Oil spill modeling and related topics: summary of recent activities

FIRESPILL | ARPA FVG (PP 11) | Massimo Bagnarol

Internal meeting | Palmanova | 05.08.2021

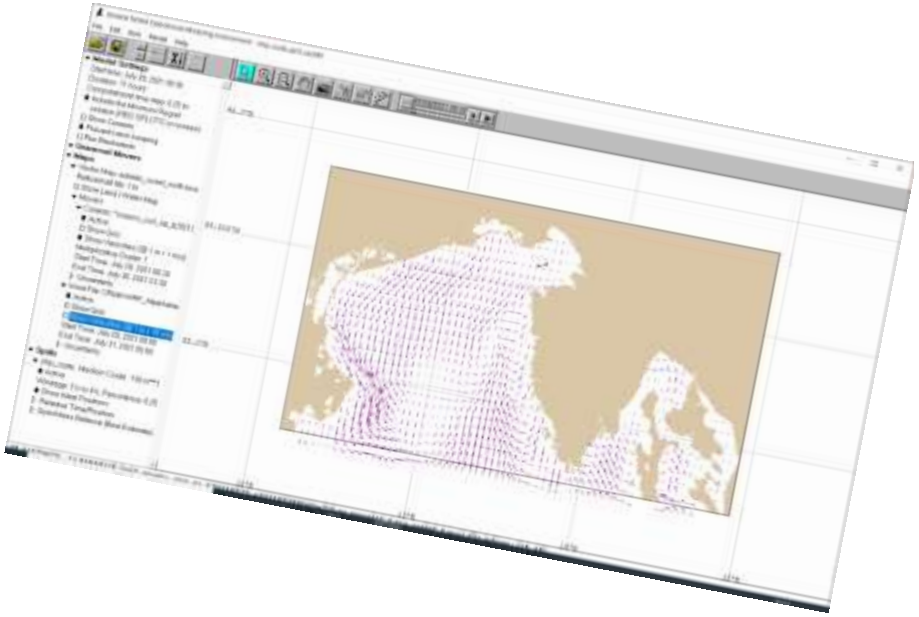
European Regional Development Fund

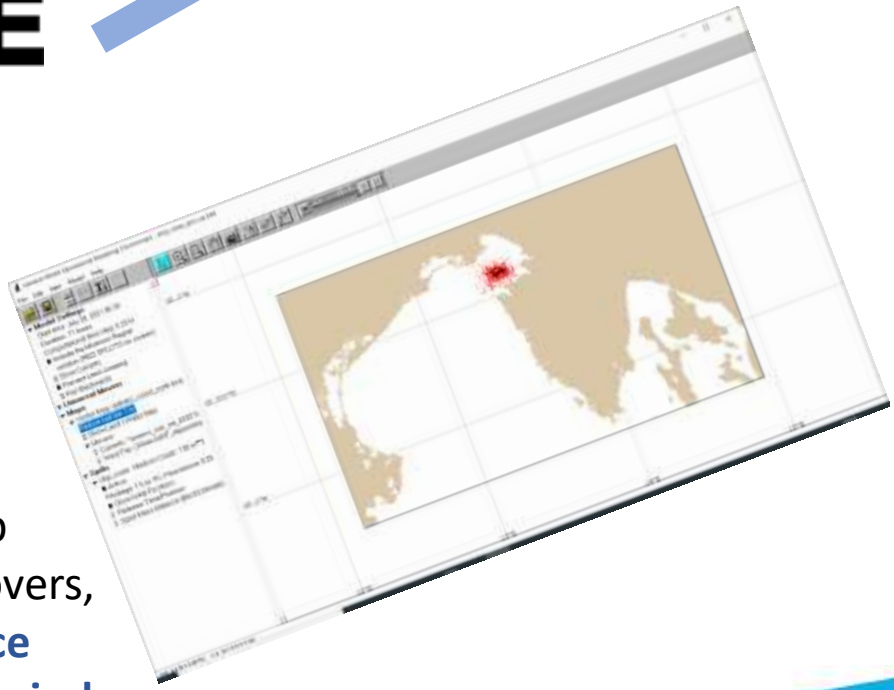
Model for oil-spill emergency response: GNOME

2D Eulerian/Lagrangian model

GNOME

GUI desktop version





Needed inputs:

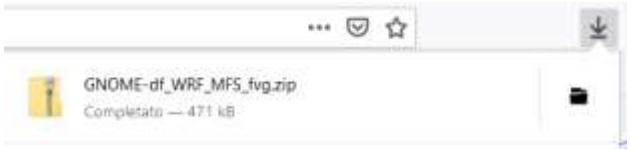
- **coastline** map
- data of oil movers, such as **surface currents and winds**
- **spill** details

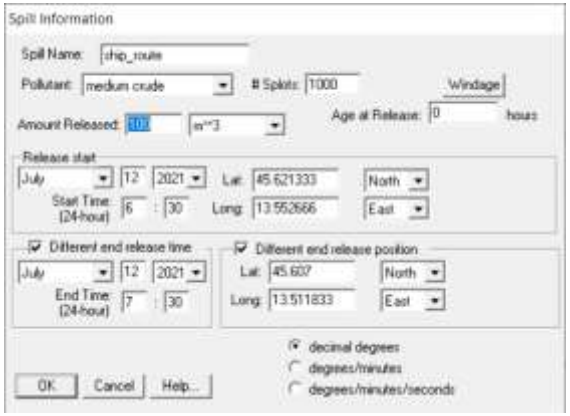
Interreg Italy - Croatia FIRESPILL
European Regional Development Fund

EUROPEAN UNION

ARPA FVG
AGENZIA REGIONALE PER LA PROTEZIONE DELL'AMBIENTE DEL FRIULI VENEZIA GIULIA

Support to oil-spill emergencies





Data processing for GNOME: CMEMS currents

INPUT DATA

Content: **current velocity fields**

Format: **NetCDF**

Type: both **forecast (3D)** and **reanalysis (2D)**

Model: **MFS** by CMCC

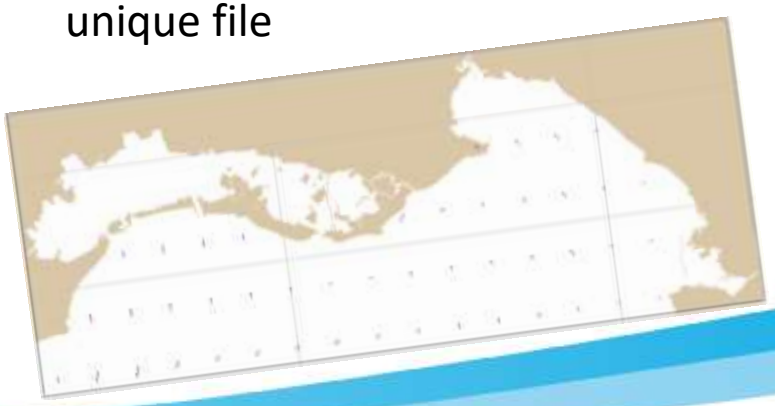
Horizontal resolution: **1/24°** (ca. 4 km)
Vertical resolution: **141 levels for forecast**

Temporal resolution: **1 h**

FOR GNOME

Operations to do:

- **data cut** to retain only those relevant to the sea surface and to the area of interest
- **time axis shift**
- **variable renaming** and **attribute change** to be compliant with GNOME standard
- **merging** of single-day datafiles into a unique file



Data processing for GNOME: WRF winds

INPUT DATA

Content: **wind velocity fields at 10 m**

Format: **NetCDF**

Type: **analysis**

Model: **WRF** at ARPA FVG - CRMA

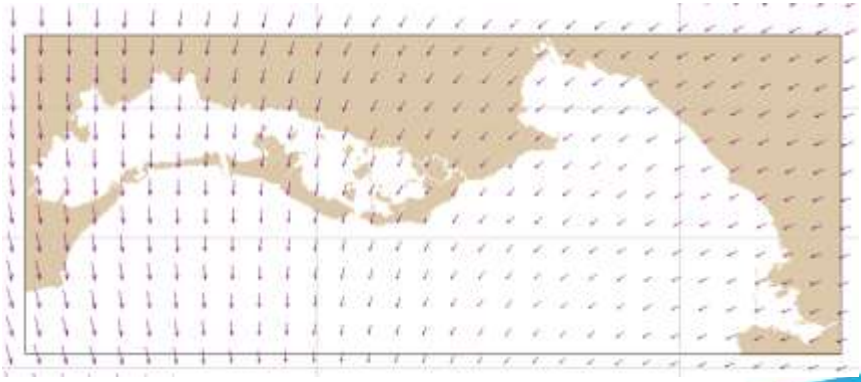
Horizontal resolution: **2 km for AlpeAdria**
10 km for Italy

Temporal resolution: **1 h for AlpeAdria**
3 h for Italy

FOR GNOME

Operations to do:

- **merging** of files contaning data of a single component
- **variable renaming** and **attribute change** to be compliant with GNOME standard



Data processing for GNOME: SHYFEM currents

INPUT DATA

Content: **current velocity fields**

Format: **SHY**

Type: both **hindcast** and **forecast**

Model: **SHYFEM** at ARPA FVG - CRMA

Horizontal resolution: **variable**, up to **tens of meters** in the lagoon
Vertical resolution: **variable**

Temporal resolution: **1 h**

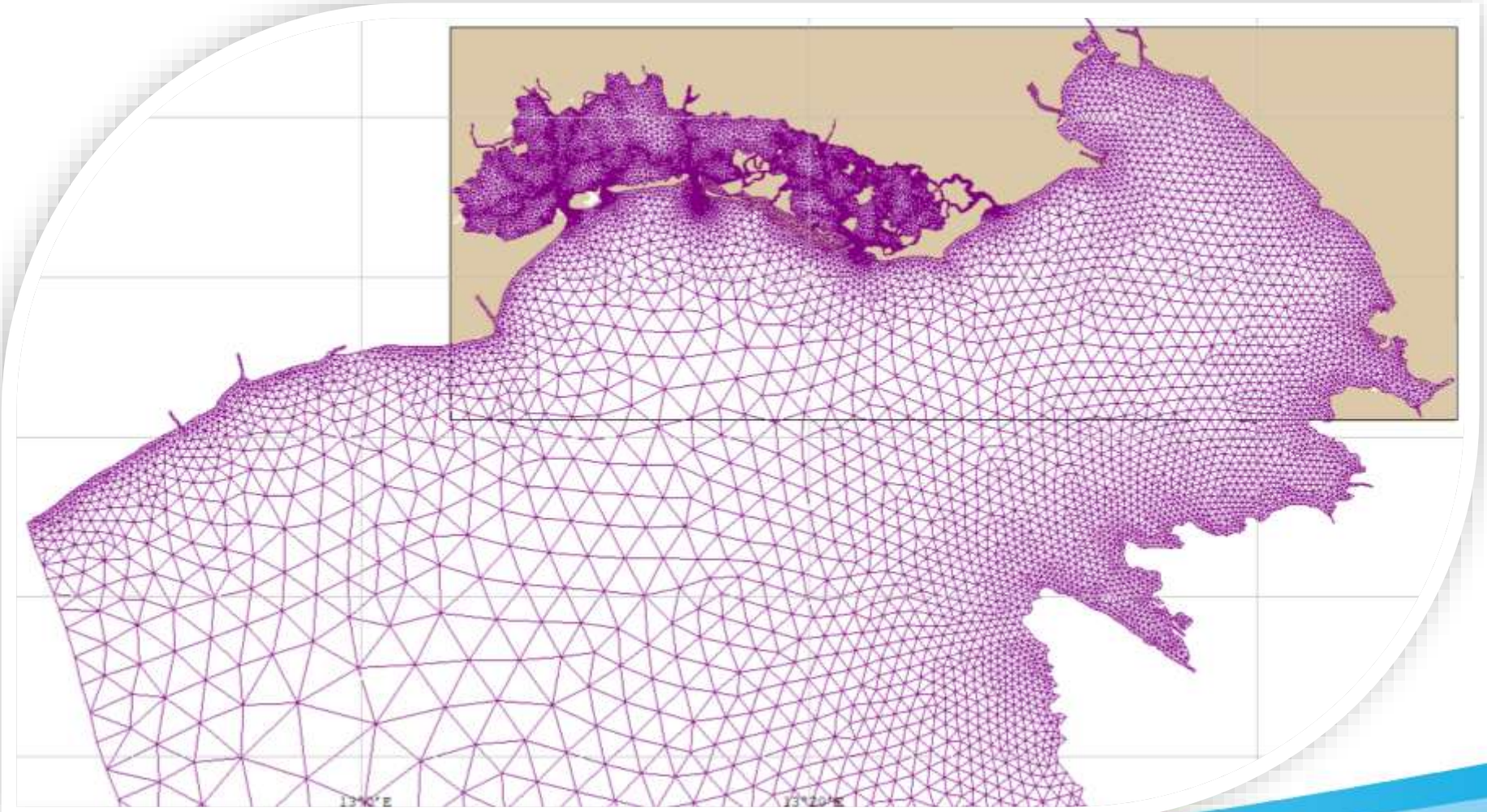
FOR GNOME

Operations to do:

- **conversion from SHY to NetCDF** to be loadable by GNOME
- **extraction of grid boundary** nodes and lines, and **classification** of boundary lines
- **insertion of** a **new variable** in the NetCDF file, with information about boundary lines
- **variable renaming** and **attribute change** to be compliant with GNOME standard
- **data cut** to retain only those relevant to the sea surface

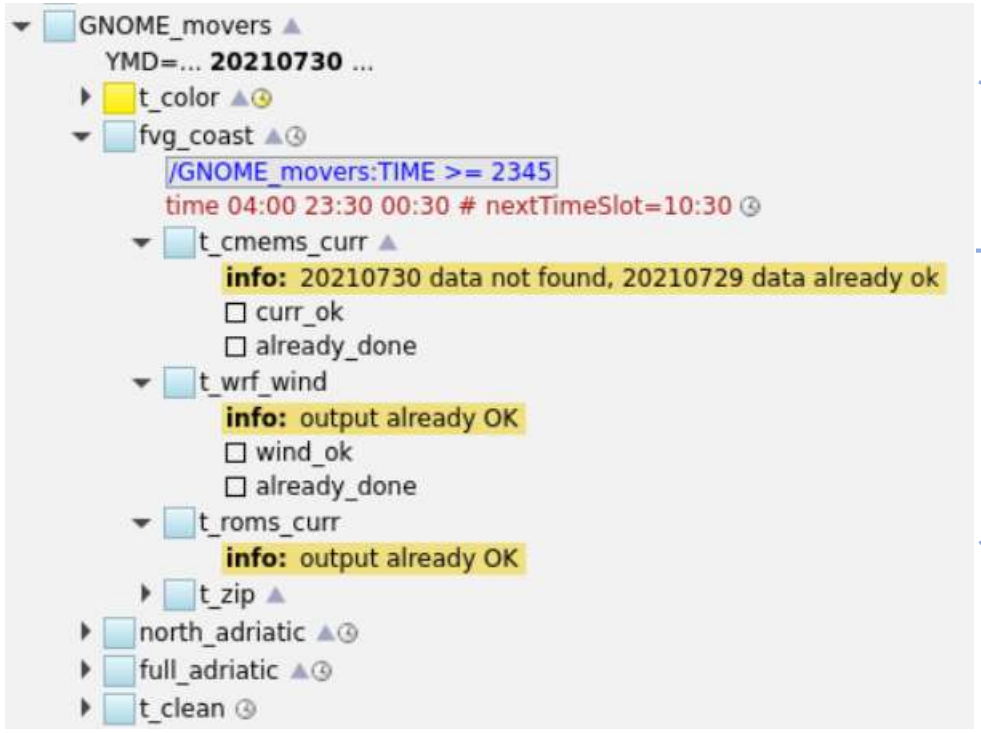
NB: joint work with A. Minigher

SHYFEM grid as viewed via GNOME



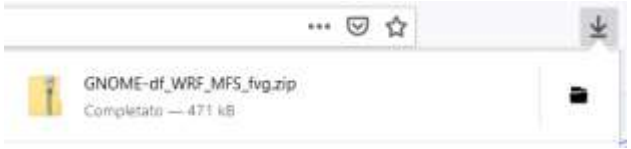
Daily processing of forecast data

Work flow is managed by ***Gnome_movers*** **ecFlow suite**



Availability of daily GNOME inputs to external users

Zip archive



Public access **webpage**

Act 4.3 OIL SPILLS AND OTHER MARINE HAZARDS PILOTS DEPLOYMENT
Start date: 01/02/2021
End date: 30/06/2022

Activities refer to the development of methodology for risk assessment for oil spills in the Adriatic Sea providing data collection on maritime traffic, possible sources of pollution, exposure, environmental sensitivity, impacts on human life, environment and economy etc. Simulation of oil spill scenarios using oil spill trajectory models for tracking the movement of the oil slick, and oil spill dispersion model for predicting possible impacts to the environment are foreseen. Capitalization of existing simulation models for oils spills and its upgrade with new functionalities will be available to all partners through web interface and interoperable services and development of oil spill operational prototype and hazard mapping capacities relevant for all partners. Equipment to act in case of oil spills and other marine hazards will be improved, as well as specialized exercises and simulations for coast guards and civil protection units thus increasing their level of preparedness.

Deliverable

D.4.3.1 - N° 1 Pilot deployment of "Oil spills and other marine hazards" Pilot deployment of "Oil spills and other marine hazards" will consist of:

- N° 1 Methodology/guidelines for risk assessment for oil spills in the Adriatic Sea developed (PP4)
- N° 1 Oil spill operational prototype and hazard mapping capacities developed (PP5)
- N° 2 Enhanced simulation models for oils spills and other marine hazards (PP5, PP11)
- N° 5 Specialized exercises implemented (with usage of personal protective equipment and specialized equipment(floating booms, boats, drones,...) (1 exercise per PP)

Contribution to **deliverable 4.3.1** of FIRESPILL project

Model for oil-spill risk assessment: pyGNOME

pyGNOME

GNOME

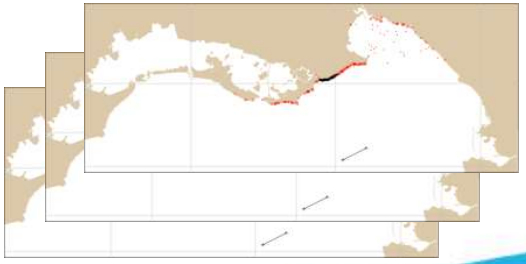
GNOME + new features

Simulation tests

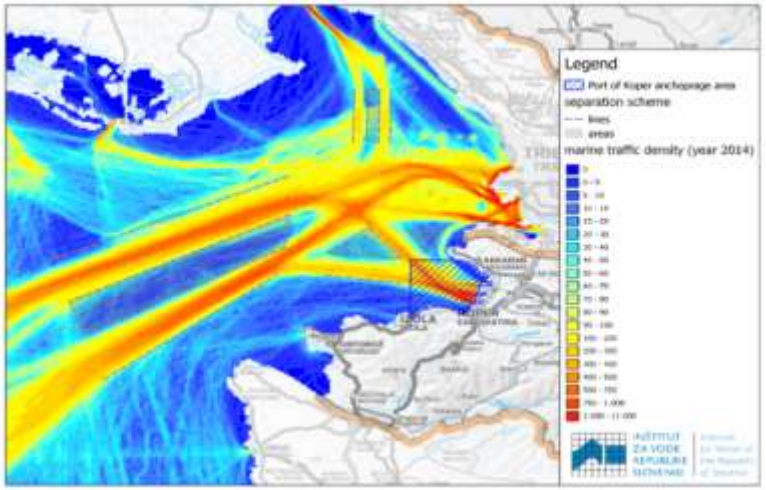
Can be installed on C3HPC cluster

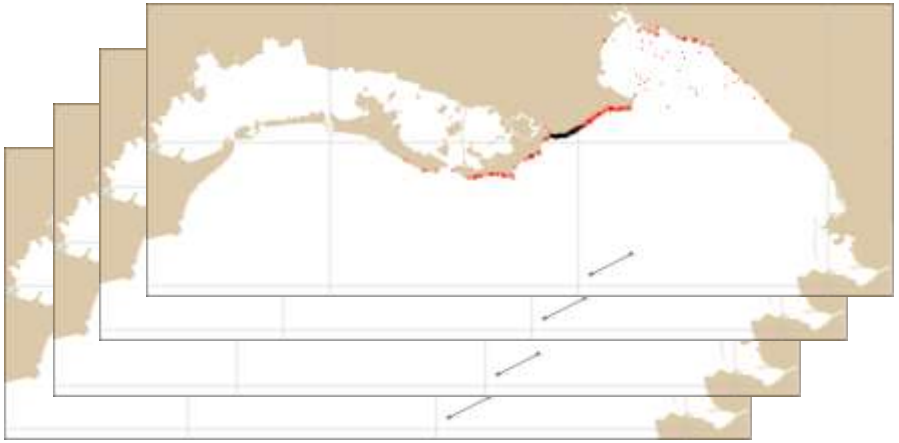
Python scripting

Suitable to run many simulations



Planned activities for risk assessment (1)

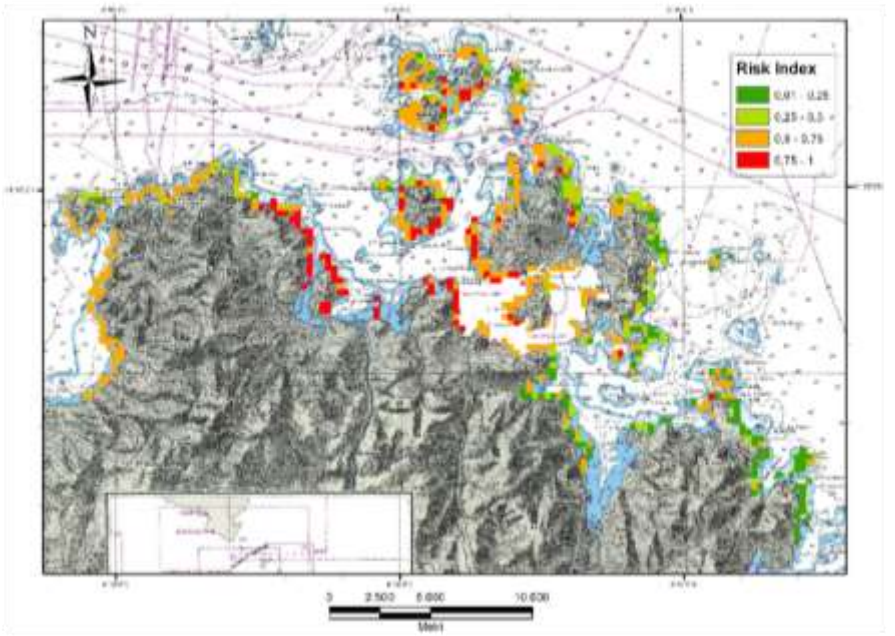




1. **Identification of** possible **sources**, for instance by means of the analysis of shipping routes

2. For each source, **simulations of hourly occurrence of an oil spill** for a whole year

Planned activities for risk assessment (2)



3. **Output** analysis and interpretation

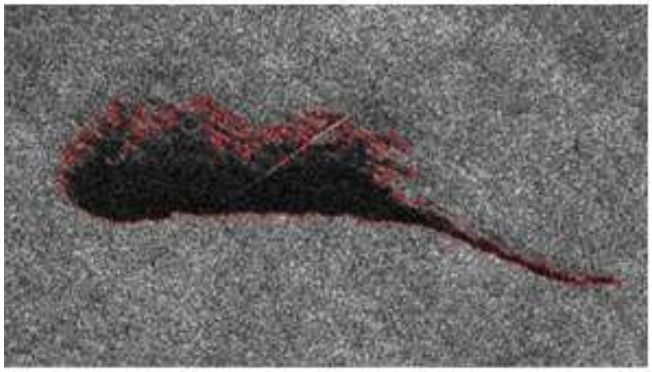
4. **Risk maps**

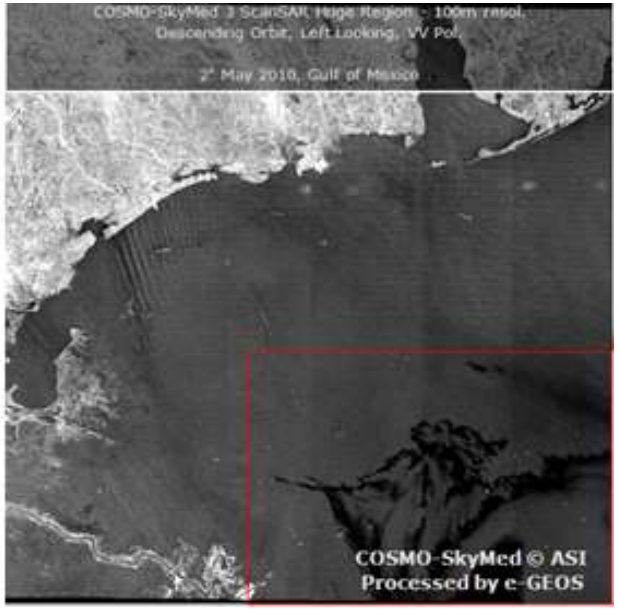
Complementary activities

Model validation via **remote sensing** tools

costeLAB

Pre-operative platform for monitoring coastal areas through **satellite image** processing





Communication to stakeholders

Presentation of pilot concepts to target groups

Deliverable 4.1.2

What's next?

Adding daily **SHYFEM forecasts** for emergency response with GNOME

Proceeding with oil-spill **risk assessment**

Using **STELLA** software for system dynamics modeling

Introducing **MEDSLIK-II** model

References

Interreg IT-HR FIRESPILL: https://www.italy-croatia.eu/web/firespill

ARPA FVG – FIRESPILL: http://www.arpa.fvg.it/cms/istituzionale/servizi/progetti_europei/firespill.html

GNOME driving forces webpage: http://interreg.c3hpc.exact-lab.it/FIRESPILL/gnome_inputs/gnome_inputs.html

GNOME model: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/response-tools/gnome.html

pyGNOME: https://gnome.orr.noaa.gov/doc/pygnome/index.html

MEDSLIK-II model: http://www.medslik-ii.org/

CMEMS: https://marine.copernicus.eu/

WRF model: https://www.mmm.ucar.edu/weather-research-and-forecasting-model

SHYFEM model: https://sites.google.com/site/shyfem/home

costeLAB platform: https://www.costelab.it

Contacts

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