



Generation of operational forecasts on demand:

The OPENCoastS platform



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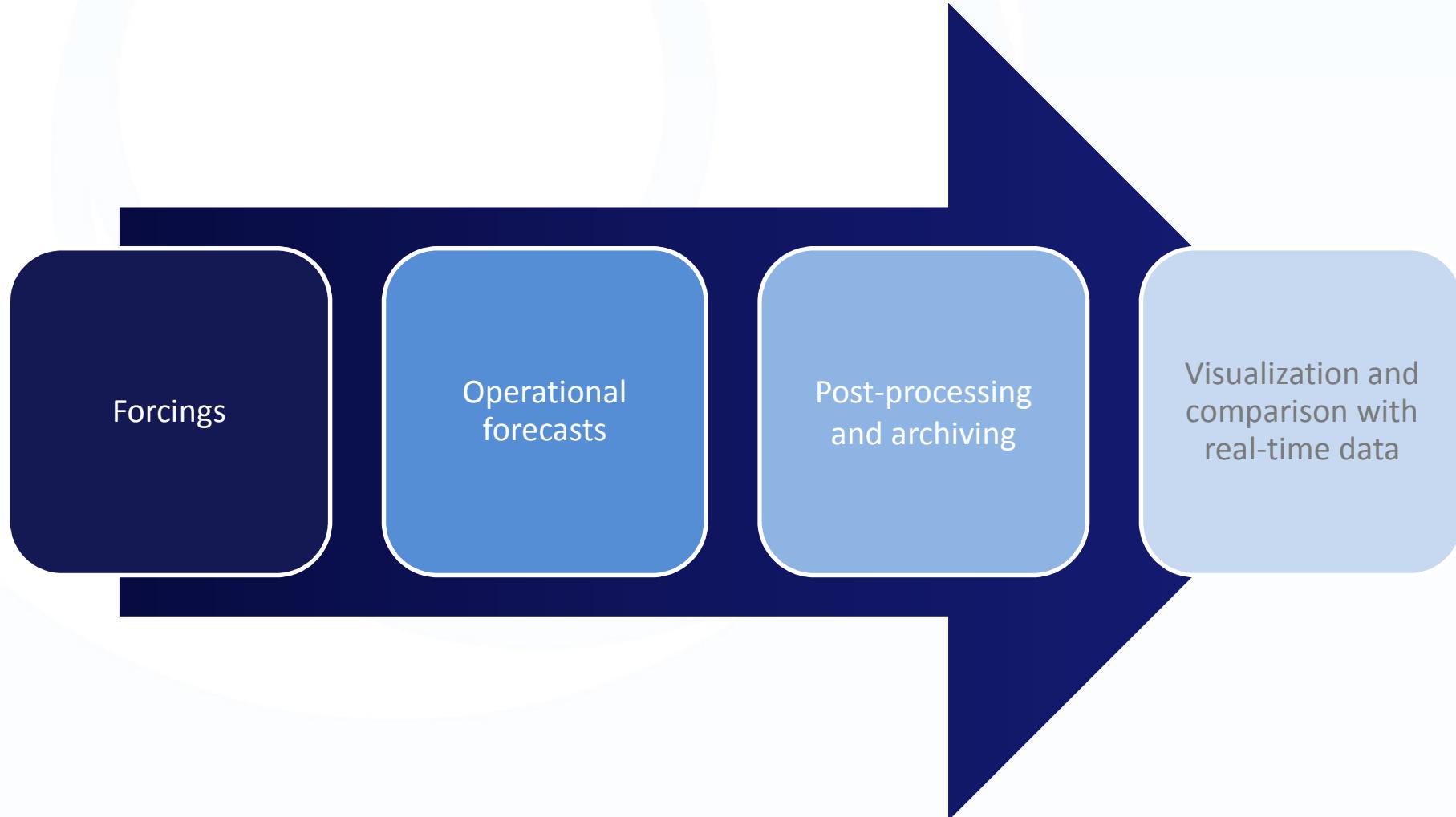


- *Motivation*
- *The OPENCoasts platform*
 - *Concept*
 - *Interface components*
 - *Examples*
- *Summary and perspectives*



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Forecast systems





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Forecast systems: present difficulties

- *The development requires mixed teams, with expertise in both numerical modeling and information technologies*
- *Significant effort for development and maintenance*
- *Redundancies are necessary to minimize failures*
- *Computational resources must be available every day*



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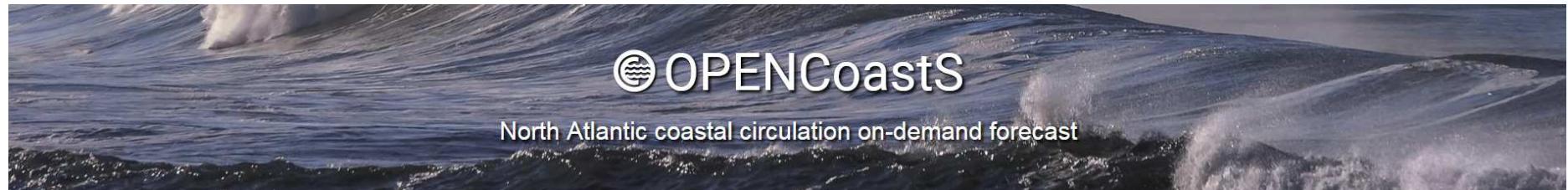
Forecast systems: present challenges

- *Develop forecast systems as a service*
- *Make it accessible to people with modeling expertise, but not necessarily IT experts*
- *Make the service flexible in the choice of forcings, processes and models (and their versions)*
- *Take advantage of available online data and model results*
- *Provide computational resources*
- *Manage output files generated daily*
- *Make the development quick and easy*



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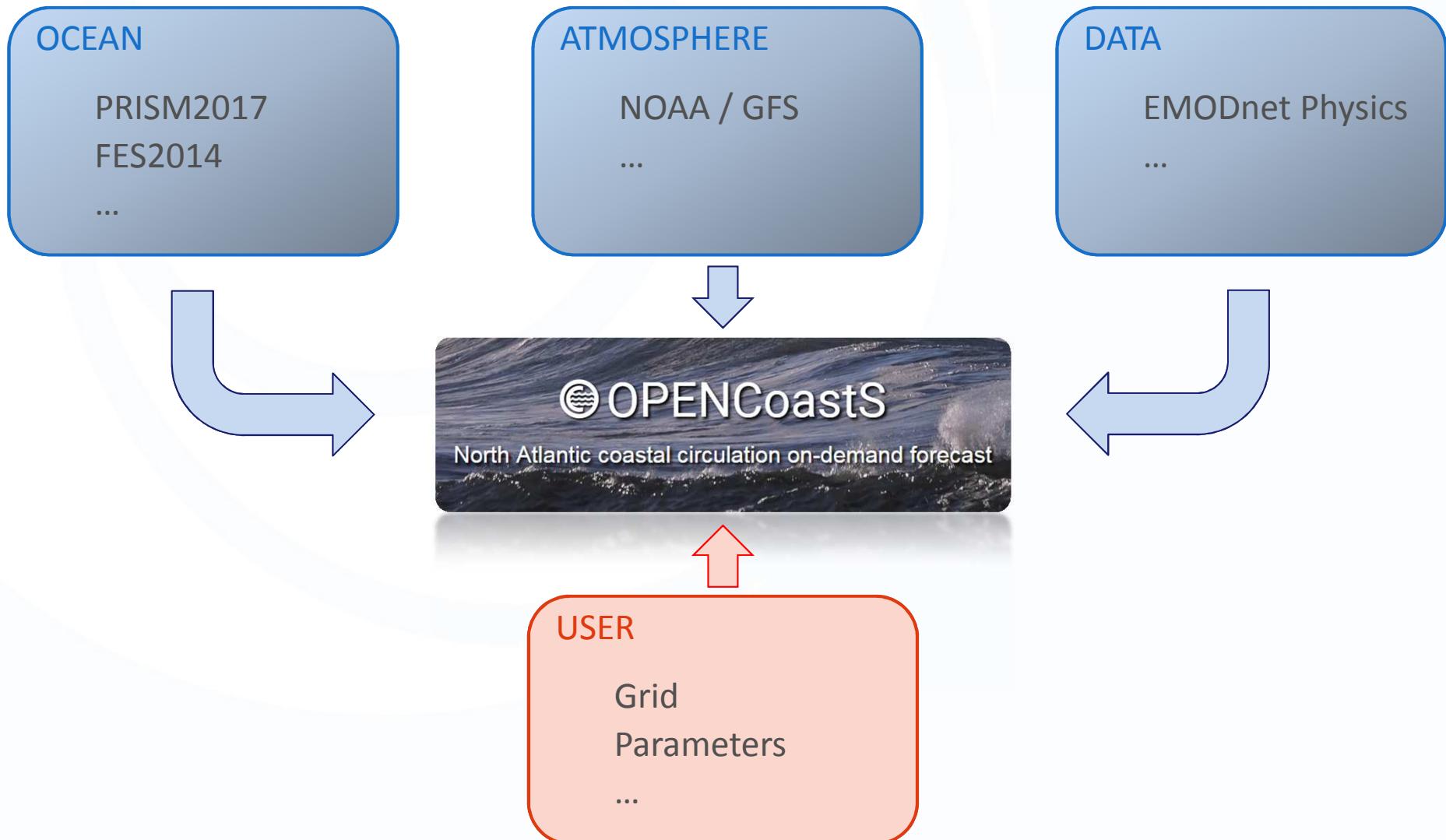
The OPENCoastS platform: concept



● A platform to:

- *Implement forecast systems through a browser-based, user-friendly, interface*
- *Allow the choice of the processes, model and forcings*
- *Allow the replication and change of forecast systems*
- *Avoid the need of a large team to generate forecast systems*
- *Take advantage of the European Open Science Cloud (EOSC) to provide the required computational resources*

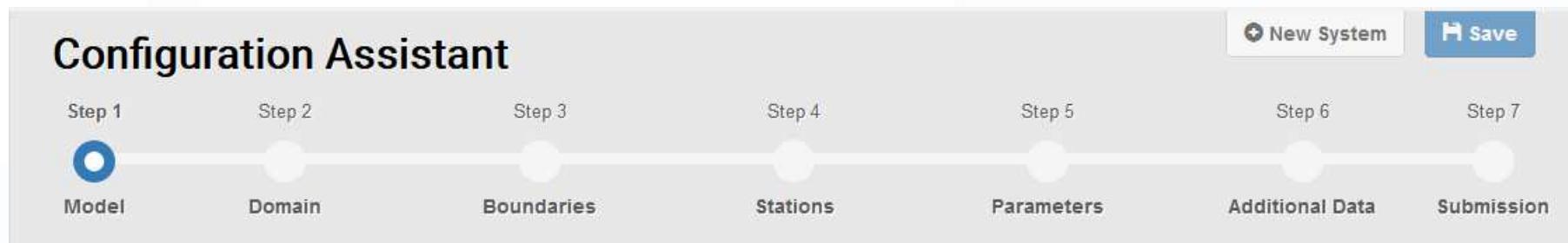
The OPENCoastS platform: information requirements





1. Configuration Assistant

- *Guides the user through the generation of a forecast system*
- *Provides guidance, detailed information and suggestions*
- *Performs basic verifications*





2. Forecast manager

- Lists all present and past forecasts of the user
- Allows viewing the forecast configurations, stopping and restarting forecasts, cloning forecasts, etc.

The screenshot shows the 'Forecast Systems' management page for the OPENCoasts platform. The top navigation bar includes links for 'OPENCoasts', 'User Manual', 'afortunato@inec.pt', 'PT', and 'EN'. Below the header, there are buttons for 'Extension requests' and 'New System'. The main section is titled 'Forecast Systems' and contains a table for 'Forecasts management'. The table has columns for ID, Model, Name, Dates, and State. Each row represents a different forecast system, with detailed information provided in a tooltip for each row. The five listed forecasts are:

ID	Model	Name	Dates	State
73	SCHISM, v5.4.0 (48h)	Ave_PRISM+GFS	<i>Created at 05/09/2018 8:47 a.m. Start 01/09/2018 End 01/10/2018 Last run 07/09/2018</i>	Active
70	SCHISM, v5.4.0 (48h)	Tejo2018_PRISM+GFS	<i>Created at 03/09/2018 4:14 p.m. Start 01/09/2018 End 01/10/2018 Last run 07/09/2018</i>	Active
69	SCHISM, v5.4.0 (48h)	Arade_FES2014+GFS	<i>Created at 03/09/2018 3:36 p.m. Start 01/09/2018 End 01/10/2018 Last run 07/09/2018</i>	Active
68	SCHISM, v5.4.0 (48h)	Guadiana_PRISM+GFS	<i>Created at 03/09/2018 3:26 p.m. Start 01/09/2018 End 01/10/2018 Last run 07/09/2018</i>	Active
67	SCHISM, v5.4.0 (48h)	Leixões_PRISM+GFS	<i>Created at 03/09/2018 2:56 p.m. Start 01/09/2018 End 01/10/2018 Last run 07/09/2018</i>	Active

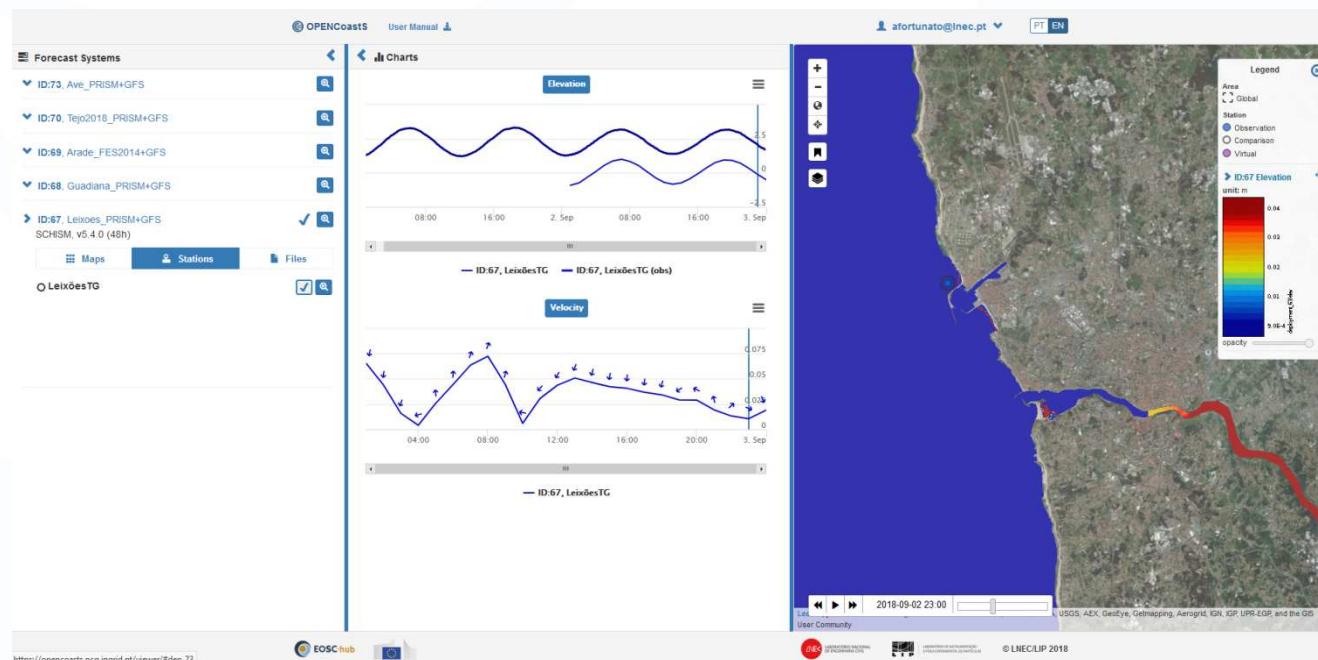


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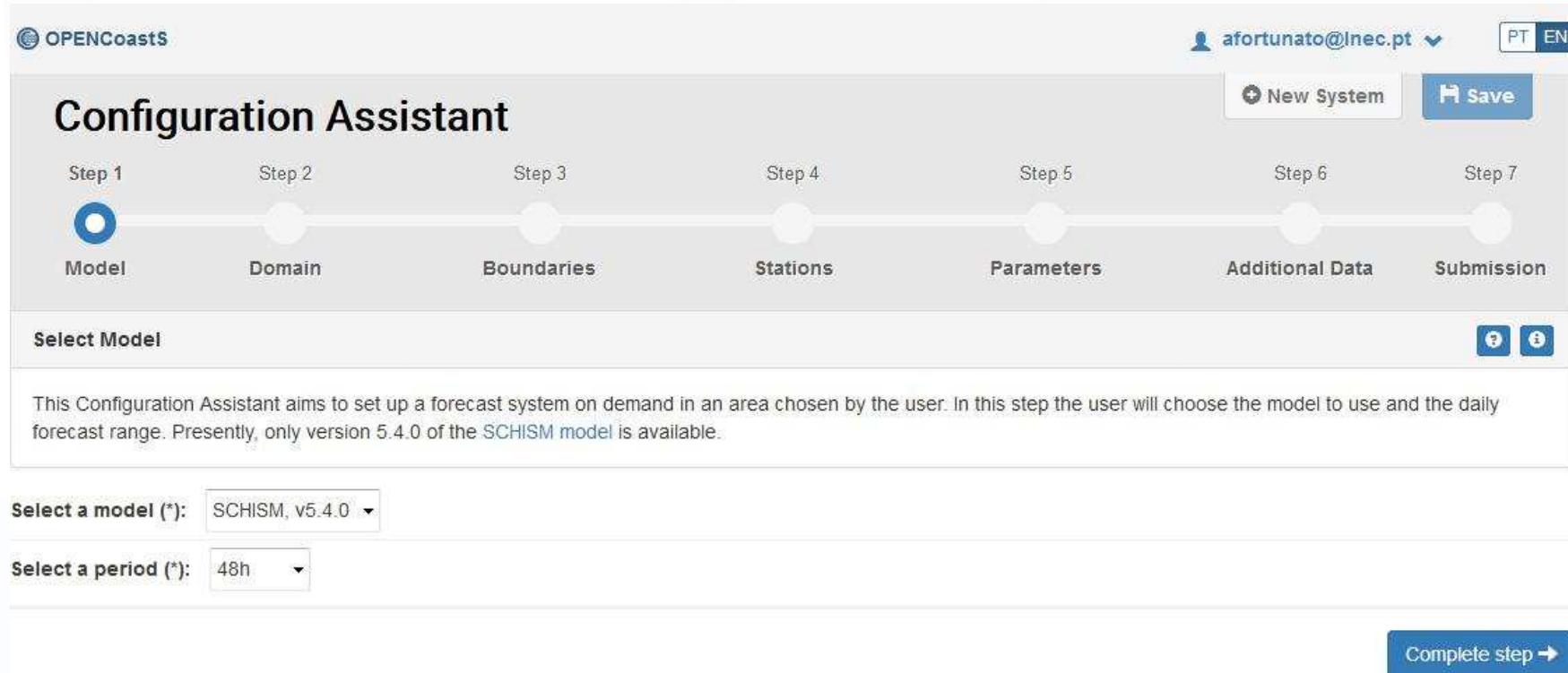
The interface components

3. Outputs viewer

- Provides access to the outputs files
- Shows scalar and vector maps through a Web-GIS
- Shows time series and data-model comparisons



• Step 1: Select the model and the duration



The screenshot shows the 'Configuration Assistant' interface for generating a forecast system. The top navigation bar includes the 'OPENCoastS' logo, a user profile for 'afortunato@inec.pt', language options ('PT EN'), and buttons for 'New System' and 'Save'. A progress bar at the top indicates the process is at Step 1 of 7, specifically 'Model'. The main content area is titled 'Select Model' and contains a descriptive text about the configuration assistant's purpose: 'This Configuration Assistant aims to set up a forecast system on demand in an area chosen by the user. In this step the user will choose the model to use and the daily forecast range. Presently, only version 5.4.0 of the SCHISM model is available.' Below this, there are two dropdown menus: 'Select a model (*):' with 'SCHISM, v5.4.0' selected, and 'Select a period (*):' with '48h' selected. A large blue button at the bottom right says 'Complete step ➔'.

● Step 2: Upload and verify the grid

 OPENCoasts

Configuration Assistant

Step 1 Step 2

Model Domain

Upload Grid

In this step the user has to provide the computational geographical domain of study. The user must also indicate the horizontal and vertical reference systems.

Select a horizontal grid (*): leixoes.ll

Coordinate Reference System for the grid:

EPSG:4326 | WGS84 / World Geodetic System 1984

Vertical reference of the grid: or enter a vertical offset

Calculate a suggestion for the time step (dt):

 OPENCoasts

Configuration Assistant

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

Model Domain Boundaries Stations Parameters Additional Data Submission

Preview

File	EPSG	Vert. Ref.	Elements	Nodes	Boundaries
leixoes.ll	4326	0.00m	115139	58966	Open: 3; Land: 3; Island: 0

Leaflet | Tiles © Esri — Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

9/7/2018

⌚ Step 3: Specify boundary conditions

OPENCoasts

Configuration Assistant

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

Model Domain Boundaries Stations Parameters Additional Data Submission

Define Boundary Conditions

In this step the user has to define the forcing sources for the ocean, river and atmospheric boundaries from the available options.

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

ID	Type	Forcing
open-1	River	Jan: 300, Feb: 250, Mar: 200, Apr: 150, May: 100, Jun: 75, Jul: 50, Aug: 50, Sep: 75, Oct: 100, Nov: 200, Dec: 250
open-2	River	Jan: 300, Feb: 250, Mar: 200, Apr: 150, May: 100, Jun: 75, Jul: 50, Aug: 50, Sep: 75, Oct: 100, Nov: 200, Dec: 250
open-3	River	Jan: 5, Feb: 4, Mar: 3, Apr: 2, May: 2, Jun: 1, Jul: 1, Aug: 1, Sep: 2, Oct: 3, Nov: 4, Dec: 5

Define type and forcing condition



Leaflet | Tiles © Esri — Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

Select a forcing source to apply to all ocean boundaries:

PRISM2017 - Portuguese Tide-Surge Model

Select an atmospheric forcing:

GFS - Global Forecast System NOAA/NCEP

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⌚ Step 4: Define output stations

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Configuration Assistant

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

Model Domain Boundaries Stations Parameters Additional Data Submission

Define Stations

In this step the user selects the stations (virtual sensors) in which time series are extracted with full model resolution. These can be locations where real time data is available, (predefined comparison stations) or other places of interest (virtual stations).

Select/Deselect desired stations. You can add new ones by selecting the location on the map or using the button New Station.

Name	Latitude	Longitude	Comparison
<input checked="" type="checkbox"/> LeixõesTG	41.18775	-8.71212	LeixõesTG (41.18775, -8.71212)

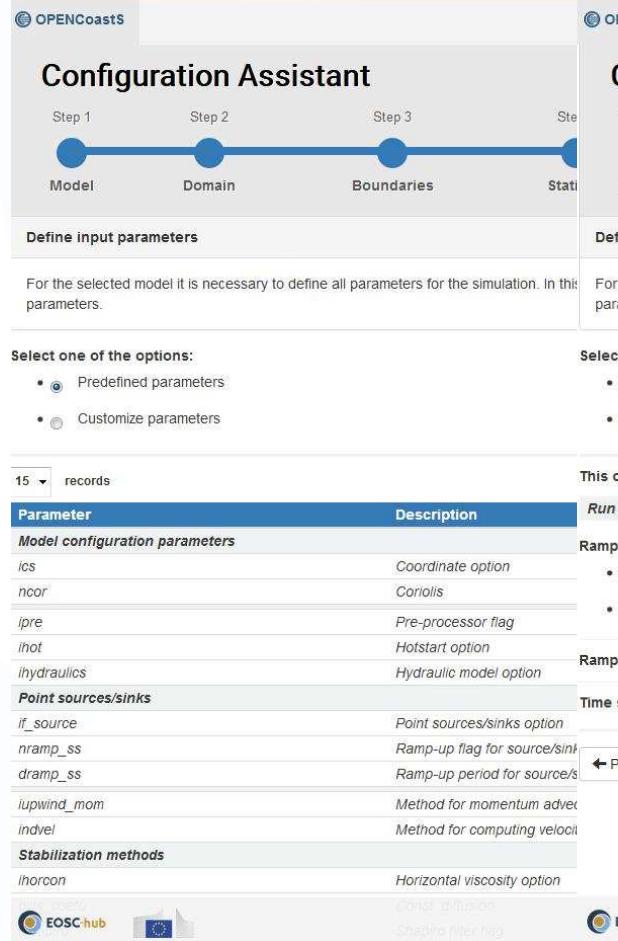


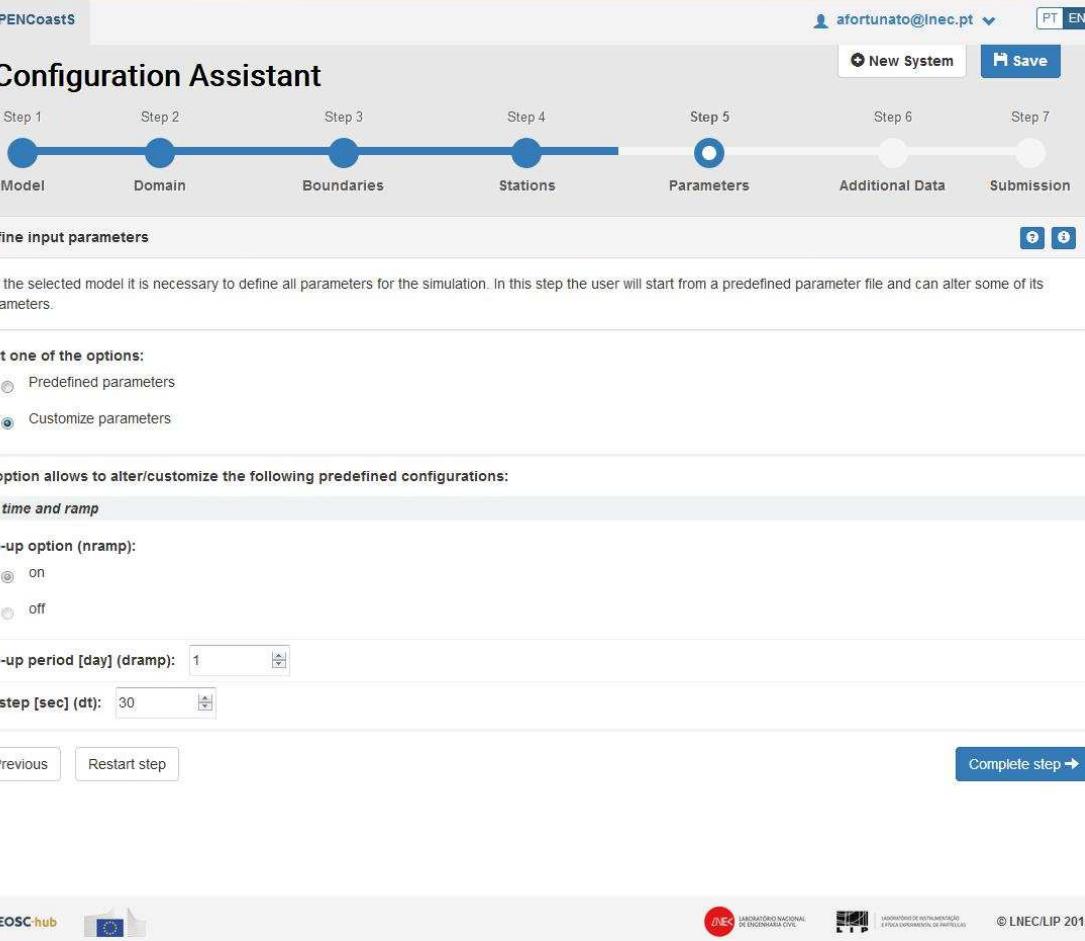


The map displays the coastline of Northern Portugal, specifically the region around Porto and Leixões. A blue circle highlights the location of the selected station, LeixõesTG, near the mouth of the Douro River. The map includes place names like Viana do Castelo, Braga, Porto, Aveiro, Viseu, and Guarda. A legend on the right side of the map area provides information about areas, boundaries, and station types.

● Step 5: Define physical and numerical parameters





● Step 6: Define space-dependent parameters

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Configuration Assistant

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

Model Domain Boundaries Stations Parameters Additional Data Submission

Additional info 

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.

Coefficiente de Manning [m^{1/3}/s]

Select one of the options:

- Customize value
- Upload file

Select a file: manning.gr3

 Previous Complete step ➔

⌚ Step 7: Review and submit

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Configuration Assistant

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

Model Domain Boundaries Stations Parameters Additional Data Submission

Submit Forecast System

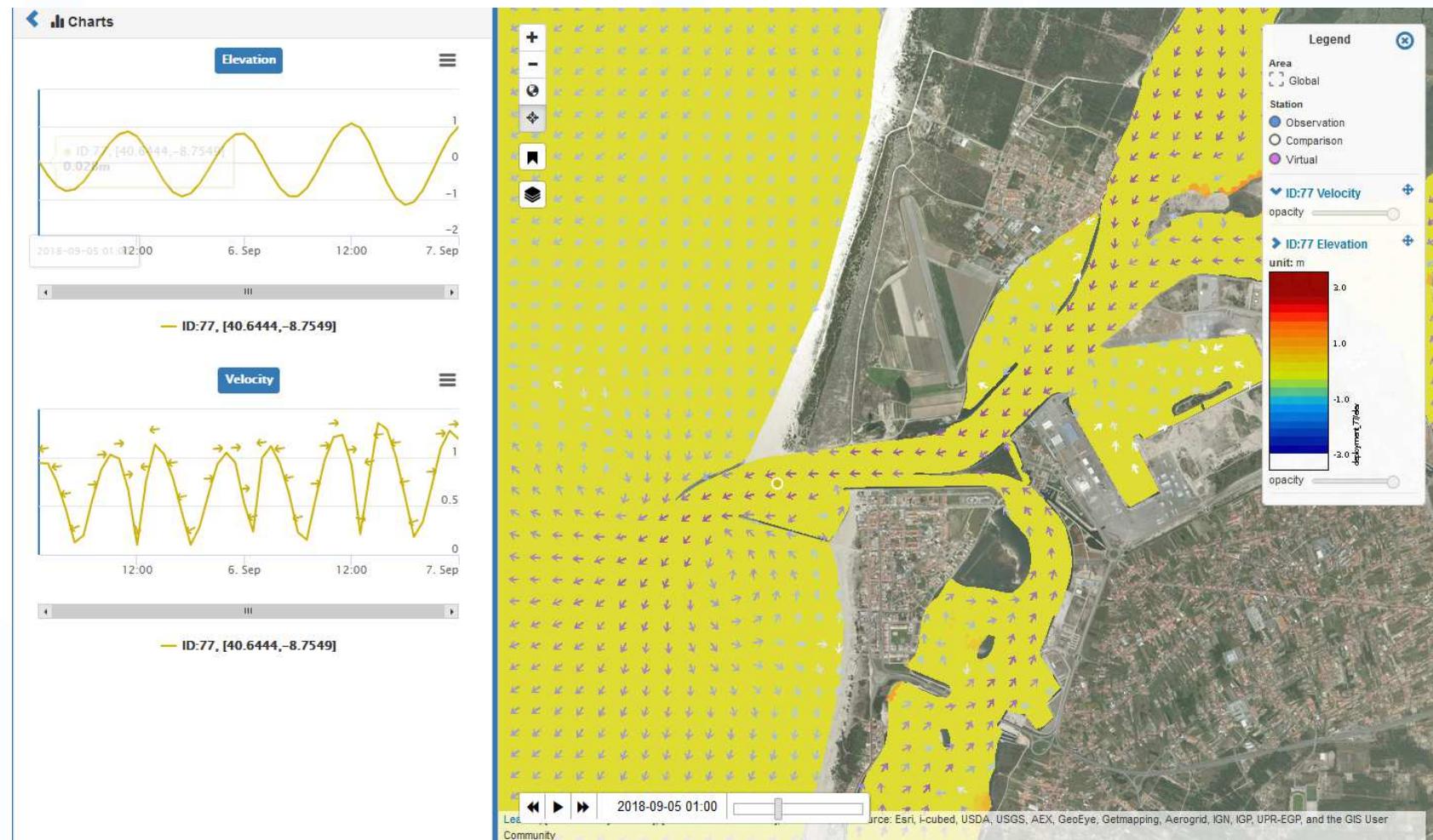
Confirm the selected configurations and activate the forecast system.

Summary		Submit
1	Model	Name (*): Leixões_PRISM+GFS
2	Domain	Description: Leixões and Douro grid, forced by PRISM2017 and GFS
3	Boundaries	
4	Stations	
5	Parameters	<input checked="" type="checkbox"/> I Accept Terms and conditions of use
6	Additional Data	Activate System

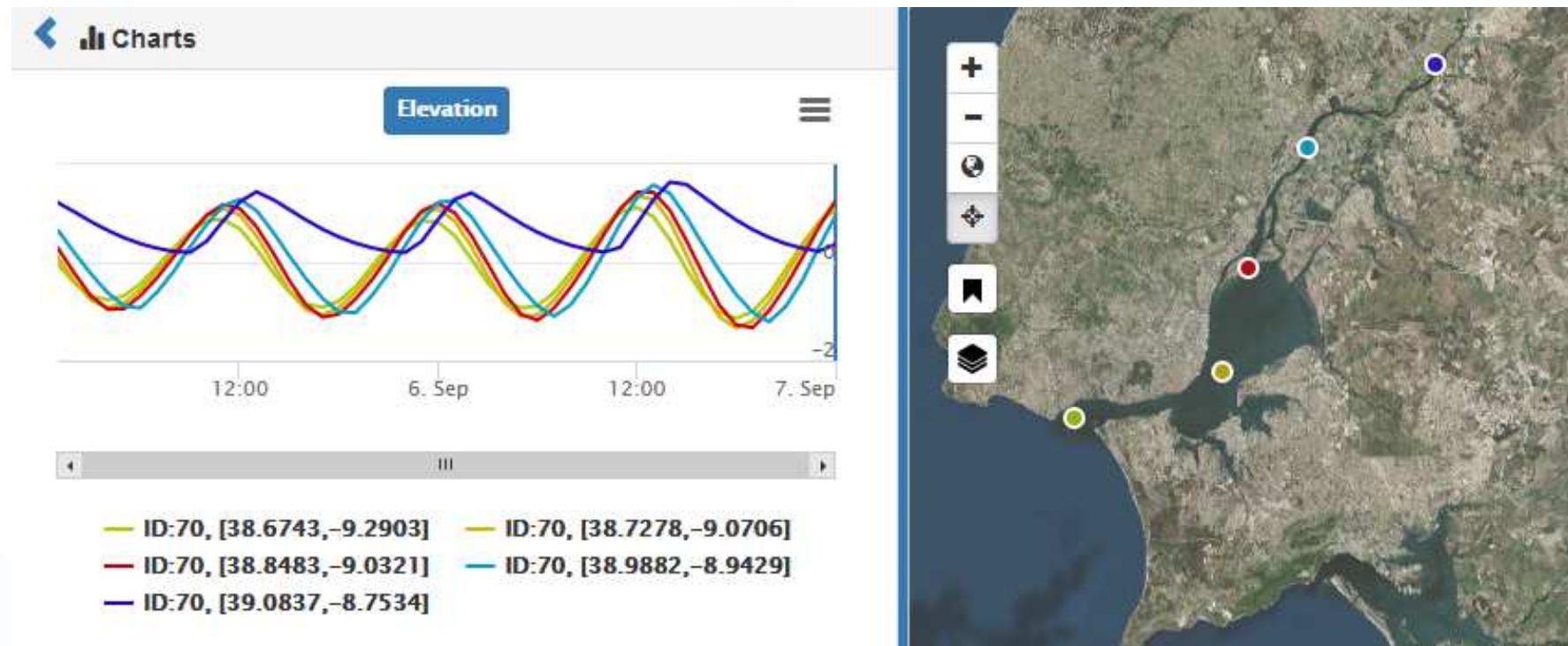
Example: flow in the Arade estuary



Example: flow, elevation and time series in the Aveiro lagoon



Example: tidal propagation in the Tagus estuary



- Innovative platform to generate on-demand ocean forecasts is publicly available (opencoasts.ncg.ingrid.pt)
- Forcings (FES2014 and GFS) allow worldwide applications
- Limited physics: 2D barotropic shallow water flows

- 3D baroclinic physics (SCHISM)
- Improved viewer
- Improved and extended NE Atlantic model for boundary conditions (PRISM2018)
- Atmospheric forcings from METEO-FRANCE
- Coupled wave-current model (SCHISM-WWM), including forcing by WW3
- Perform 72 hour forecasts
- Migrate to larger computational resources
- Open code at the end of the project (2021)

- This afternoon, from 18:00 to 19:00
- Please register as an OPENCoastS user at
<https://opencoasts.ncg.ingrid.pt/>
- Please register for the course at
https://docs.google.com/forms/d/e/1FAIpQLSeESZ0hi2Pea3WN9PbIPD9hKyO_wL1ZiwG1zPGWFzMPuCqU8A/viewform
- Bring your own triangular grid – limited to 150,000 nodes (or use one of ours)

Thank you for your attention!

Acknowledgments:

SCHISM (model)

GFS (atmospheric predictions)

FES2014 (tidal predictions)

EMODnet (tidal data)



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