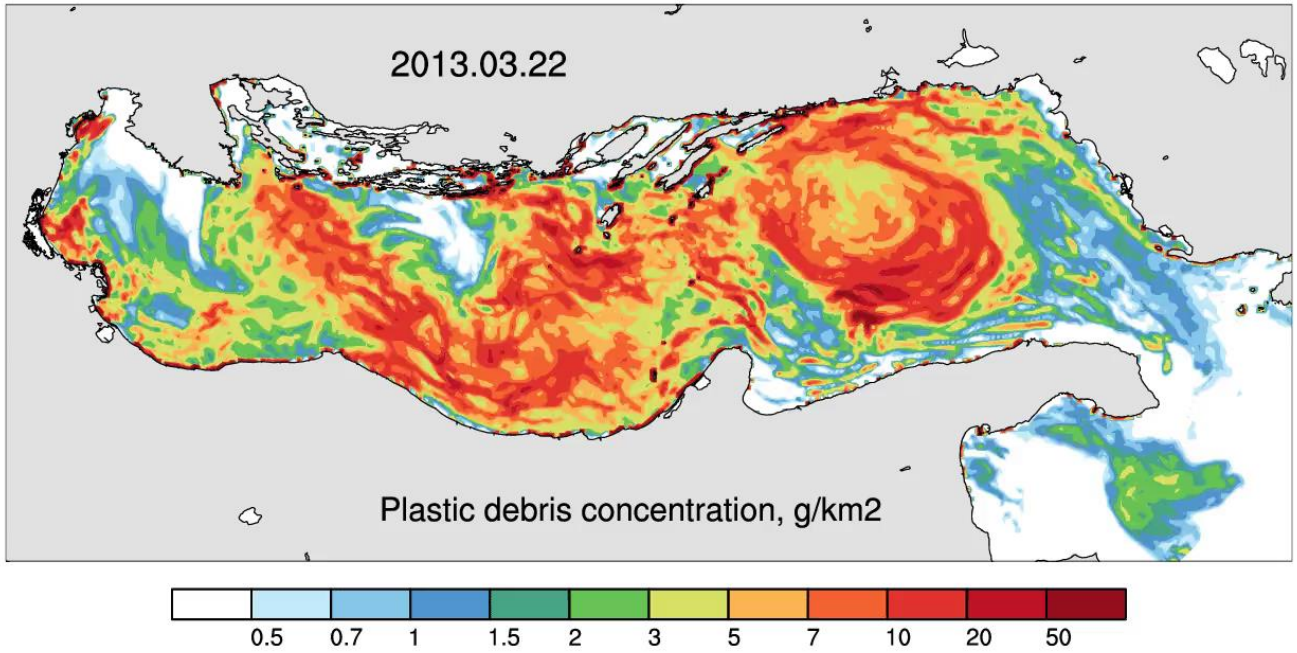
Plastic drift in the Adriatic Sea: demonstration

http://plastics.cmcc.it/files/DFG_suppl.mov



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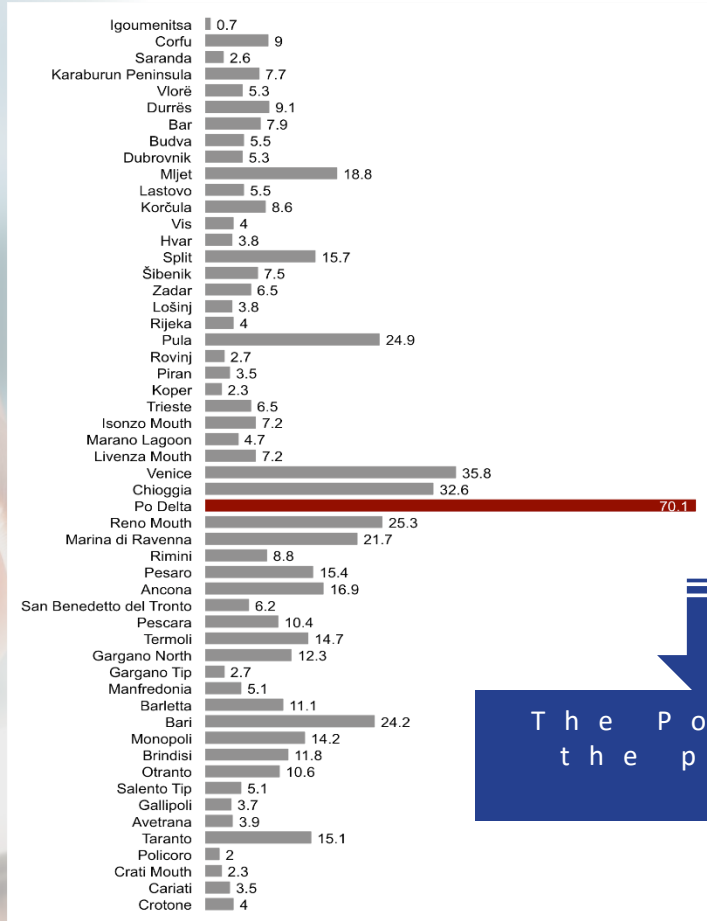
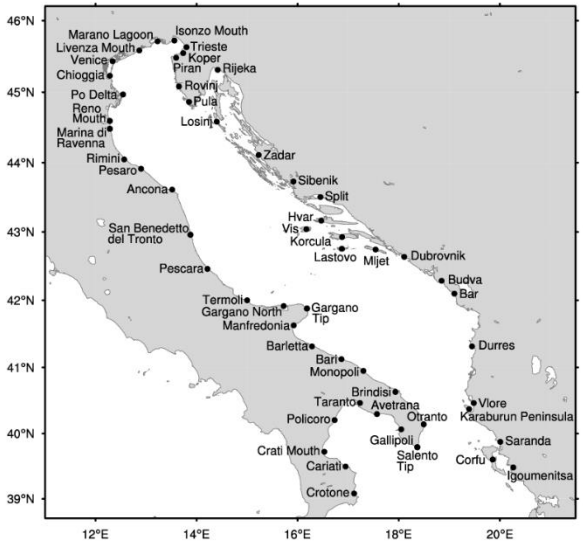
Plastic debris drift modeling: demonstration



Plastics' fluxes onto the coastline



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

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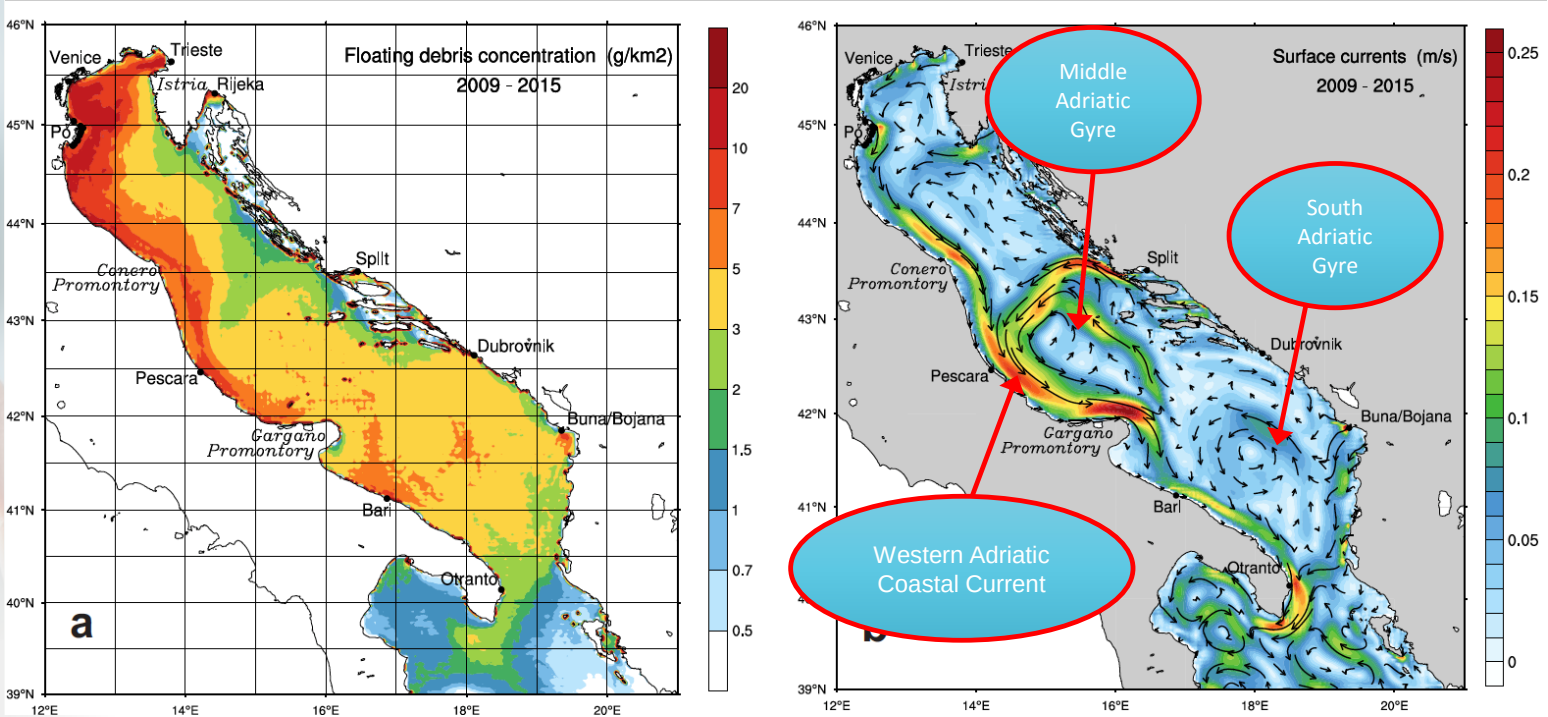
Plastic debris drift modeling: demonstration

Connection between plastic concentration and ocean currents



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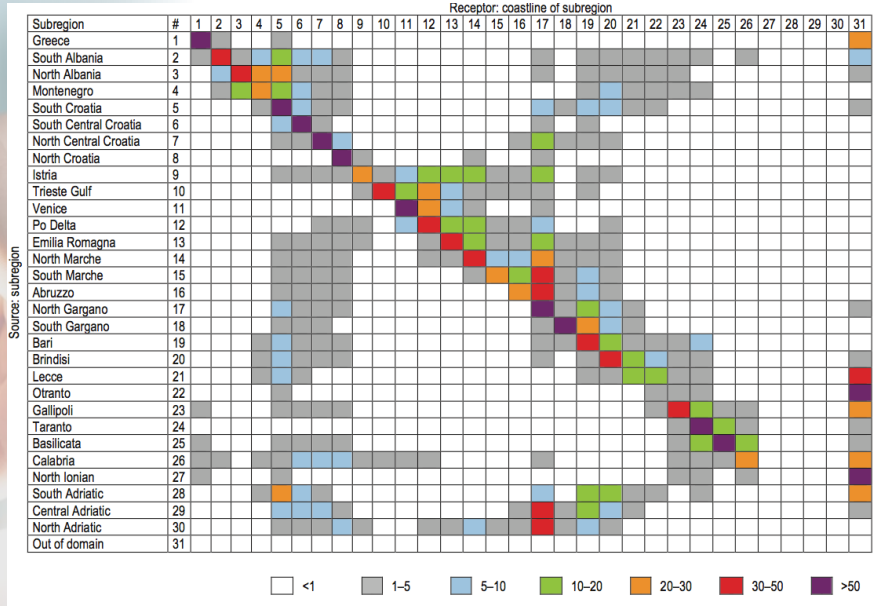
Plastic debris drift modeling: demonstration

Impact matrices for quantification of the regional inter-connections



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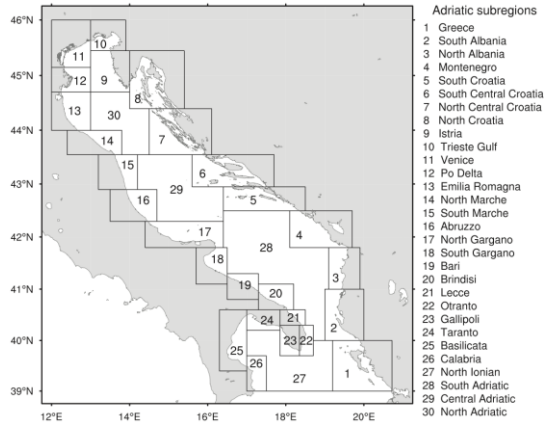
journal homepage: www.elsevier.com/locate/marpolbul

Regional approach to modeling the transport of floating plastic debris in the Adriatic Sea

S. Liubartseva [a,*], G. Coppini [b], R. Lecci [b], S. Creti [b]

[a] Centro EuroMediterraneo sui Cambiamenti Climatici, Bologna, Italy
[b] Centro EuroMediterraneo sui Cambiamenti Climatici, Lecce, Italy



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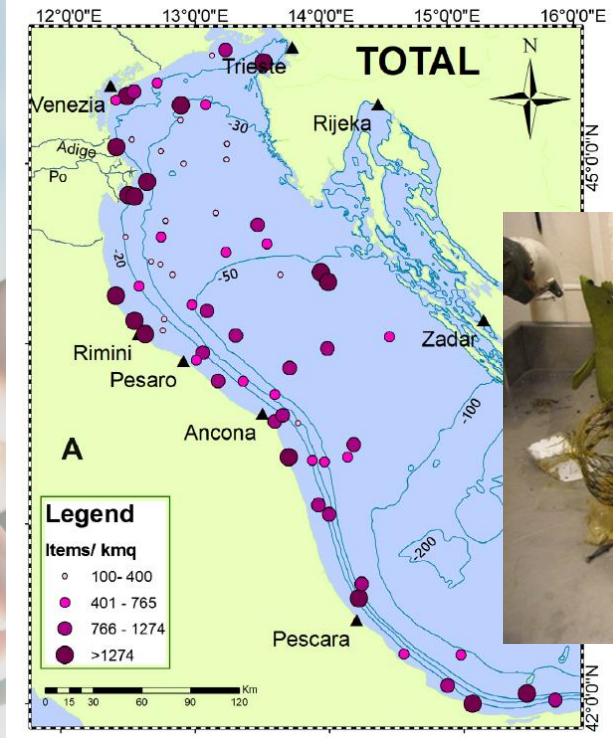
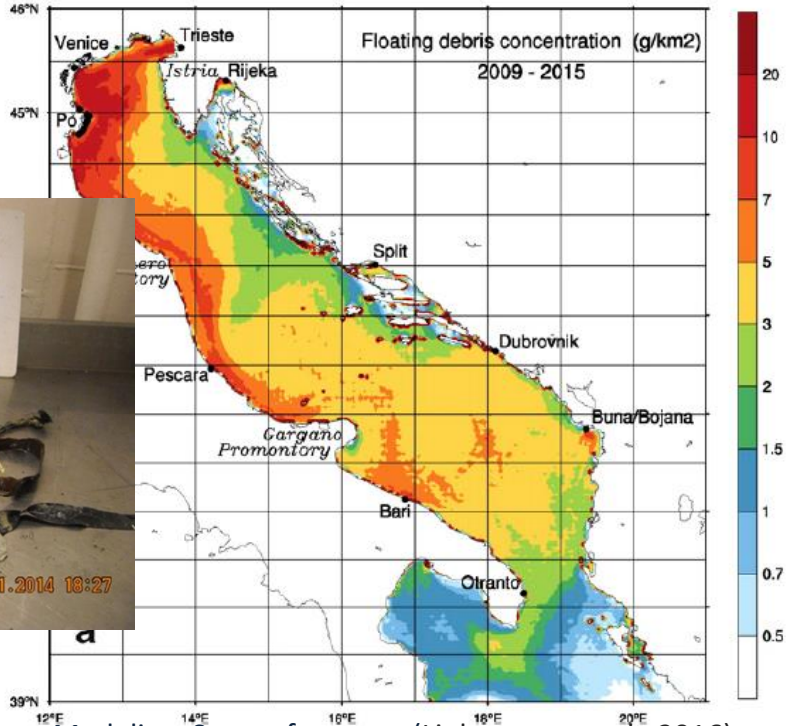
Plastic debris drift modeling: demonstration

Comparison with the field measurements





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

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

DeFishGear

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