

Development of Earth Observation products for coastal waters in support of water quality monitoring



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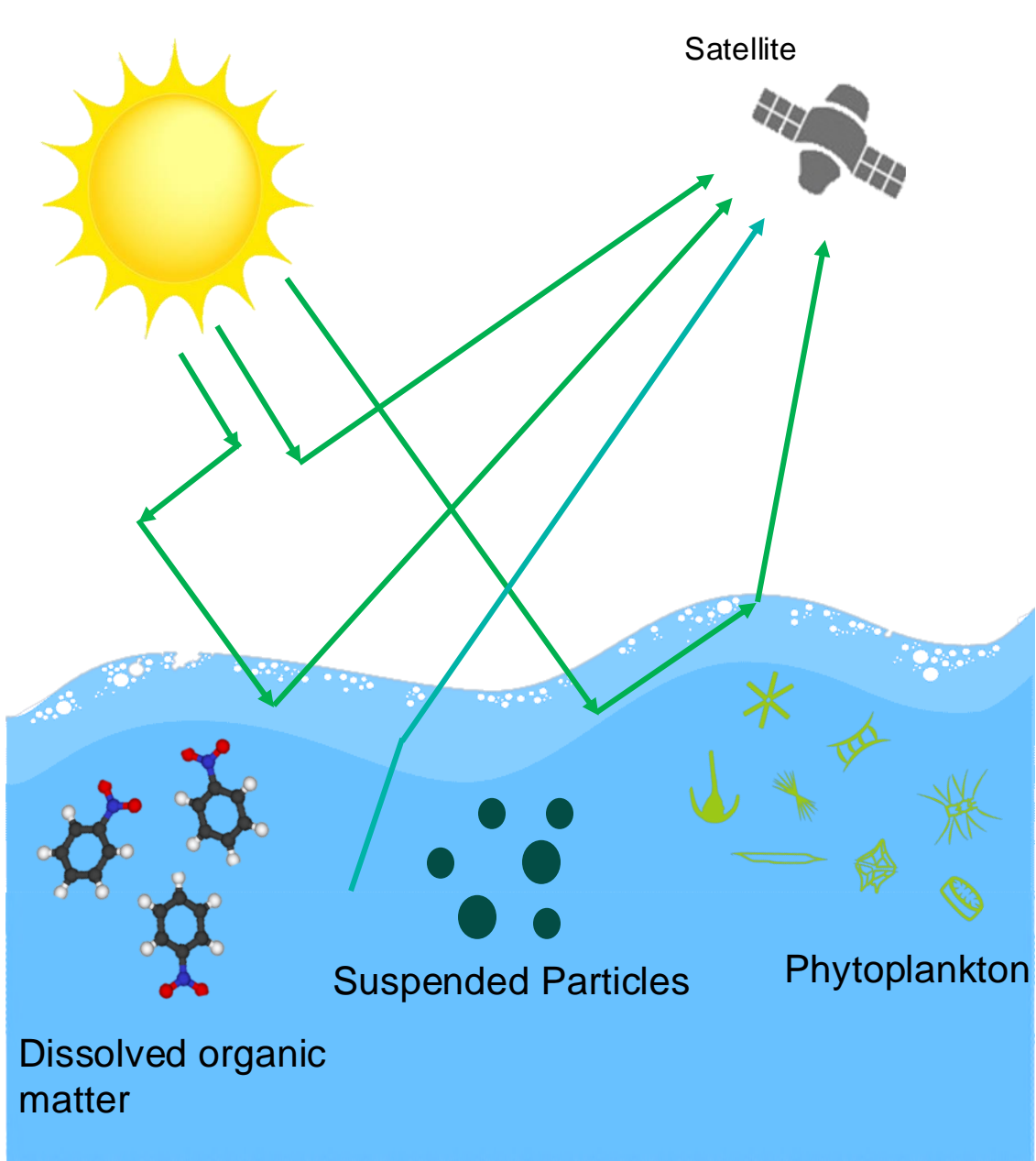
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IDEAS TO IMPACT

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Framework

With the increasing anthropogenic pressures on coastal and transitional ecosystems, it is crucial to promote a continuous monitoring of their water quality. Remote Sensing (RS) methods offer a unique opportunity for a synoptic monitoring of these systems, by providing large-scale, high-frequency data and allowing to obtain information of inaccessible areas. Nevertheless, RS has been far less successful in transitional waters than in other areas given the high optical complexity of the waters and the proximity to the land.

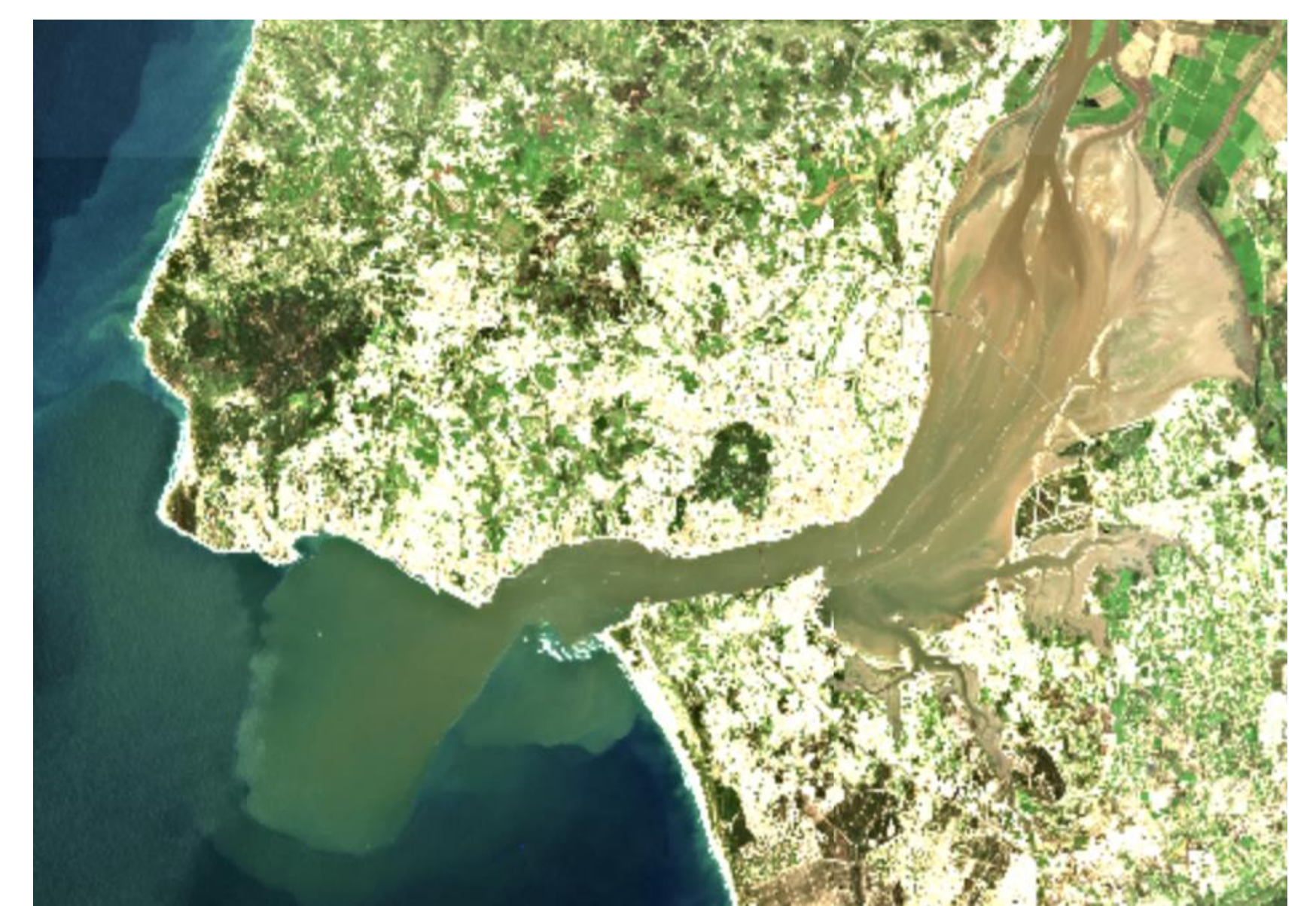


Therefore, an approach based on the classification of water pixels based on RS reflectance characteristics, Optical Water Types (OWT) is becoming a popular method. Although multiple studies have shown the potential of OWT classification to obtain improved oceanic/coastal products, transitional water are still to be properly addressed.

Objectives

Use OWT classification as a tool to monitor water quality changes in transitional waters.

- Use in-situ data to associate OWT classes to specific environmental conditions
- Spatio-temporal analysis of dominant OWT to define “normal” and “anomalous” conditions of a transitional water body
- Support the continuous monitoring in the framework of WFD and MSFD



Validation of satellite products

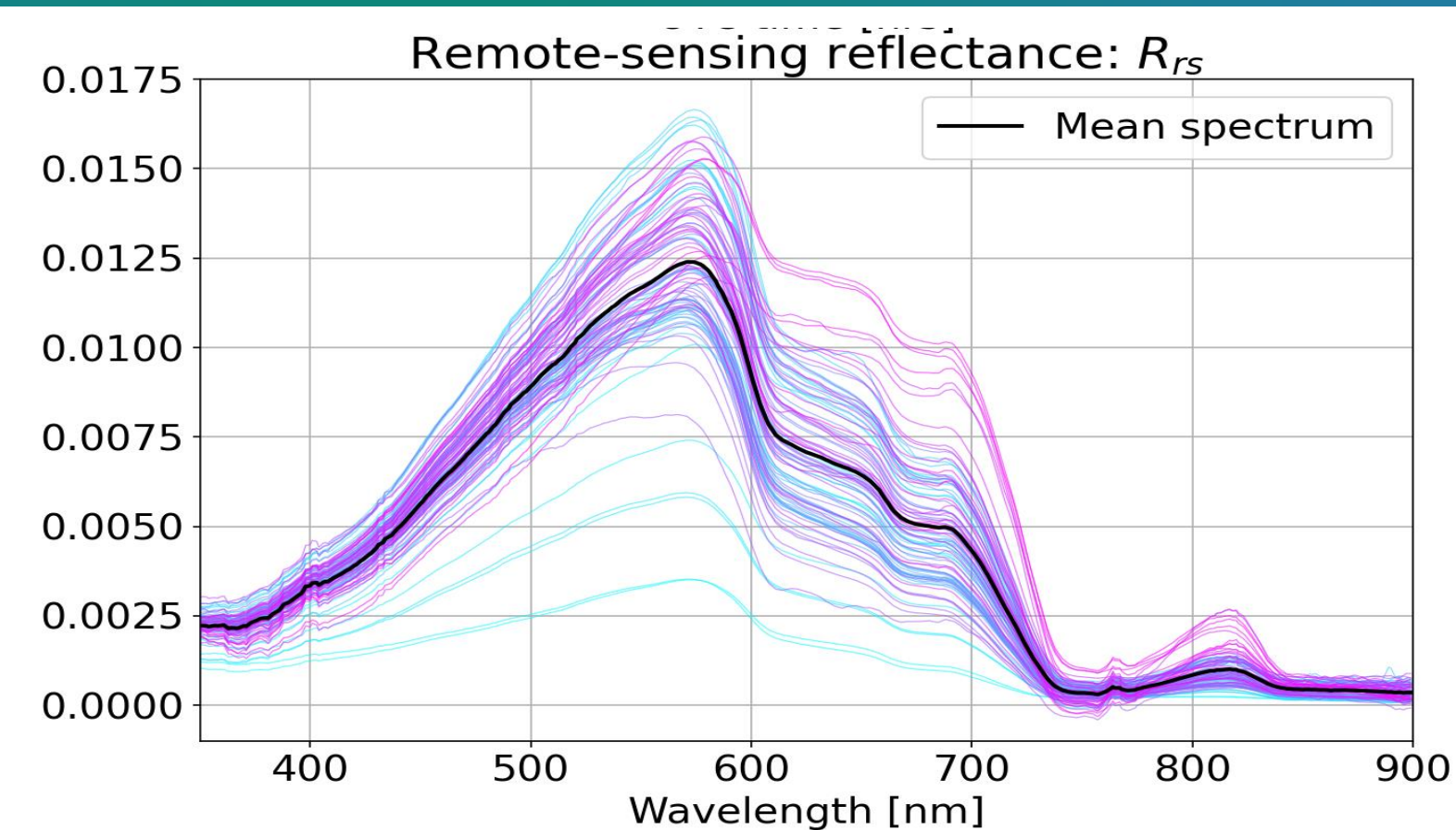


Figure. Example of Rrs measured in-situ in the Tagus estuary

Historical and new in-situ data are used for the **validation and calibration of remote sensing products** and for the characterization of the bio-optical properties of the study areas. The radiometric quantity (Rrs) is converted to concentration of Water Quality products (Chl-a, turbidity, Dissolved Organic Matter).

The tidal problem

In transitional waters, tides can be the main factor driving water dynamics. Due to the daily time shift of the tide peaks, a sun-synchronous satellite will observe a different tidal condition at each overpass.

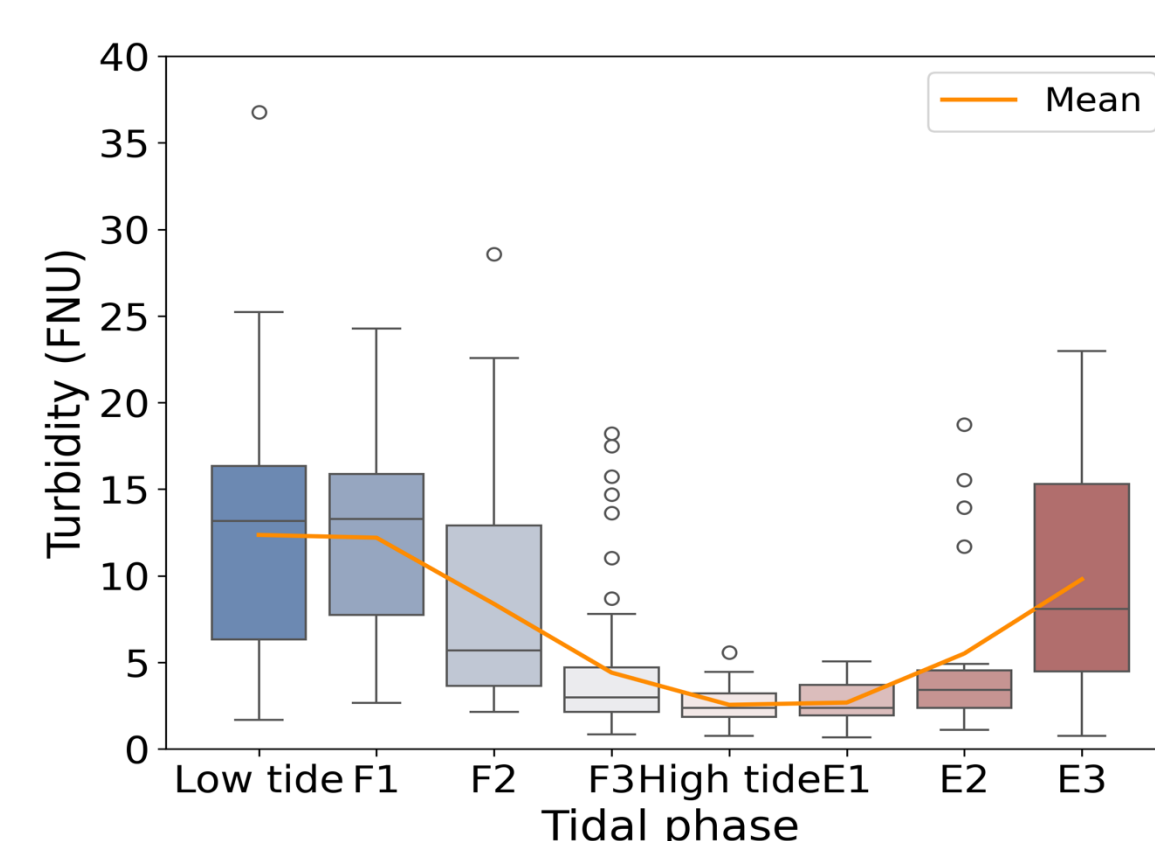
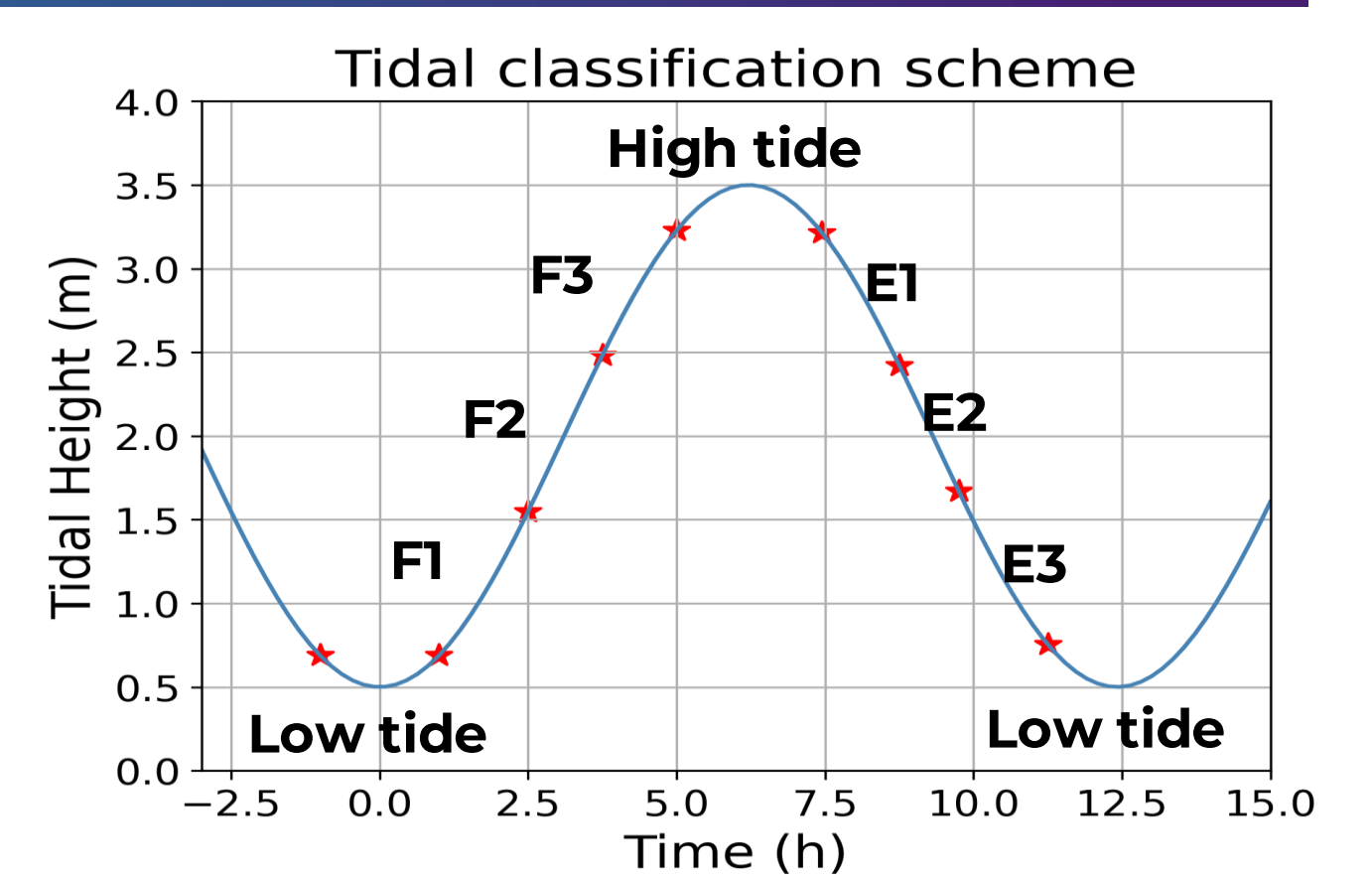


Figure. Satellite-derived turbidity of the Tagus estuary per tidal phase



A tidal classification was developed to analyse data corresponding to the same tidal condition in order to unravel smaller scale variabilities.

Optical Water Types development and characterization with in-situ data

• **c-means fuzzy clustering** on atmospherically corrected (Polymer AC) MSI and OLCI data processed within CERTO project and representative of 6 different transitional systems in Europe

• **17 clusters** were identified and applied to Tagus area

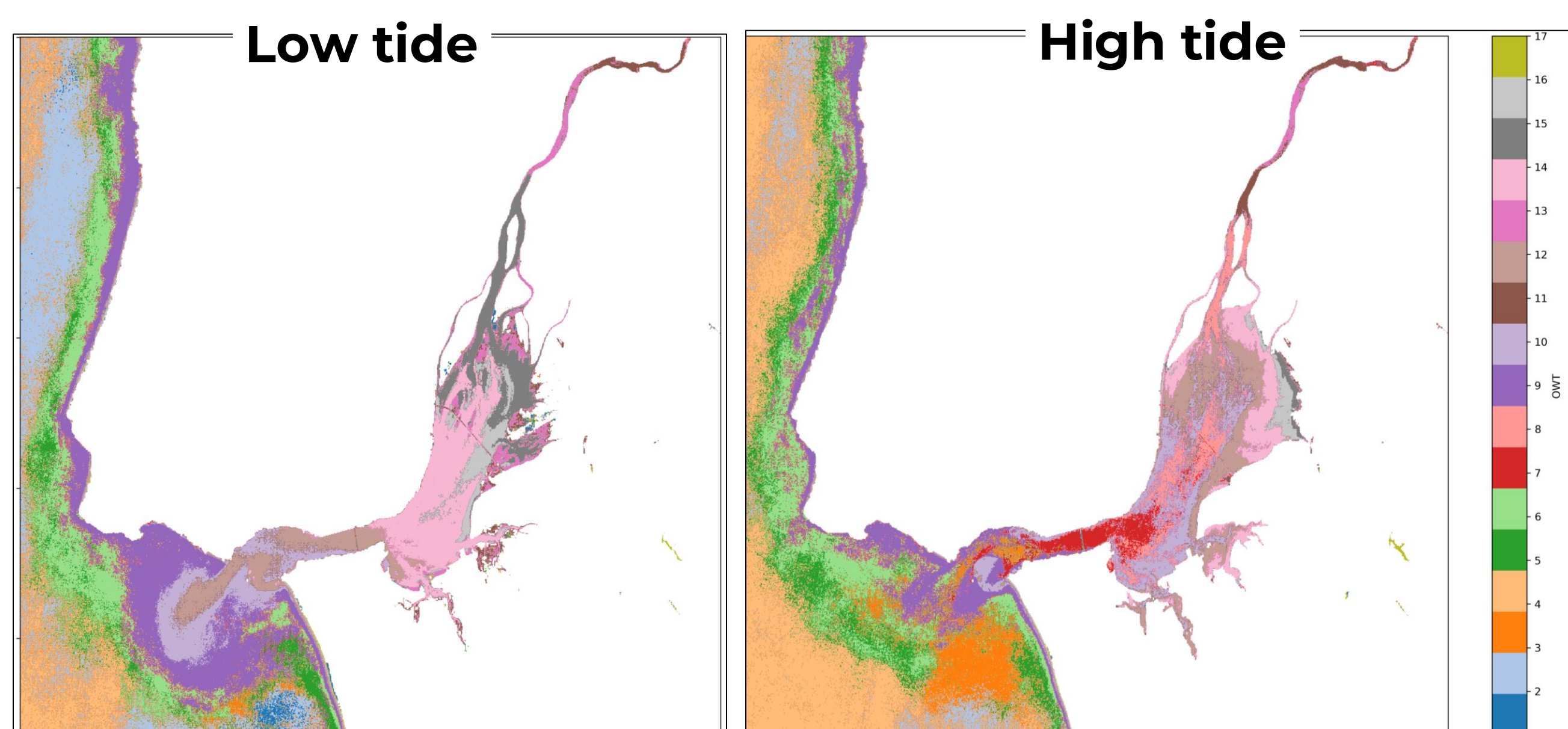


Figure. Dominant Optical Water Types of the Tagus estuary during Low tide condition (left) and High tide (right)

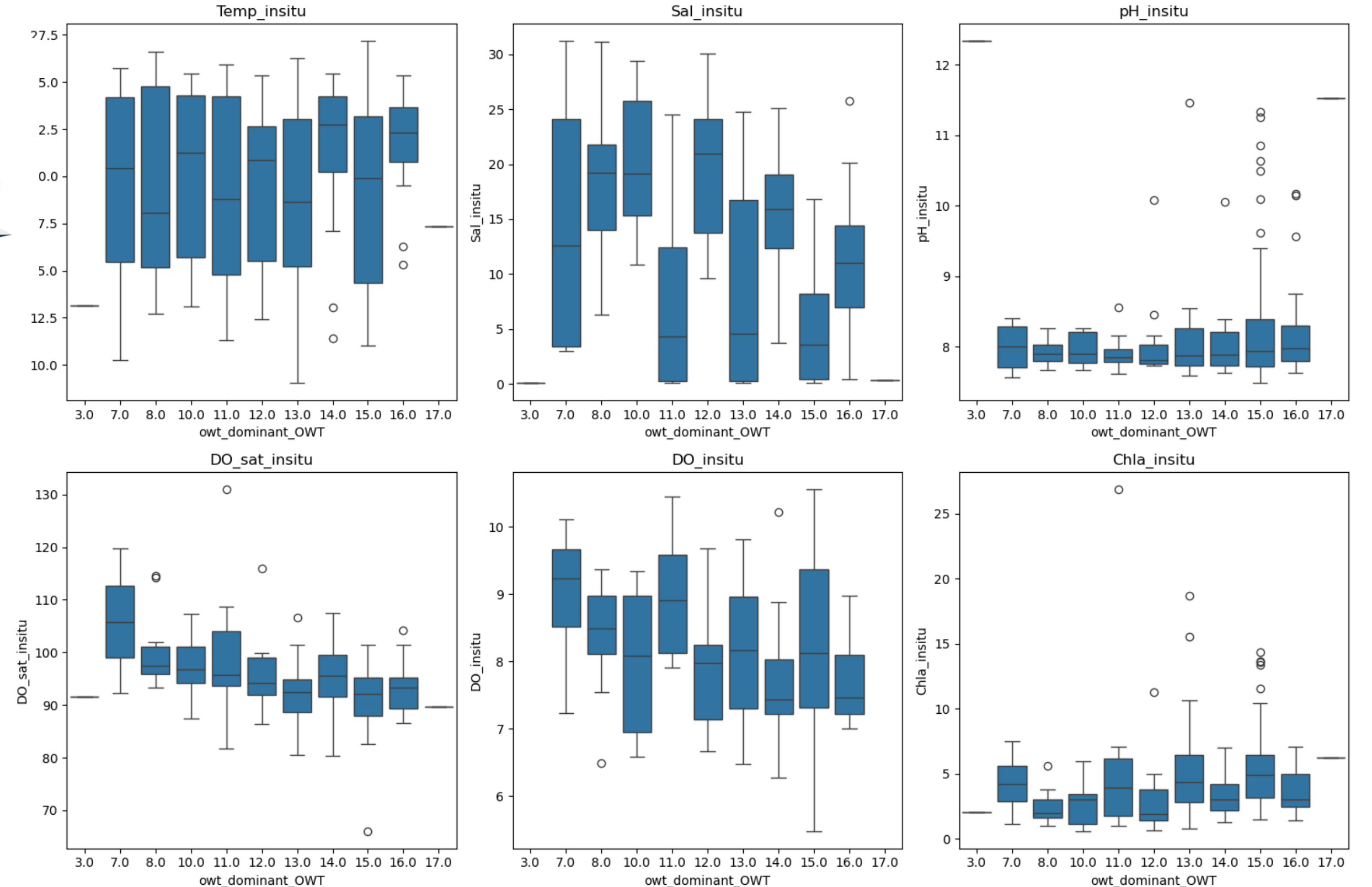


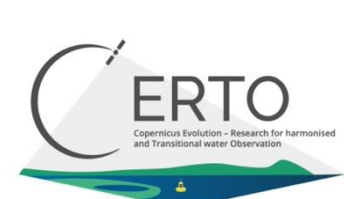
Figure. Range of in-situ parameters of the different OWT



Future work

The dominant OWT will be associated to environmental conditions and used as proxy for monitoring water quality changes. The analysis of the spatio-temporal-tidal distribution of the dominant OWT will be used to define “normal” and anomalous conditions aiming to support the monitoring in the context of the Water Framework Directive and Marine Strategy Framework Directive.

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