

# OPENCoastS<sup>+</sup>: a tool for on-demand forecasts of circulation and water quality in coastal regions

## Demonstration course and hands-on training



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LABORATÓRIO NACIONAL  
DE ENGENHARIA CIVIL

## 2D waves & currents forecasts: relevance and OPENCoastS<sup>+</sup> setup

# 2D waves and currents forecasts

*Why are wind waves important for circulation?*

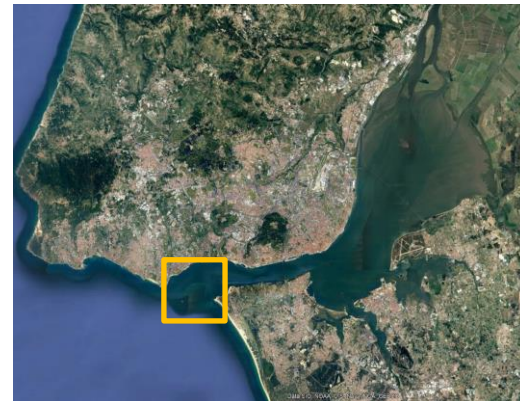
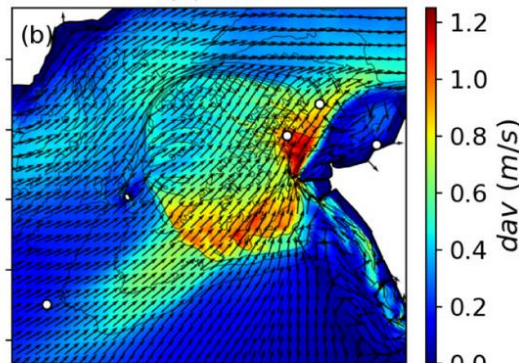
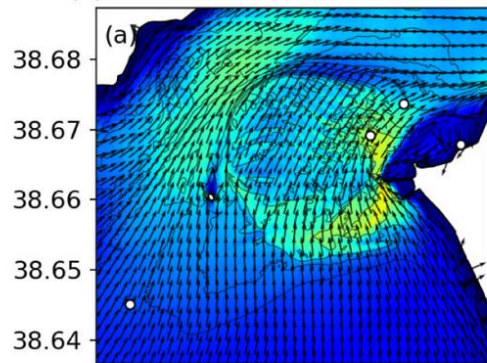
- Wave breaking along the coast generates littoral currents. It is the dominant process in the generation of currents along the beaches and determines the littoral transport
- Waves increase the bed shear stress, thereby affecting currents even outside the surf zone
- Wave breaking generates a setup of the water levels along the shore, thereby contributing to coastal inundations
- The wave setup can propagate along estuaries and lagoons, affecting the water levels within transitional waters

# 2D waves and currents forecasts

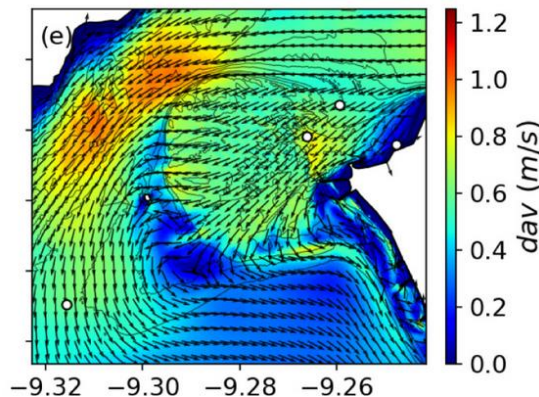
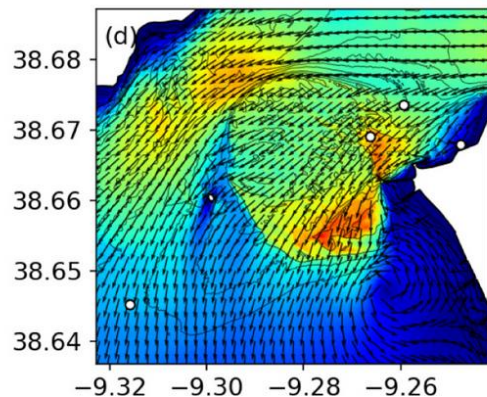
*Why are wind waves important for circulation?*

(1) Run 4: no wave forces in SCHISM

(2) Ref



Tagus estuary, Portugal

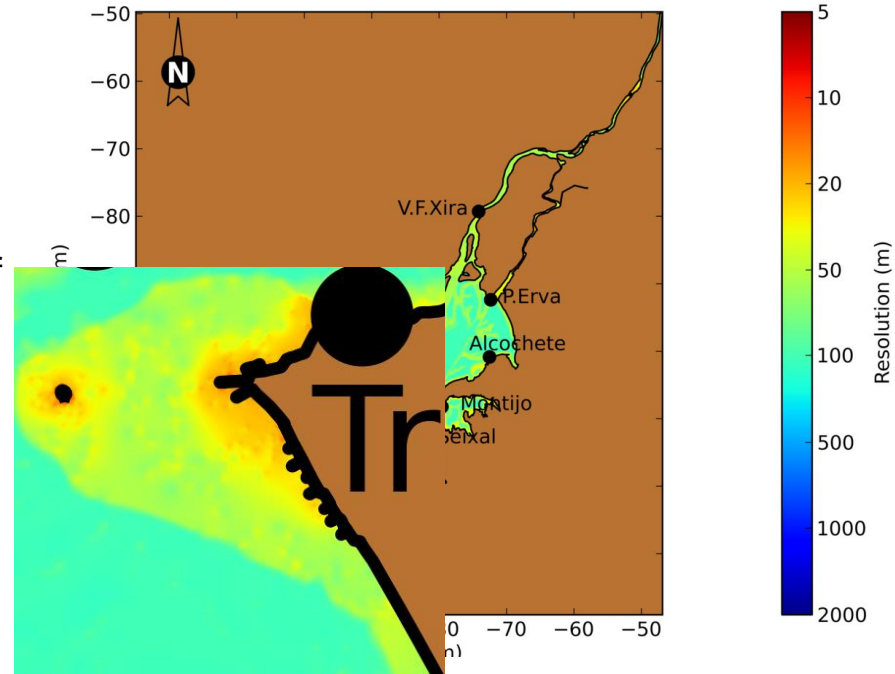


Mengual et al.,  
*Ocean Modelling*,  
2022

# 2D waves and currents forecasts

## *Implications for grid resolution*

- The grid spacing should be sufficient to resolve the surf zone
- The width of the surf zone depends on the bed slope:
  - Mild slope (dissipative) beaches: wide surf zone
  - Steep slope (reflective) beaches: narrow surf zone
  - The wave spectrum also affects the width of the surf zone
- The wetting and drying areas should also be explicitly represented



# 2D waves and currents forecasts

Generate a 2D W&C forecast in OPENCoastS<sup>+</sup>

Step 1: choose the simulation with waves

Step 2: Load and validate only the 2D grid

Step 3: specify the wave forcing at the ocean boundaries

## Select run type

### Baroclinic Simulation:

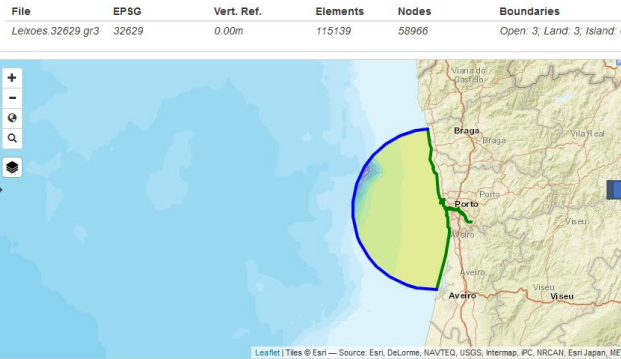
- ☒ No
- ☐ Yes (3D)

### Waves:

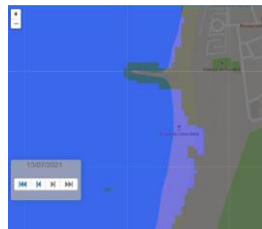
- ☐ No
- ☒ Yes

### Water Quality:

- ☒ No
- ☐ Generic Tracer
- ☐ Fecal Contamination



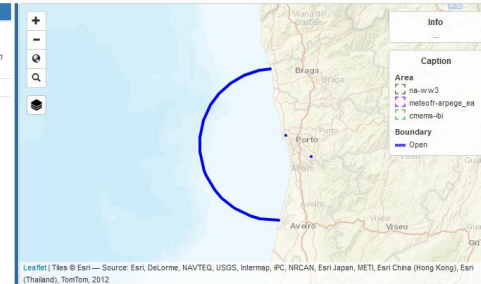
The grid must be provided in cartesian coordinates



## Select one or more boundaries and define their type and forcing condition

ID	Type	Forcing
<input type="checkbox"/> open-1	Ocean	Circulation: FES2014 - Finite Element Solution Waves: North Atlantic WW3Waves: North Atlantic WW3
<input type="checkbox"/> open-2	River	annual=100
<input type="checkbox"/> open-3	River	annual=5

Define type and forcing condition



### Forcings for Circulation to apply to all oceans boundaries:

FES2014 - Finite Element Solution

### Forcings for Waves to apply to all oceans boundaries:

North Atlantic WW3

### Atmosphere Forcing:

Météo-France | ARPEGE Europe-Atlantique

Only available for the North Atlantic!



# 2D waves and currents forecasts

Generate a 2D W&C forecast in OPENCoastS<sup>+</sup>

## Step 5: Define physical and numeric parameters for both the wave and currents models

**Define input hydrodynamic parameters**

For the chosen model it is necessary to define all input hydrodynamic parameters for the simulation of this model. In this step the user will start from a predefined hydrodynamic parameters file and you can customize some of the hydrodynamic parameters. For Wave and currents runs it is also necessary to define the parameters for the 'wwminput.nml' file.

Select one of the options:

- ☒ Predefined parameters
- ☐ Customize parameters

**Circulation (param.nml)**

Open Template param.nml

**Run time and ramp**

Ramp option flag (nramp):

- ☒ on
- ☐ off

Ramp-up period [day] (dramp): 1.0

Time step [sec] (dt): 60.0 Value must be always dividable by 3600.

**WWM**

Steps to call WWM (nstep\_wwm): 10 Will match 'wwm\_input.nml'.PROC\_DELTTC / 'param.nml'.dt (must be integer)



**Define input hydrodynamic parameters**

For the chosen model it is necessary to define all input hydrodynamic parameters for the simulation of this model. In this step the user will start from a predefined hydrodynamic parameters file and you can customize some of the hydrodynamic parameters. For Wave and currents runs it is also necessary to define the parameters for the 'wwminput.nml' file.

Select one of the options:

- ☒ Predefined parameters
- ☐ Customize parameters

**Circulation (param.nml)**

Open Template wwminput.nml

Time step [sec] (PROC\_DELTTC): 600.0 Must match 'param.nml' dt\*nstep\_wwm. Changes to this value are obtained by swapping dt and nstep\_wwm in the Circulation tab.

**Source Terms**

Wave breaking coefficient (ENG5\_BRHD): 0.78 For constant type wave breaking criterion

# 2D waves and currents forecasts

Generate a 2D W&C forecast in OPENCoastS<sup>+</sup>

## Step 6: additional information

**Configuration Assistant** New System Save

Step 1 Step 2 Step 3 Step 4 Step 5 Step 6 Step 7 Step 8

Model Domain Boundaries Stations Hydrodynamic Parameters Additional Data Water Quality Submission

**Additional Information**

In this step the user can select some additional parameters of the model, by specifying values or uploading a file for spatial variability of the values.

**Manning Coefficient [m<sup>1/3</sup>/s]**

Select one of the options:

- ☒ Customize value
- ☐ Upload file

Constant:

Step 7: does not exist, so it is automatically skipped

## Step 8: review and submit

**Configuration Assistant** New System Save

Step 1 Step 2 Step 3 Step 4 Step 5 Step 6 Step 7 Step 8

Model Domain Boundaries Stations Hydrodynamic Parameters Additional Data Water Quality Submission

**Submit Forecast System** ? ?

Confirm the selected configurations and activate the forecast system.

**Summary**

- 1 Model**  
SCHISM-5.8 (48h)  
Baroclinic Simulation: No  
Waves: Yes  
Water Quality: No
- 2 Domain**
- 3 Boundaries**
- 4 Stations**
- 5 Hydrodynamic Parameters**
- 6 Additional Data**

**Submit**

Name (\*):

Description:

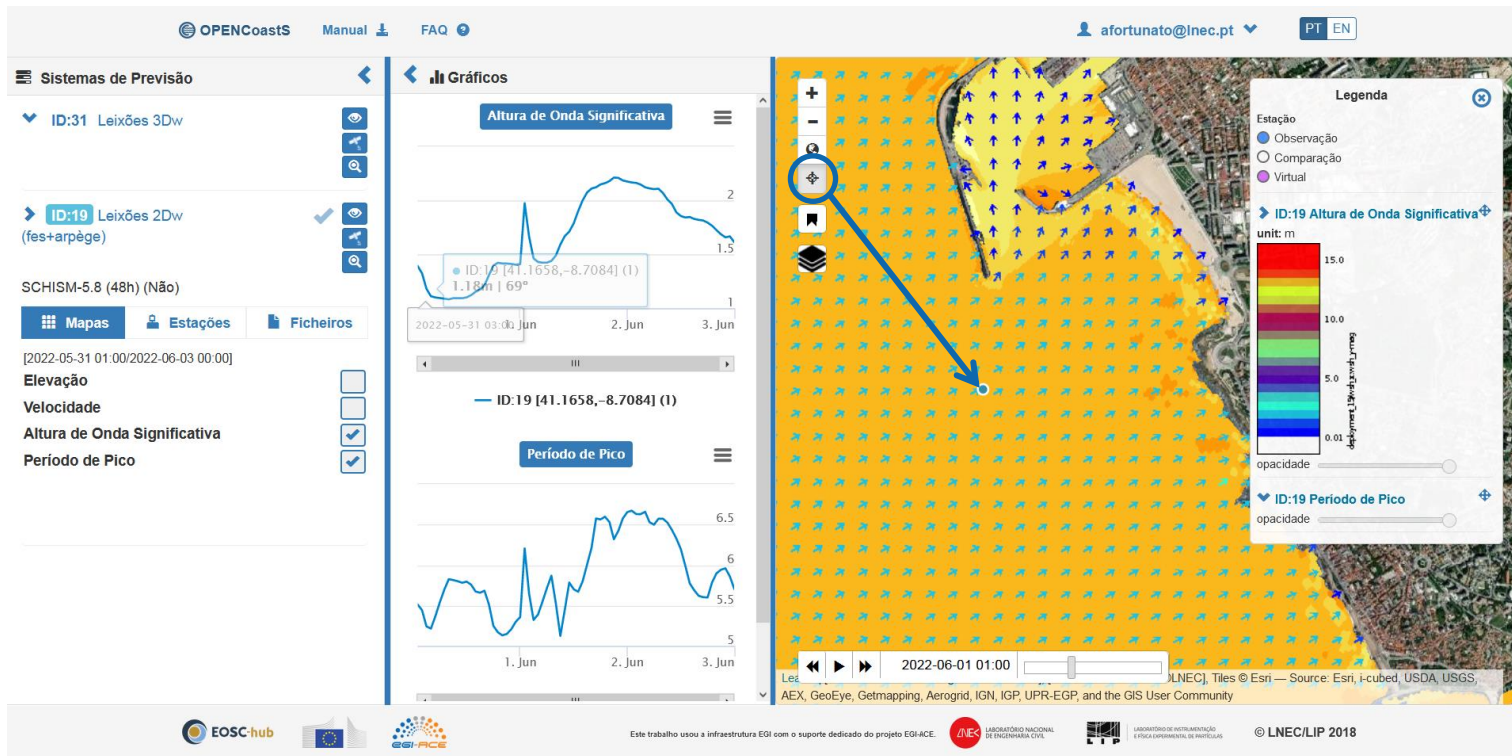
☐ I accept [Terms and Conditions of Use](#)

Activate System



# 2D waves and currents forecasts

## Visualization of W&C results in OPENCoastS+



# Team and contacts

## Questions?

You can contact me at: [afortunato@lnec.pt](mailto:afortunato@lnec.pt)  
Suggestions and corrections are most welcome. Thank you for your attention!

