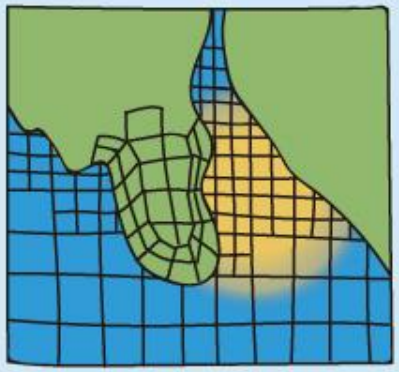

HAZRUNOFF

PROJECT

Modelling in the response strategy

Instituto Superior Técnico

Lígia Pinto

Ana Oliveira

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Civil Protection
and Humanitarian Aid

Outline

Introduction to the HazRunoff modelling tools (watershed, estuarine and meteorological models):

- Models description; input data and models outputs;
- Model results exploitation: an example based on one of the HazRunoff case study using HazRunoff platform.

Water pollutant and debris dispersion model:

- Model description and input data;
- Practical exercise on how to perform a lagrangian simulation using the HazRunoff platform

Final debrief / question and answer session

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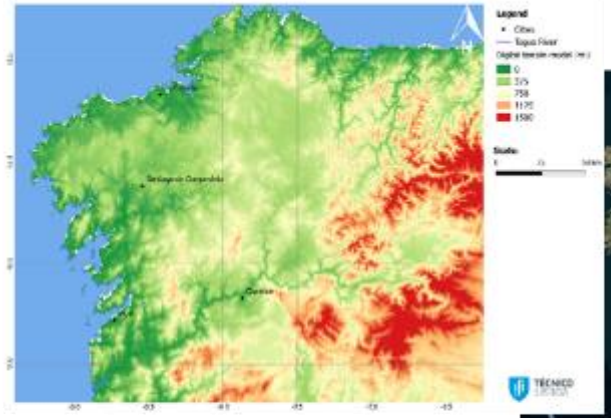
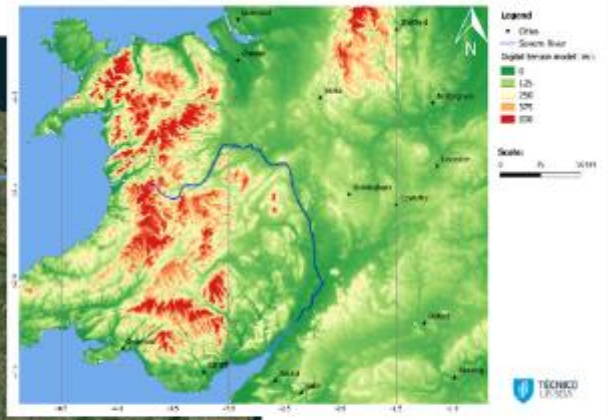
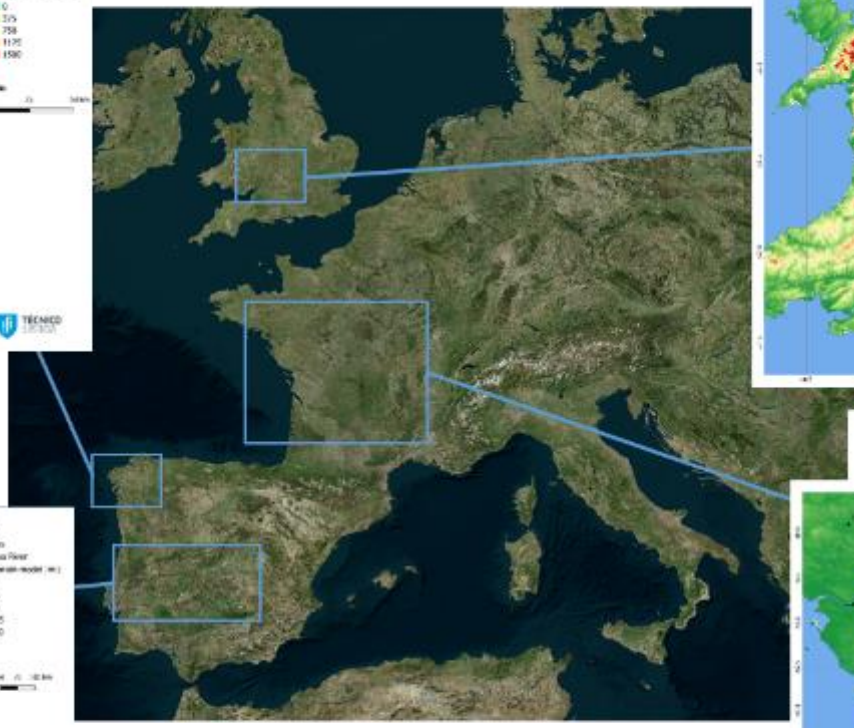
HazRunoff study areas

Ulla and Sar rivers \ Ria Arosa

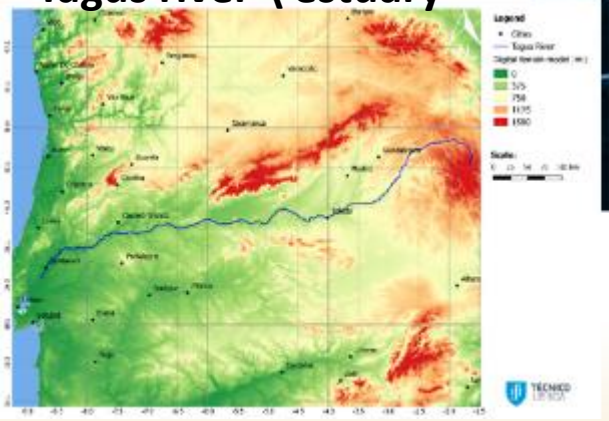


Severn river \ estuary

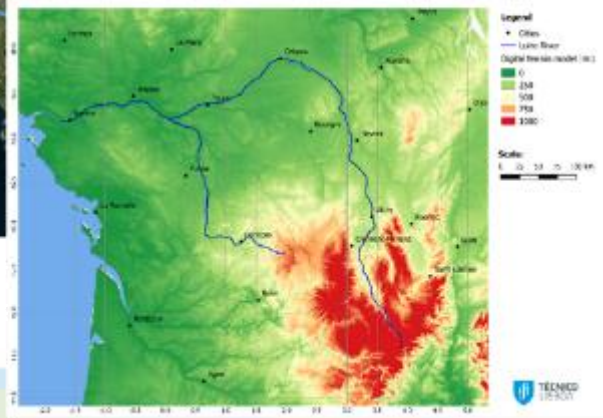




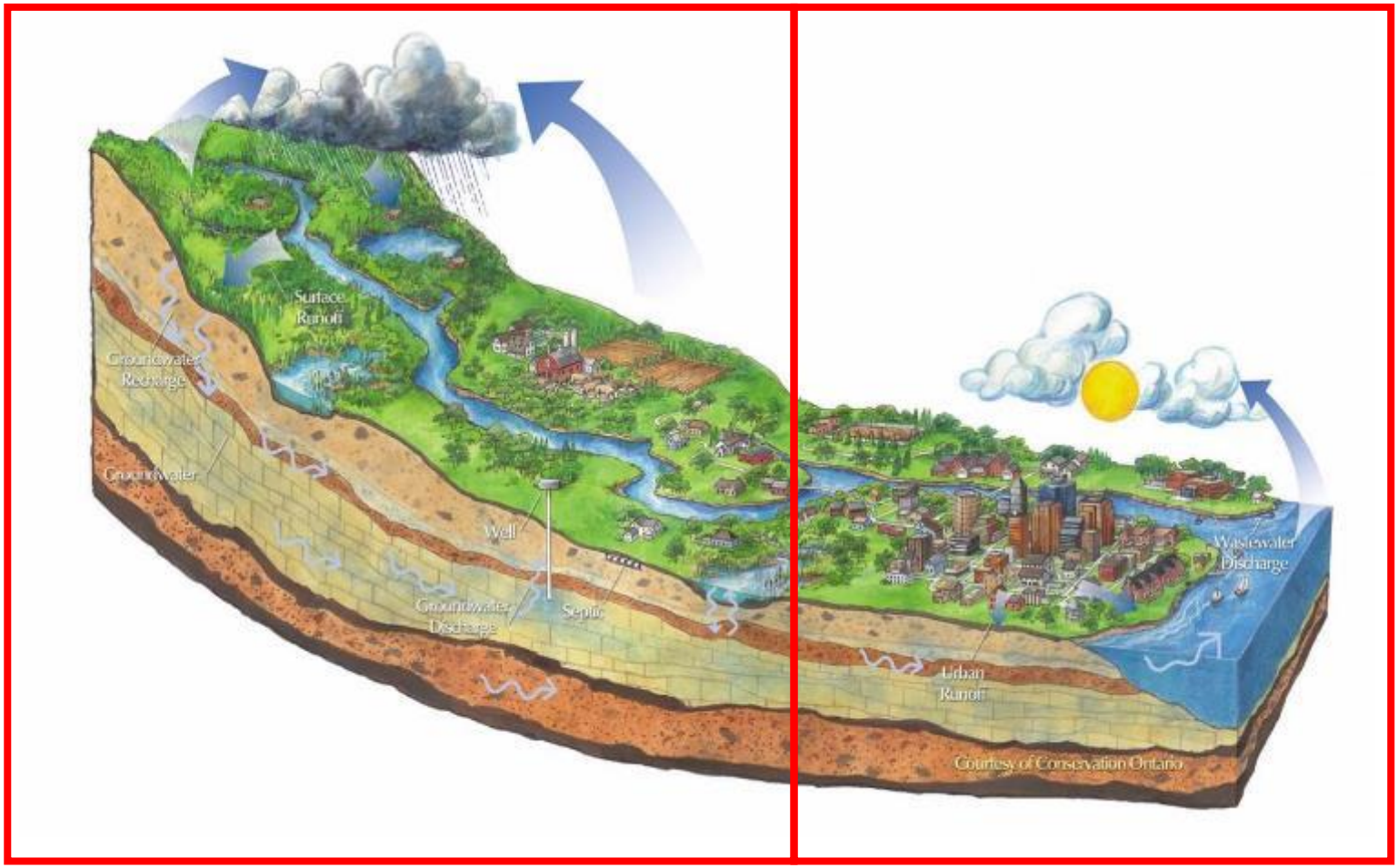
Tagus river \ estuary



Loire river \ estuary



Watershed – Estuary – Coastal zone connection



Watershed modelling **Coastal modelling**

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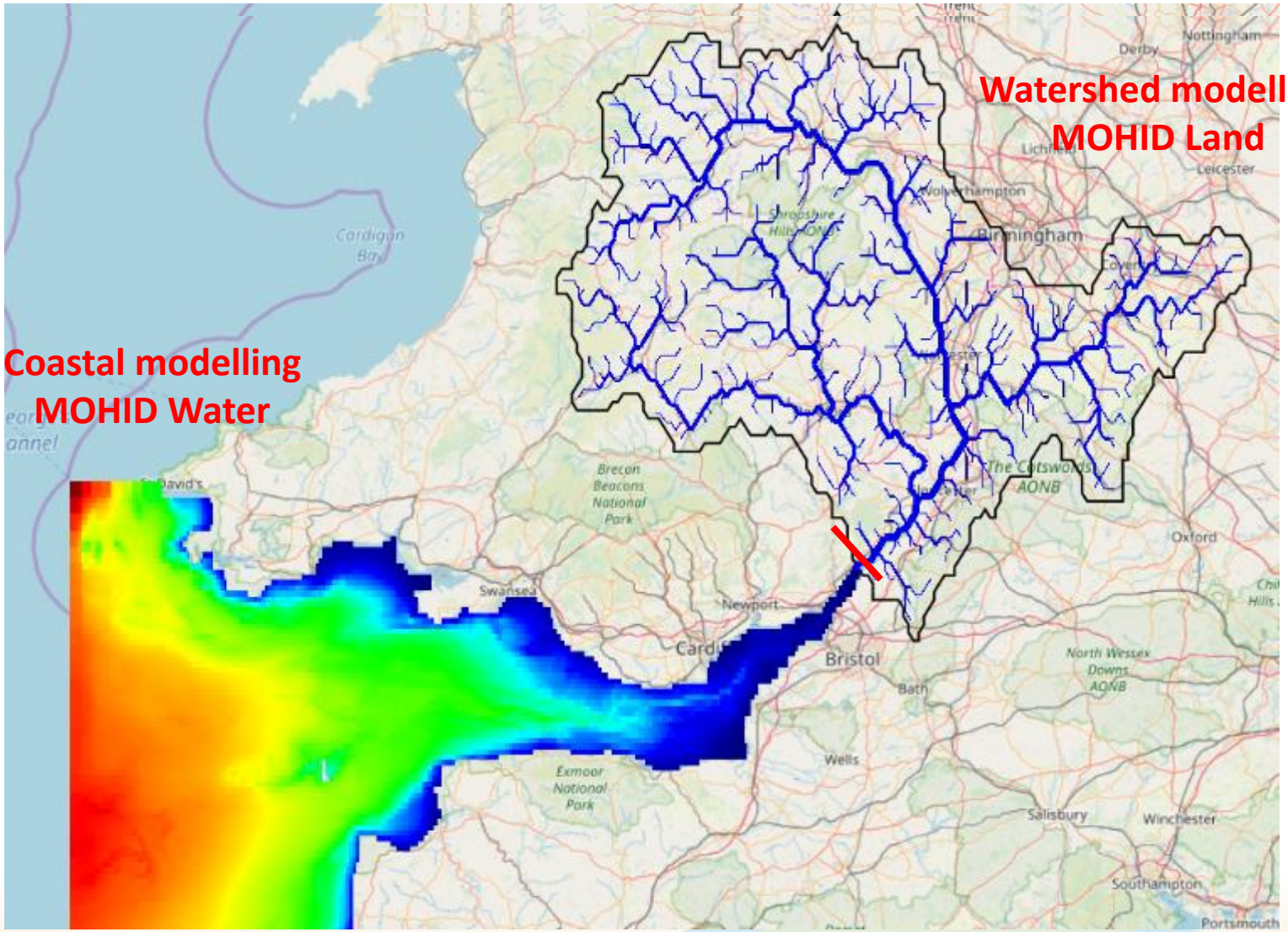
Watershed – Estuary connection in MOHID model



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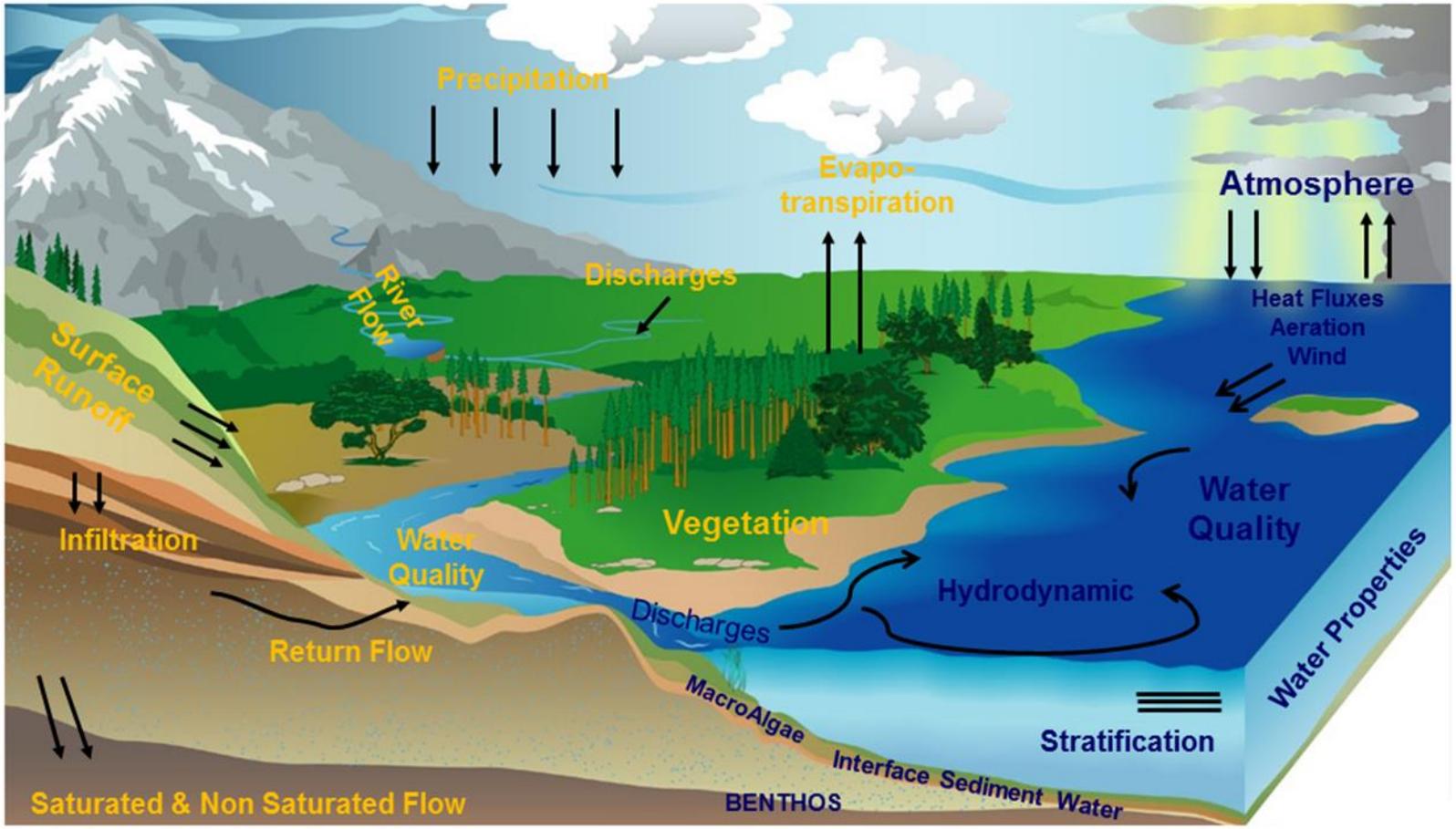
MOHID

Water Modelling System

Copyright by Maretec

Open-source community model

http://www.mohid.com



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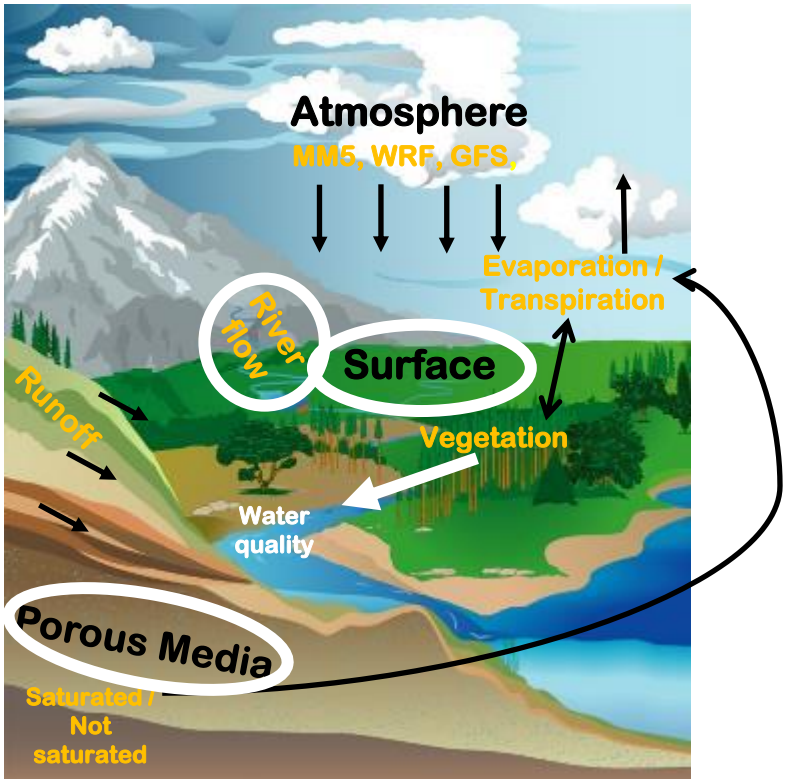
MOHID Land – Watershed Modelling

- According to a bidimensional regular grid and based on meteorological information, the precipitated water is estimated for each grid cell.
- Water deposited in each cell is distributed by the surface, as runoff, by the porous media, as infiltration, and by the drainage network.
- Water fluxes between the porous media, the surface and the drainage network are calculated.
- Water extraction occurs by evaporation and transpiration.
- Properties related to water quality are estimated in the porous media, in the surface and in the drainage network.
- Main input of nutrients comes from the vegetation.



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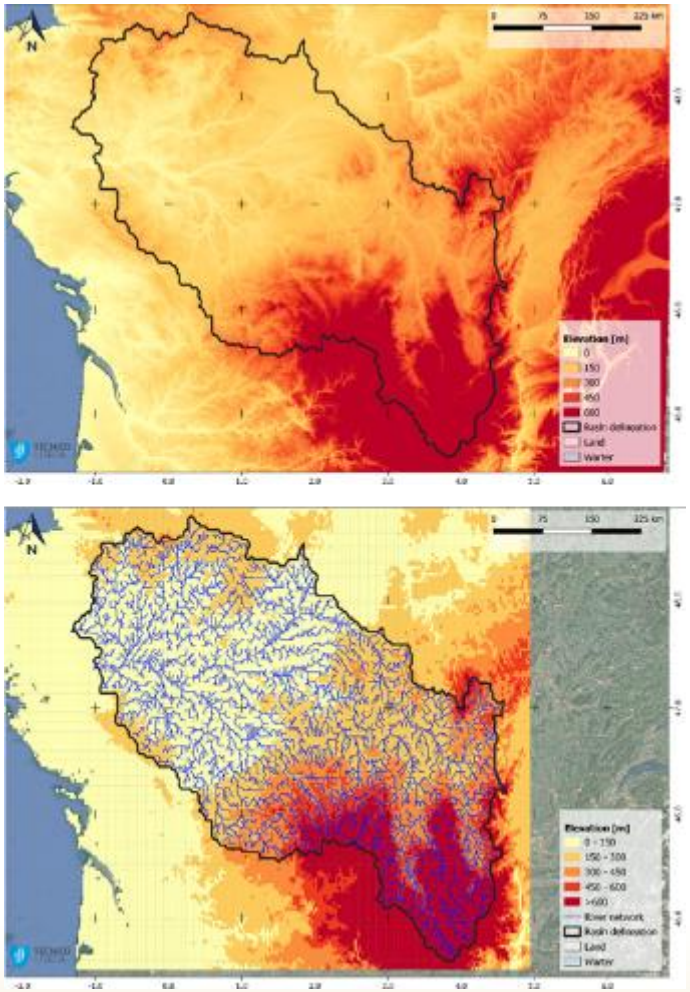
MOHID Land – input data



Digital Terrain Model

Interpolation to MOHID grid

Delineation of watershed and drainage network

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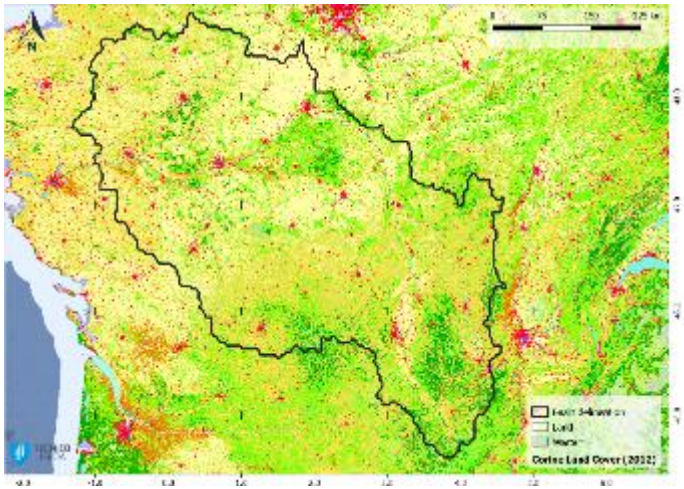
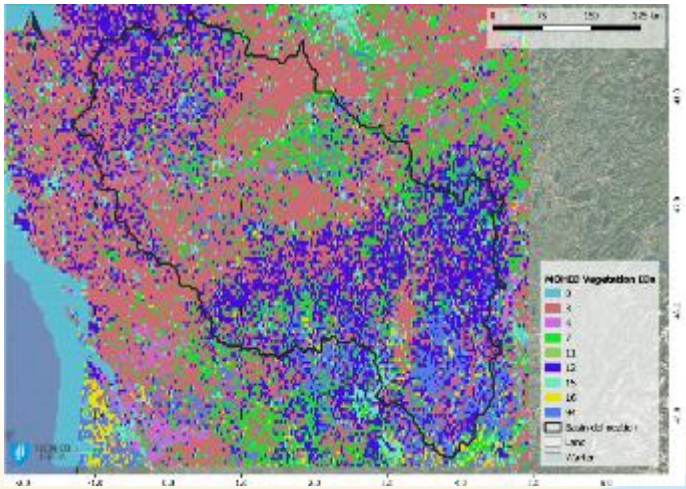
MOHID Land – input data





- Land Use
- Identification of vegetation types
- Interpolation to MOHID grid
- Vegetation ID's, crops coefficient and Manning values

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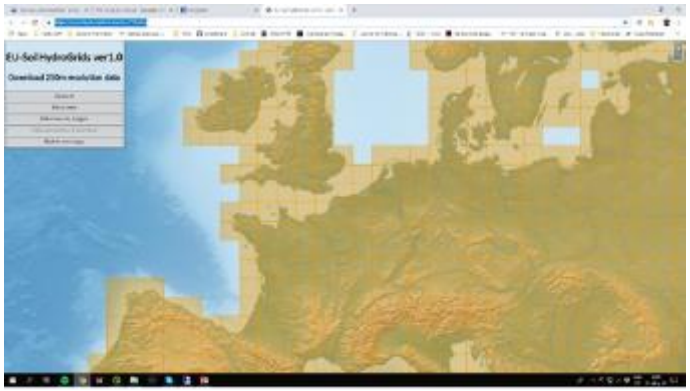
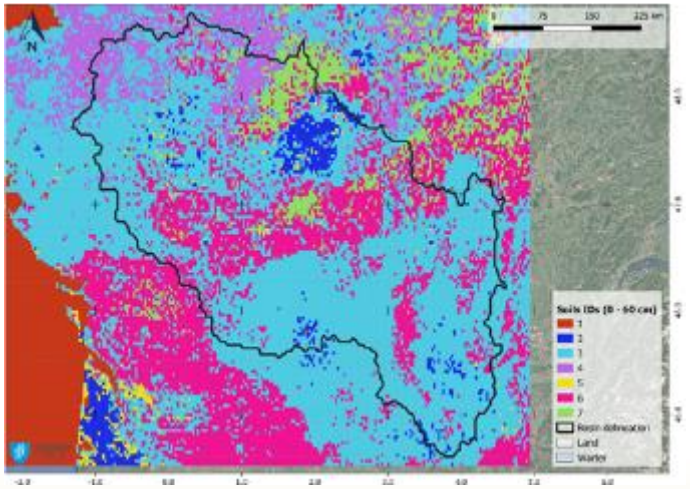
MOHID Land – input data





- Soil hydraulic properties
- Definition of number of layers
- Interpolation to MOHID grid
- ID's to identify soils with different hydraulic properties (different soil type)

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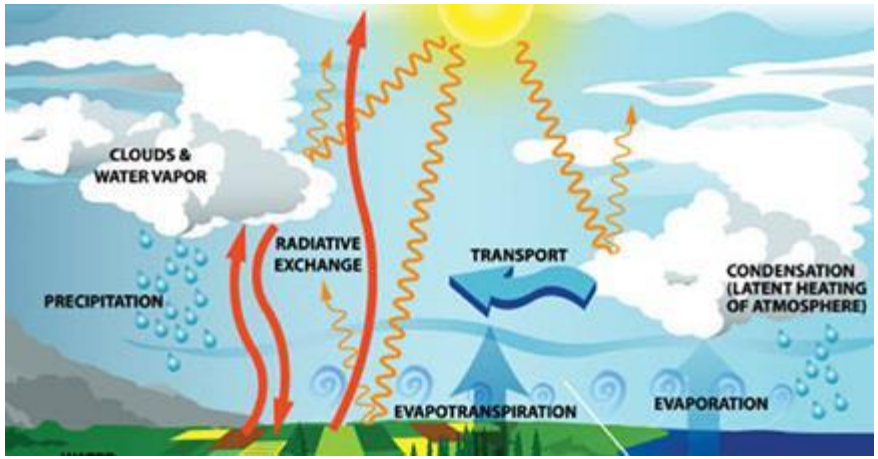
Mohid Land – input data

Boundary conditions

Atmospheric:

- Precipitation
- Wind speed and direction
- Air temperature
- Cloud cover
- Relative humidity



Source: NOAA

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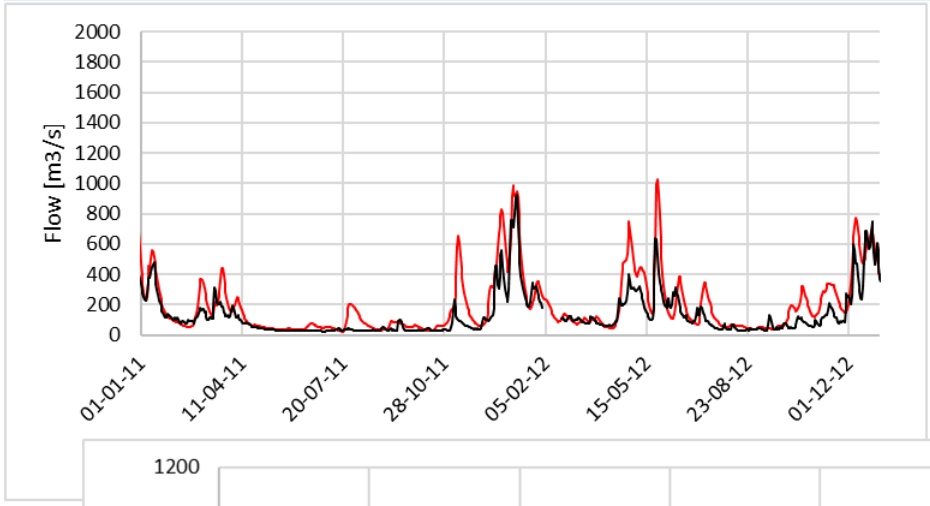
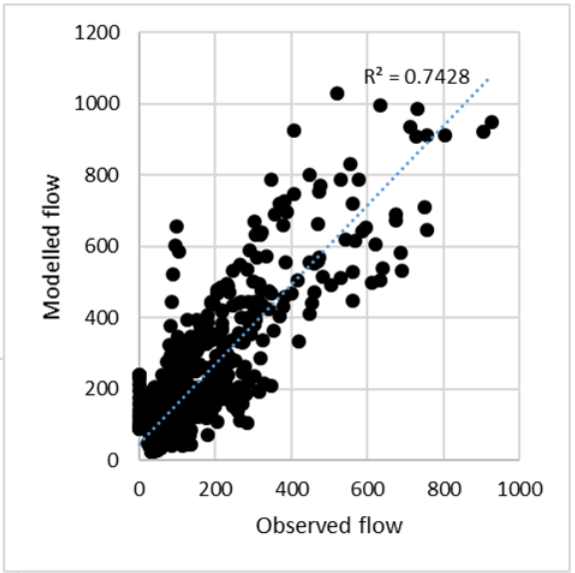
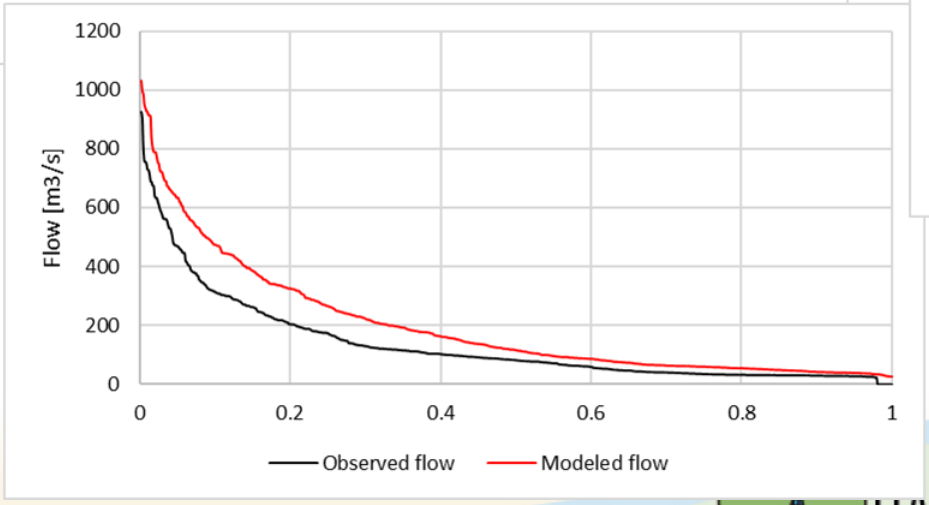
MOHID Land – output data

La Loire à Nevers station – Loire river







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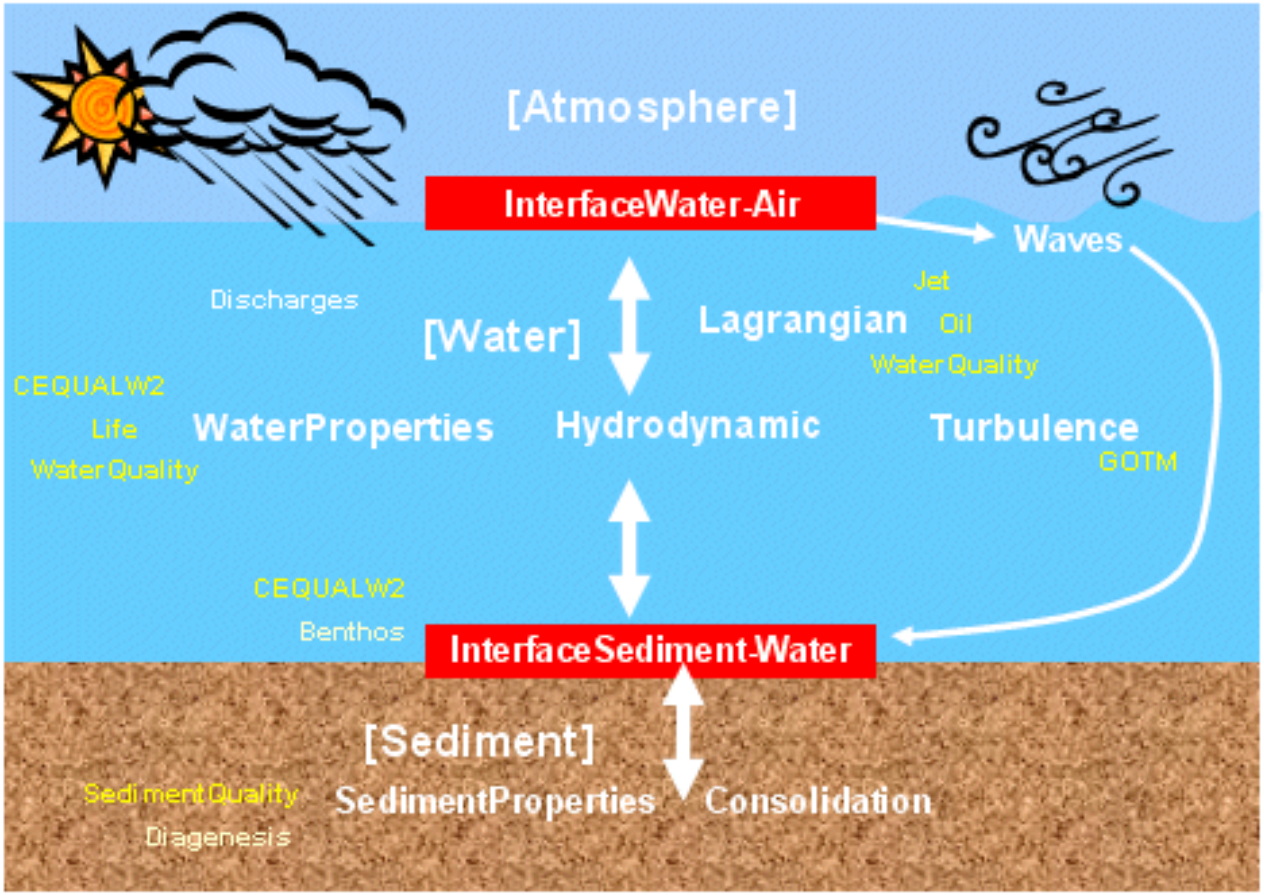
MOHID Water Model – estuary model



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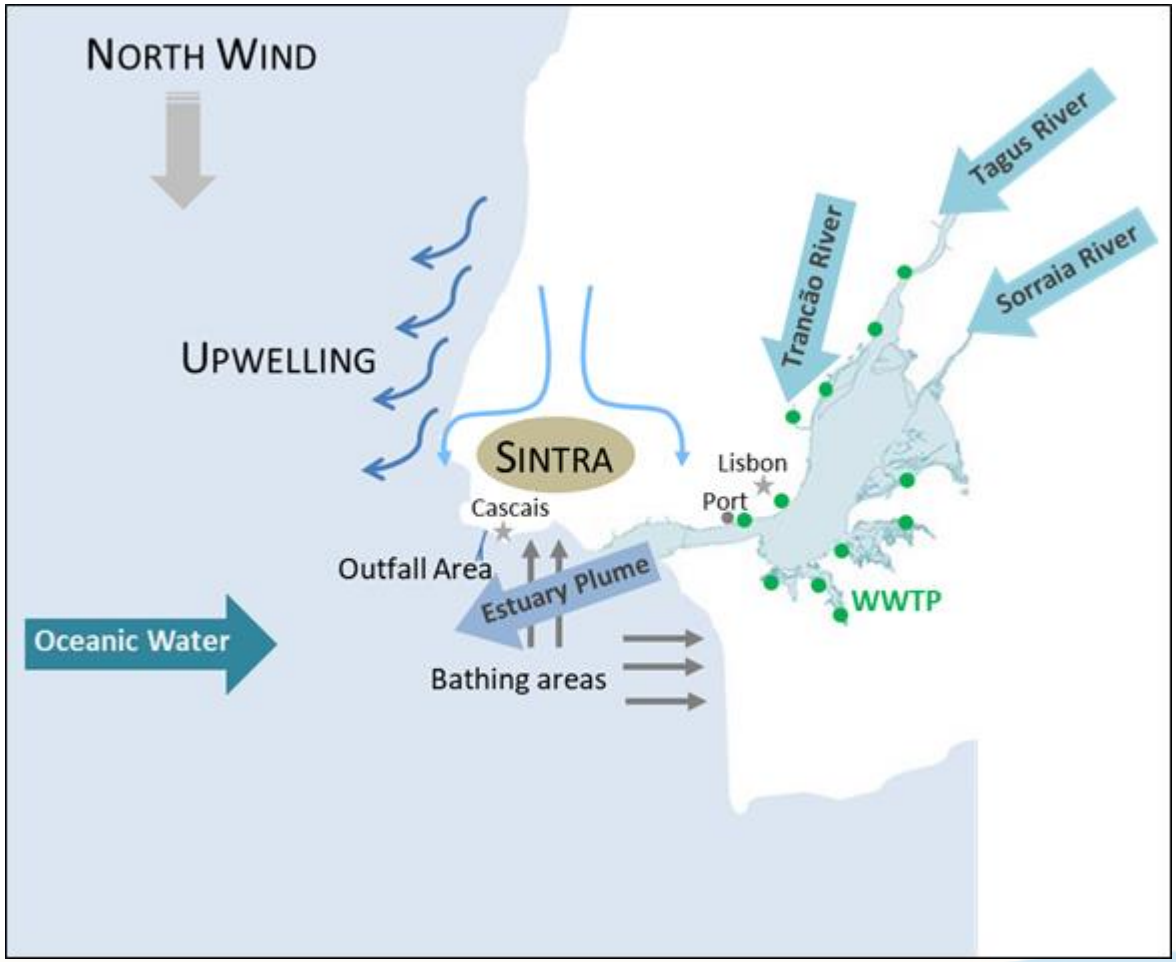
Study area caracterization – Tagus estuary



For each study area first identify the important forcings

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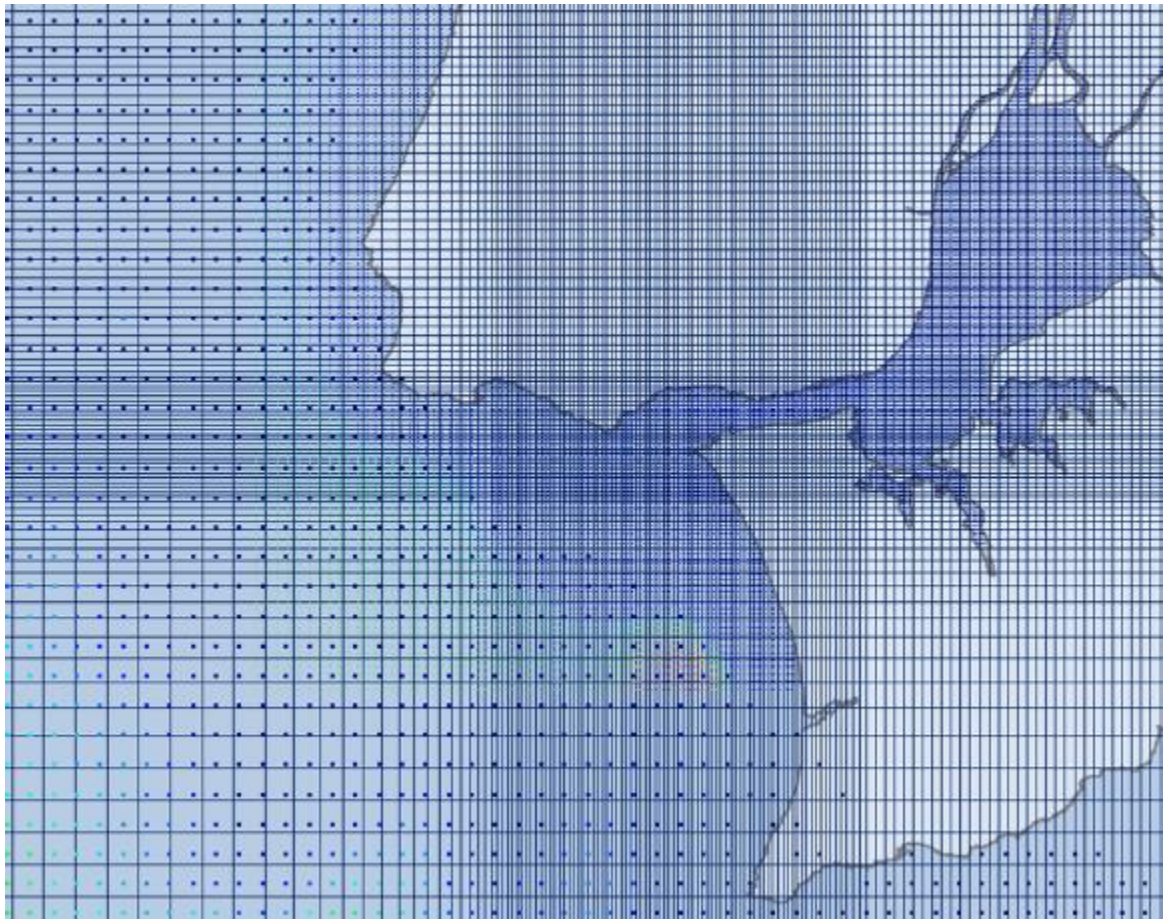
MOHID Water – input data



- Grid
- Bathymetric points
- Coastal line

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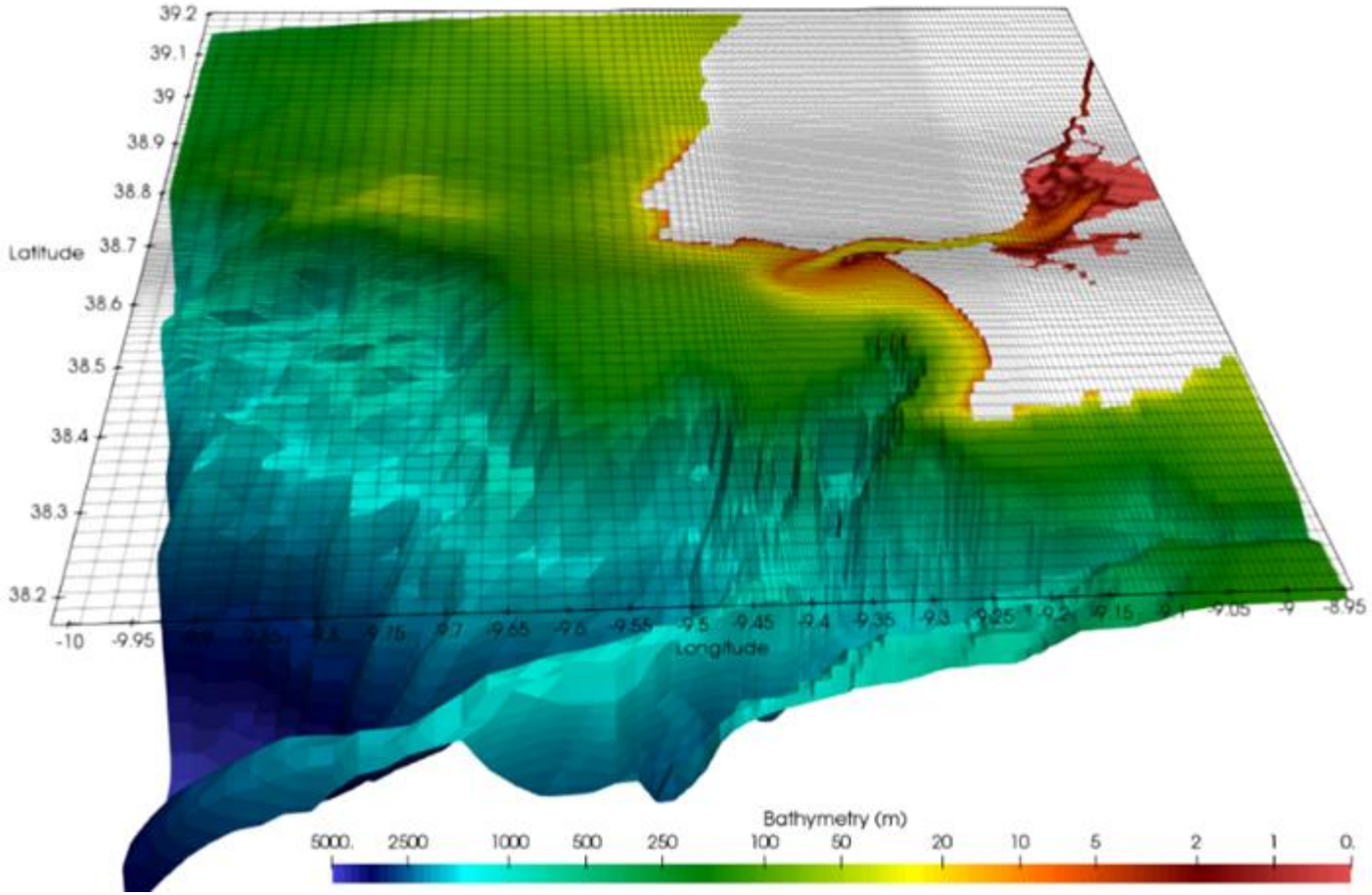
MOHID Water – input data



- Vertical discretization for 3D model

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MOHID Water – input data

Boundary conditions

- Ocean:
  - Water level from FES2014 model
  - Velocity, temperature and salinity from copernicus
- River:
  - Flow and water temperature from MOHID land model output
- Atmospheric:
  - WRF model – wind speed, wind direction, air temperature, precipitation, solar radiation, long wave radiation, mean sea level pressure, albedo, relative humidity

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Model main outputs

- **Mohid water – estuary model:**

- Water temperature and salinity
- Water velocity

- **Mohid land – watershed model:**

- River flow
- Water temperature

- **WRF – atmospheric model:**

- Wind speed and direction
- Air temperature
- precipitation

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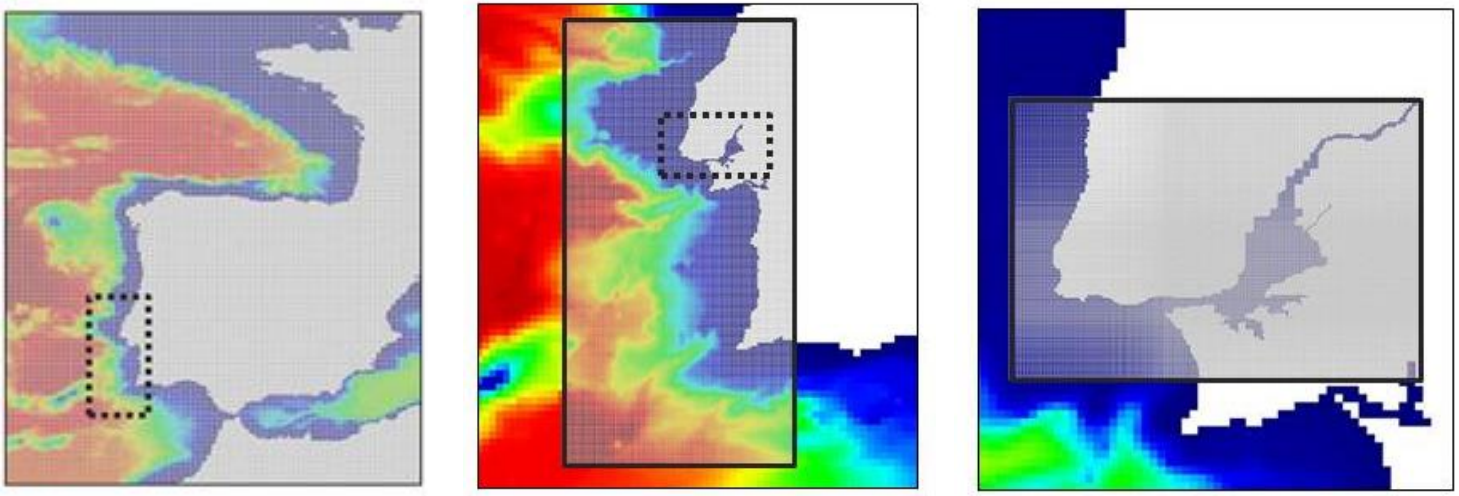
MOHID Water – nested domains

- Tagus river case



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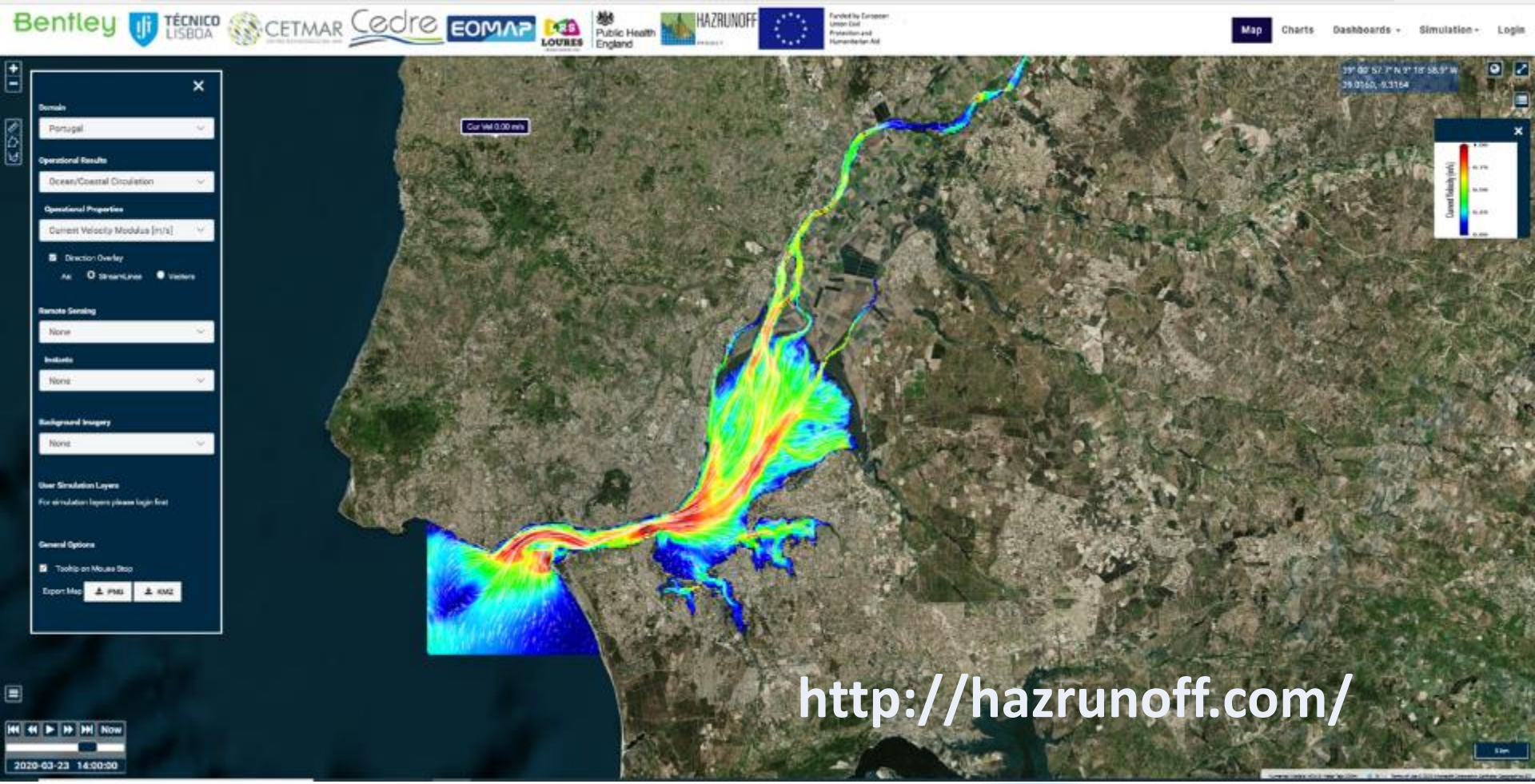
Model results exploitation - HazRunoff platform



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Water pollutant and debris dispersion model

- Lagrangian transport models are very useful to simulate localized processes with sharp gradients (e.g. submarine outfalls, sediment erosion due to dredging works, oil dispersion).

- MOHID's Lagrangian module uses the concept of lagrangian tracers, the most important property of a tracer is its position (x,y,z):
  - for a physicist a tracer can be a water mass, for a geologist it can be a sediment particle or a group and for a chemist it can be a molecule or a group of molecules. A biologist can spot phytoplankton cells in a tracer (at the bottom of the food chain) as well as a shark (at the top of the food chain).

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MOHID lagrangian module

- MOHID Lagrangian transport module uses the concept of tracer, assuming that the spilled contaminant can be represented as an amount of several different small tracers / spillets, and tracked as they move in three-dimensional space over time:
  - this software is used in several different studies, as oil spills, floating containers, dispersion of plumes in submarine outfalls, sediments transport, etc.

- MOHID lagrangian module can be run simultaneously with the hydrodynamic model (currents, water temperature, salinity, etc.), or in "offline" mode. In both modes, this model is able to digest currents, water properties, wave parameters and atmosphere properties from different models.

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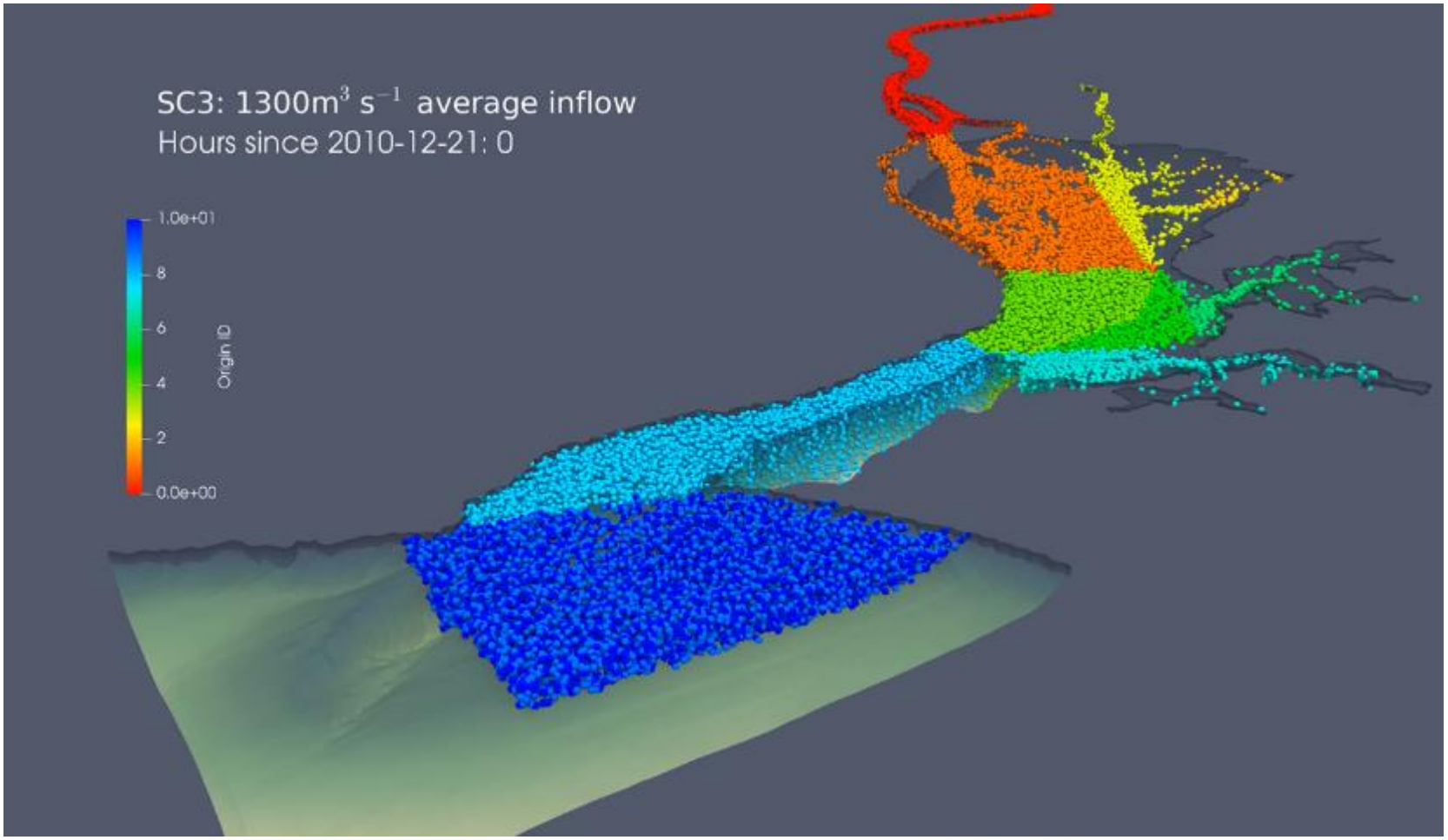
Tagus estuary – residence time



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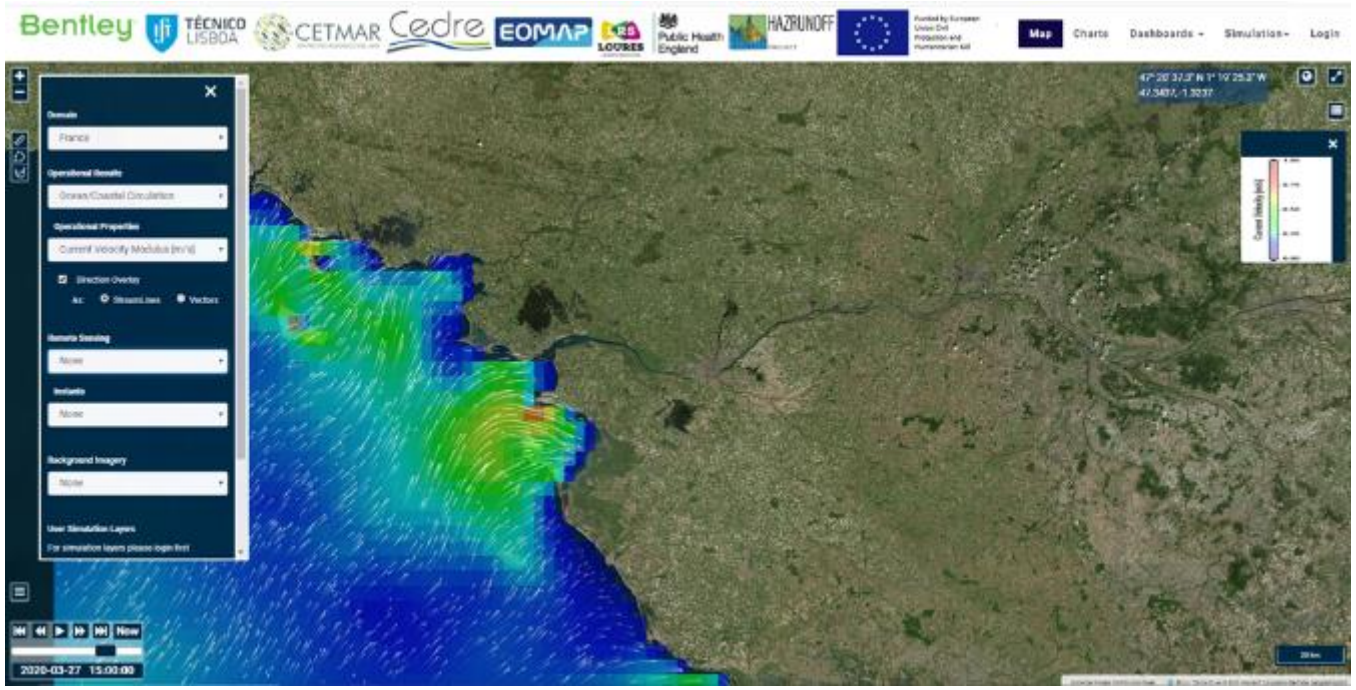
Lagrangian simulation - HazRunoff platform



- The system is able to handle on-demand transport simulations of multiple types, namely: oil spills in water, HNS (chemical) spills in water, human body (search and rescue purposes), passive tracers (water mass transport like ballast waters), floating objects (e.g. container or vessel adrift) and airborne HNS emissions.

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User friendly platform- simulation in 4 steps

1. What?

Incident Name

Simulation Name

Substance Type

Oil Spill

Oil Spill
HNS Spill
Human Body
Passive Tracer (e.g. Ballast water)
Floating Object (e.g. Container)
Airborne HNS Emission

2. Where?

Domain

France

Pick Incident Locations Interactively

3. When?

Incident Type

Continuous Instantaneous

Incident Instant/Simulation Start

2017-12-26 00:00

Simulation End

2017-12-26 06:00

Volume (m3)

100

4. Run

Simulation Resume

Name : Simulation Name
Substance : Oil Spill
Localization : -15.808 28.949
Emission Type : instantaneous
Start Date : 2017-12-26 00:00
End Date : 2017-12-26 06:00

Advanced

Ensemble Probabilistic Run

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Spill simulation – HazRunoff platform

Obrigada

Thank you

Questions?

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TÉCNICO LISBOA

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