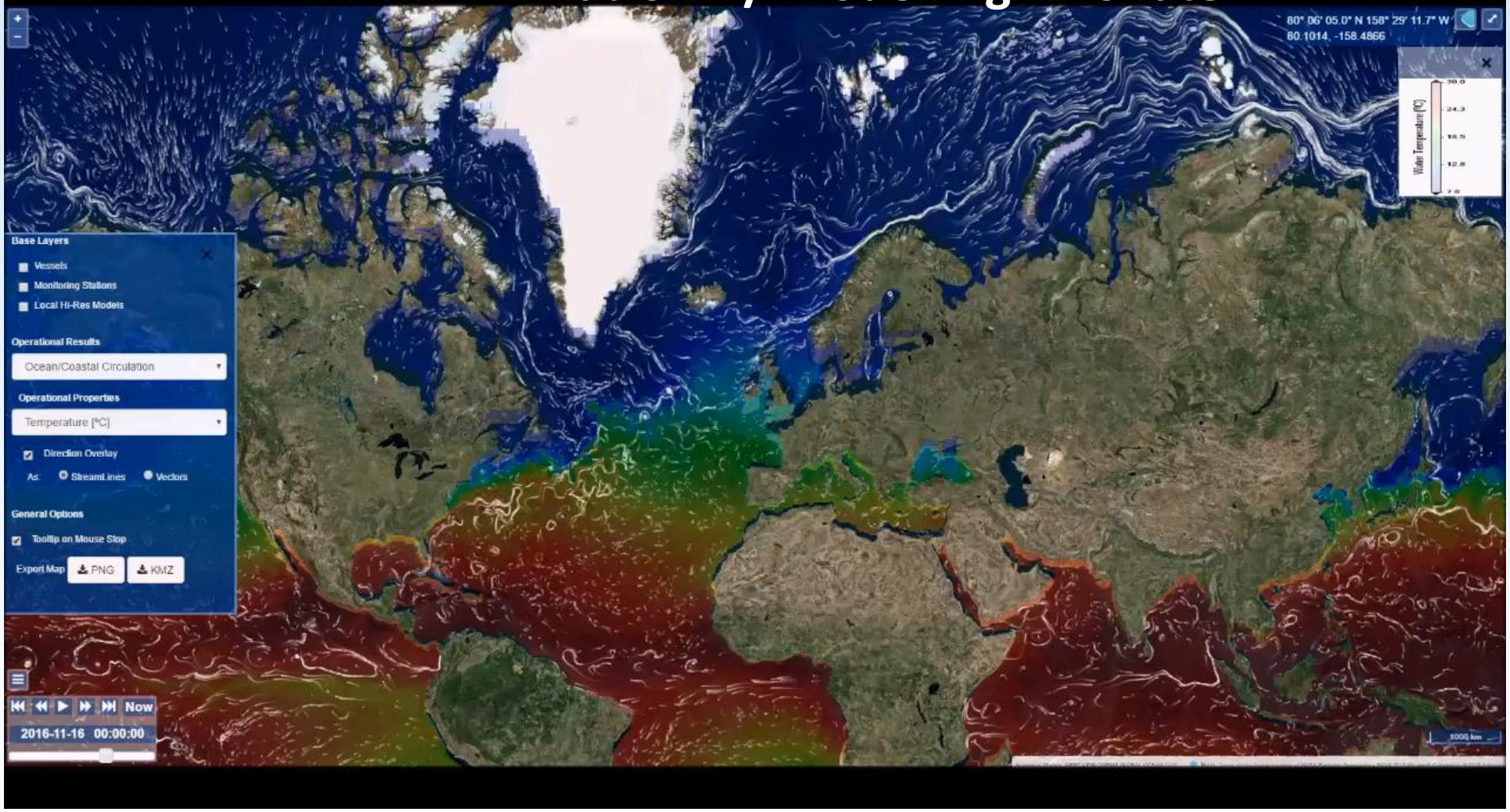
MARINER Platform / Modelling HNS fate



Rodrigo Fernandes, David Brito, Frank Braunschweig - Bentley Systems

Pedro Montero - INTECMAR

Bentley® Advancing Infrastructure

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Bentley Systems

- Global leading company in infrastructure and engineering software development

Bentley®

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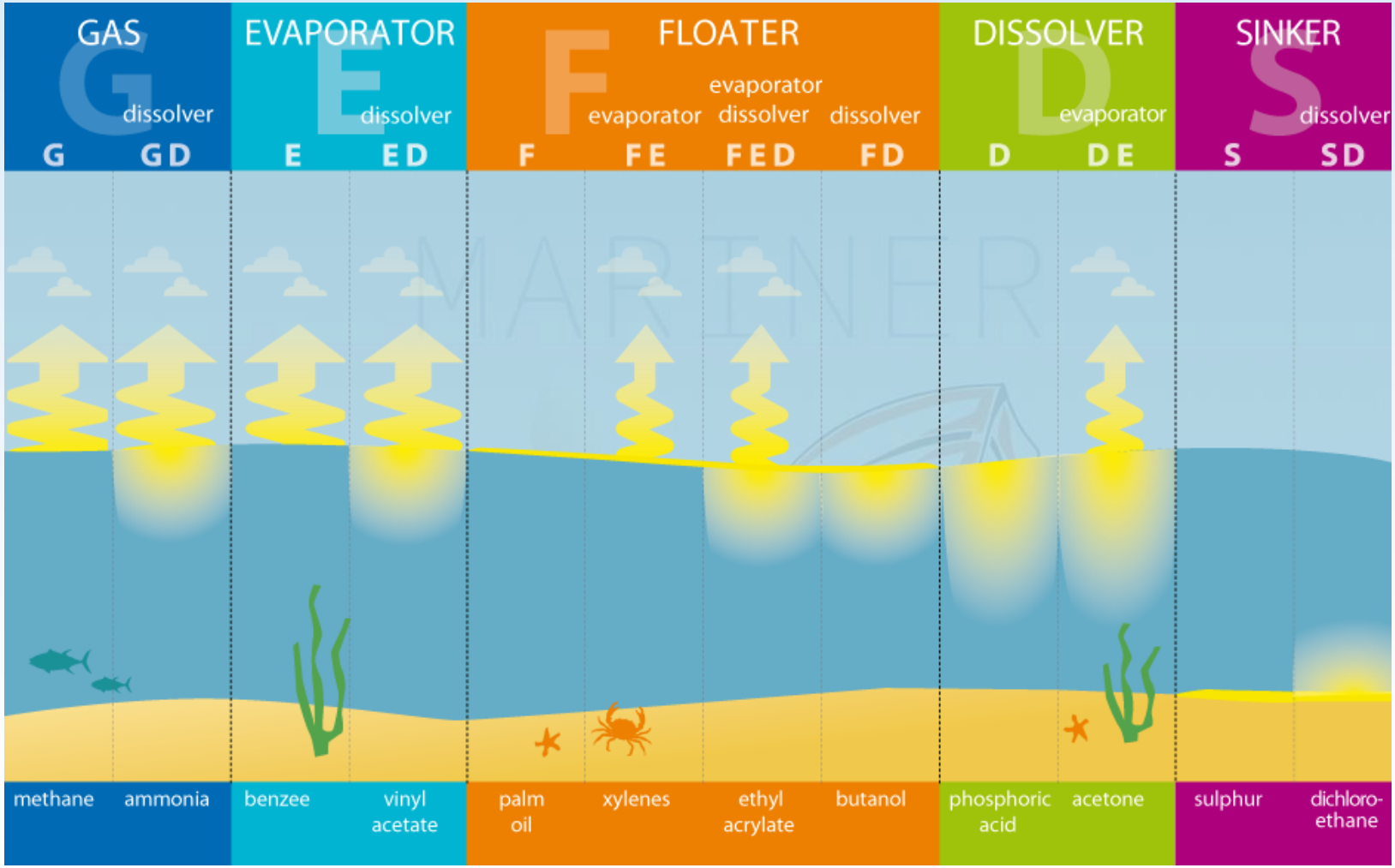
HNS: behaviour classes



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HNS: behaviour classes

- Classes are far from reality…

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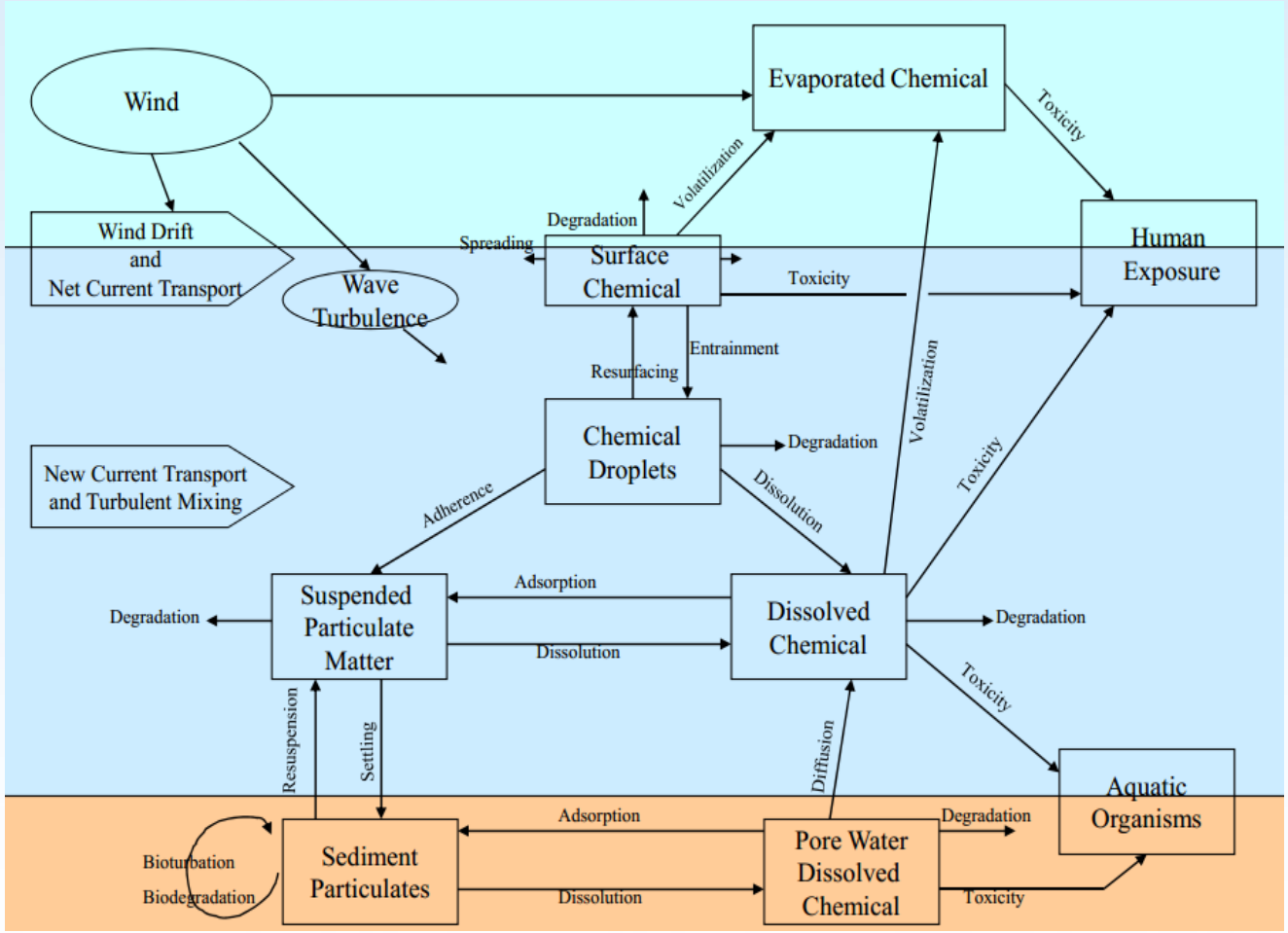
HNS fate & behaviour



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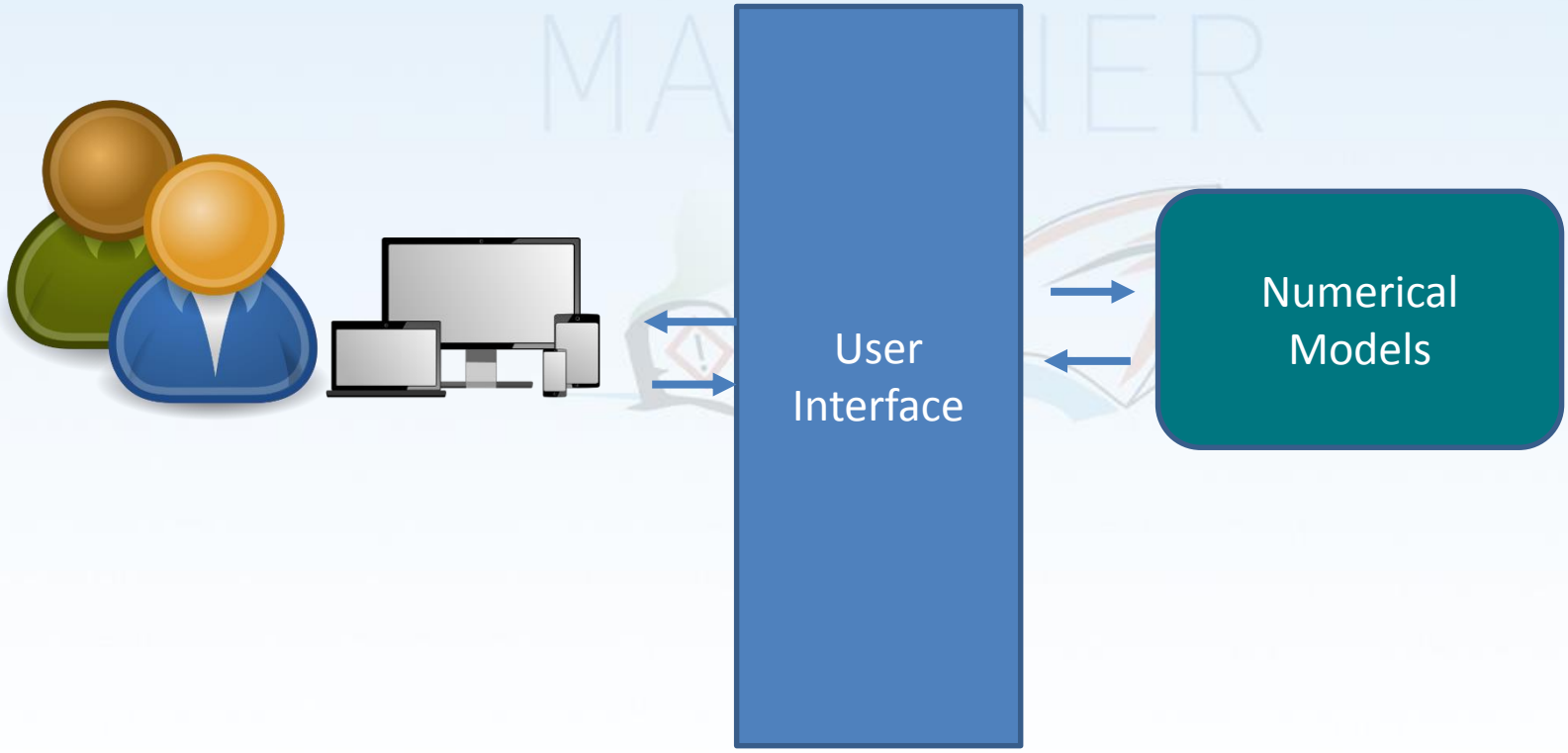

COP
(Common Operating Picture)

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Context: Why a COP?

Spill Event

Unified Commander

Responders

Public and Stakeholders

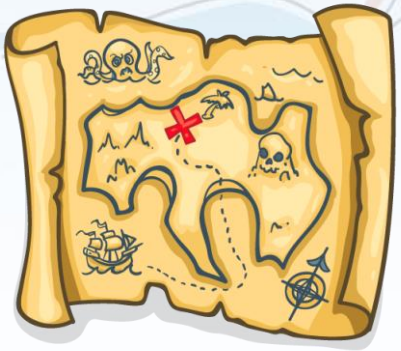
...

Planning map

Tactical map

Situation map

All of them need a Map!



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Context: Why a COP?

Spill Event

Unified commander

Responders

Public and Stakeholders

...

Planning map

Tactical map

Situation map

- Accurate and timely
- Several sources
- Real-time information
- Accesible everywhere
- Pan, zoom,…
- Understandable

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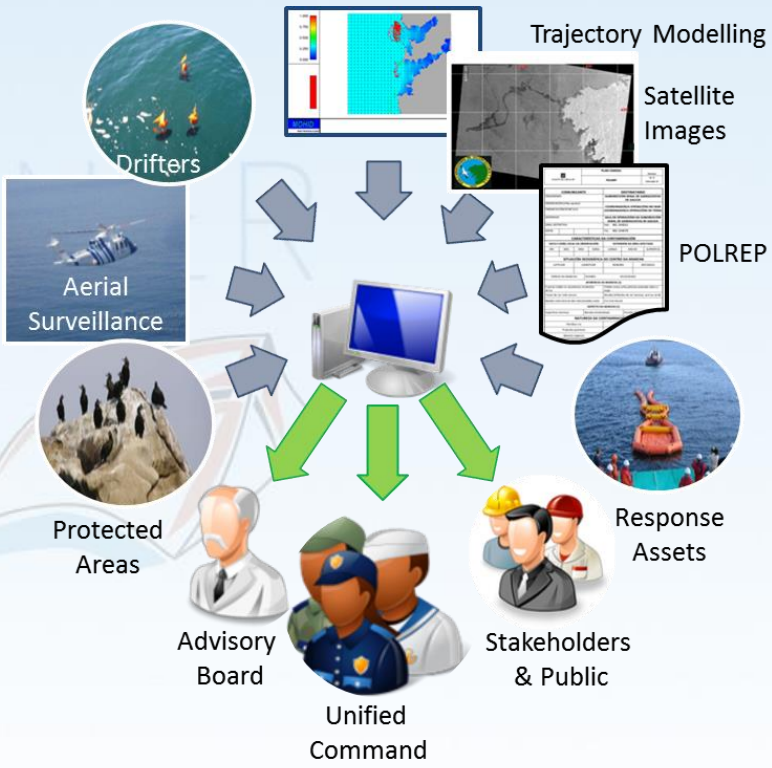
Common Operating Picture

A **COP** is:

- a computing platform based in GIS technology
- provides a single source of data and information
- to support management and response personnel and other stakeholders involved in or affected by an incident



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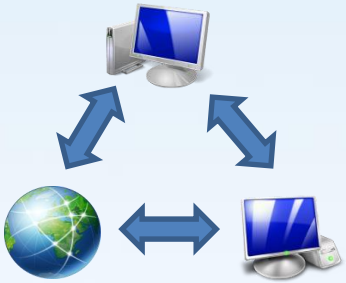
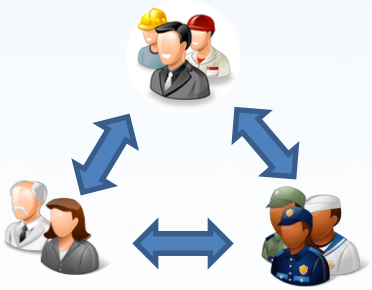
Interoperability

Computers:



Common formats to share information about HNS incident

Human Beings:



Information about HNS on a COP easy to understand

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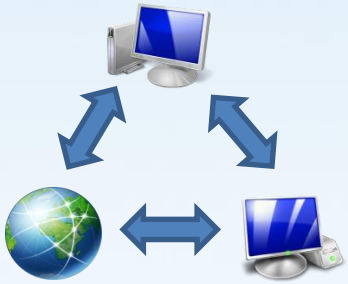
Computers interoperability: HNS GML

A common format to share information about HNS events between computers.

Characteristics:

- Standard.
- Autocontent
- With geographic data but not only
- Extensible



How:

- Based on GML (Geography Markup Language)
- EMSA Clean SeaNet GML

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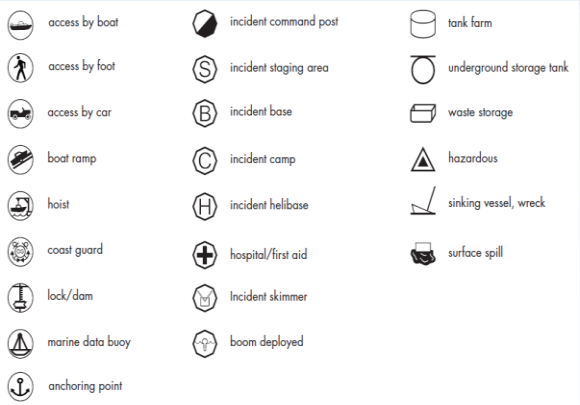
HNS Symbology and Styles:

Several initiatives…

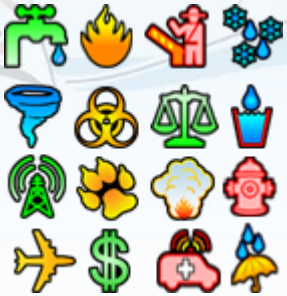
GHS Pictograms



IPIECA Logistic and Operational Resources

HSWG Symbology

EMSINA Symbology



Canadian Emergency Mapping Symbology

… but misleading

Helibase (USCG)

Helibase (IPIECA)

Hotel (IPIECA)

Hospital (NAPSG Foundation)

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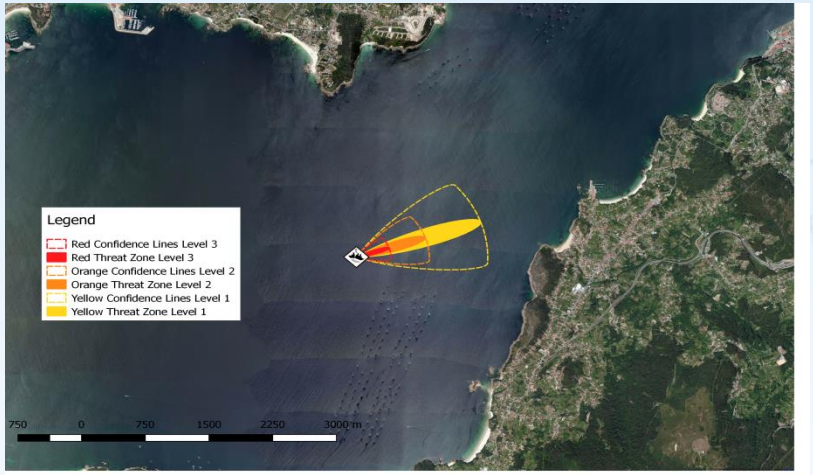
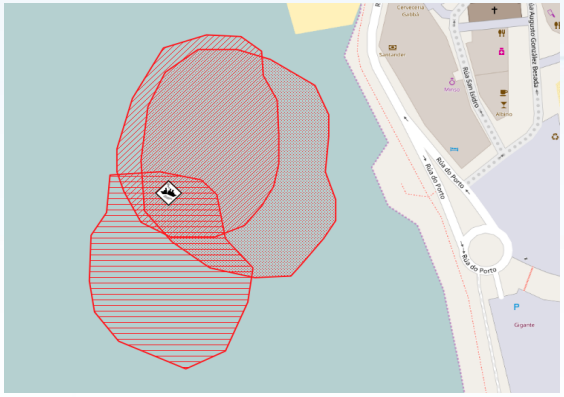
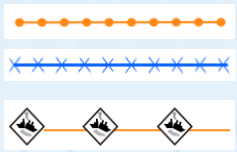
HNS Symbology and Styles: examples





Areas

Lines

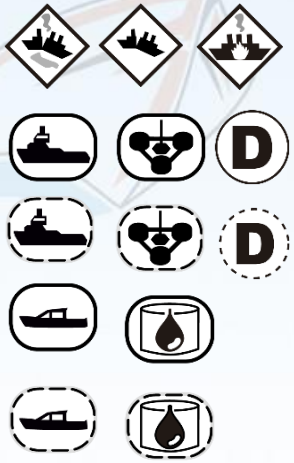


Boom

Absorbent

Feature line

Symbology



Based on and in collaboration with American Simbology

NAPSG Foundation

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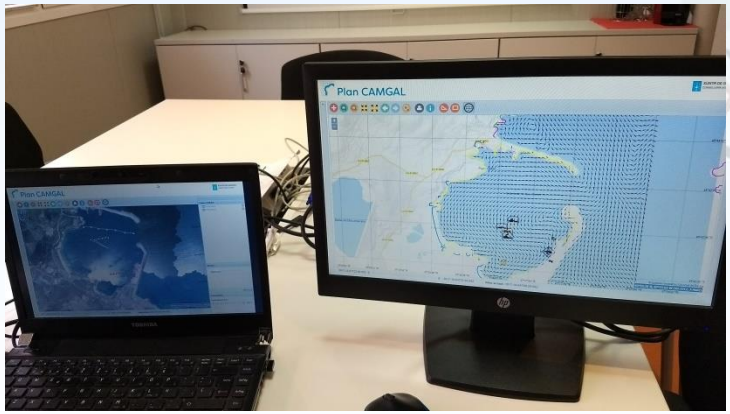
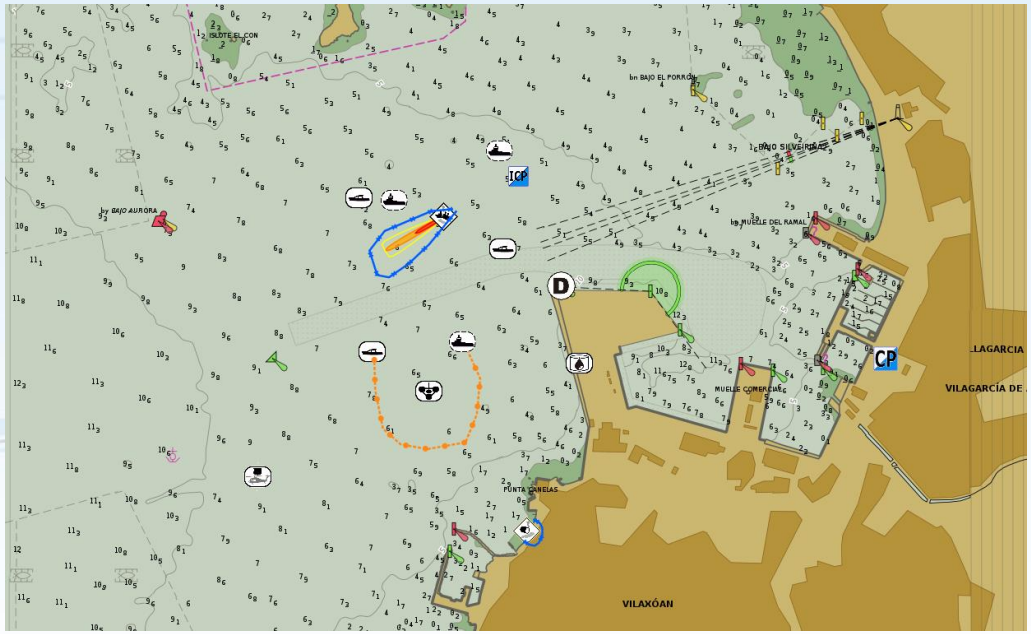
Example: Symbology

Morrazo2016 Training Exercise: 30/11/2016



SanCibrao 2017 Training Exercise 4/10/2017

Vilagarcía 2017 Training Exercise: 23/11/2017



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MARINER Platform

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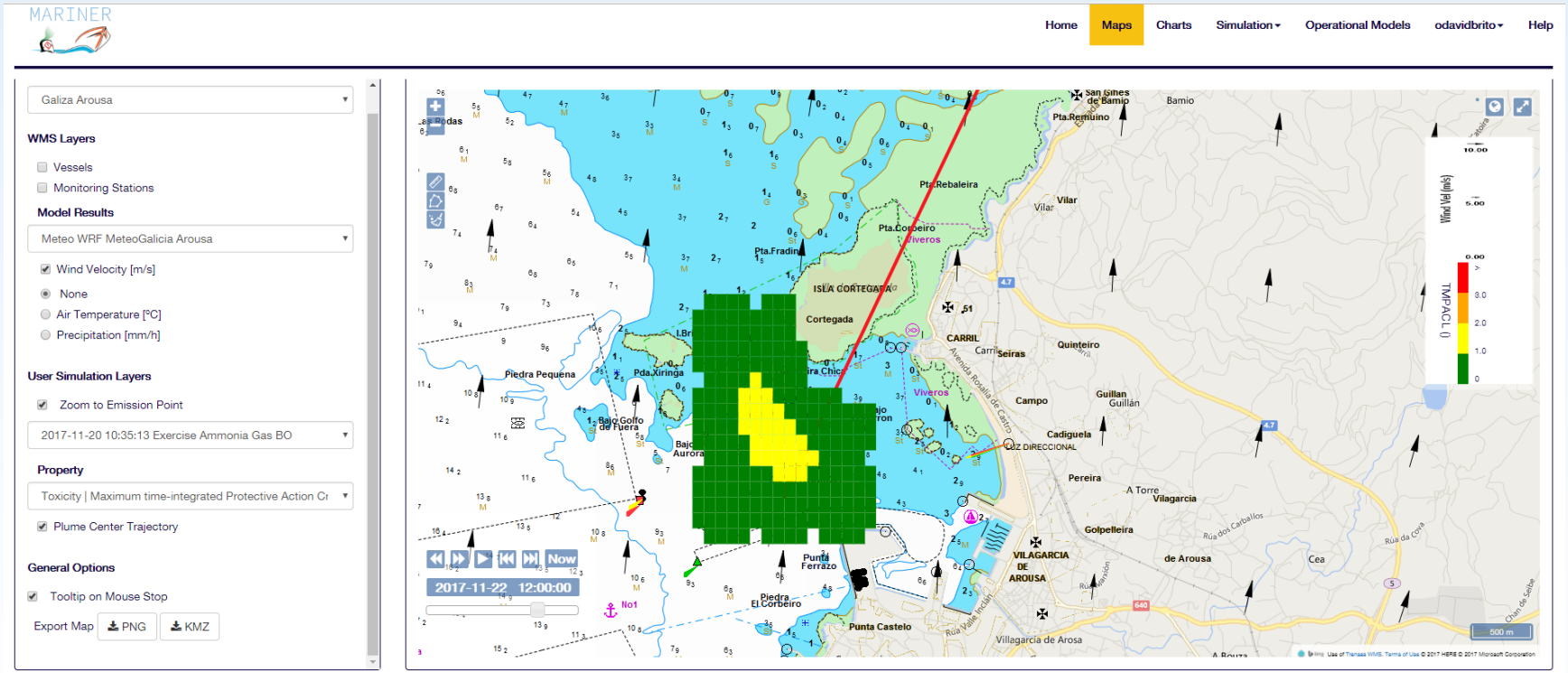

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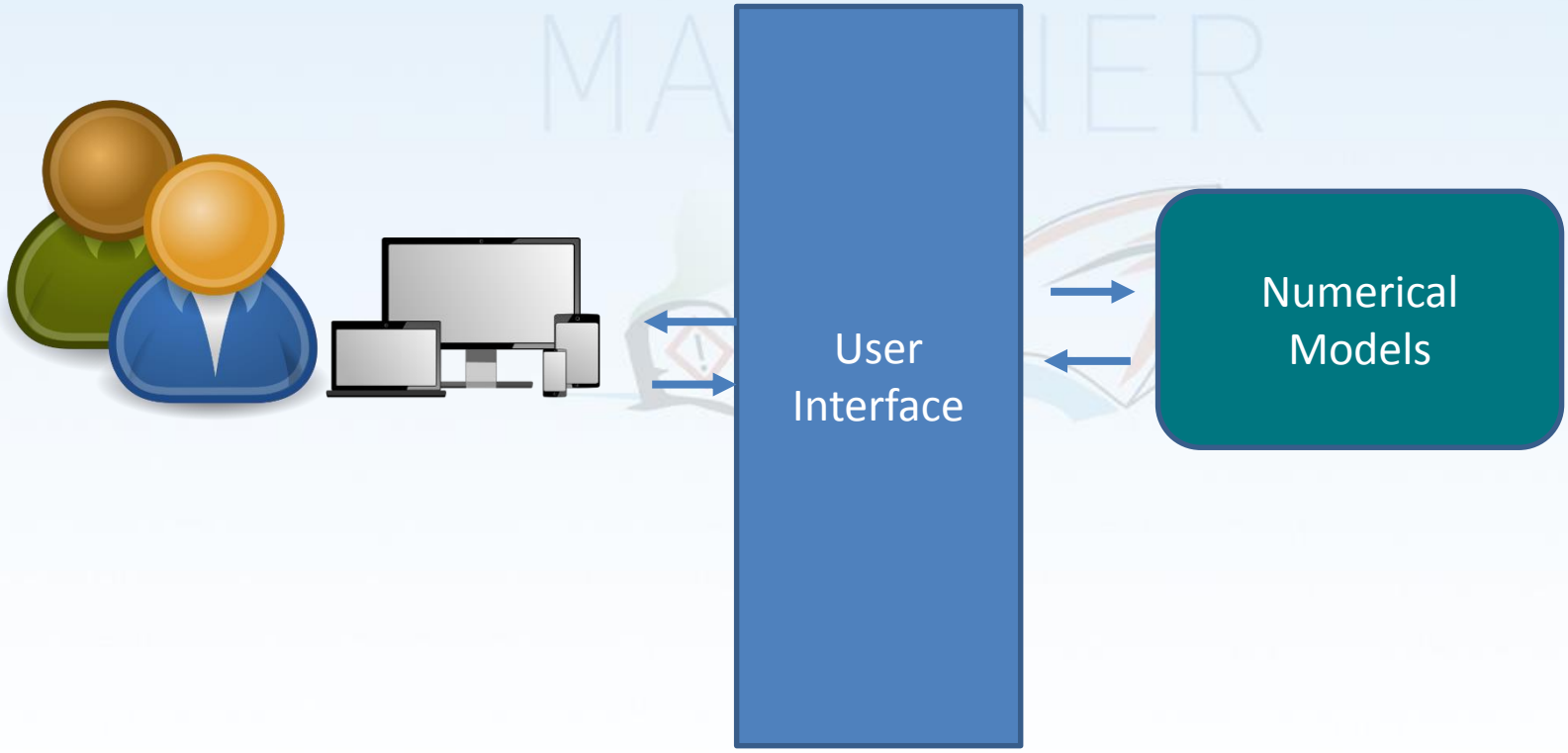

COP
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3. Flexibility & transferability: applicable in any place, and with seamless integration of different metocean models

4. Dynamic connection with HNS products database *

5. Environmental impact modelling *

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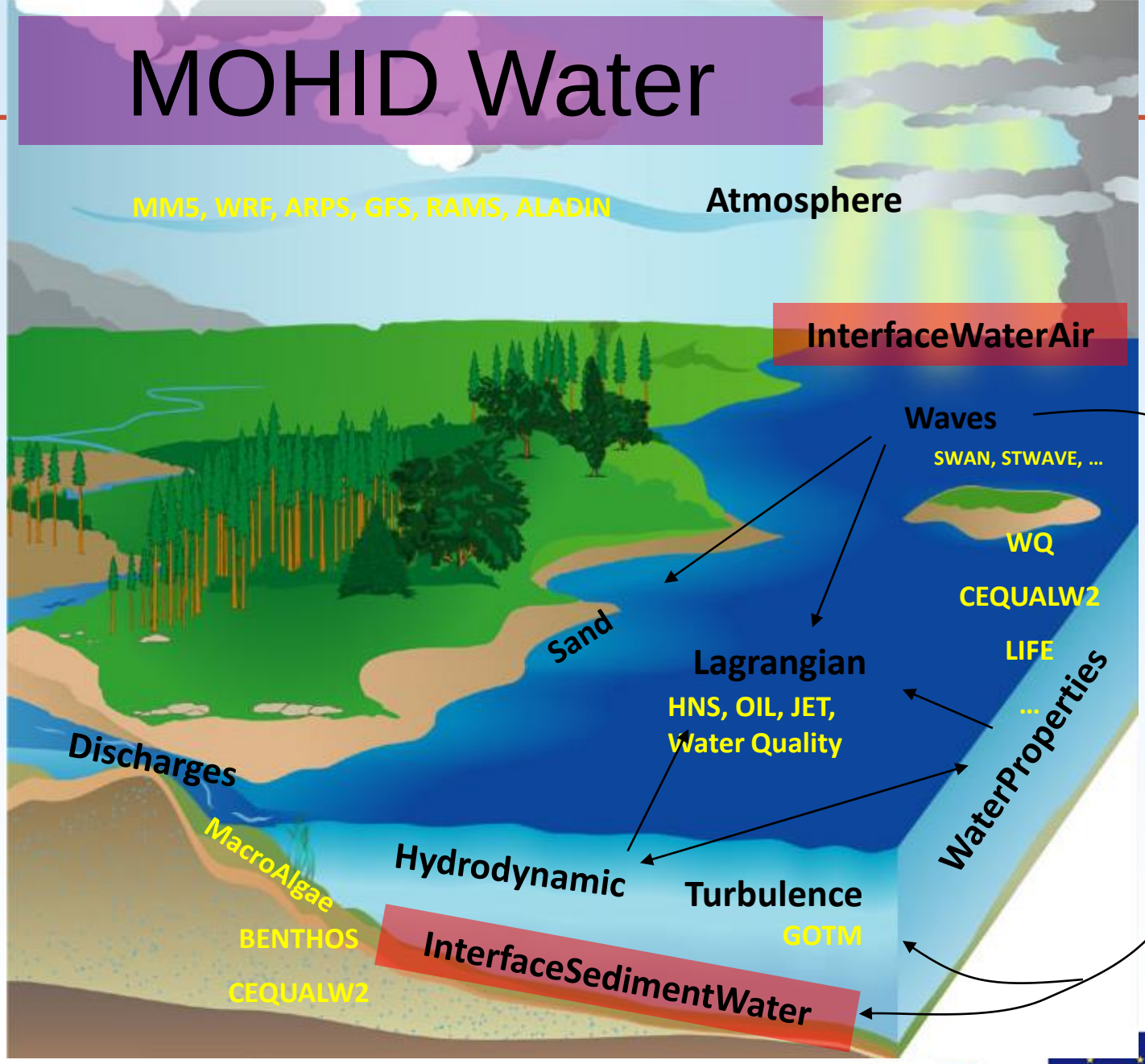
MOHID Water



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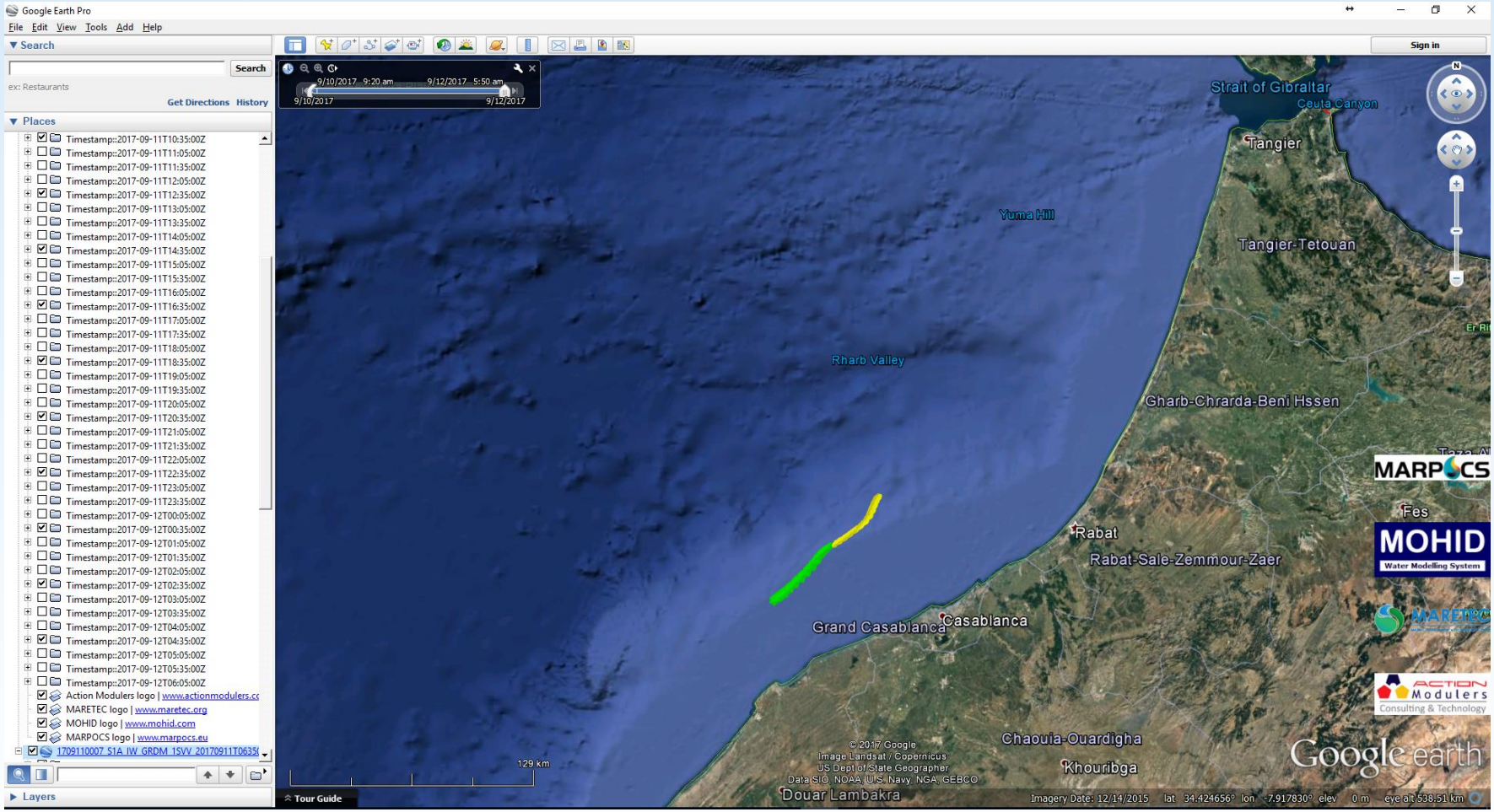
MOHID-CLEANSEANET early warning forecasting system



MARPOCS

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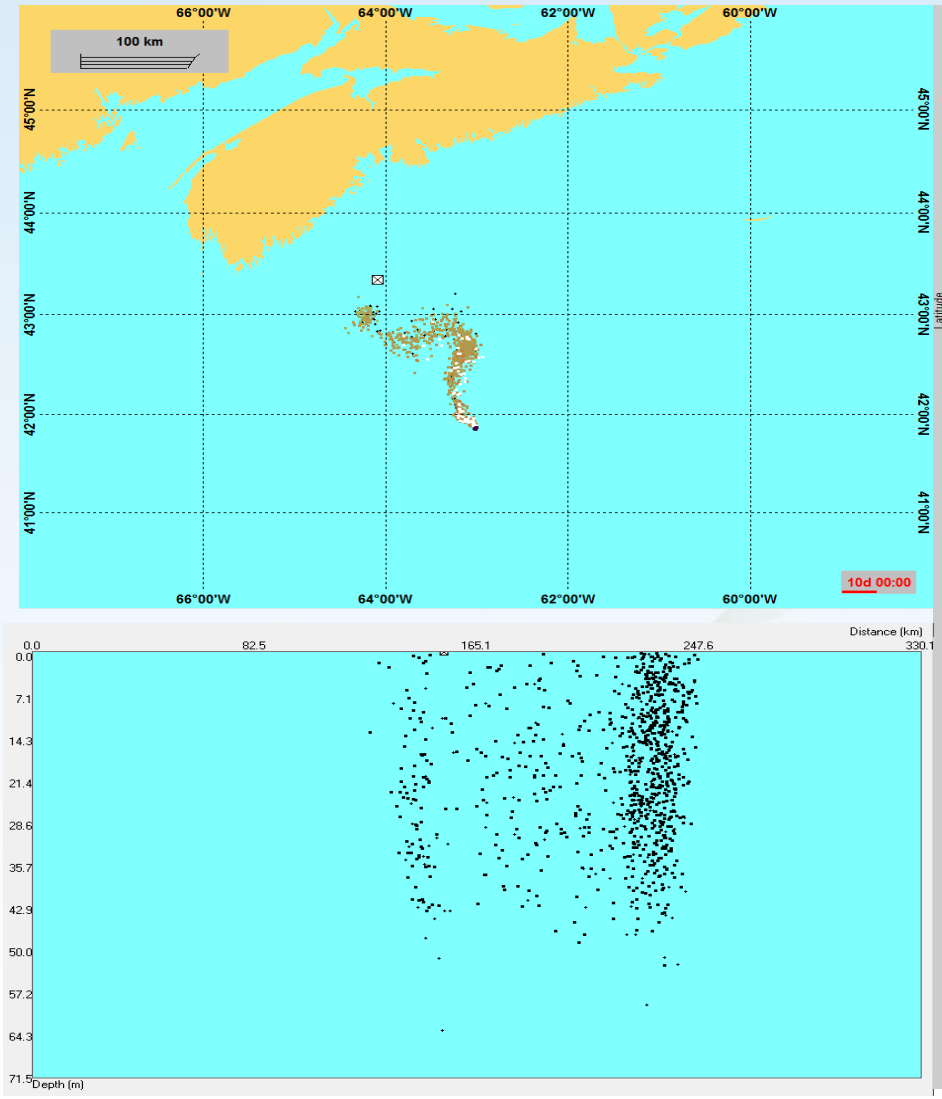
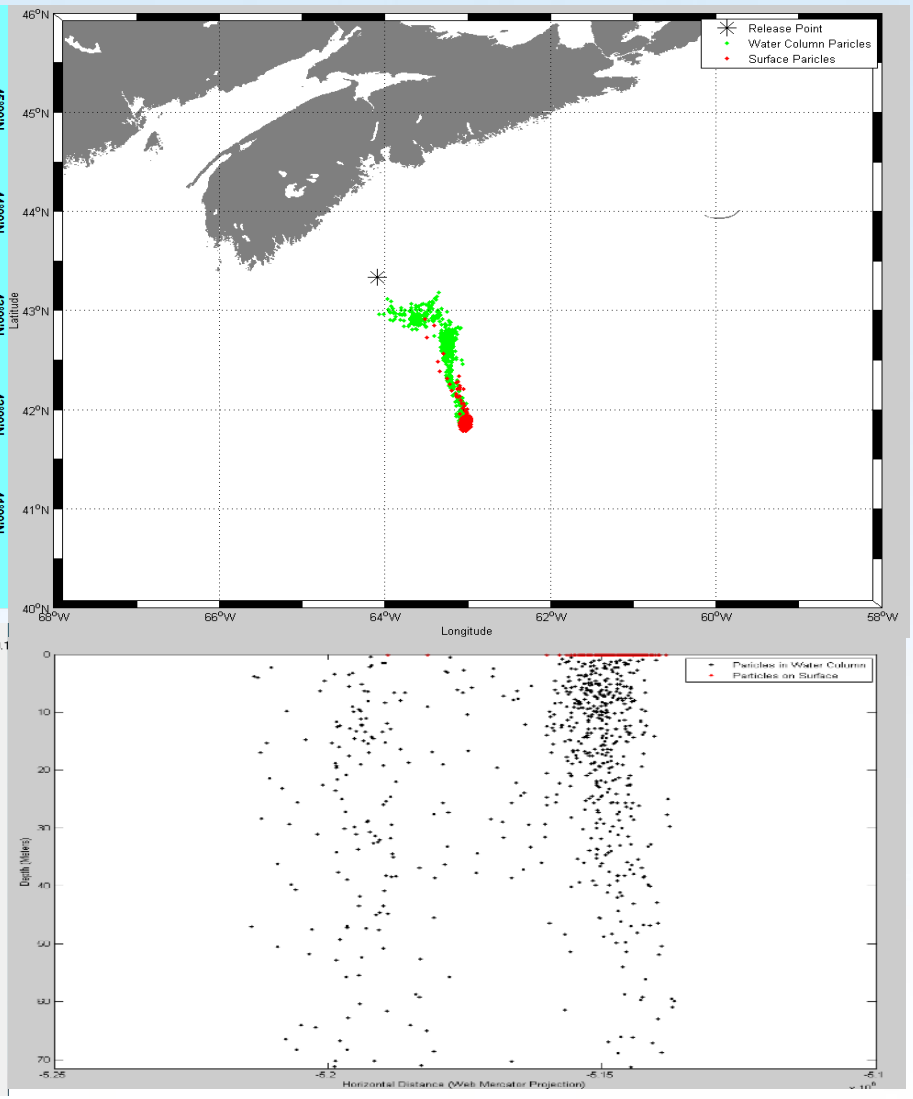
OSCAR vs. MOHID: trajectory comparison





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MEOPAR
MARINE ENVIRONMENTAL OBSERVATION PREDICTION & RESPONSE NETWORK

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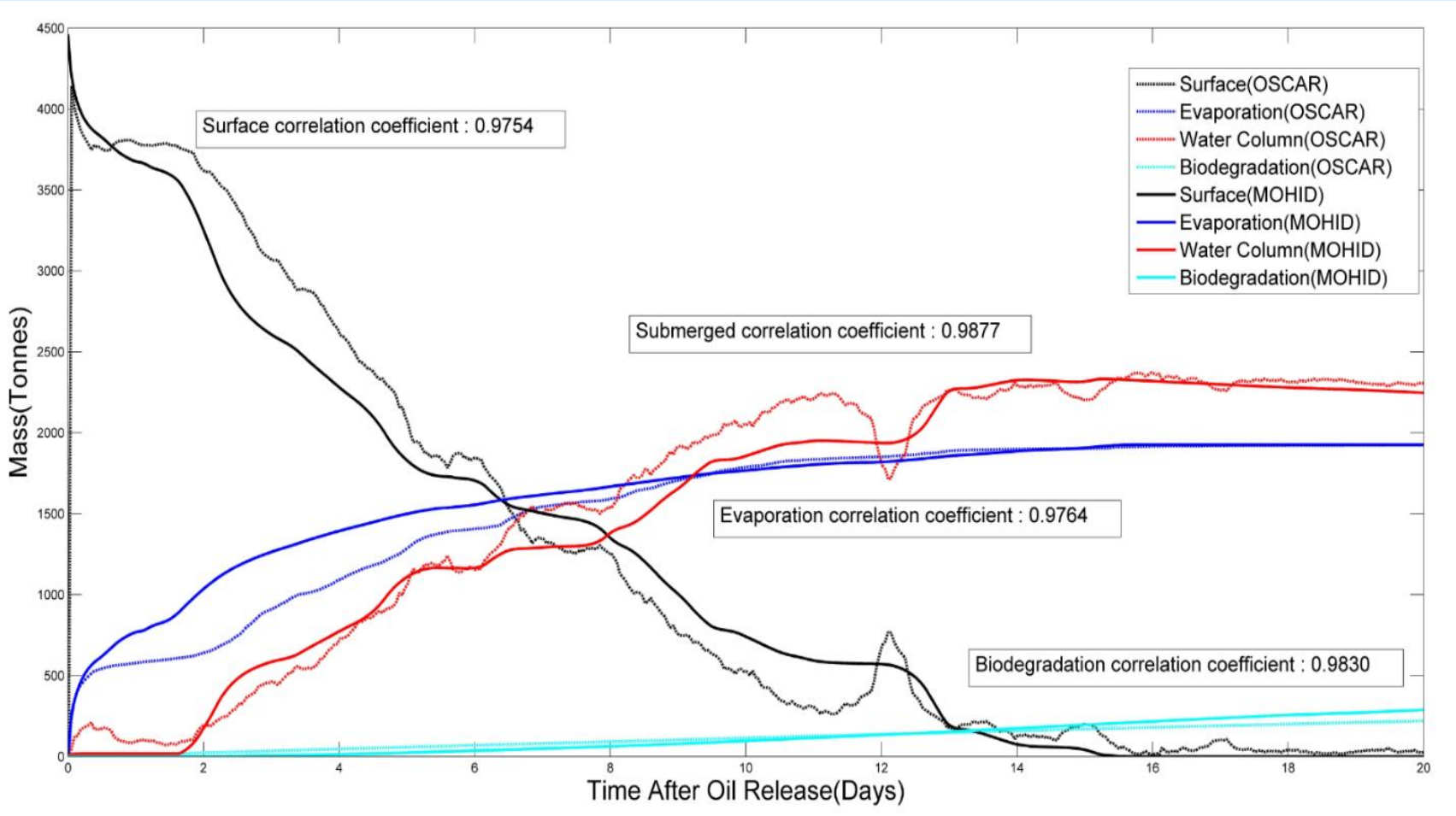
OSCAR vs. MOHID: Mass balance comparison



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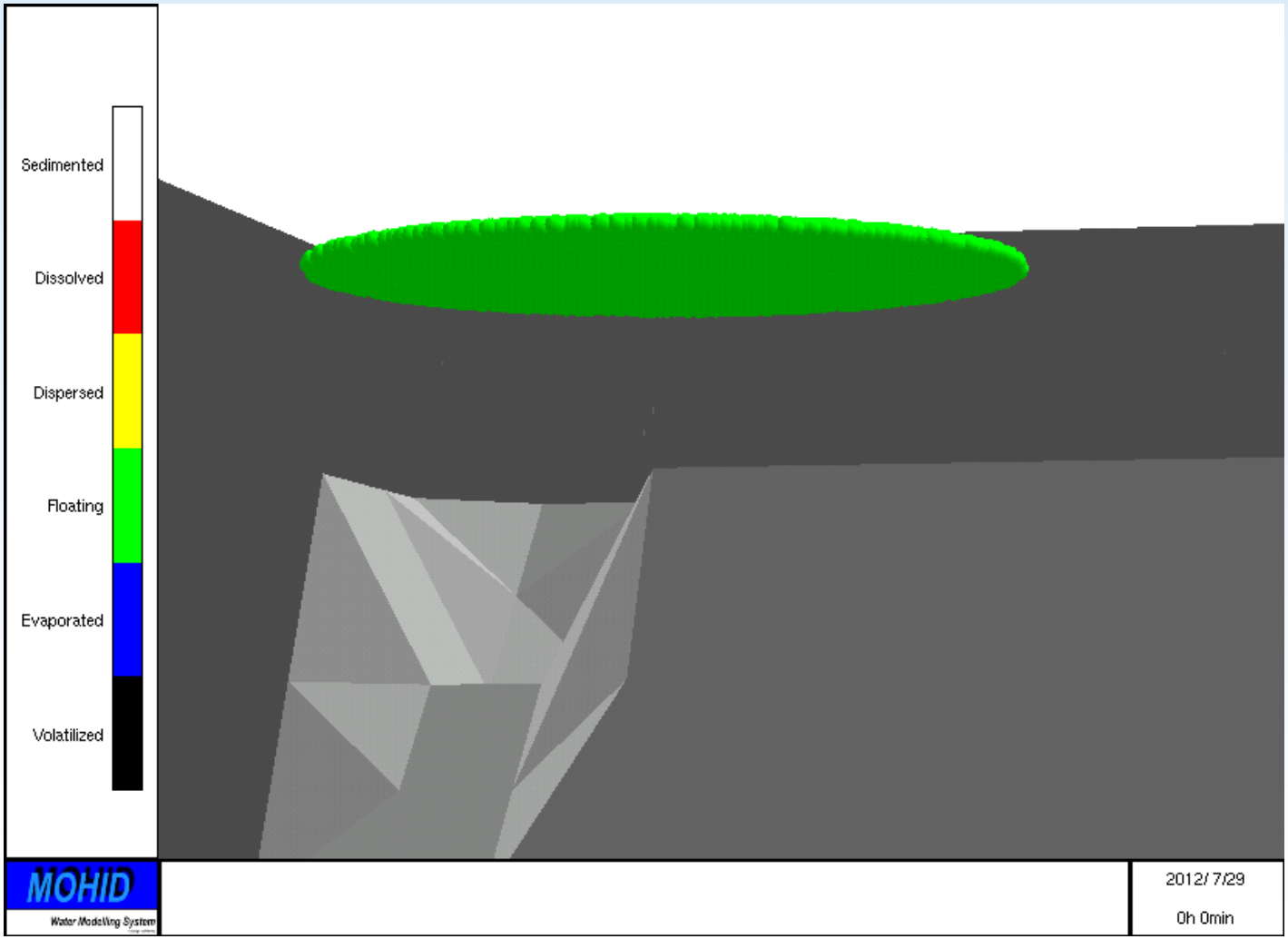
MOHID: HNS spill module



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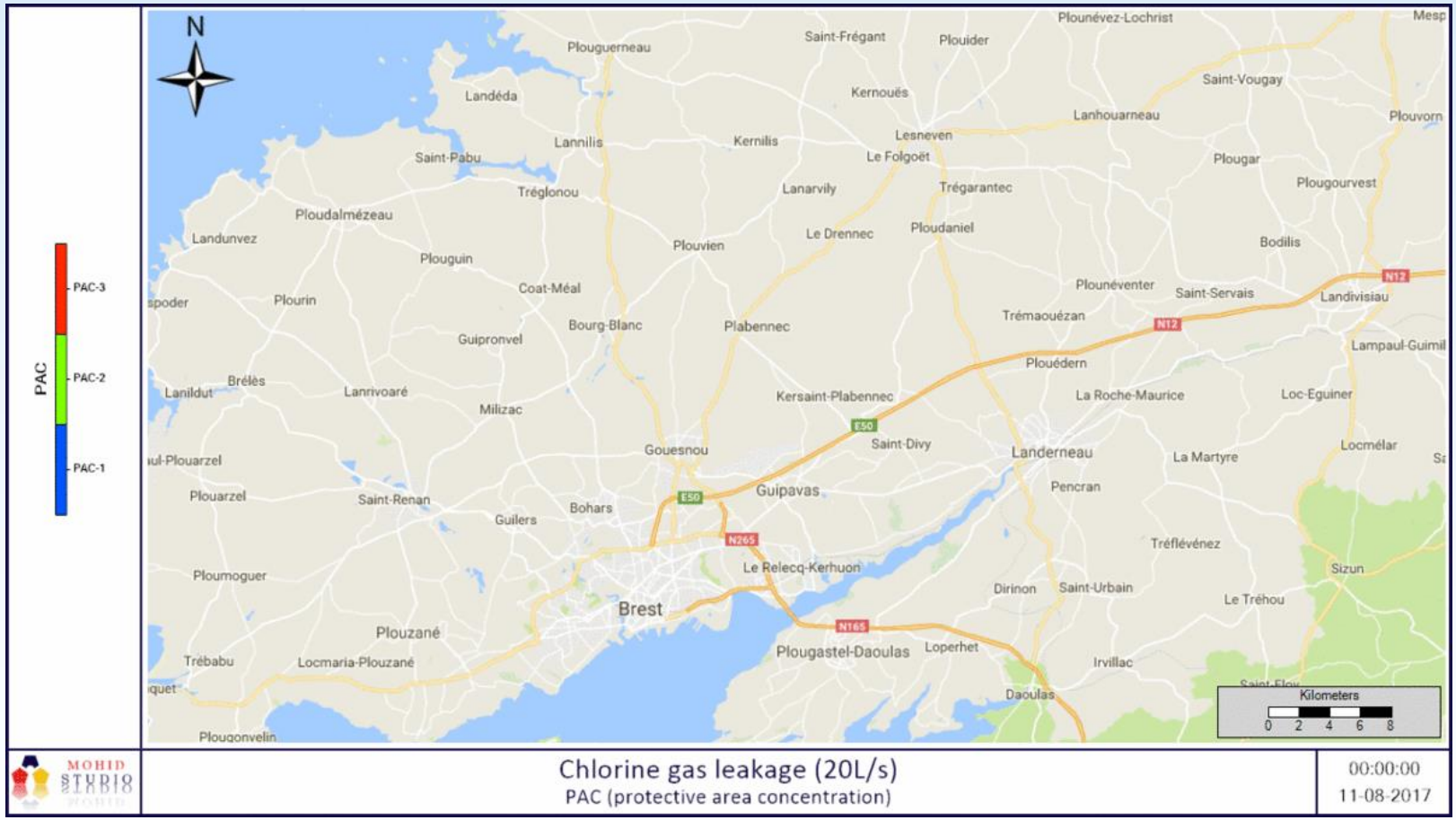
MOHID: HNS gas release



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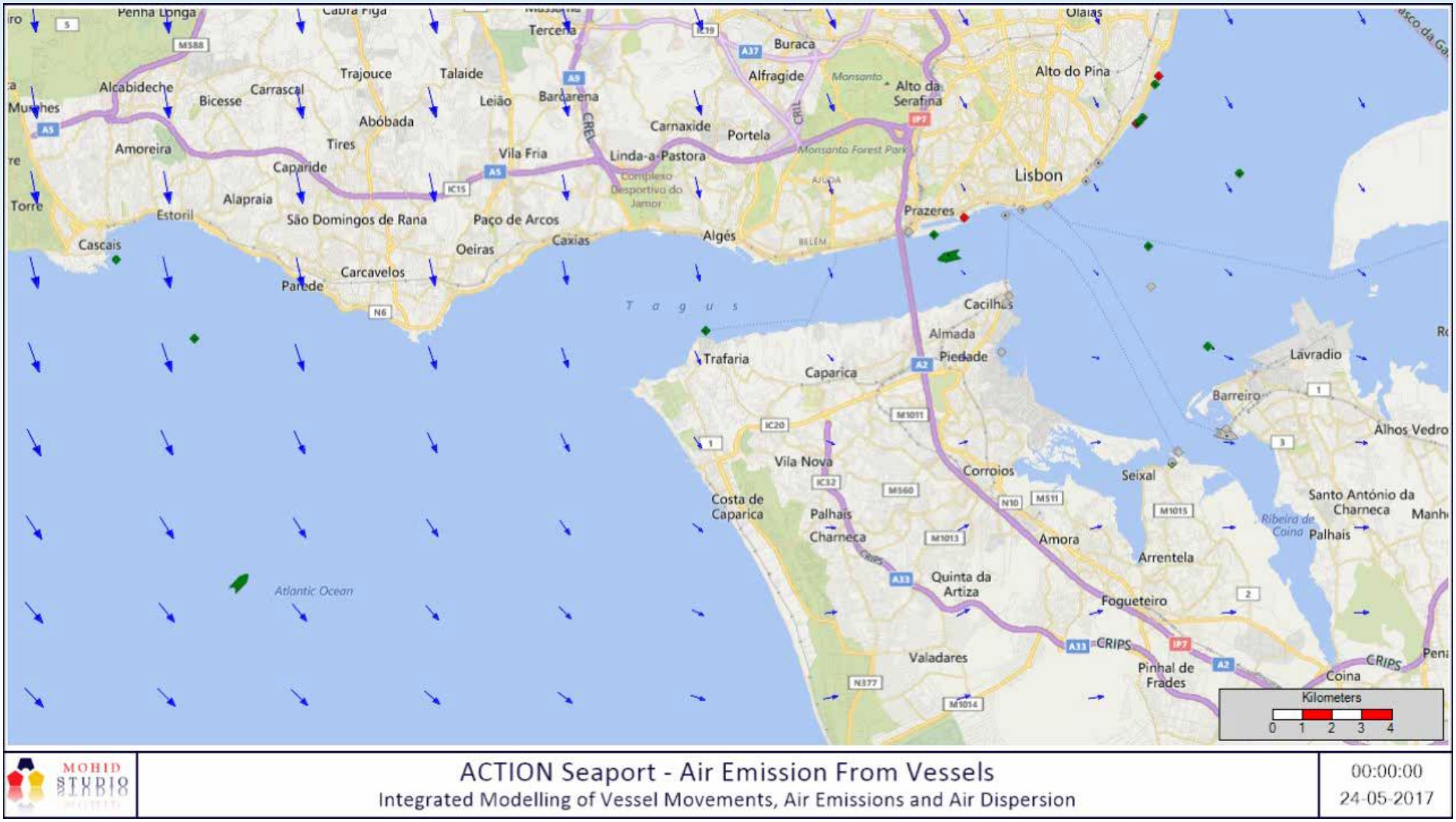
Air emission from vessels / air quality



MOHID STUDIO

ACTION Seaport - Air Emission From Vessels

Integrated Modelling of Vessel Movements, Air Emissions and Air Dispersion

00:00:00
24-05-2017

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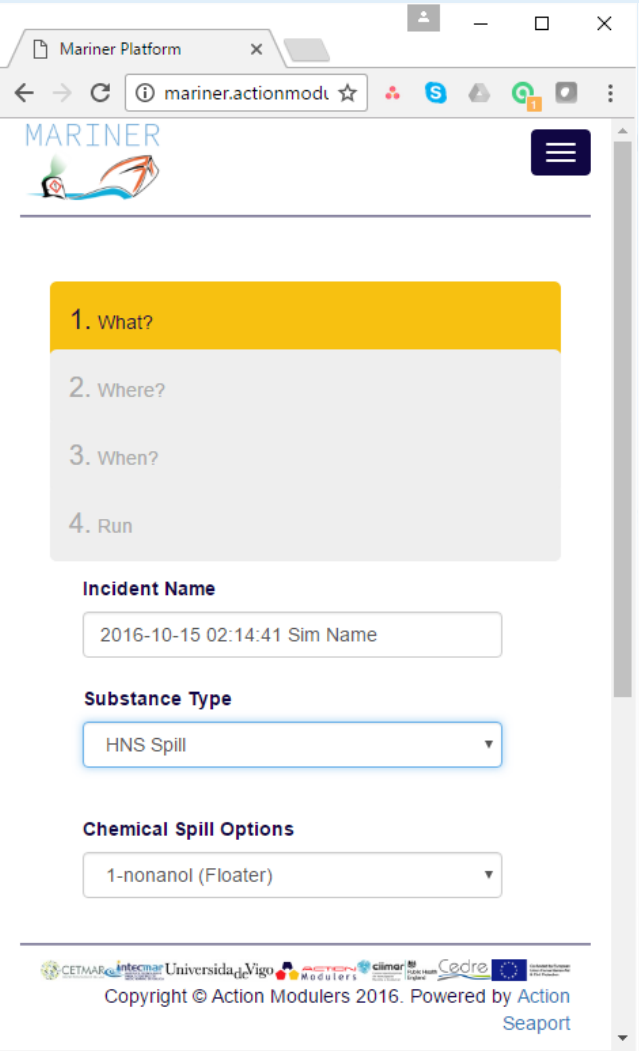
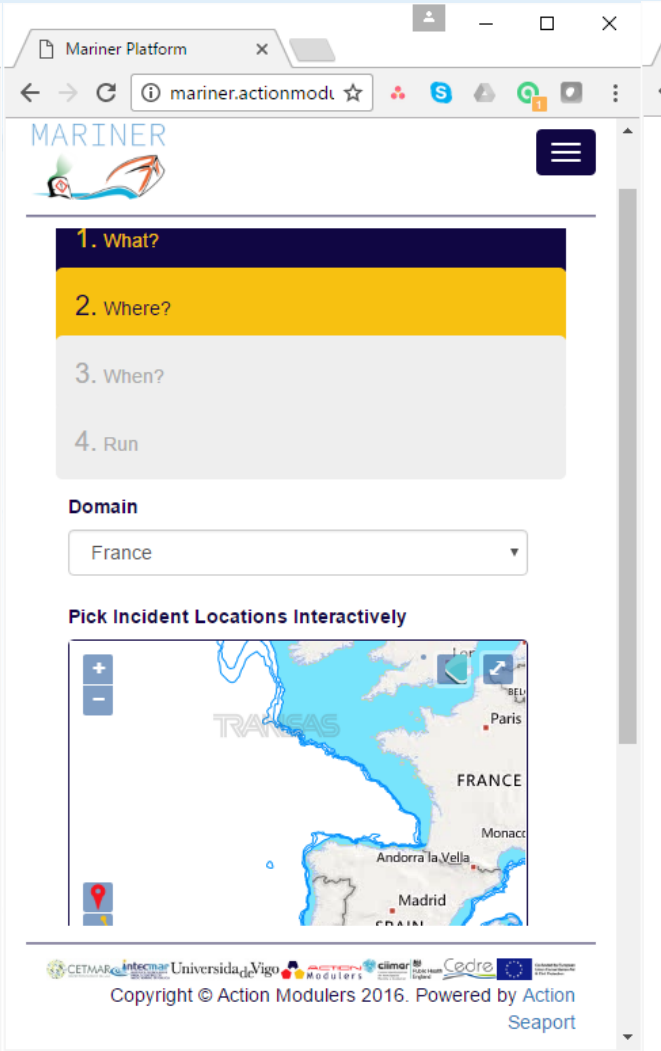
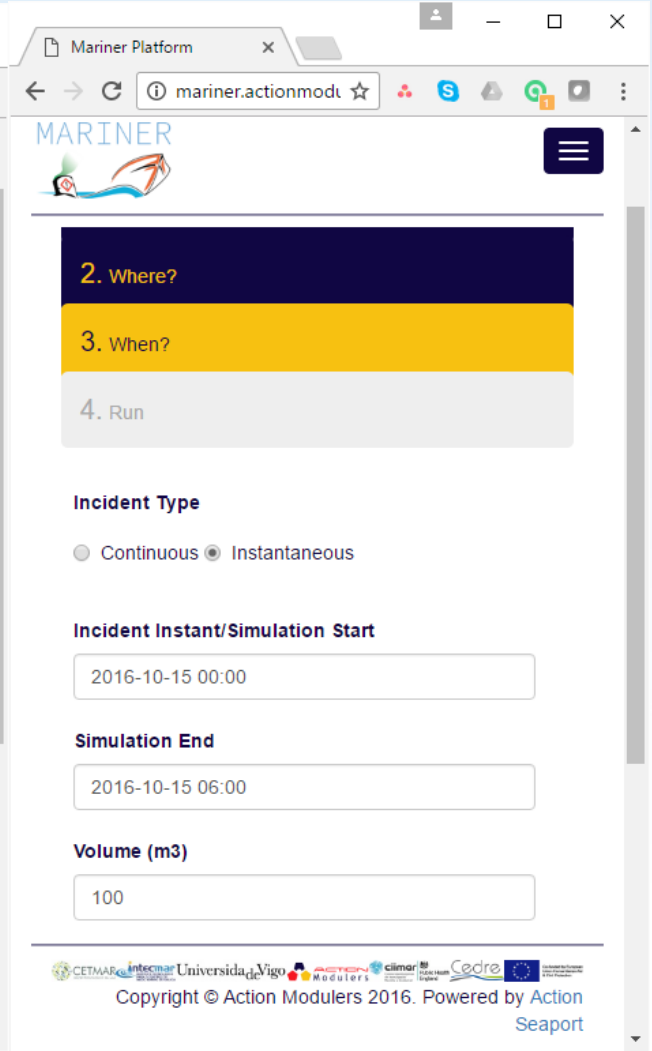
Web interface: going mobile

MARINER PLATFORM: Web responsive design / mobile friendly technology

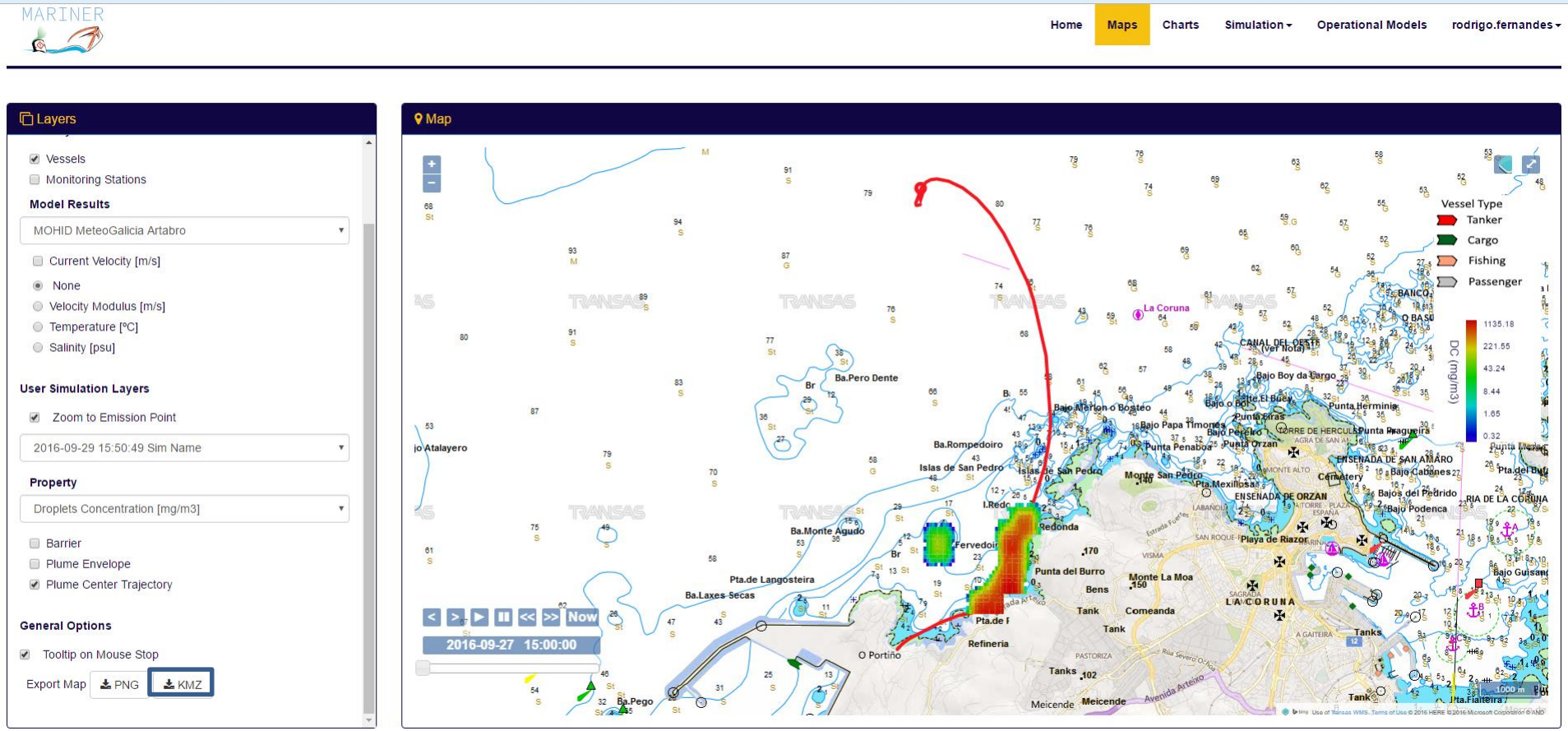






Web interface: results exportable to 3rd party GIS

MARINER PLATFORM: exporting results to Google Earth



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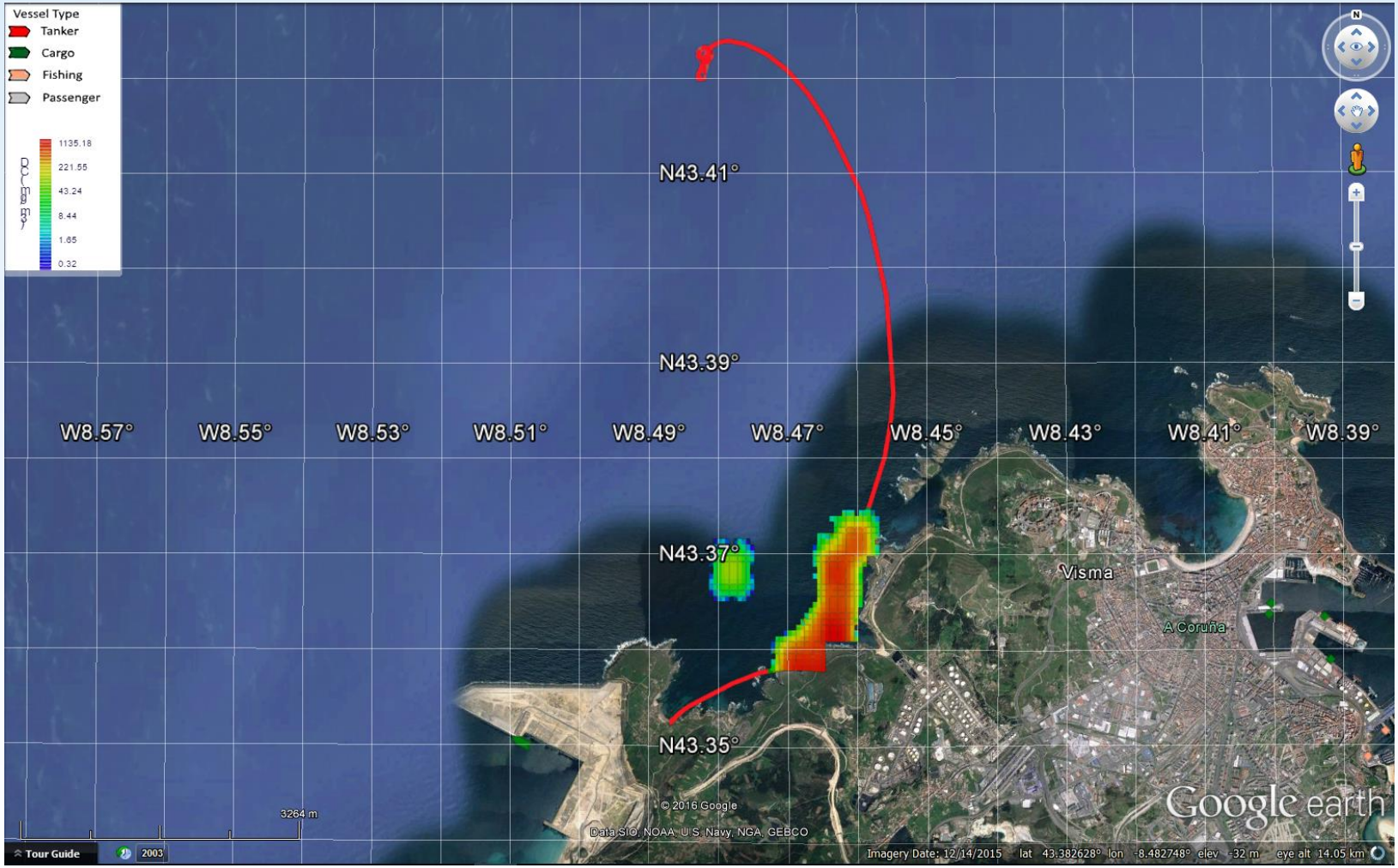
MARINER PLATFORM: exporting results to Google Earth



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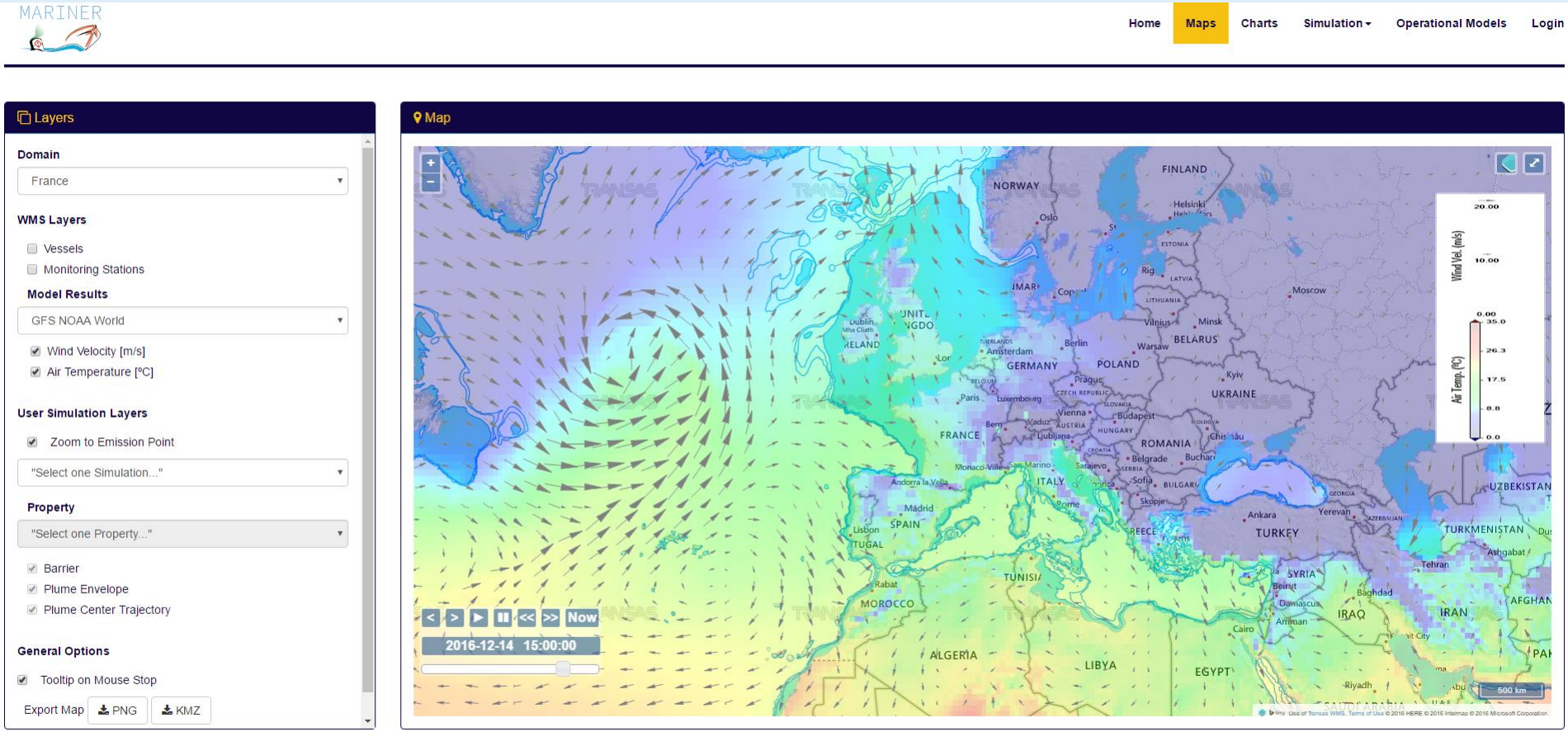
Flexibility & Transferability: different regions and models

MARINER PLATFORM: NOAA GFS meteorological model



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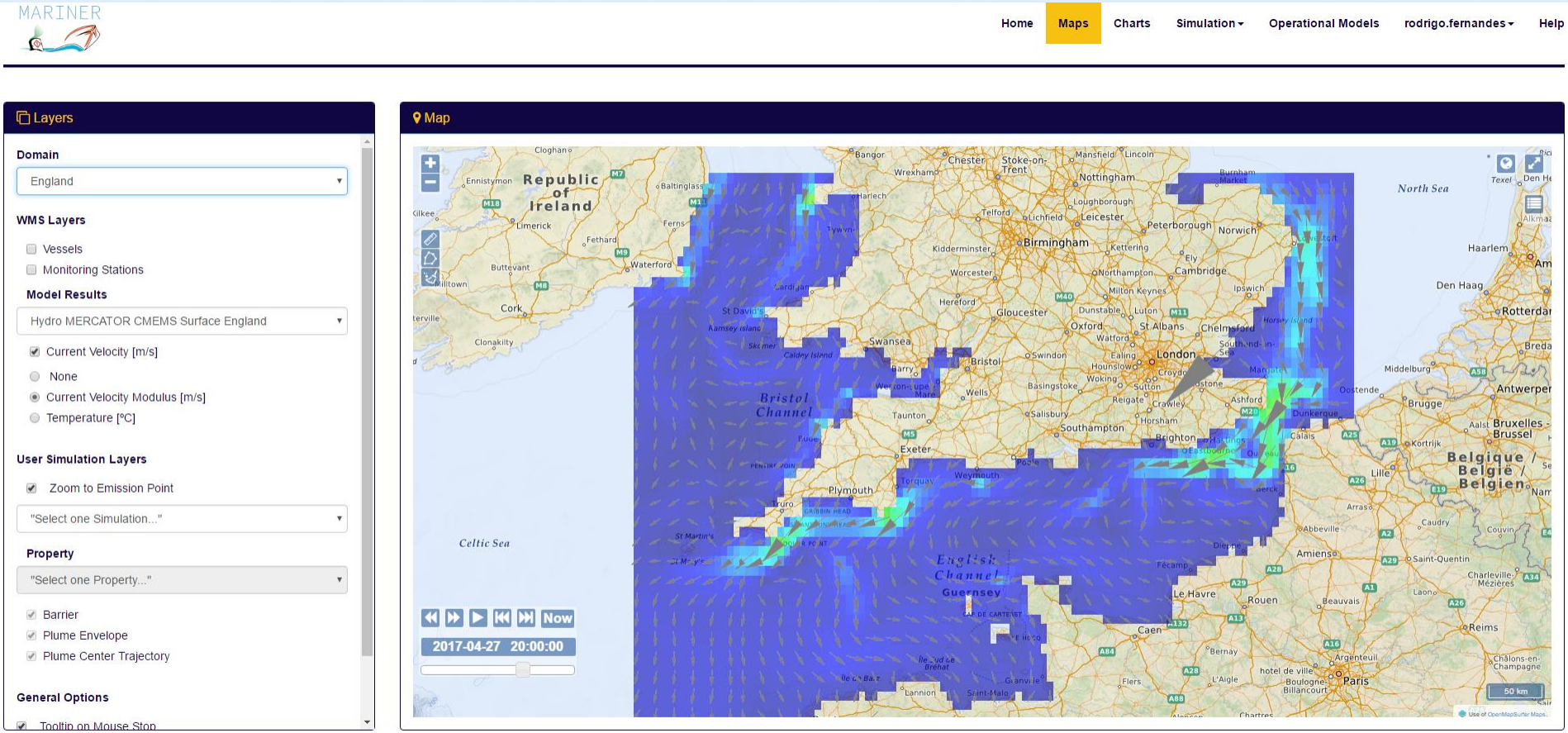
Flexibility & Transferability: different regions and models

MARINER PLATFORM: CMEMS model for Bristol Channel



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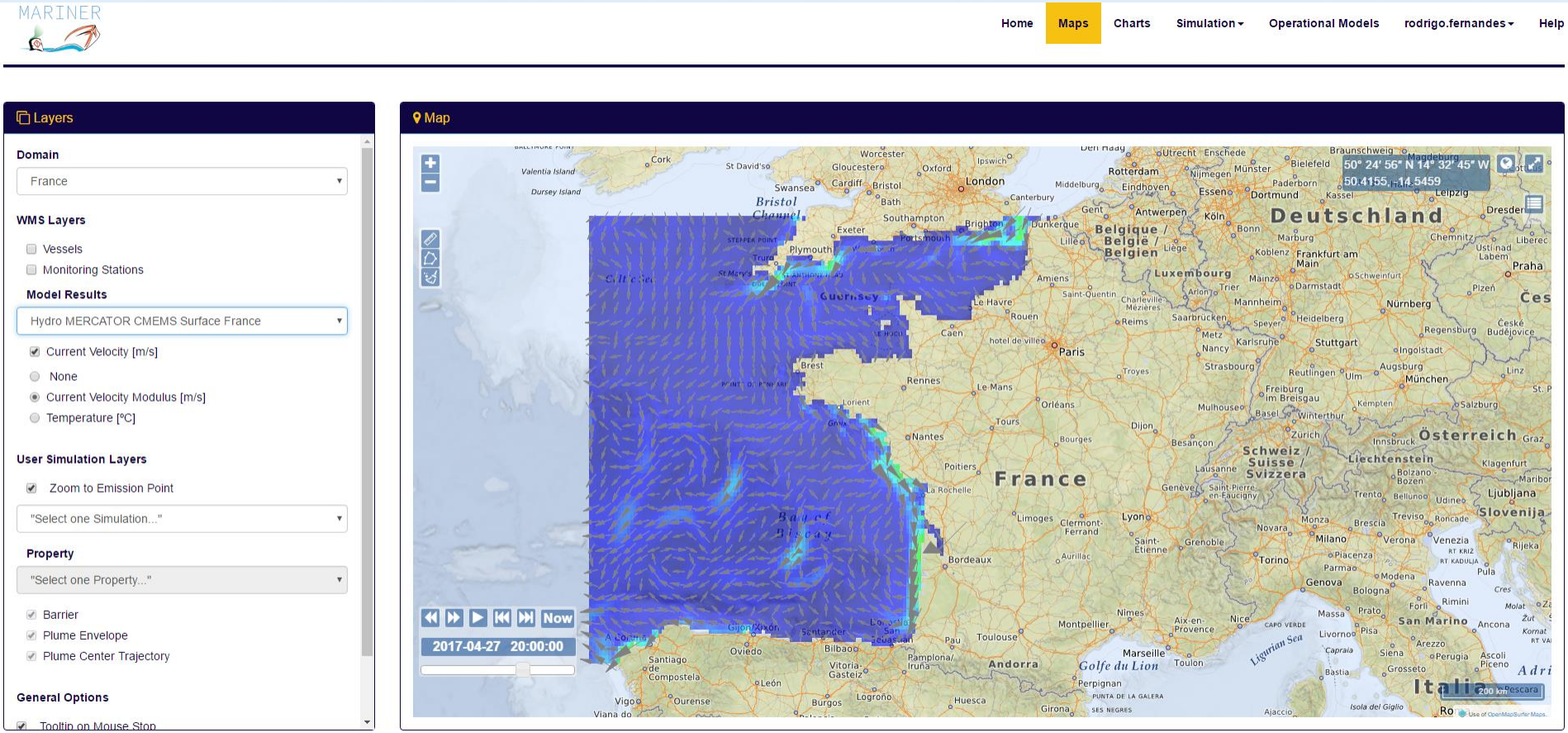
Flexibility & Transferability: different regions and models

MARINER PLATFORM: CMEMS model for Biscay Bay



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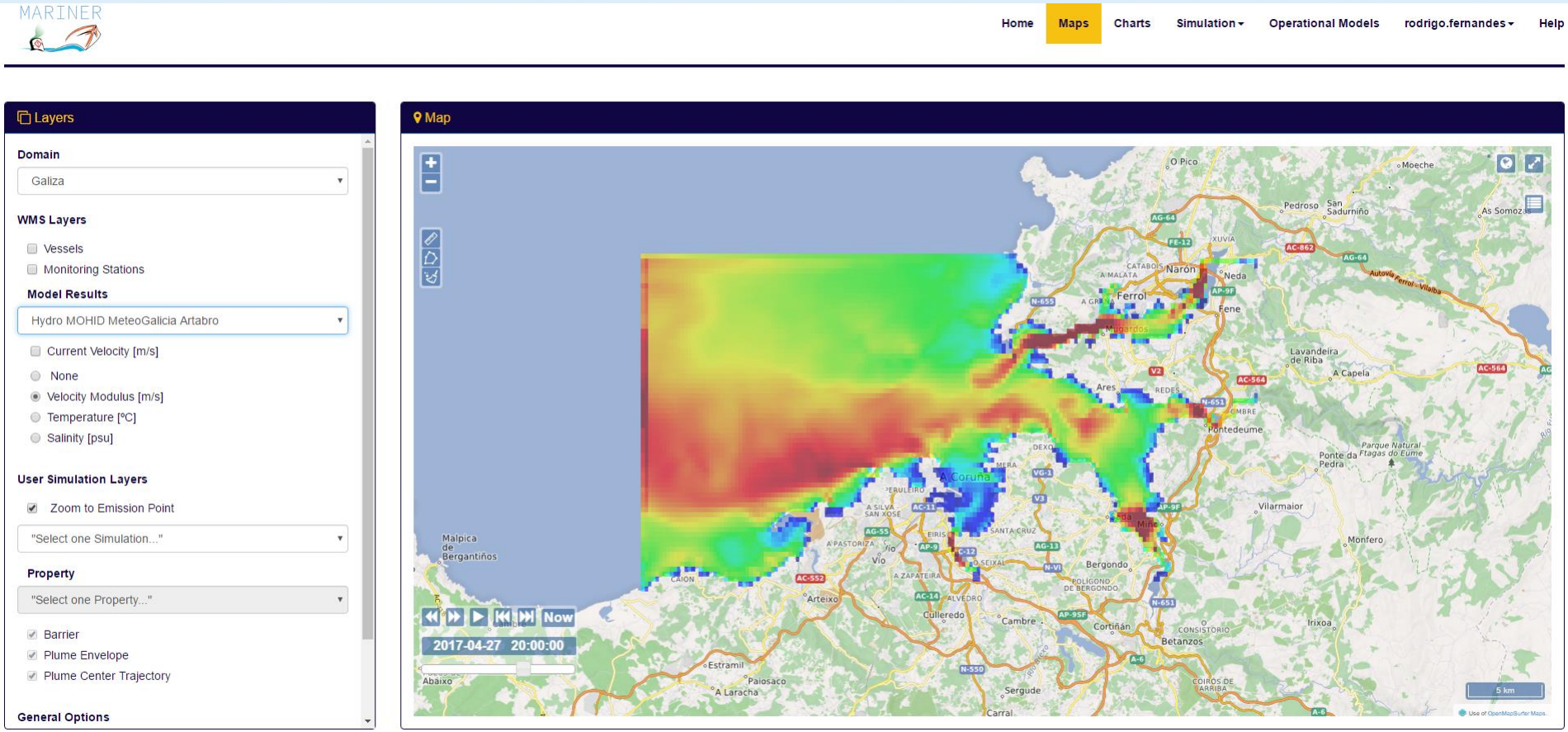
Flexibility & Transferability: different regions and models

MARINER PLATFORM: Meteogalicia model for Artabro (Galicia)



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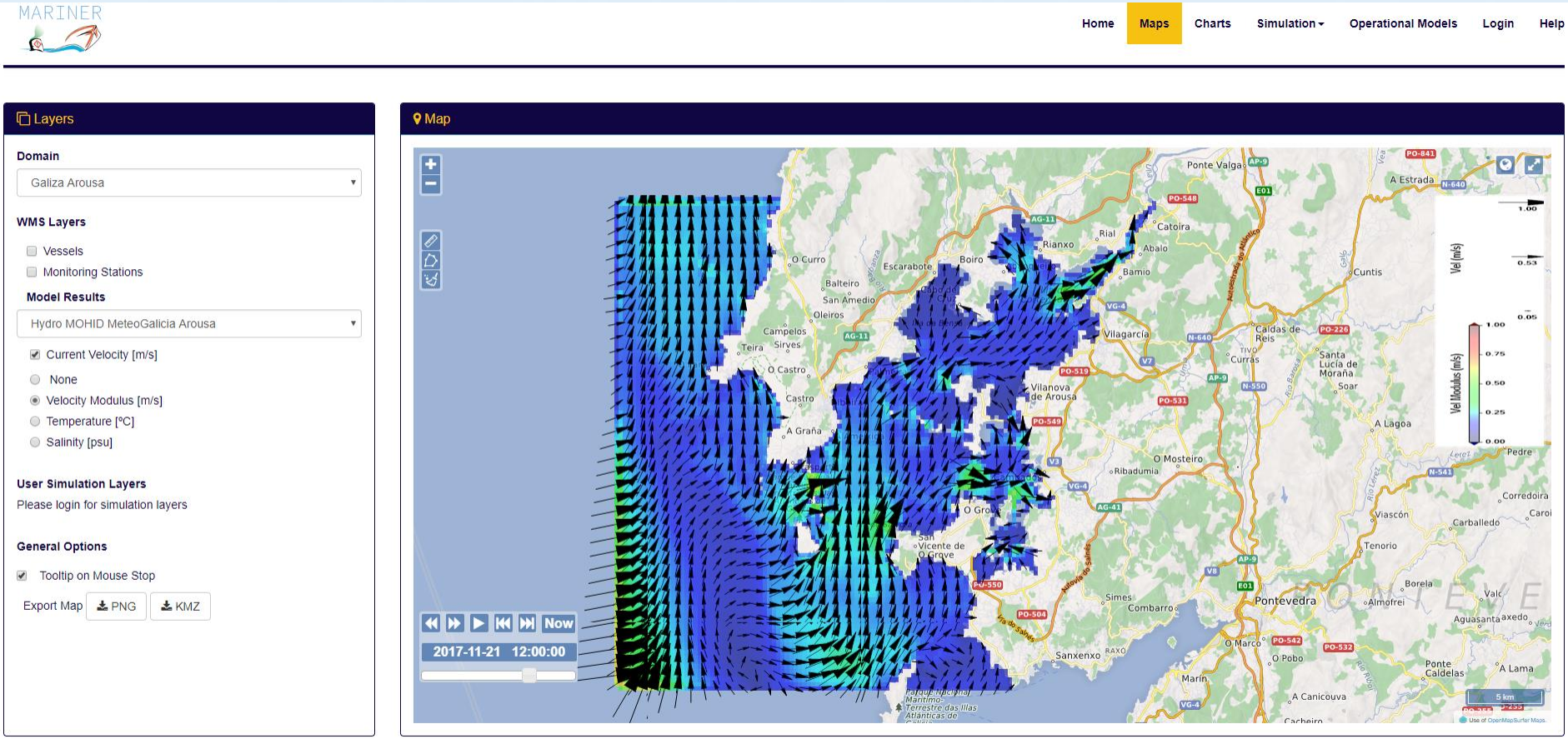
Flexibility & Transferability: different regions and models

MARINER PLATFORM: Meteogalicia model for Arousa (Galicia)



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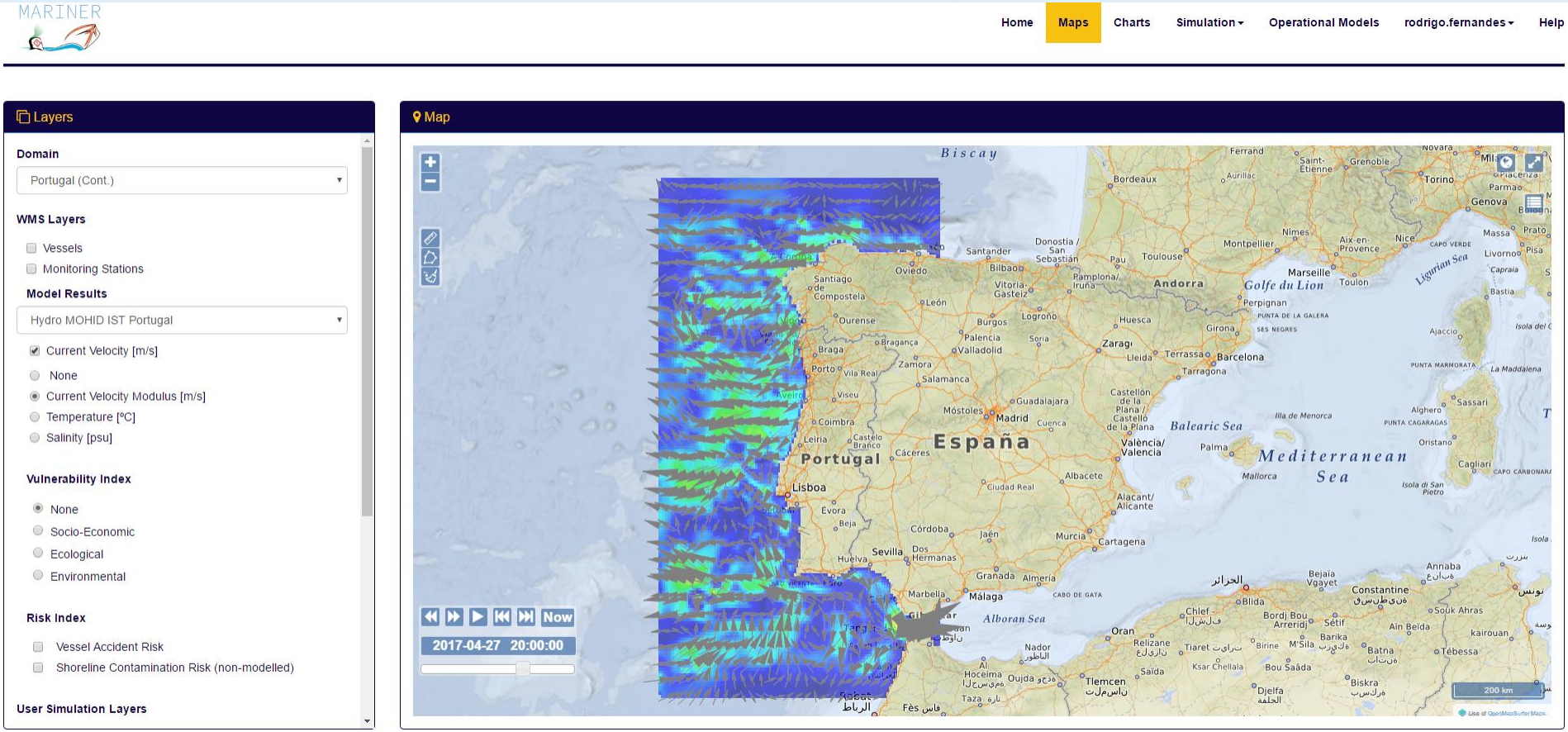
Flexibility & Transferability: different regions and models

MARINER PLATFORM: IST (Lisbon University) model for Portuguese continental coast



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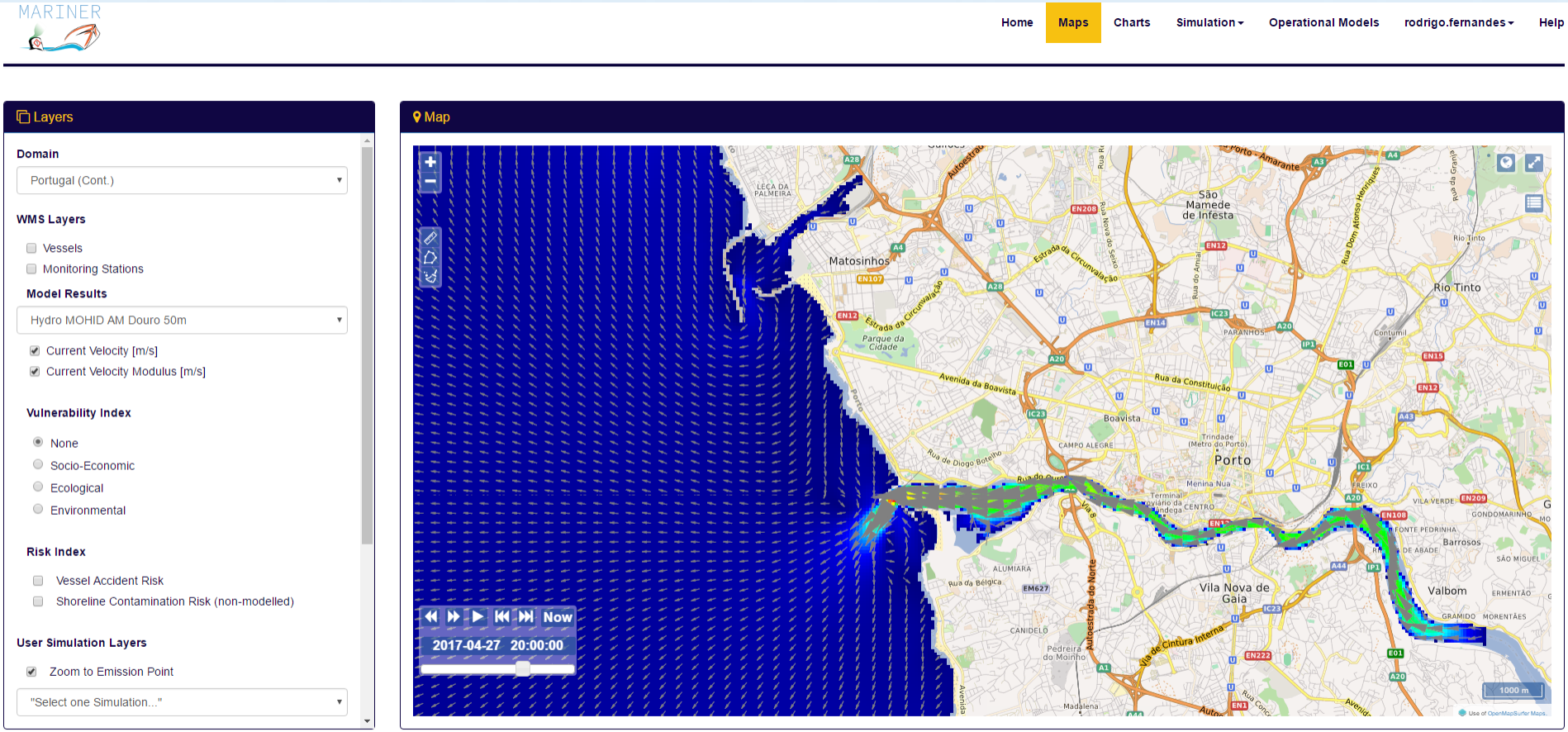
Flexibility & Transferability: different regions and models

MARINER PLATFORM: Action Modulers model for Porto region (Portugal)



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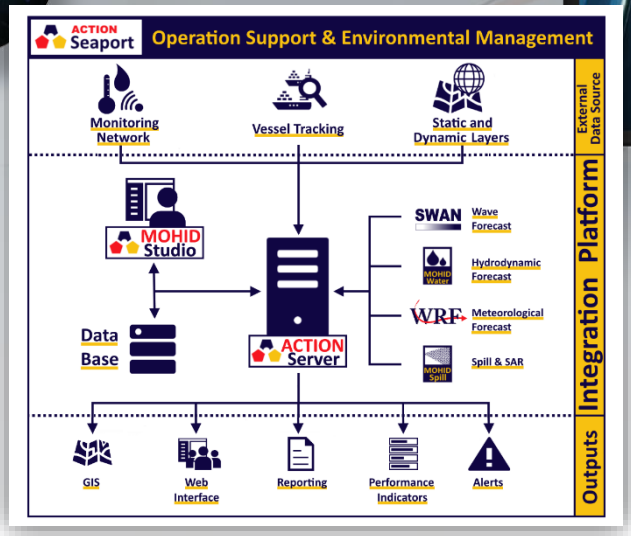
MARINER technology application in different contexts

ACTION Seaport / Porto de Lisboa



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MARINER technology application in different contexts

ACTION Seaport in action | Charts (table format)

ACTION Modulers Consulting & Technology — Porto de Lisboa

Home | Maps | **Charts** | Alerts | Dashboard | Simulation | Performance | Contacts | Login

Select Location to obtain modelled values in blue and measured values in yellow (if exist).

Vertical Line indicates current date.

Torre VTS

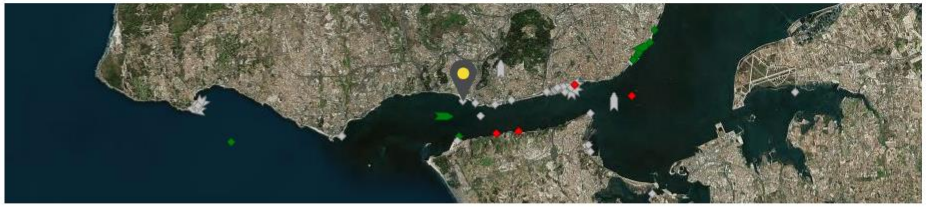

Chart | **Table**

	Tue 07																							
Hours	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Level m	3	2.6	2.1	1.6	1.3	1.1	1.2	1.5	1.9	2.3	2.7	2.9	2.9	2.7	2.3	1.8	1.4	1.2	1.1	1.3	1.7	2.2	2.7	3
Cur Vel knots	0.5	0.8	0.6	0.3	0.1	0.2	0.5	0.7	0.7	0.8	0.7	0.5	0	0.6	0.7	0.5	0.3	0	0.4	0.6	0.7	0.8	0.9	0.8
Cur Dir °	◄	◄	◄	◄	◄	►	►	►	►	►	►	►	▲	◄	◄	◄	◄	►	►	►	►	►	►	►
Wind Vel knots	3.8	3.4	3.3	3.8	4.4	5	5.3	5.9	5.5	5.6	6.4	6.3	5.8	4.9	4.3	4.3	5.2	8	10.1	9.4	10.3	10.3	10	9.5
Wind Dir °	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Rain mm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Temp °C	12	11	12	12	12	12	12	12	12	12	12	13	15	17	18	19	20	20	20	17	15	14	14	13

	Wed 08											
Hours	0	1	2	3	4	5	6	7	8	9	10	11
Level m	3.2	3.1	2.8	2.2	1.7	1.3	1	1	1.3	1.7	2.2	2.7
Cur Vel knots	0.5	0.2	0.8	0.7	0.4	0.2	0.1	0.4	0.7	0.8	0.8	0.9
Cur Dir °	►	◄	◄	◄	◄	◄	►	►	►	►	►	►
Wind Vel knots	9.1	9.2	9.1	8.7	8.2	8	8.1	8.3	8.1	7.8	9	9
Wind Dir °	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Rain mm	0	0	0	0	0	0	0	0	0	0	0	0
Air Temp °C	13	13	12	12	11	11	11	10	10	11	14	16

Possibility of online comparison (measures vs. models) in multiple points

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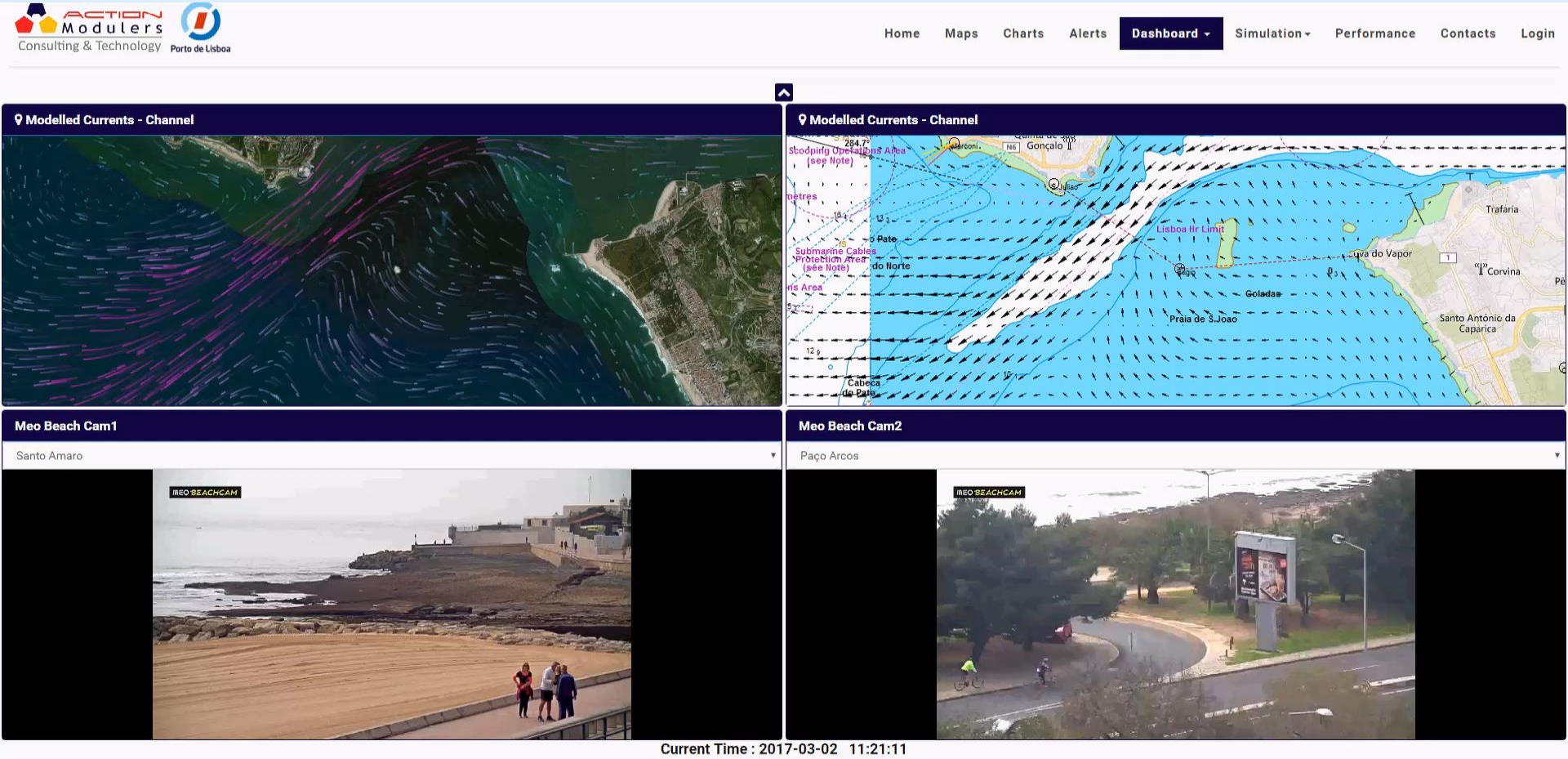
MARINER technology application in different contexts

ACTION Seaport in action | Dynamic dashboards I



Multiple data sources automatically updated in dynamic dashboards for wall screens

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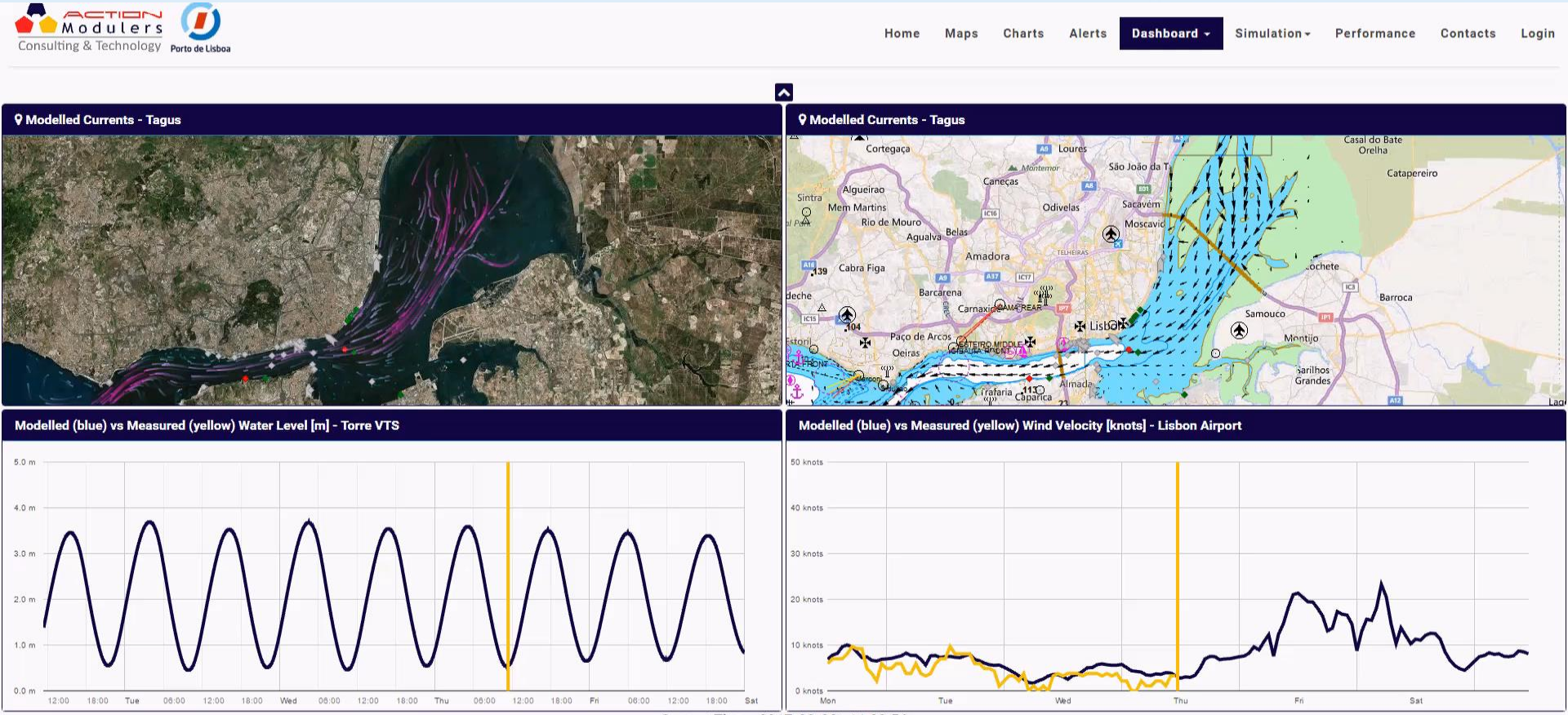
MARINER technology application in different contexts

ACTION Seaport in action | Dynamic dashboards II



Multiple data sources automatically updated in dynamic dashboards for wall screens

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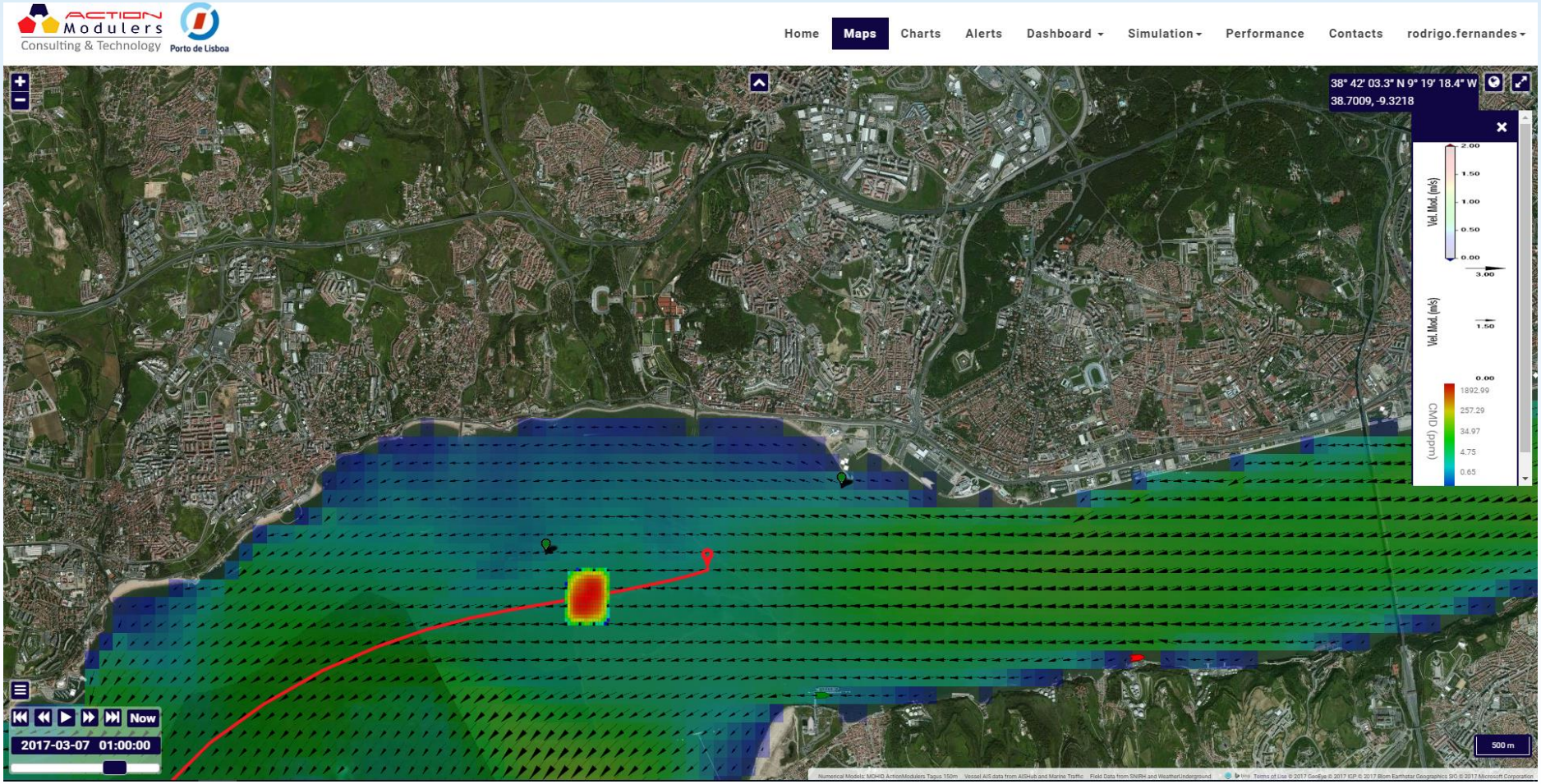
MARINER technology application in different contexts

ACTION Seaport |
Emergency response: oil / chemical spill simulations



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MARINER technology application in different contexts

Exchange with other DG-ECHO projects:

- MARPOCS (Multination Response to Oil and Chemical Spills
  - MARPOCS -> HNS spill model calibration
  - MARINER -> HNS spill model comparison with other models
  - MARPOCS new lab data -> integration in dynamic database used by MARINER COP
  - MARINER -> CIIMAR database used by MARPOCS

- HNS-MS
  - MARINER using dynamic database

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MARINER technology application in different contexts

DG-ECHO project 2018-2019

HazRunoff: Integration of sensing and modelling technologies for early detection and follow-up of hazmat and flood hazards in transitional and coastal waters

TÉCNICO LISBOA

Bentley®

Cedre

CETMAR
CENTRO TECNOLÓGICO DEL MAR

EOMAP

Public Health England

LRS LOURES
câmara municipal

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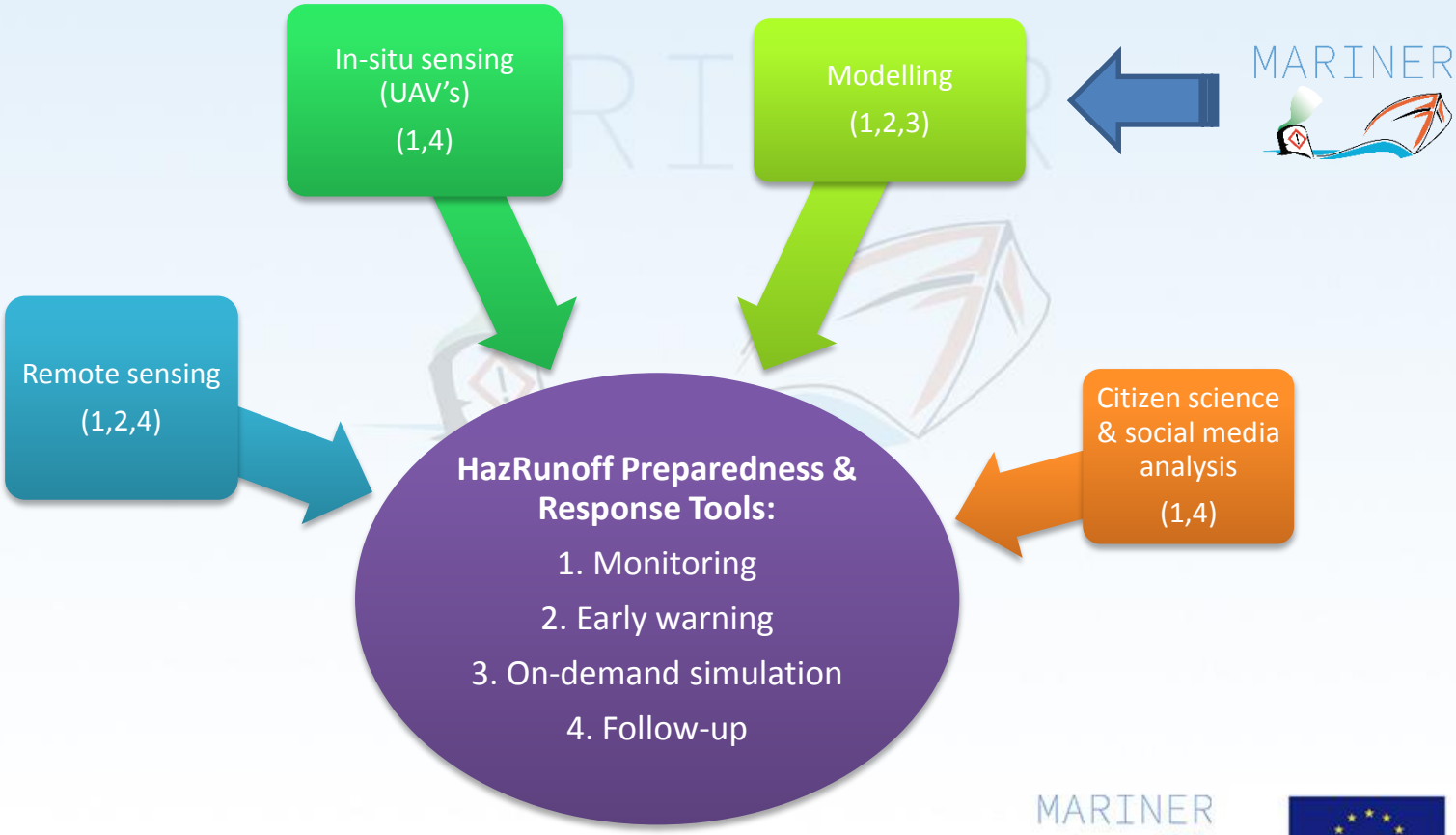
MARINER technology application in different contexts

HazRunOFF

- DG-ECHO project 2018-2019



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MARINER technology application in different contexts

MARPOCS final meeting:

Gran Canaria

13 / 14 December

Includes presentations from external partners:

- SAMOA project (Puertos del Estado)
- e-URready4OS DG-ECHO project (Univ. Politecnica Cartagena, SASEMAR)
- MARINER project

MARPOCS

Co-funded by European Union Humanitarian Aid & Civil Protection

AGENDA – Gran Canaria

Day 1 – Workshop / Roadshow

Place: PLOCAN (Crta. Taliarte s/n, Telde)

13th December 2017	
09:30 - 10:00	**Welcome (PLOCAN, ULPGC, IST)**
10:00 - 10:20	**Bentley Systems** (formerly Action Modulers, Portugal)
10:20 - 10:40	**CEDRE** (Centre of Documentation, Research and Experimentation on Accidental Water Pollution, France)
10:40 - 11:00	**Coffee Break**
11:00 - 11:20	**ULPGC/PLOCAN** (Universidad de Las Palmas de Gran Canaria / Plataforma Oceánica de Canarias, Spain)
11:20 - 11:40	**IST focused on Canary Islands modelling** (Instituto Superior Técnico, Portugal)
11:40 - 12:00	**OOM** (Oceanic Observatory of Madeira, Portugal)
12:00 - 12:20	**INRH** (Institut National de Recherche Halieutique, Morocco)
12:20 - 12:40	**Open discussion**
12:40 - 13:30	**Lunch**
13:30 - 15:30	**15' or 20' talks tbd** (Public Health England, Universidad Politécnica de Cartagena, etc)
15:30 -16:00	**Round table**
16:00 - 16:20	**Coffee Break**
16:20 - 17:00	**Plocan visit, land**
20:30	**Dinner at place tbd**

Day 2 –Tabletop exercise

Place: PLOCAN (Crta. Taliarte s/n, Telde)

14th December 2017	
09:00 - 10:30	**MARPOCS Decision support tools demonstration**
10:30 - 11:00	**Coffee Break**
11:00 - 12:30	***Hands-on / live training session on MARPOCS Decision support tools****
12:30 - 13:30	**Lunch**
13:30 - 15:30	**Tabletop exercise**
15:30 - 16:30	**Debriefing of the exercise**

MARINER technology application in different contexts

EOSC-hub

- H2020 project
- 74 beneficiaries
- 300 data centres

Bentley Systems involvement:
Business Pilot Case

- Improving ACTION Seaport performance, making use of the European Open Science Cloud Infrastructure

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MARINER technology application in different contexts

Who is behind EOSC-hub?

Austria
BBMRI-ERIC
EEA
EODC

Belgium
ULG
VUB

Croatia
SRCE

Czech Republic
CESNET
MU

Denmark
DEIK (DTU)

Finland
CSC

France
CEA
CINES
CNRS
ECRIN
eSDF
IFREMER

Germany
DKRZ
EMBL-EBI
GFZ
GWDG
JUELICH
KIT
MPG
RASDAMAN

Greece
GRNET
IASA
NOA

Hungary
MTA-SZTAKI

Italy
INFN
CINECA
CIRMMP
CMCC
CNR
INGV
MEEO
Moxoff
TERRADUE
Yottacle

Ireland
SUITE5

Netherlands
EGI
ASTRON
CLARIN
GEANT
MARIS
SURFsara

Norway
SIGMA2

Poland
ACK Cyfronet
CloudFerro
IDEGO
KOMA Nord
PSNC

Portugal
Bentley Systems
LIP
LNEC

Slovakia
IISAS

Slovenia
Sinergise

Spain
AIDIMME
BSC
CSIC
Ecohydros
Hidronav
UNICAN (UC)
USE

Sweden
EISCAT
SNIC (UU)

Switzerland
CERN

United Kingdom
CCFE (UKAEA)
EPCC (UEDIN)
F6S
JISC
STFC
TRUST-IT
UCL

Taiwan
AS (ASGC)

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MARINER platform: Achievements

1. Comprehensive water & chemical air spill model:
   - multiple processes and properties evolution at the same time;
   - Based on physical and chemical characteristics (not in classes)

2. Integration of the model in a web, mobile-friendly technology, and results exportable to other systems

3. Flexibility & transferability: applicable in any place, and with seamless integration of different metocean models

4. Dynamic connection with HNS products database *

5. Environmental impact modelling *

* CIIMAR presentation

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MARINER platform: Running an HNS spill

MARINER

Home | Maps | Charts | Simulation | Operational Models | rodrigo.fernandes | Help

1. What? | 2. Where? | 3. When? | 4. Run

Incident Name

Butyl acrylate in Douro

Substance Type

HNS Spill

Chemical Spill Options

HNS Classes ◉ HNS Online DB's

Search:

	Name	Behaviour	CAS	Density [kg/L]	Viscosity [mPa.s]	Solubility [mg/L]	Vapour Pressure [KPa]	Molecular Weight [g/mol]	Log Kow	Source
☐	Aniline	Dissolver, Floater	62-53-3	1020	4.35 at 20ºC	36000 at 25ºC	90 at 25ºC	93.129	0.9	MARINER (CIIMAR)
☐	Aniline	Floater that dissolves (FD)	62-53-3	1020	4.35 at 20ºC	35000 at 20ºC	40 at 20ºC	93.13	0.9	HNS-MS + MARPOCS
☐	Benzene	Evaporator	71-43-2	880	0.60 at 25ºC	1790 at 25ºC	12640 at 25ºC	78.114	2.13	MARINER (CIIMAR)
☐	Benzene	Evaporator (E)	71-43-2	880	0.65 at 20ºC	1780 at 20ºC	9970 at 20ºC	78.11	2.13	HNS-MS + MARPOCS
☑	Butyl acrylate	Dissolver, Evaporator,	141-32-2	890	0.79 at 25ºC	2000 at 23ºC	730 at 25ºC	128.171	2.36	MARINER (CIIMAR)

CETMAR | intecmar | Universidade Vigo | Action Modulers | ciimar | Public Health England | Cedre | Co-funded by European Union Humanitarian Aid & Civil Protection

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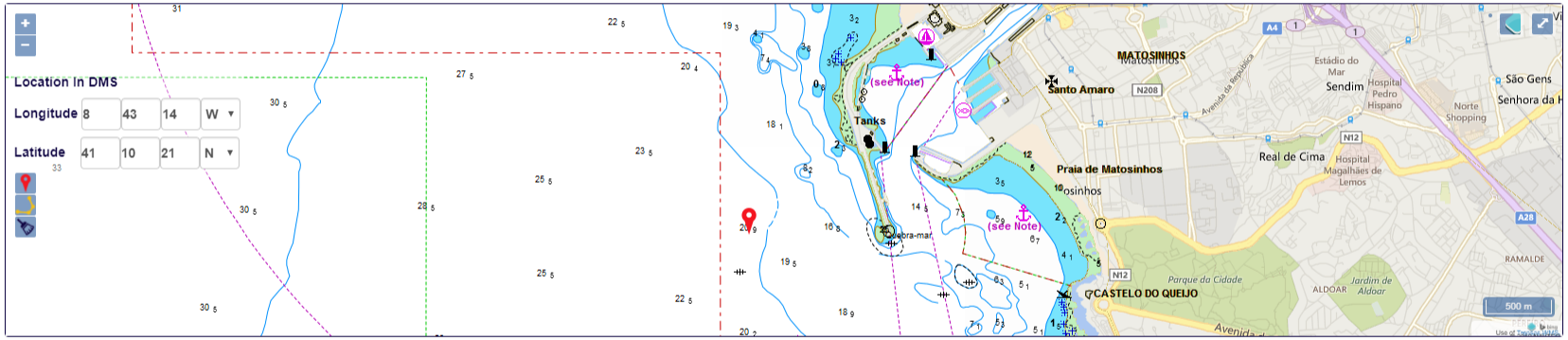
1. What? | 2. Where? | 3. When? | 4. Run

Domain

Portugal (Cont.)

Pick Incident Locations Interactively



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1. What? | 2. Where? | 3. When? | 4. Run

Incident Type

Continuous Instantaneous

Incident Instant/Simulation Start

2017-09-06 00:00

Simulation End

2017-09-07 00:00

Volume (m3)

5

Previous Next

CETMAR intecmar UniversidadeVigo Action Modulers climar Public Health England Cedre

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MARINER platform: Running an HNS spill

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1. What? | 2. Where? | 3. When? | 4. Run

Simulation Resume
Name : Butyl acrylate in Douro.
Substance : HNS Spill
Localization : -8.721 41.173
Emission Type : instantaneous
Start Date : 2017-09-06 00:00
End Date : 2017-09-07 00:00

Previous | Finish

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MARINER platform: Running an HNS spill

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1. What? | 2. Where? | 3. When? | 4. Run

Status: Preparing simulation in server. Wait for update or check simulation updated status here

Previous | Finish

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MARINER platform: Running an HNS spill

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Last 30 User Spill Simulations Status

Refresh

User successfull simulations results are presented in Maps tab

Show 10 entries

Search:

Name	Start Date	End Date	Status
Butyl acrylate in Douro_	2017-09-06 00:00:00	2017-09-07 00:00:00	Running Simulation
butylacrilate in Galicia 24h 1m3	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
butylAcrilate in Galicia 24h 5m3	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
Butyl Acrilate	2017-09-06 00:00:00	2017-09-06 06:00:00	Finished Sucessfully Simulation
Butil Acrylate in Douro 6 hours	2017-09-06 00:00:00	2017-09-06 06:00:00	Finished Sucessfully Simulation
Butyl acrylate in Douro	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
Chlorine Gas in Galicia	2017-09-07 00:00:00	2017-09-07 06:00:00	Finished Sucessfully Simulation
2017-09-11 08_51_31 Sim Name	2017-09-07 00:00:00	2017-09-07 06:00:00	Finished Sucessfully Simulation
Chlorine in Galicia	2017-09-11 00:00:00	2017-09-11 06:00:00	Simulation Run Unknown Error.
2017-09-09 19_08_09 Sim Name	2017-09-09 00:00:00	2017-09-09 12:00:00	Finished Sucessfully Simulation

Showing 1 to 10 of 30 entries

Previous 1 2 3 Next

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MARINER platform: Running an HNS spill

MARINER

Home | Maps | Charts | Simulation | Operational Models | rodrigo.fernandes | Help

Last 30 User Spill Simulations Status

Refresh

User successfull simulations results are presented in Maps tab

Show 10 entries

Search:

Name	Start Date	End Date	Status
Butyl acrylate in Douro_	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
butylacrilate in Galicia 24h 1m3	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
butylAcrilate in Galicia 24h 5m3	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
Butyl Acrilate	2017-09-06 00:00:00	2017-09-06 06:00:00	Finished Sucessfully Simulation
Butil Acrylate in Douro 6 hours	2017-09-06 00:00:00	2017-09-06 06:00:00	Finished Sucessfully Simulation
Butyl acrylate in Douro	2017-09-06 00:00:00	2017-09-07 00:00:00	Finished Sucessfully Simulation
Chlorine Gas in Galicia	2017-09-07 00:00:00	2017-09-07 06:00:00	Finished Sucessfully Simulation
2017-09-11 08_51_31 Sim Name	2017-09-07 00:00:00	2017-09-07 06:00:00	Finished Sucessfully Simulation
Chlorine in Galicia	2017-09-11 00:00:00	2017-09-11 06:00:00	Simulation Run Unknown Error.
2017-09-09 19_08_09 Sim Name	2017-09-09 00:00:00	2017-09-09 12:00:00	Finished Sucessfully Simulation

Showing 1 to 10 of 30 entries

Previous 1 2 3 Next

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MARINER platform: Visualizing HNS spill behaviour

Integrated trajectory of the mass centre

MARINER

Home | Maps | Charts | Simulation | Operational Models | rodrigo.fernandes | Help

Layers

Vulnerability Index

- None
- Socio-Economic
- Ecological
- Environmental

Risk Index

- Vessel Accident Risk
- Shoreline Contamination Risk (non-modelled)

User Simulation Layers

- Zoom to Emission Point

Butyl acrylate in Douro.

Property

"Select one Property..."

- Barrier
- Plume Envelope
- Plume Center Trajectory

General Options

- Tooltip on Mouse Stop

Export Map: PNG | KMZ

Map

Now

2017-09-06 00:00:00

Vel (m/s)

Env. Vulnerability Index

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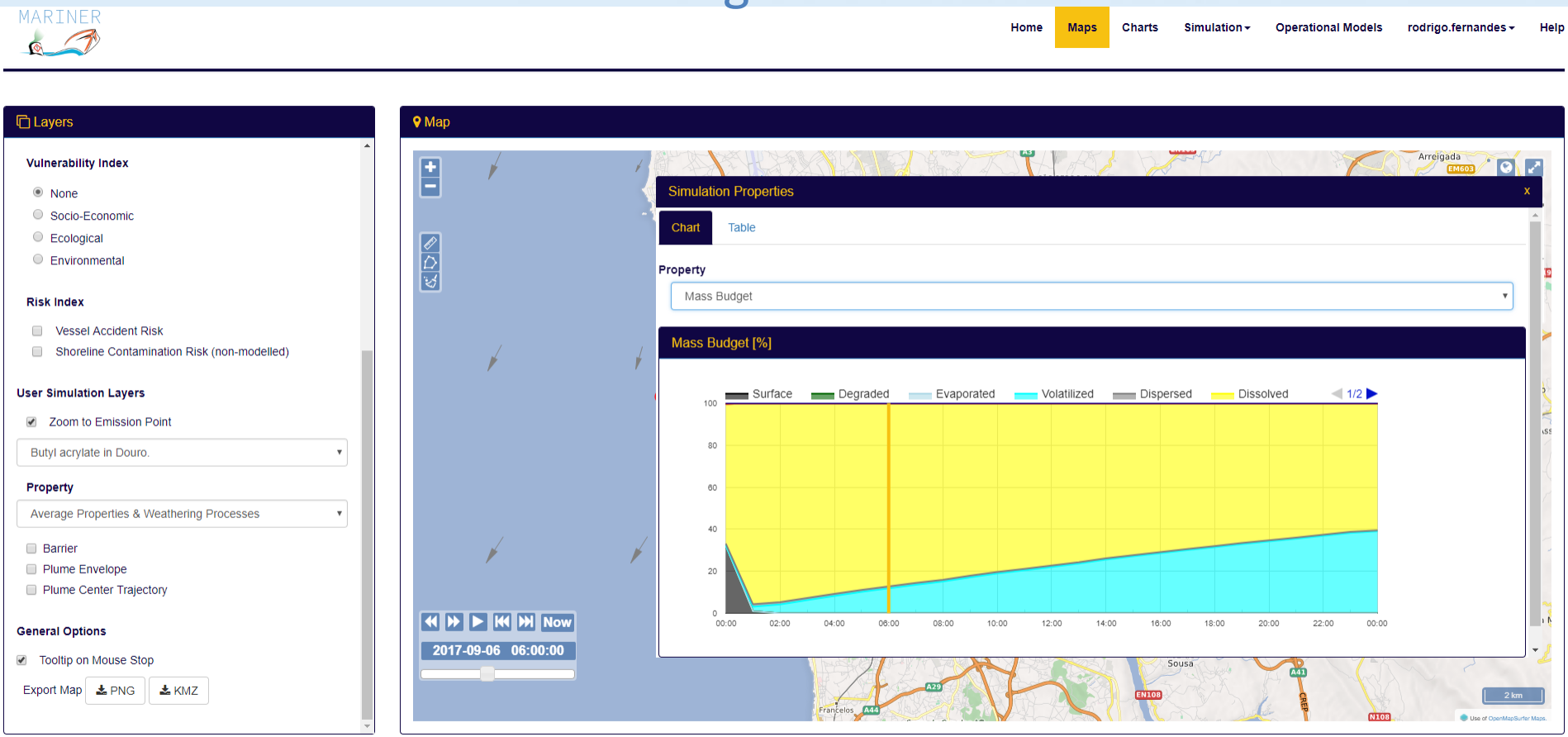
MARINER platform: Visualizing HNS spill behaviour

Mass budget



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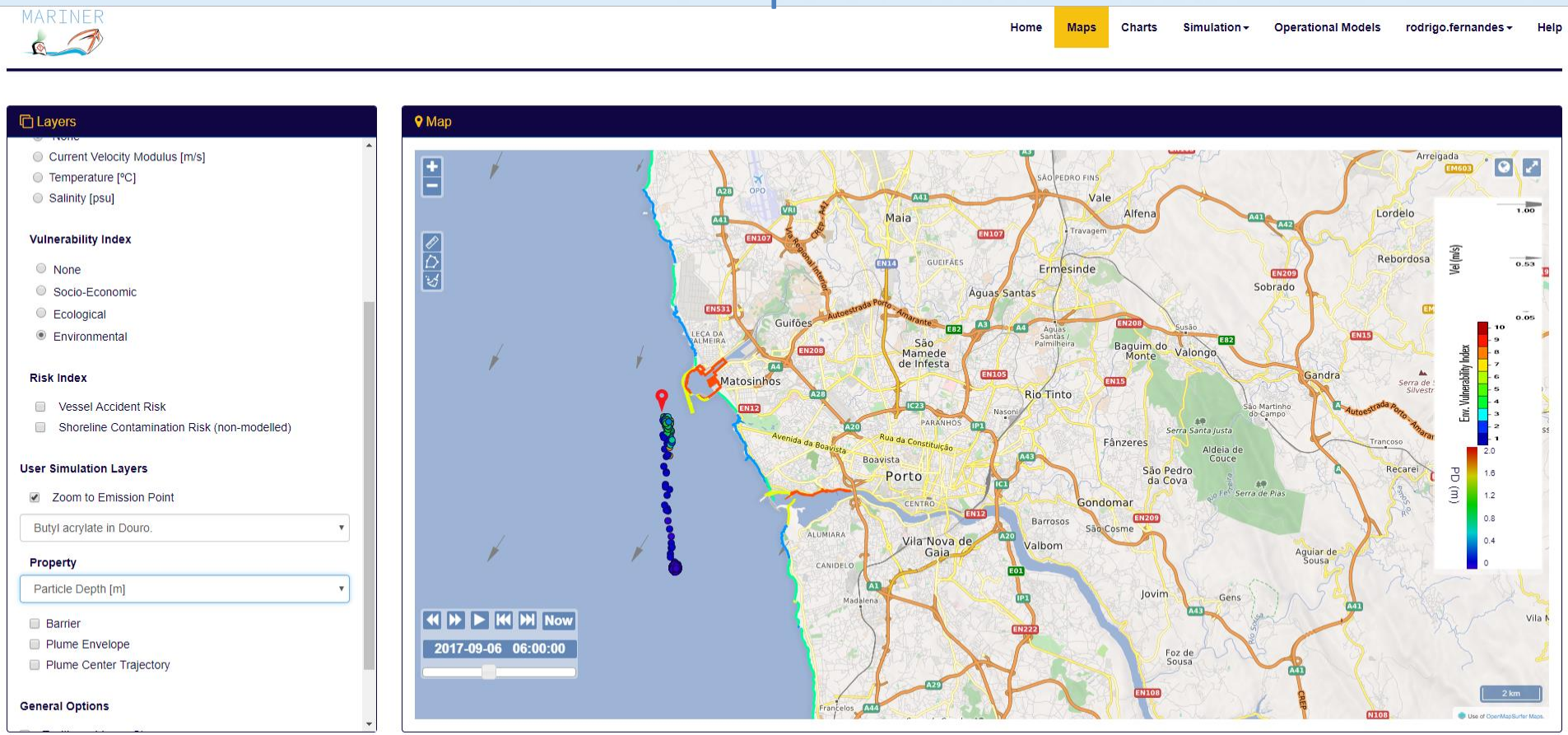
Particles depth



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Air surface concentration

MARINER

Home | Maps | Charts | Simulation | Operational Models | rodrigo.fernandes | Help

Layers

- Current Velocity Modulus [m/s]
- Temperature [ºC]
- Salinity [psu]

Vulnerability Index

- None
- Socio-Economic
- Ecological
- Environmental

Risk Index

- Vessel Accident Risk
- Shoreline Contamination Risk (non-modelled)

User Simulation Layers

- Zoom to Emission Point

Butyl acrylate in Douro.

Property

Air Surface Concentration [mg/m3]

- Barrier
- Plume Envelope
- Plume Center Trajectory

General Options

Map

Now

2017-09-06 06:00:00

Vel [m/s]

Env. Vulnerability Index

ASC (mg/m3)

2 km

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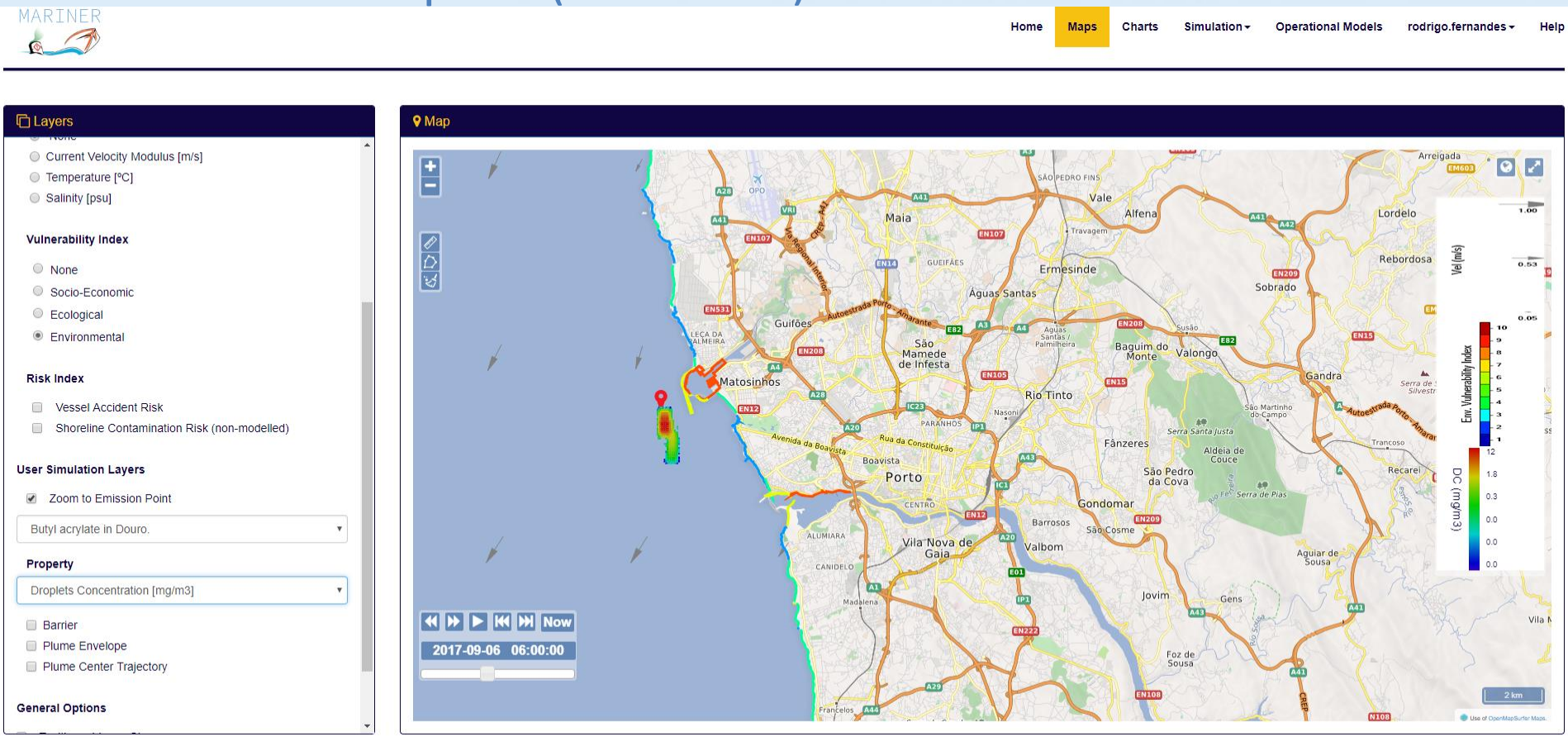
Droplets (entrained) concentration



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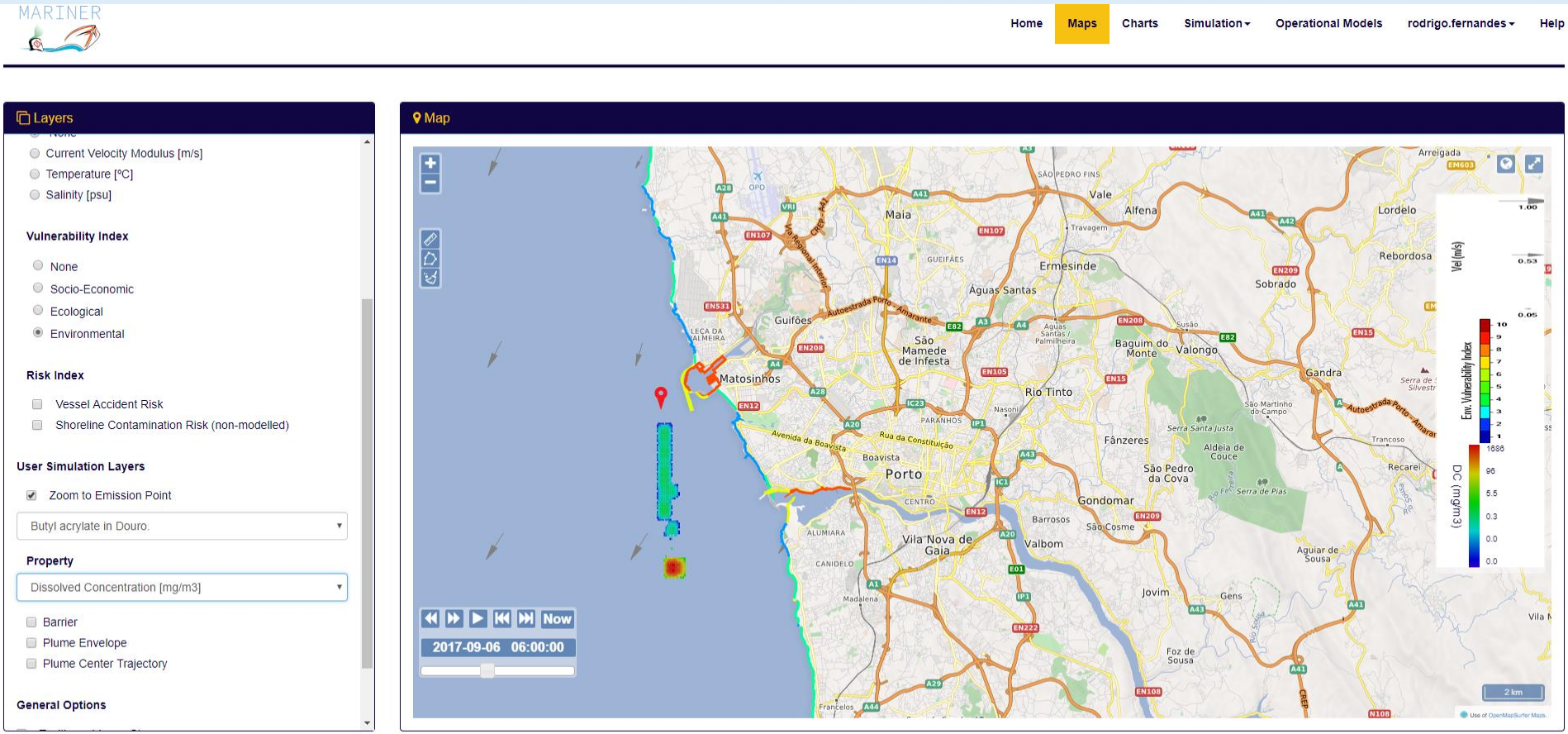
Dissolved concentration



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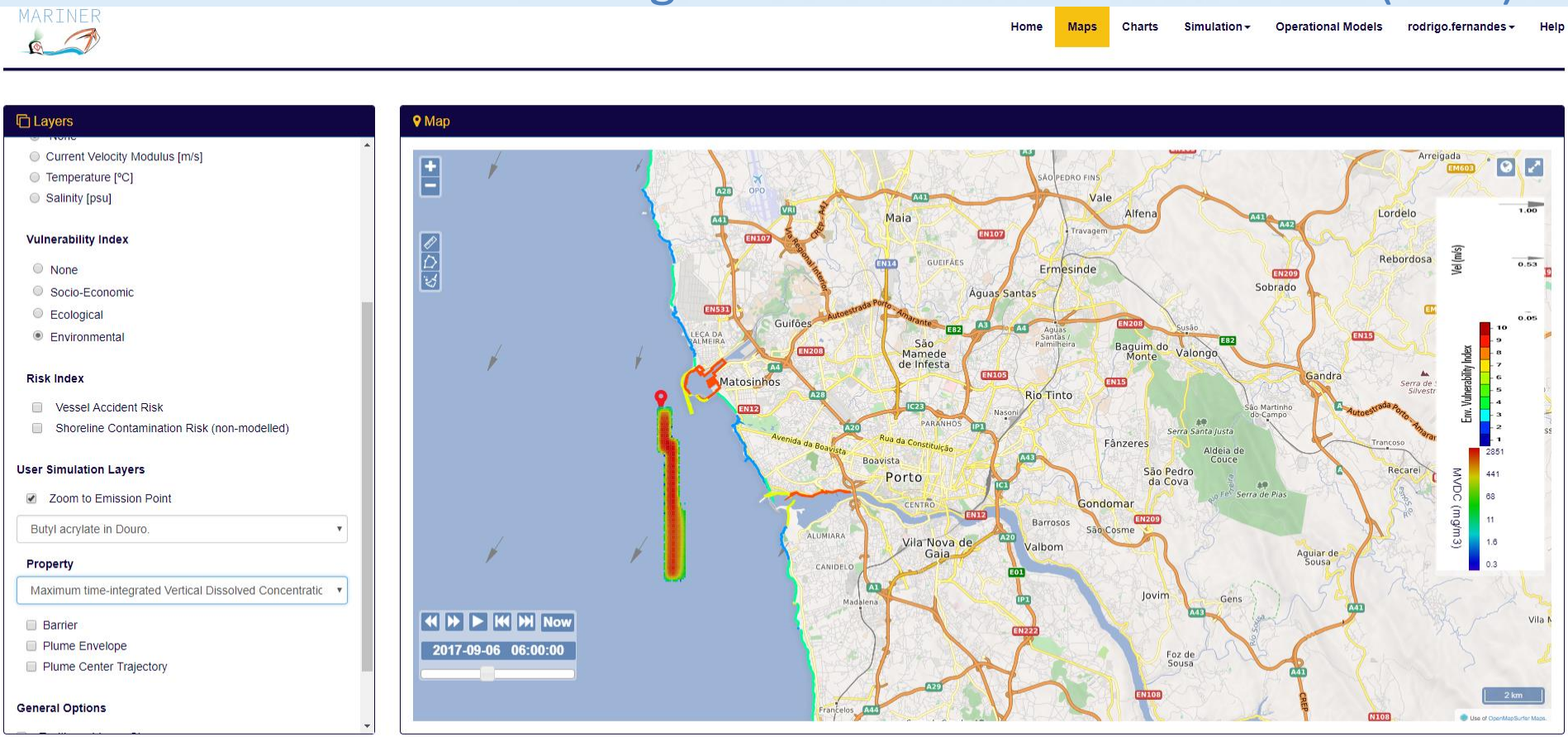
Maximum time integrated dissolved concentration (0-6h)



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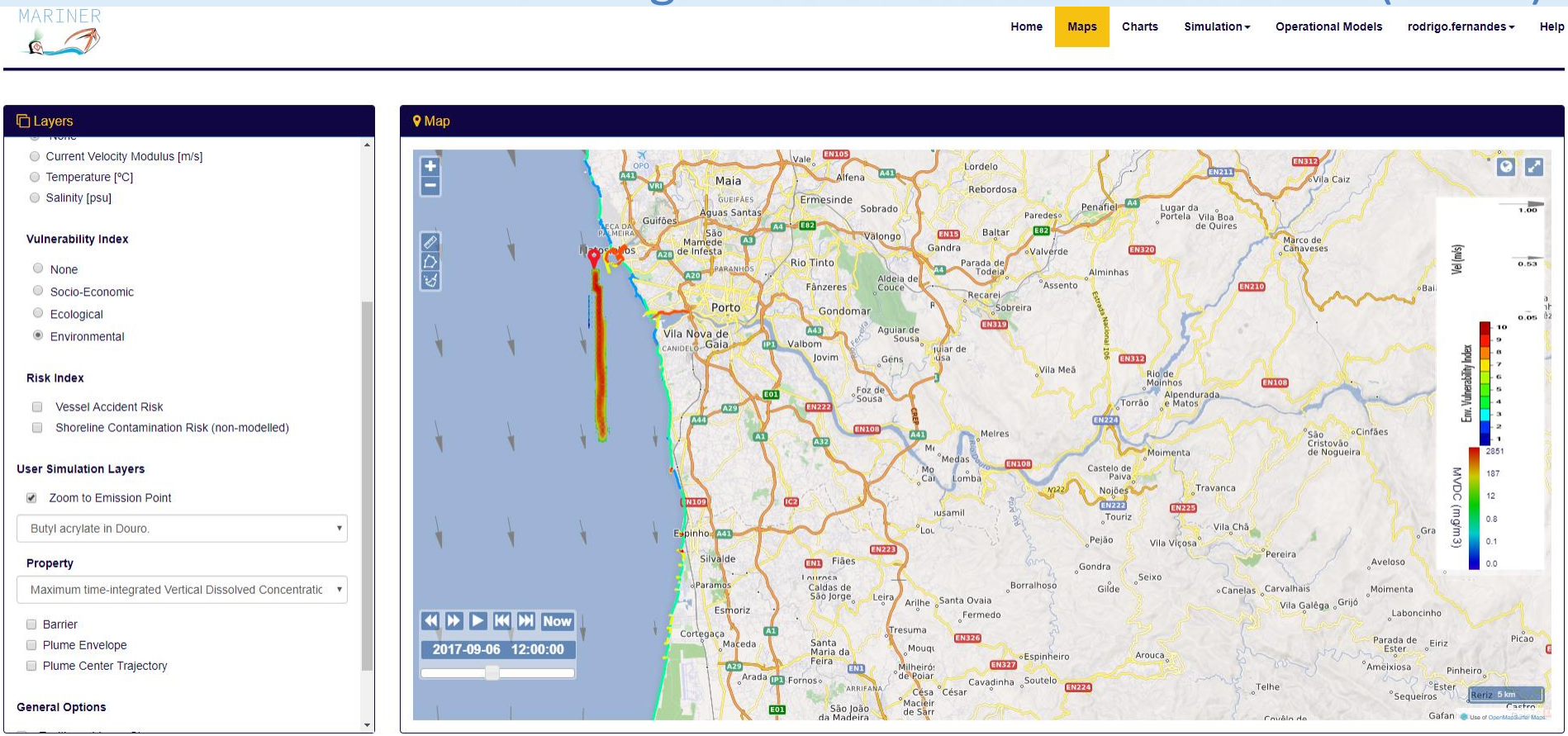
Maximum time integrated dissolved concentration (0-12h)



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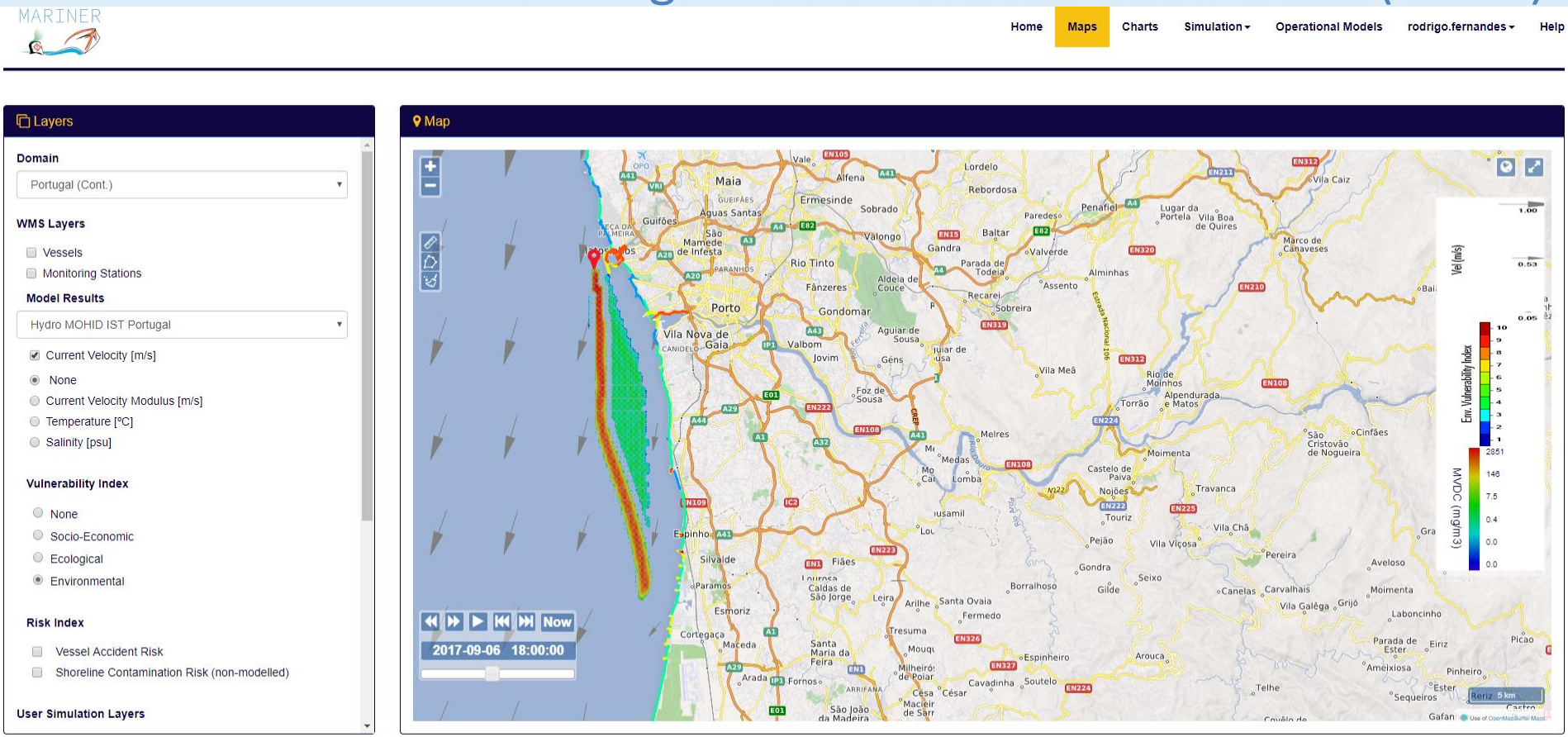
Maximum time integrated dissolved concentration (0-18h)



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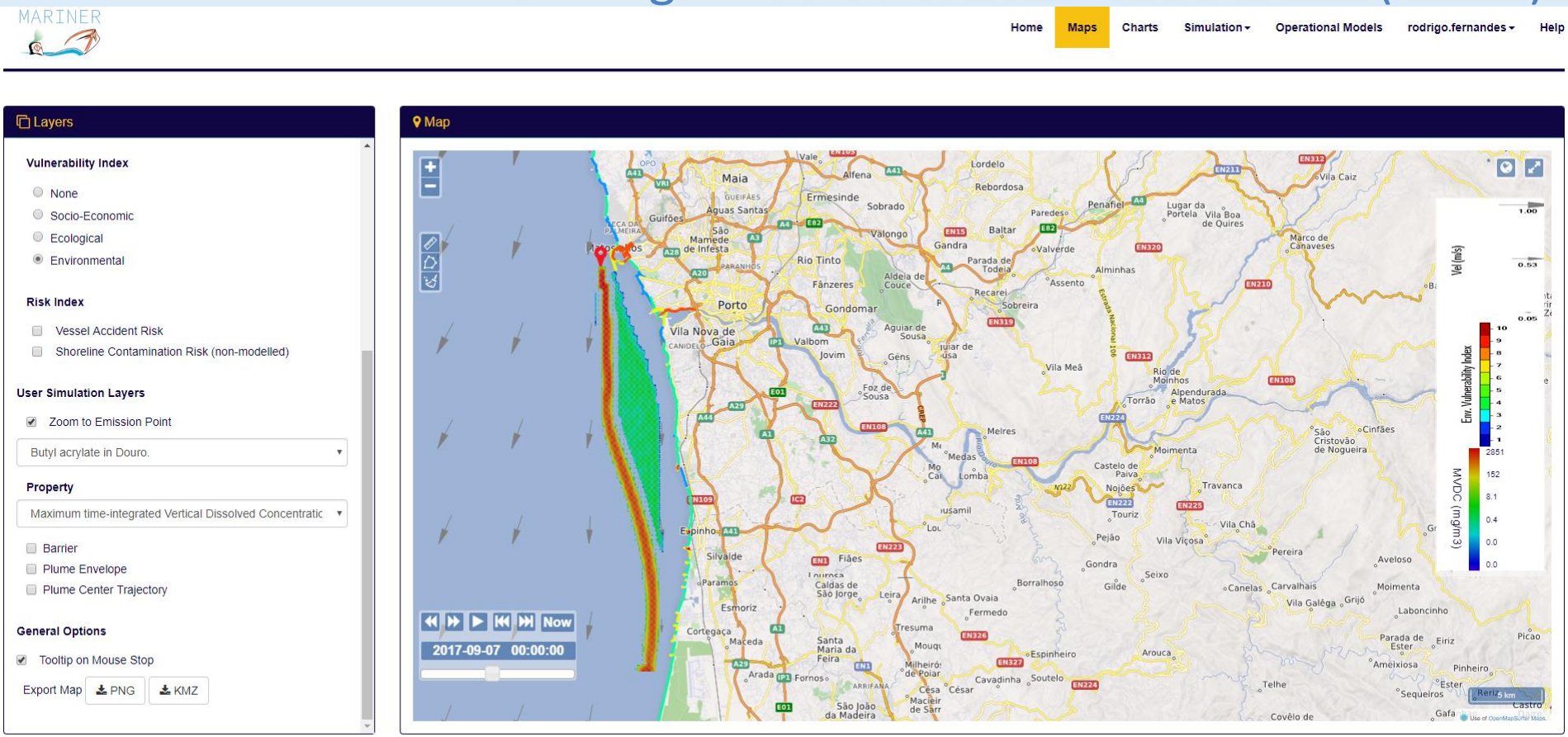
Maximum time integrated dissolved concentration (0-24h)



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Understanding spill trajectories, weathering processes, concentrations – all are useful, but…is the spill environmentally harmful?

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