Effects of coastal runoff modelled by MOHID Land on the AGORA model for the Ría de Arousa

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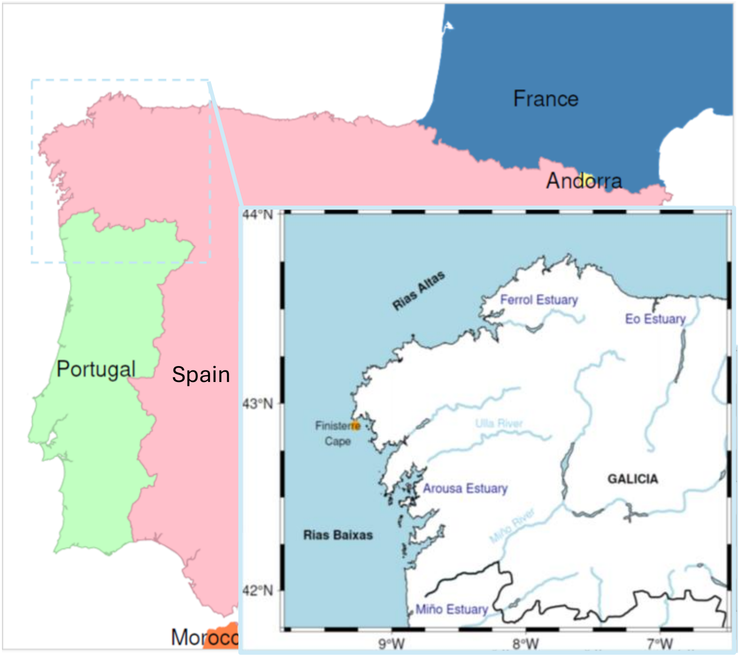
26 de julho de 2025

Motivation



In **Galicia**, coastal areas are home to more than **half of the region's population** (Annual Indicators Report, 2022) and are an **important economic asset** (Informe Anual de Indicadores, 2022[2]; Fernández et al, 2015[3]):

- 45 % of European mussel production
- ~100% of Spanish cockle production

Mollusc shellfish farming
- Water quality
- Low salinity events, high temperature

Navigation
- Safety at sea
- Port management
- Pollution

Protected areas
- Population control
- Protection and mitigation

Population centres
- Wastewater discharge
- Protection against extreme events

Tourism

Offshore renewable energy
- Feasibility studies

Accurate and reliable knowledge ➡ Efficient management

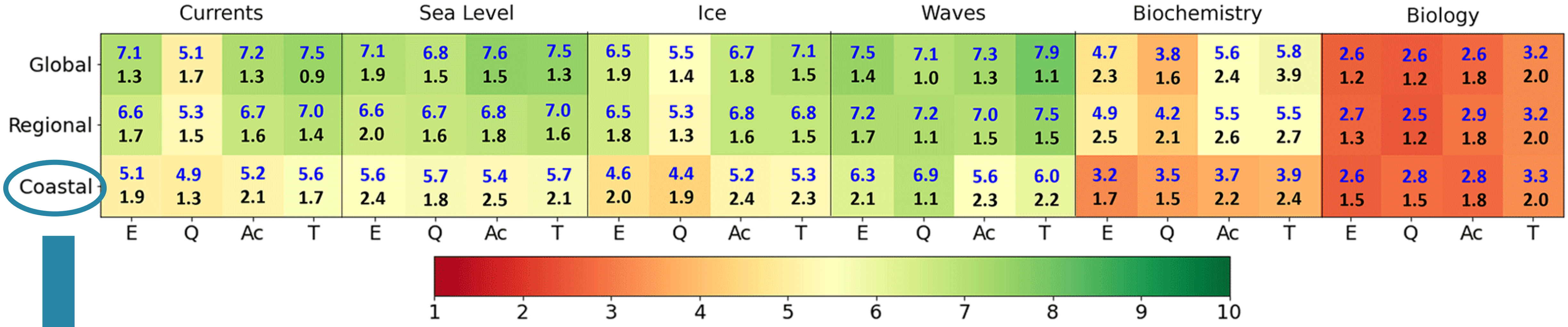
[1]IPCC, 2023: Sections. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 35-115, doi: 10.59327/IPCC/AR6-9789291691647

[2]Informe Anual de Indicadores, 2022: Ministerio de Agricultura, Pesca y Alimentación. Madrid, Spain, pp. 88-94, https://www.mapa.gob.es/es/ministerio/servicios/analisis-y-prospectiva/serie-indicadores/indicadores_semestre.aspx

[3]Fernández. E, Álvarez-Salgado. X A, Beiras. R, Aida Ovejero, Méndez. G, Coexistence of urban uses and shellfish production in an upwelling-driven, highly productive marine environment: The case of the Ría de Vigo (Galicia, Spain), Regional Studies in Marine Science, Volume 8, Part 2, 2016, Pages 362-370, ISSN 2352-4855, https://doi.org/10.1016/j.rsma.2016.04.002.

Numerical coastal models

(Ciliberti et al., 2023[1])

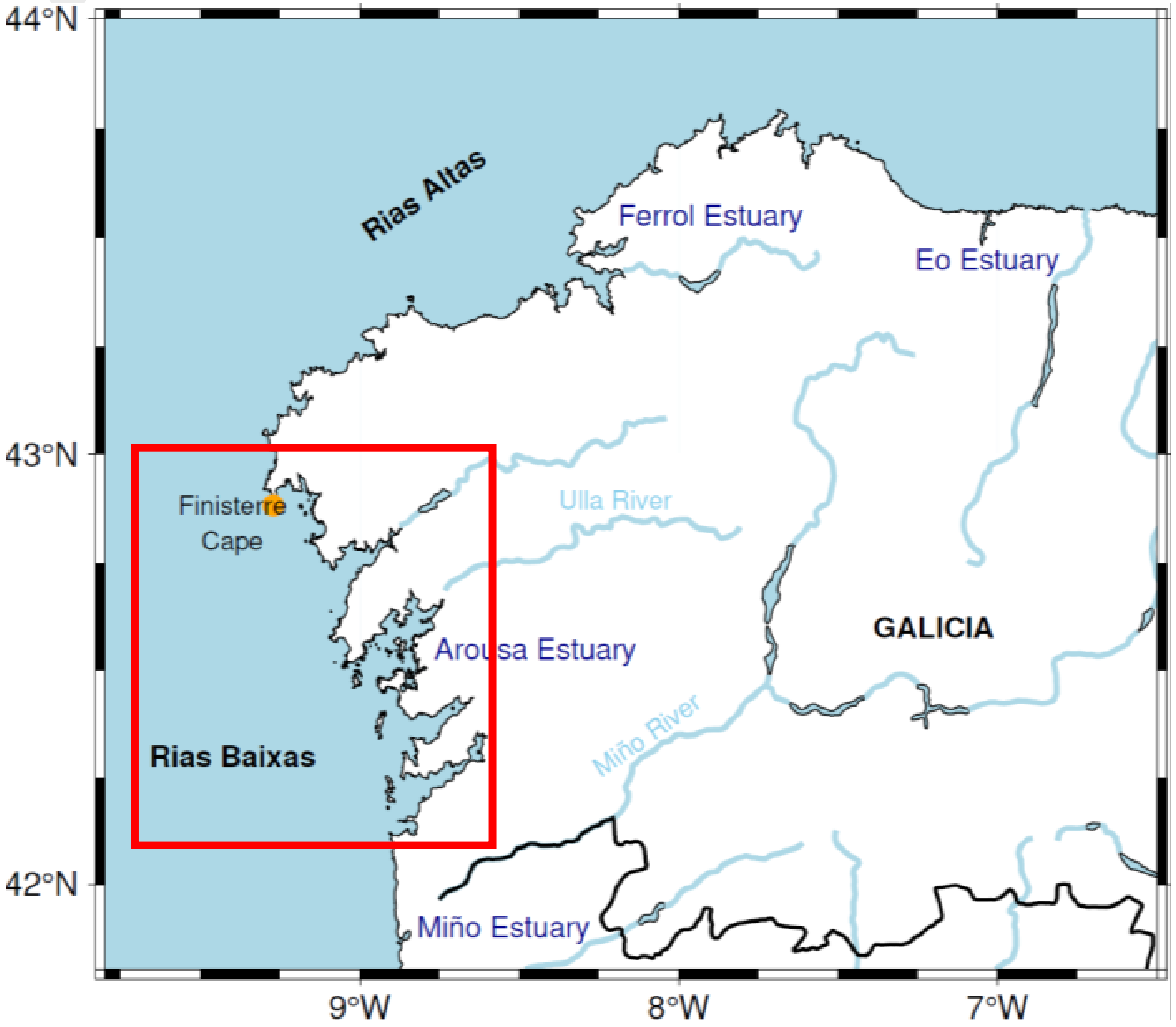


The satisfaction was always **lower at the coastal scale** than at the regional and global scales.
The demand **for quality increased with resolution and proximity to the coast**.

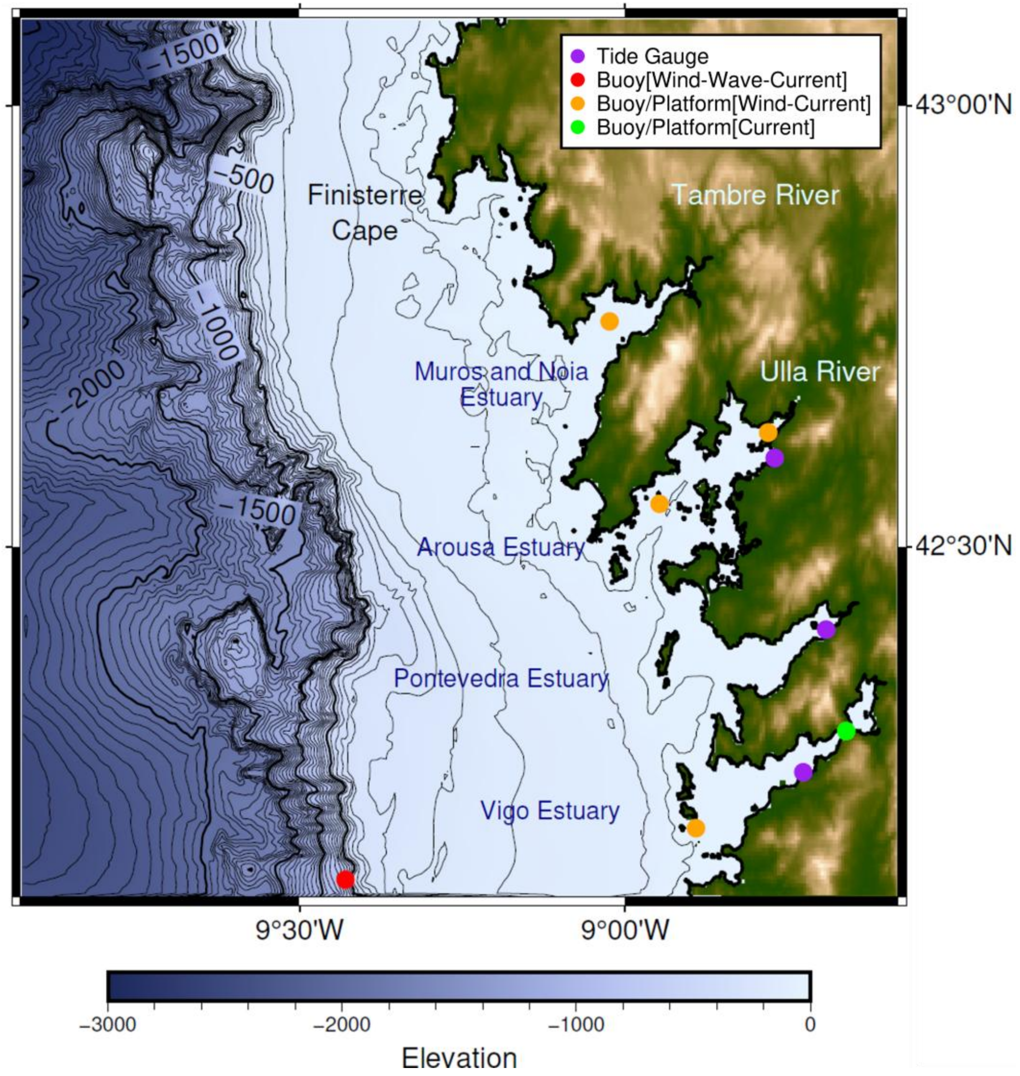
Need to improve the predictive operational capacity

[1]Ciliberti, S. A., Fanjul, E. A., Pearlman, J., Wilmer-Becker, K., Bahurel, P., Ardhuin, F., ... & Zufic, R. (2023). Evaluation of operational ocean forecasting systems from the perspective of the users and the experts. State of the Planet, 1.

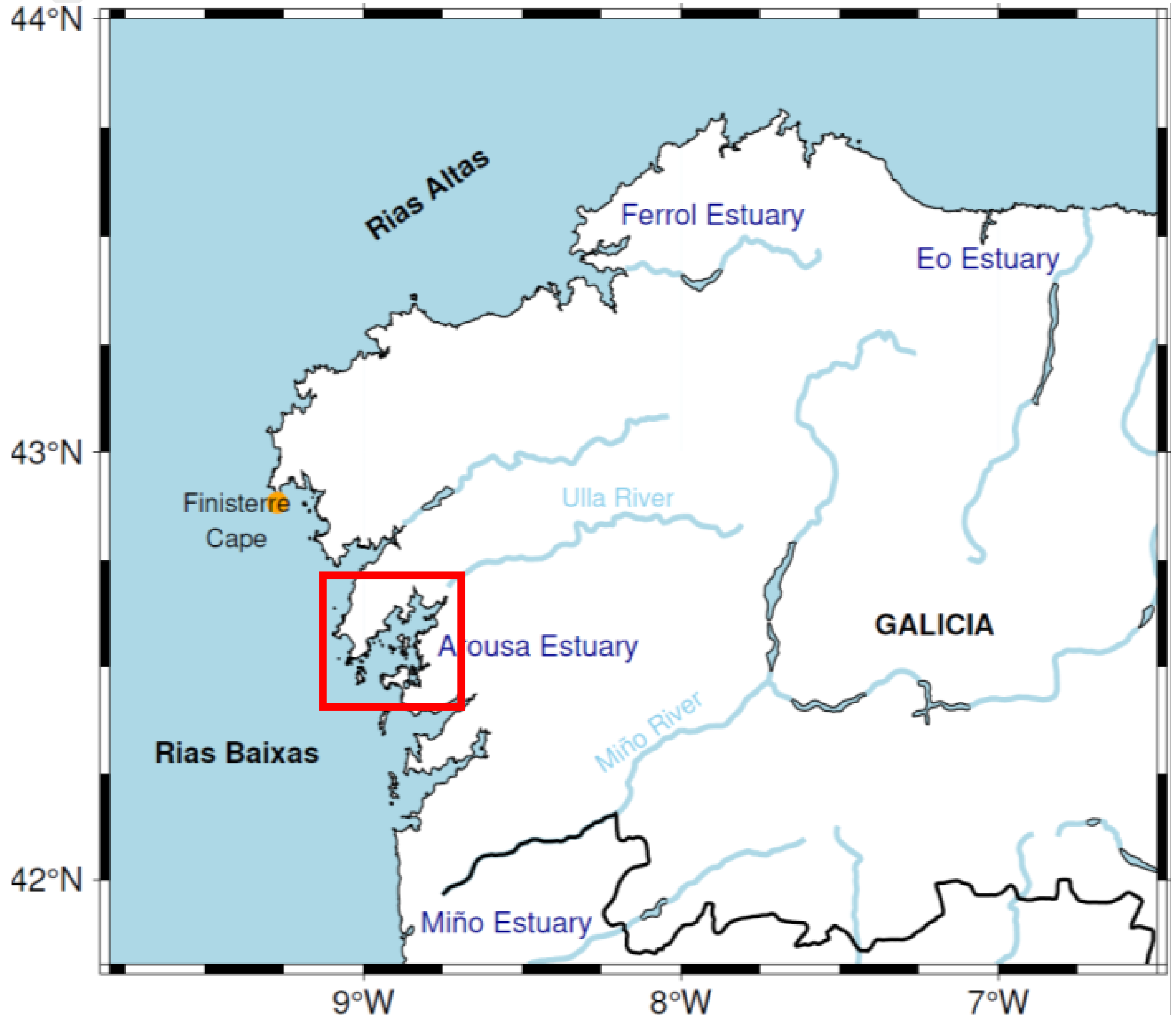
AGORA. Coastal domain



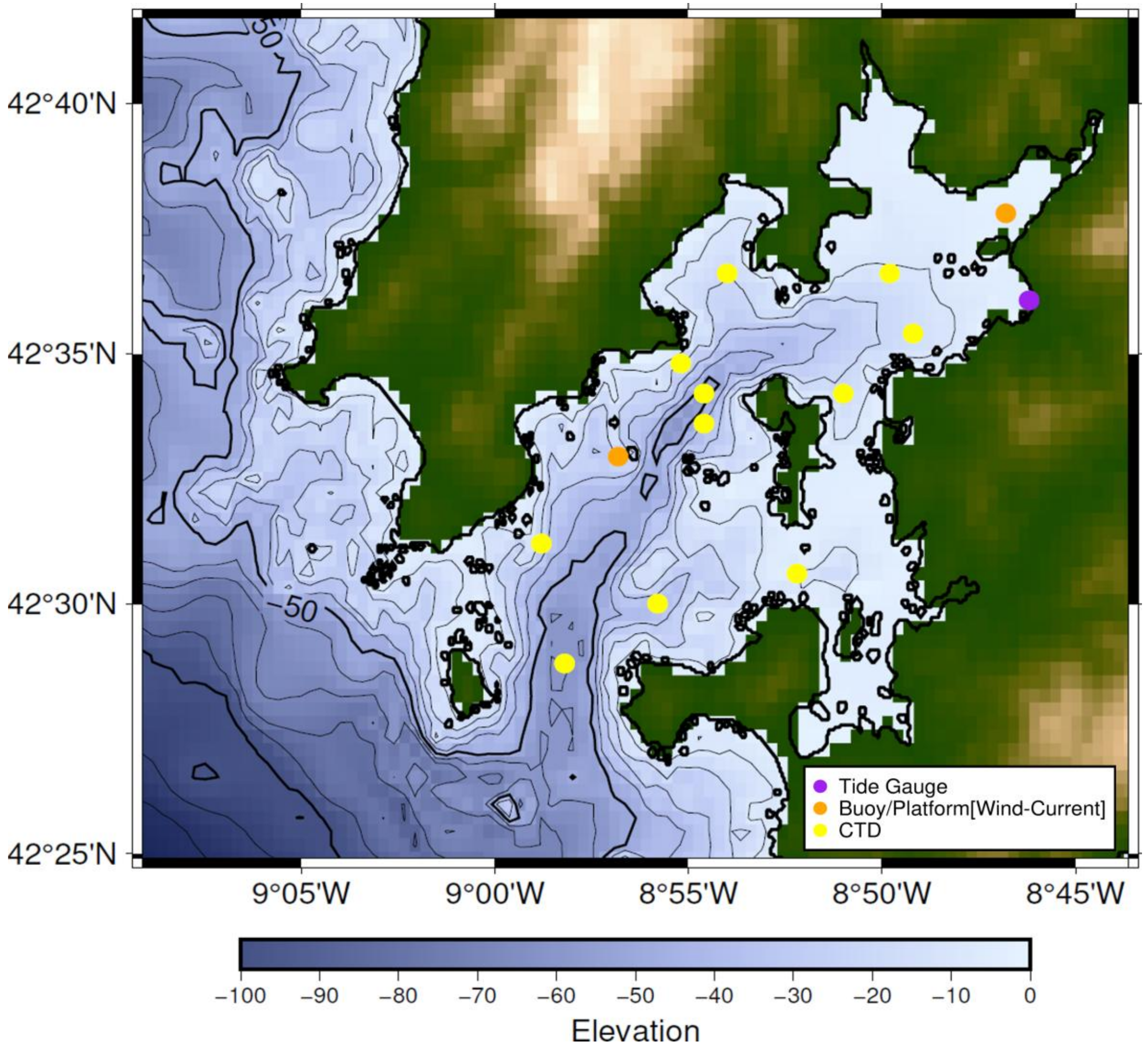
RBX (350m)



AGORA. Local domain

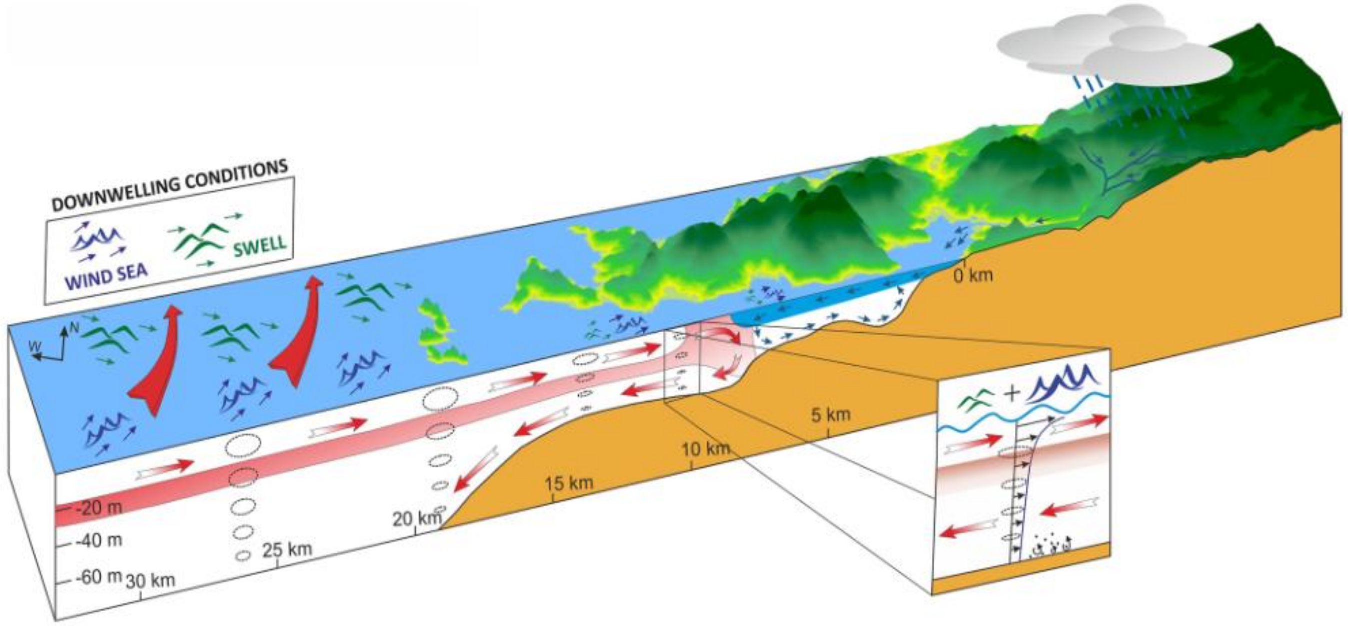


ARS (70m)



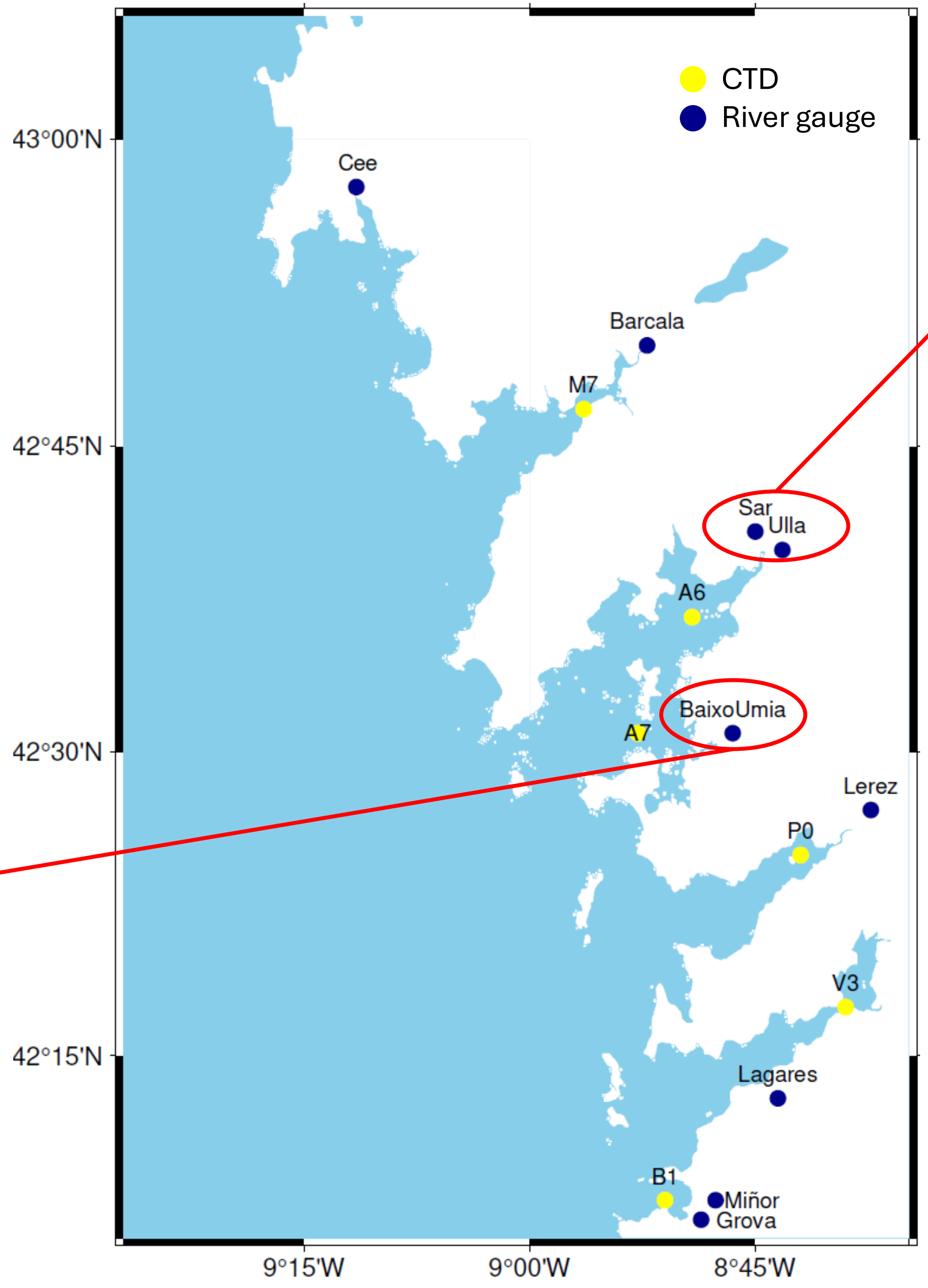
Highest river discharges → EV1, EV4

Event	Start date	End date
EV1	07 – 01 – 2023	24 – 01 – 2023
EV2	07 – 03 – 2023	05 – 04 – 2023
EV3	22 – 07 - 2023	15 – 08 – 2023
EV4	10 – 10 – 2023	18– 11 – 2023



Villacieros-Robineau, N., Gilcoto, M., Pardo, P. C., & Barton, E. D. (2021). Wave Regime and Wave-Current Coupling in an Upwelling–Driven Bay: Seasonal and Inter-Annual Variability. Journal of Geophysical Research: Oceans, 126(11), e2021JC017540.

Temperature and salinity



River Ulla

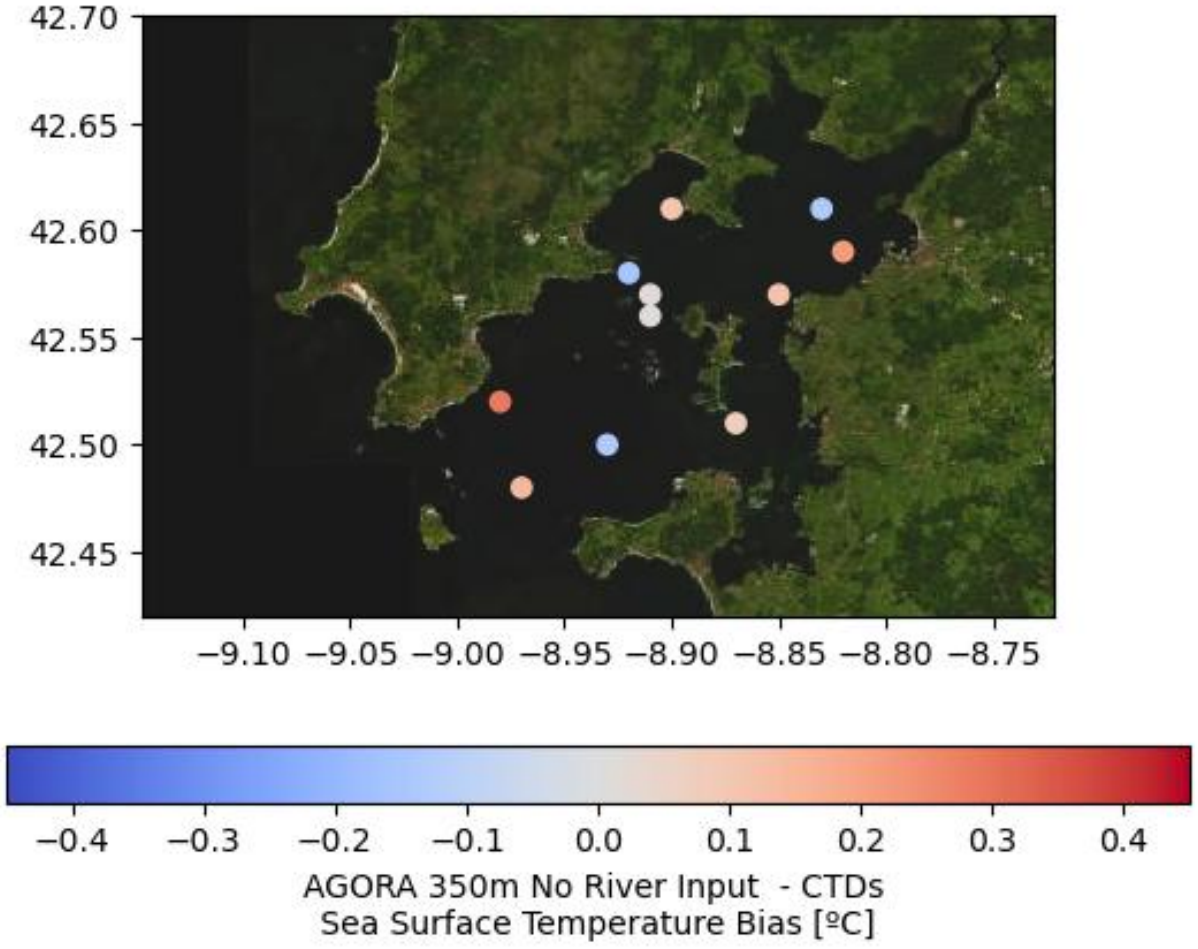
whose discharge is one of the highest among the “Rías Baixas” rivers; with an **average annual flow of 78.8 m^3s^{-1}**, with the highest flows in winter.

River Umia

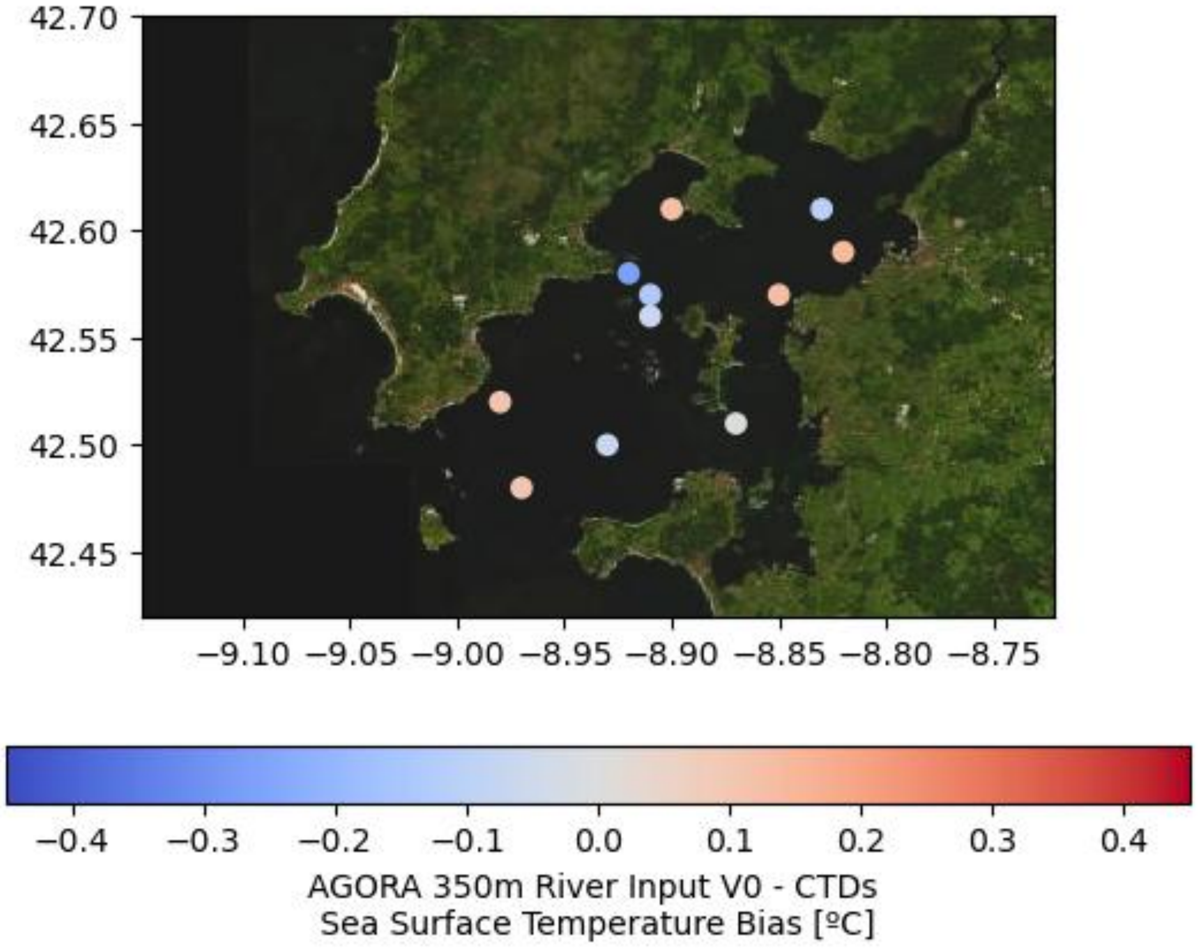
flows into the southern part of the estuary with **13.4 m^3s^{-1} on average.**

Impact of coastal runoff on SST
V0

No Rivers

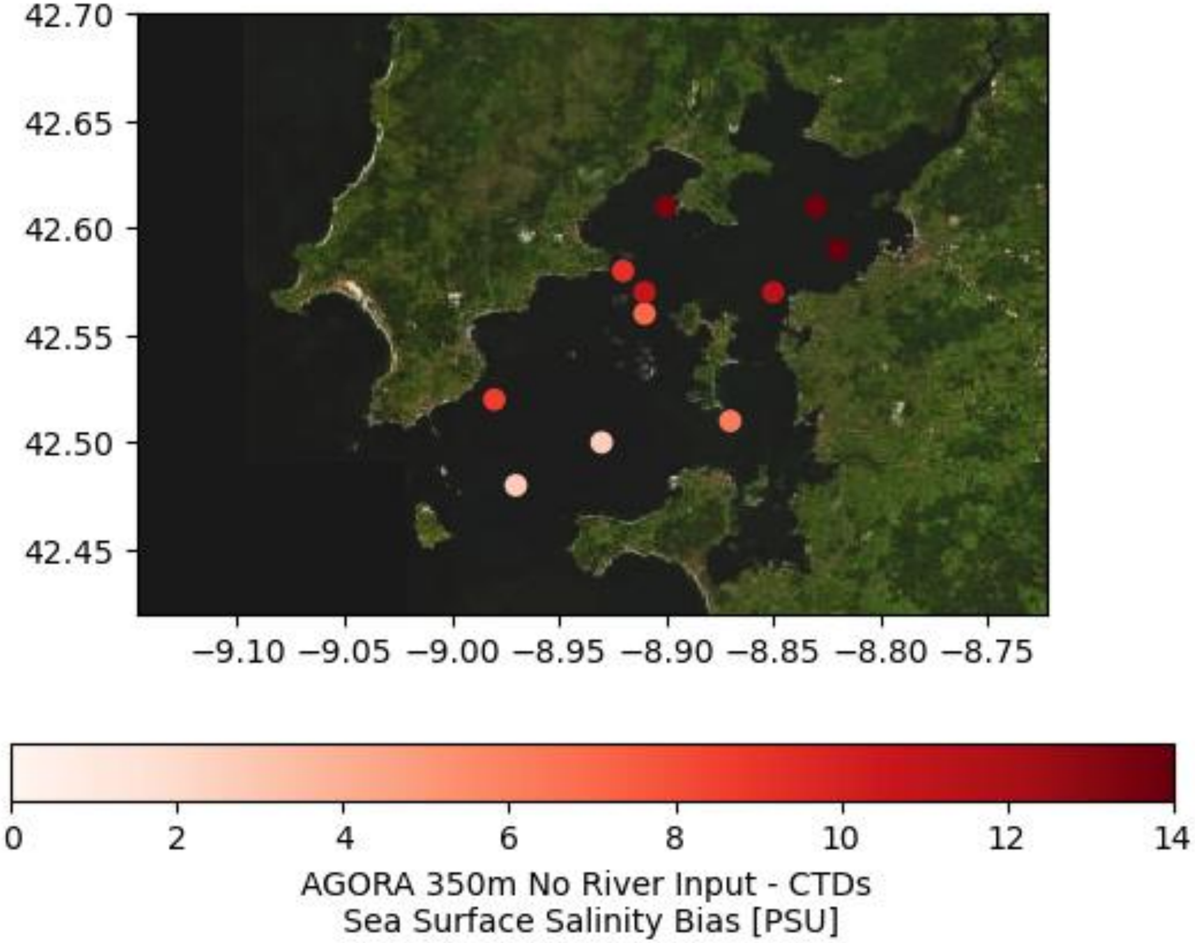


FRC_V0

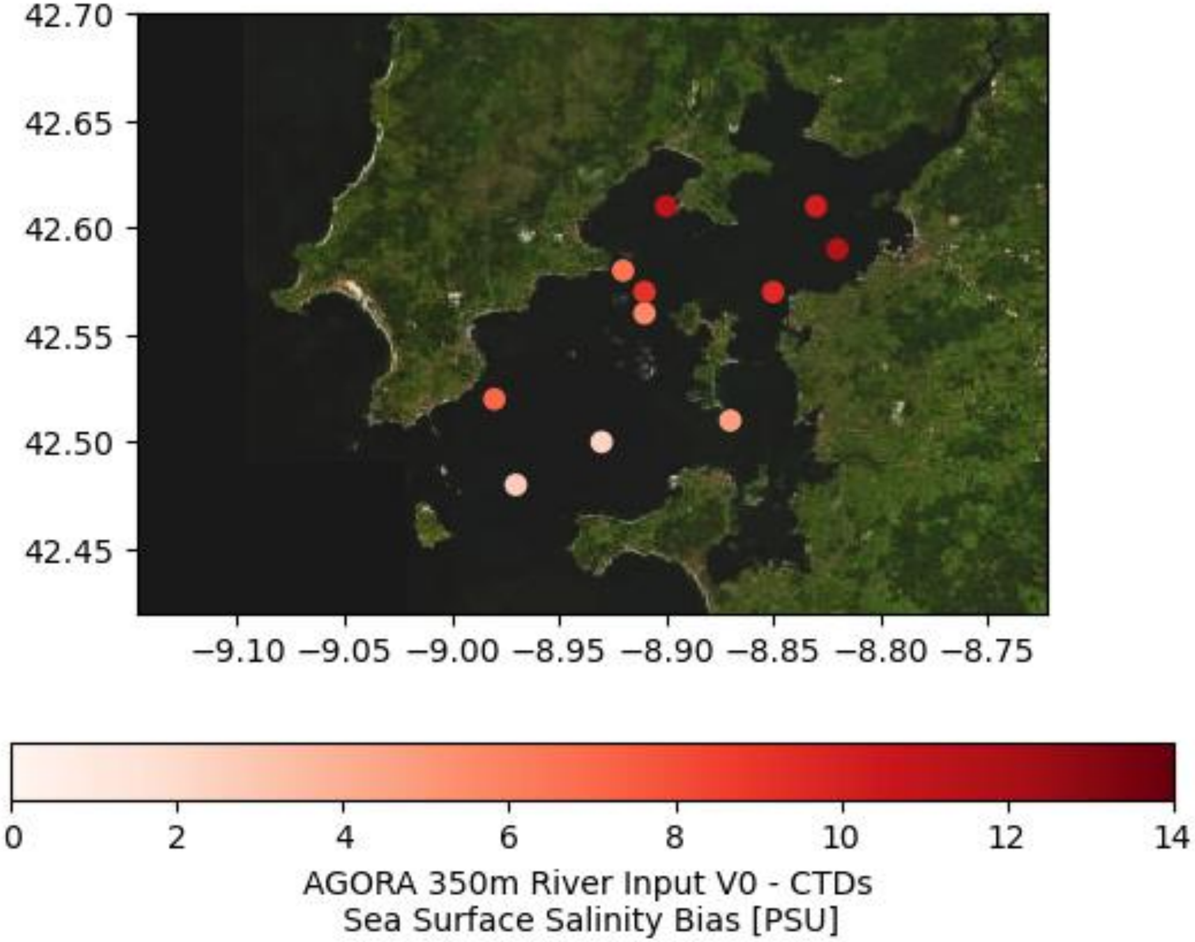


Impact of coastal runoff on SSS V0

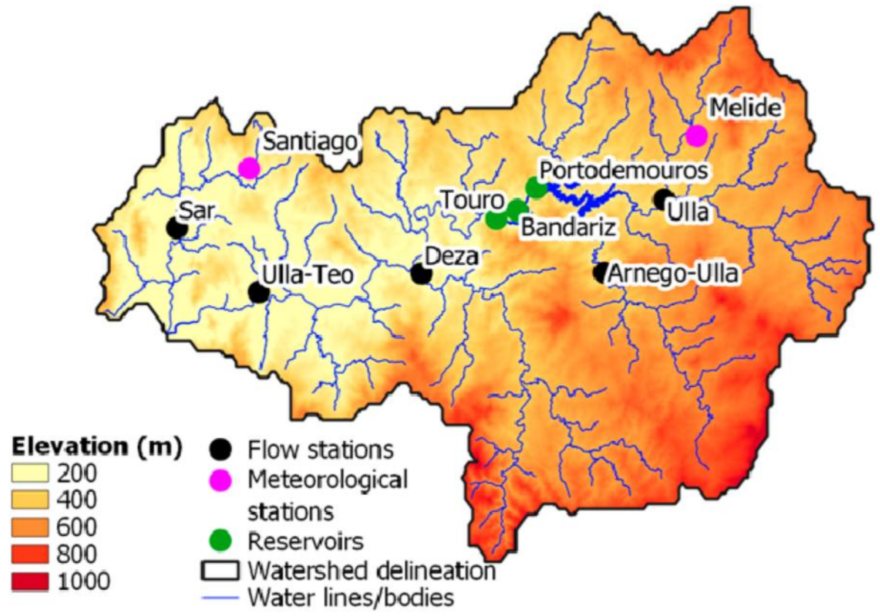
No Rivers



FRC_V0



MOHID_LAND model (Trancoso et al., 2009; Canuto et al., 2019)



Oliveira, A. R., Ramos, T. B., Simionesei, L., Pinto, L., & Neves, R. (2020)*. Sensitivity analysis of the mohid-land hydrological model: a case study of the ulla river basin. Water, 12(11), 3258.*

Meteogalicia hourly 1Km resolution model used as atmospheric forcing

- Air temperature
- Rain temperature (estimated as 2ºC less than air temperature)
- Wind velocity
- Solar radiation
- Relative humidity
- Cloud cover

Modelling temperature as a drainage network property:

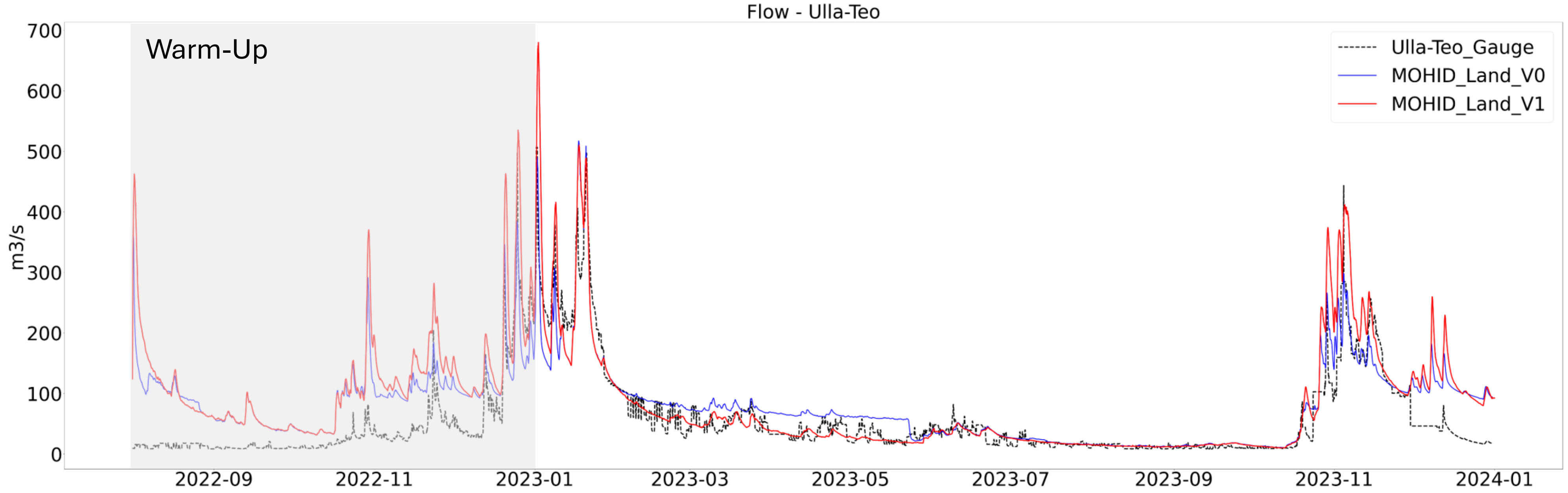
✓ Runoff properties
✓ Porous media properties
X Reservoirs

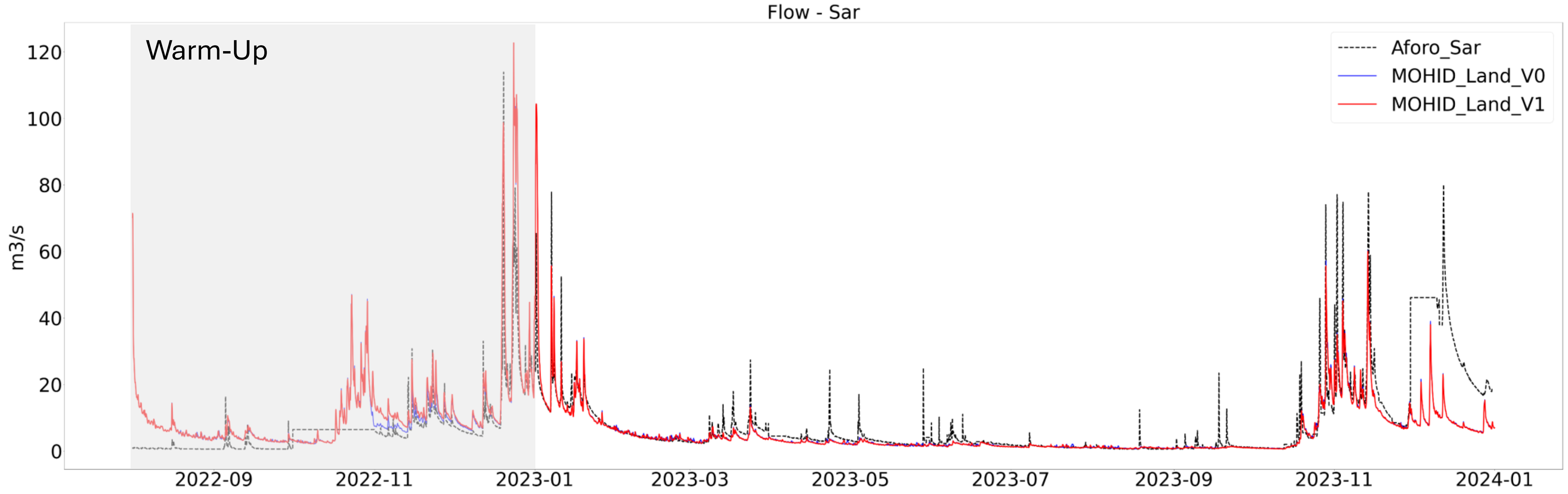
[1]Trancoso, A.R.; Braunschweig, F.; Leitão, P.C.; Obermann, M.; Neves, R. An advanced modelling tool for simulating complex river systems. Sci. Total Environ. 2009, 407, 3004–3016. https://doi.org/10.1016/j.scitotenv.2009.01.015

2Canuto, N.; Ramos, T.B.; Oliveira, A.R.; Simionesei, L.; Basso, M.; Neves, R. Influence of reservoir management on Guadiana streamflow regime. J. Hydrol. Reg. Stud. 2019, 25, 100628. https://doi.org/10.1016/j.ejrh.2019.100628

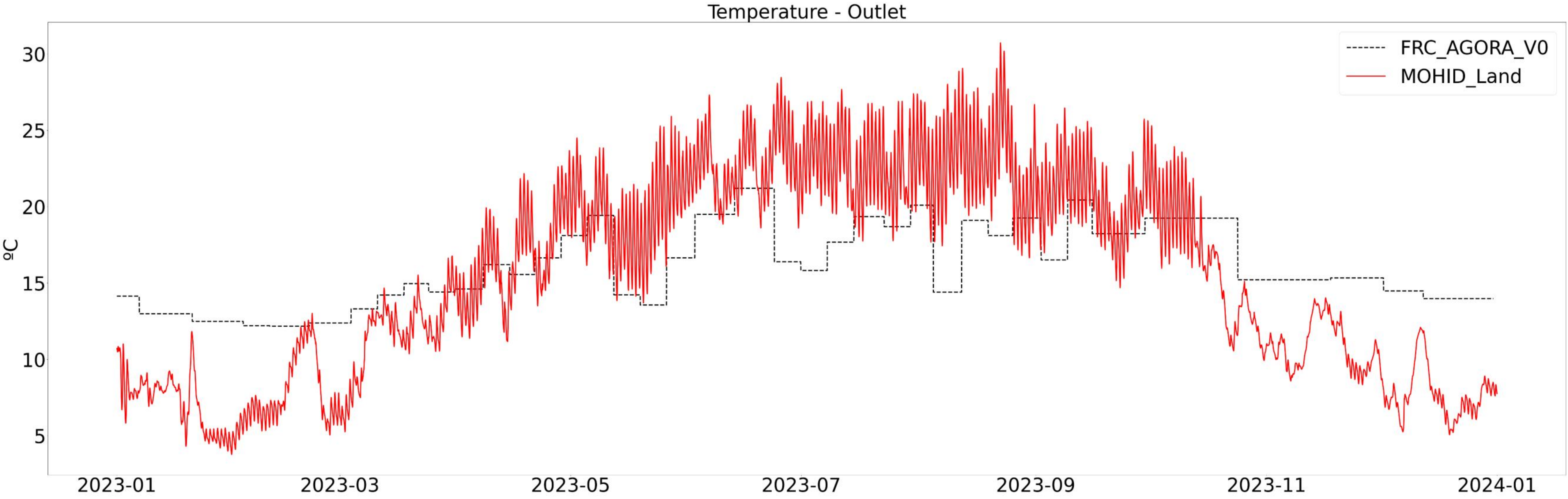
3Oliveira, A. R., Ramos, T. B., Simionesei, L., Pinto, L., & Neves, R. (2020). Sensitivity analysis of the mohid-land hydrological model: a case study of the ulla river basin. Water, 12(11), 3258.

MOHID_LAND Flow



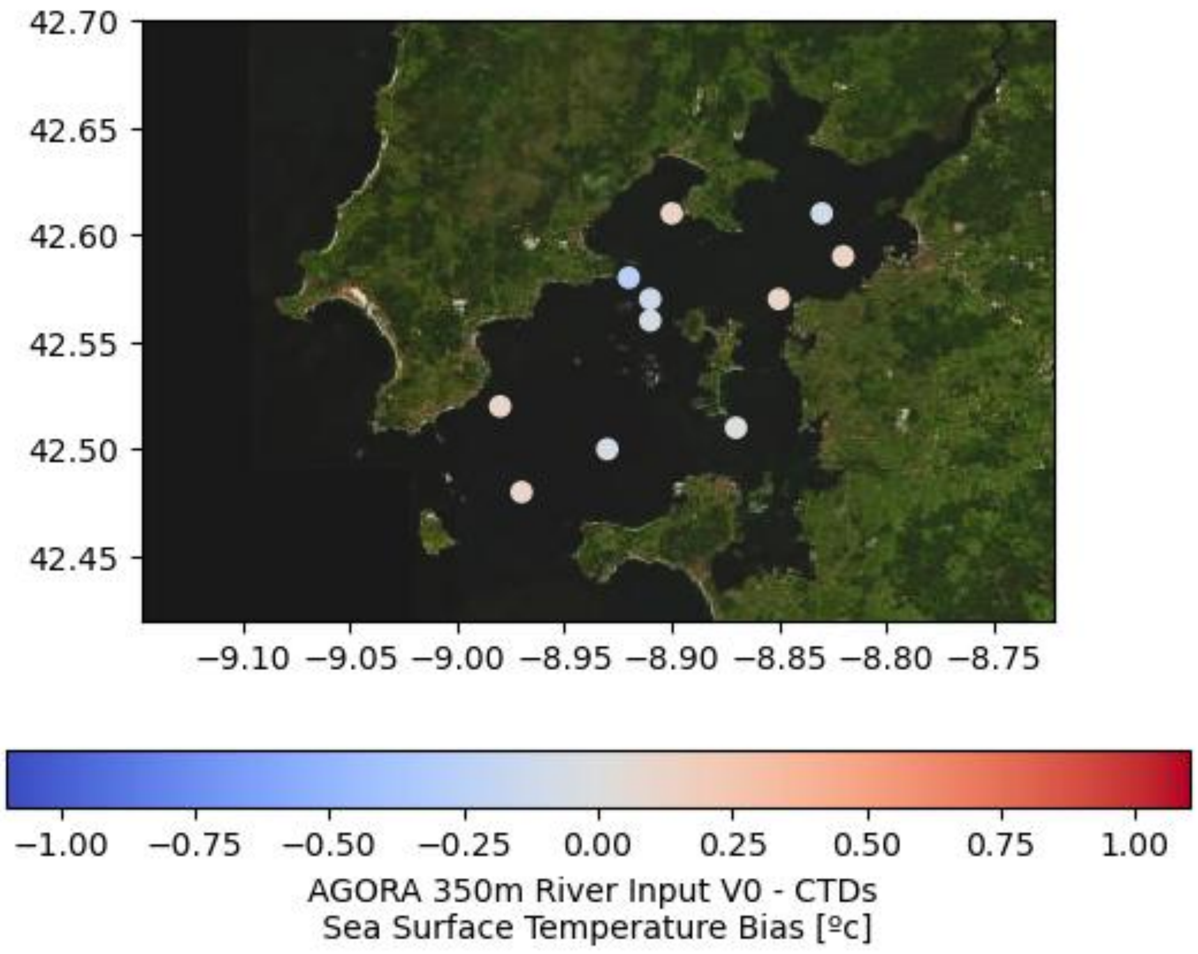


MOHID_LAND Temperature

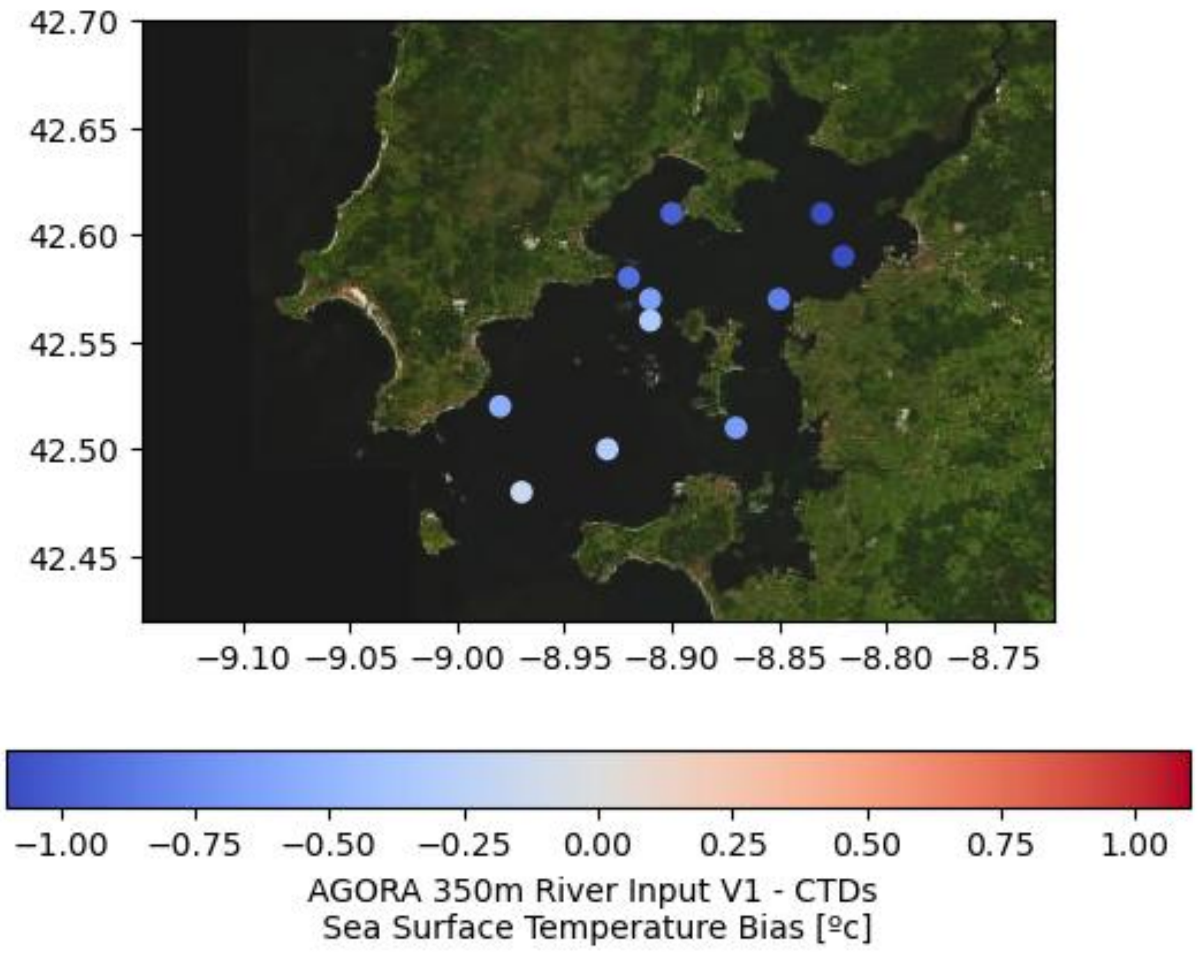


Impact of coastal runoff on SST
V1

FRC_V0

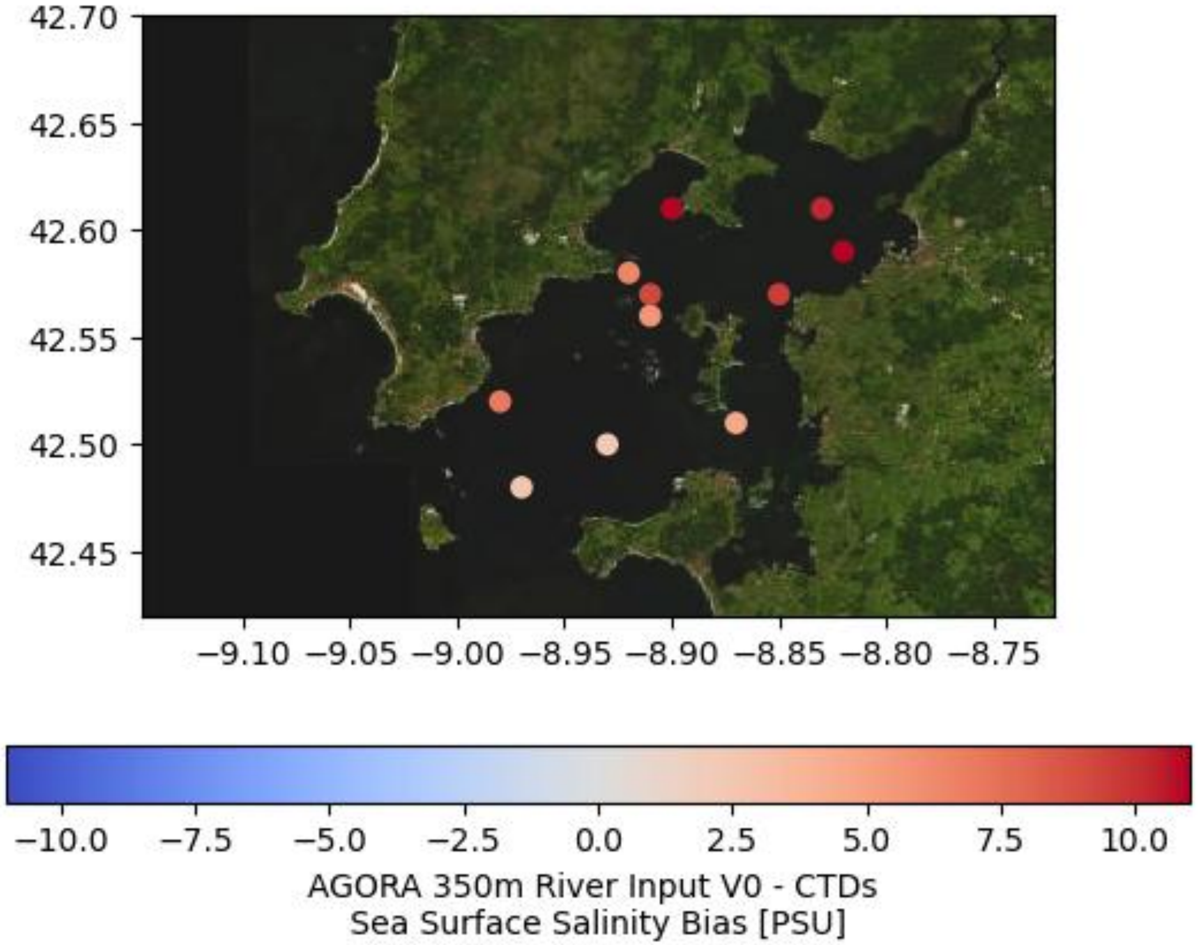


FRC_V1

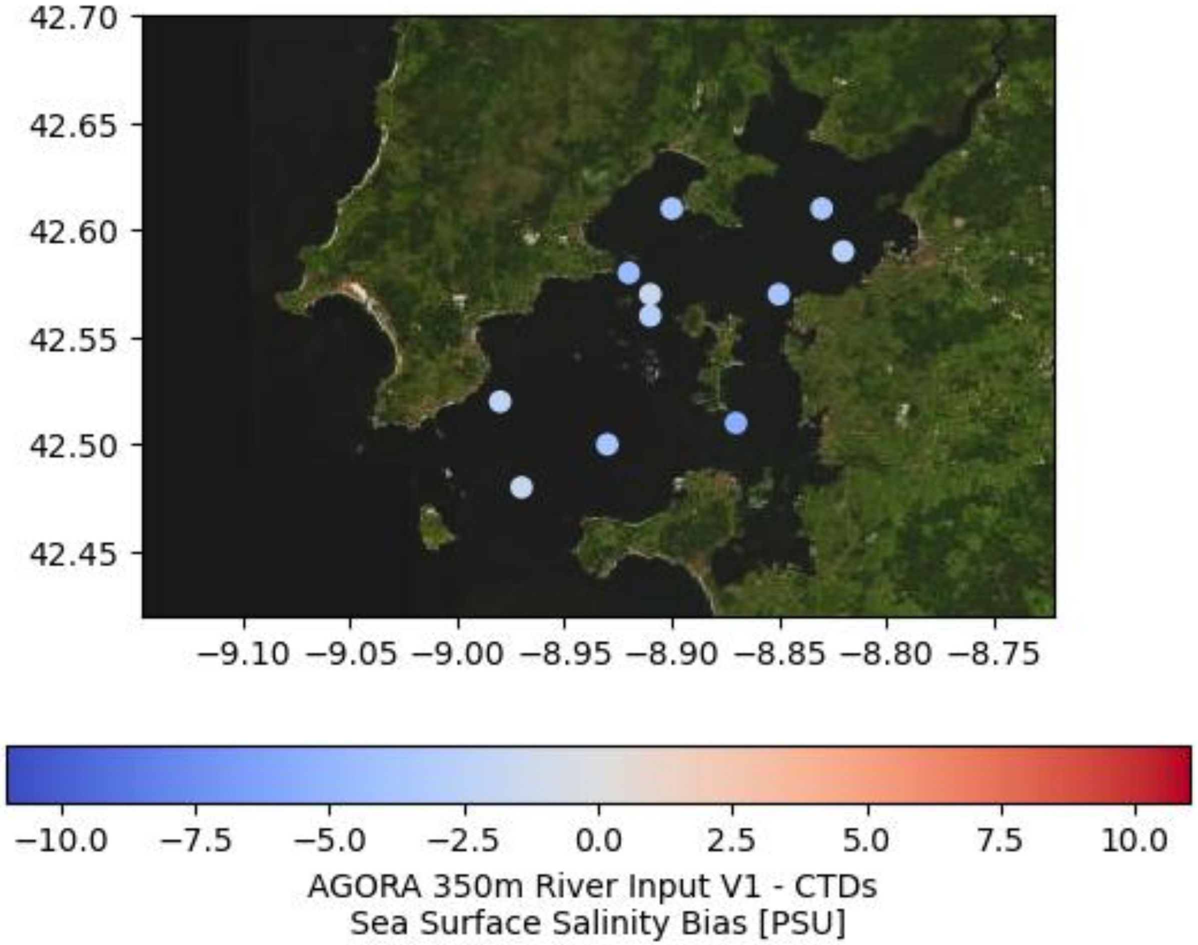


Impact of coastal runoff on SSS V1

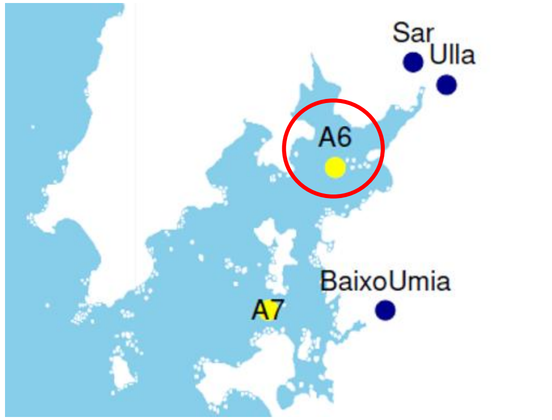
FRC_V0



FRC_V1

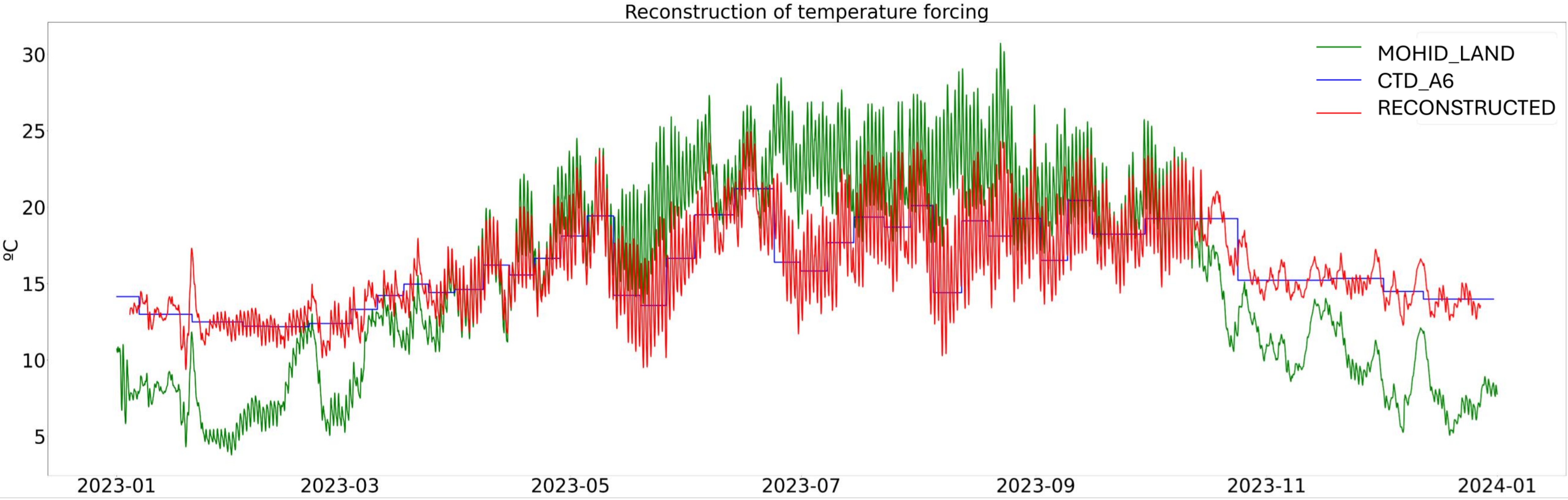


Statistical reconstruction of temperature forcing



A6 SST Trend

MOHID Land Variability

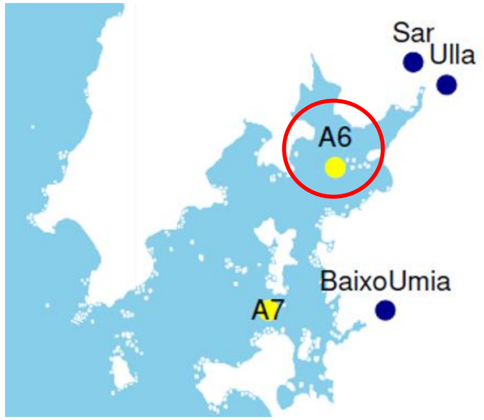


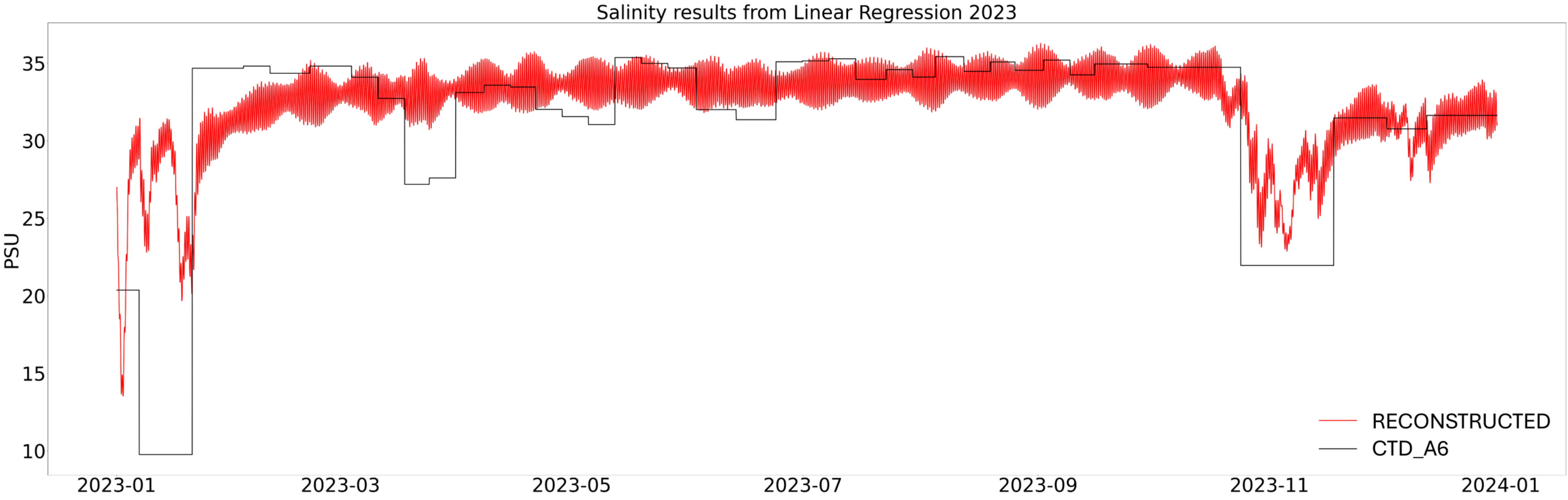
Linear regression reconstruction of salinity forcing

Variability of the volume of the estuary

Variability of the coastal runoff

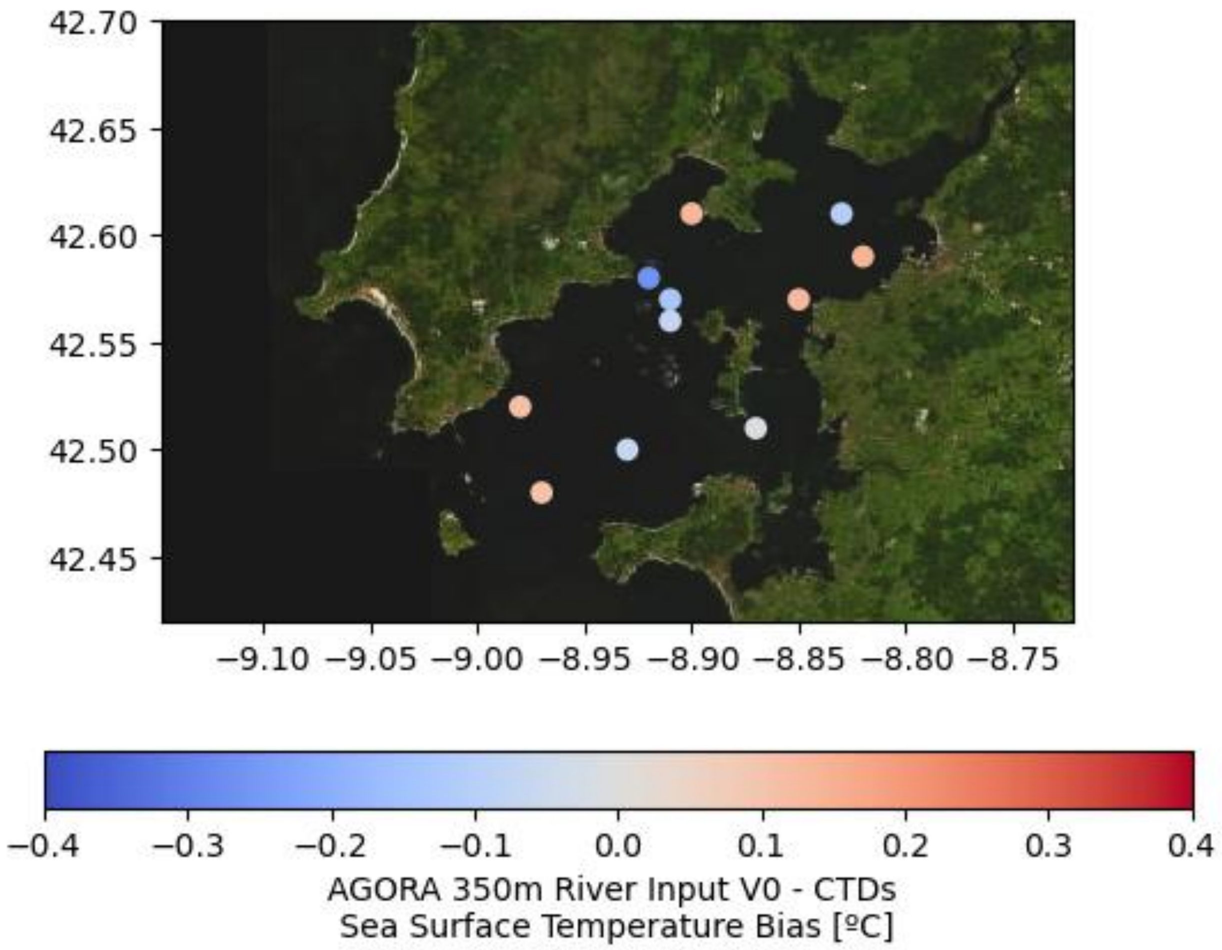
A6 SSS weekly value



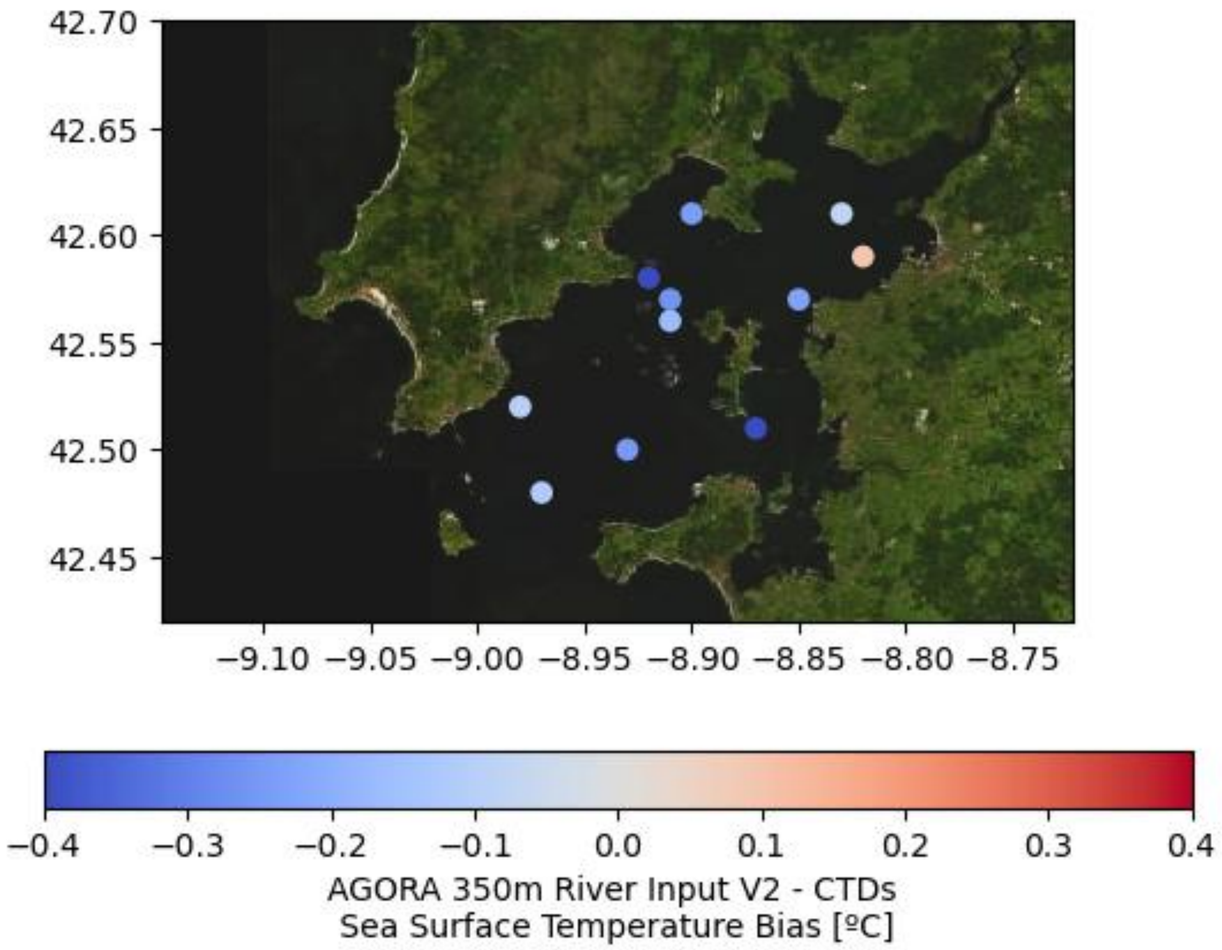


Impact of coastal runoff on SST
V2

FRC_V0

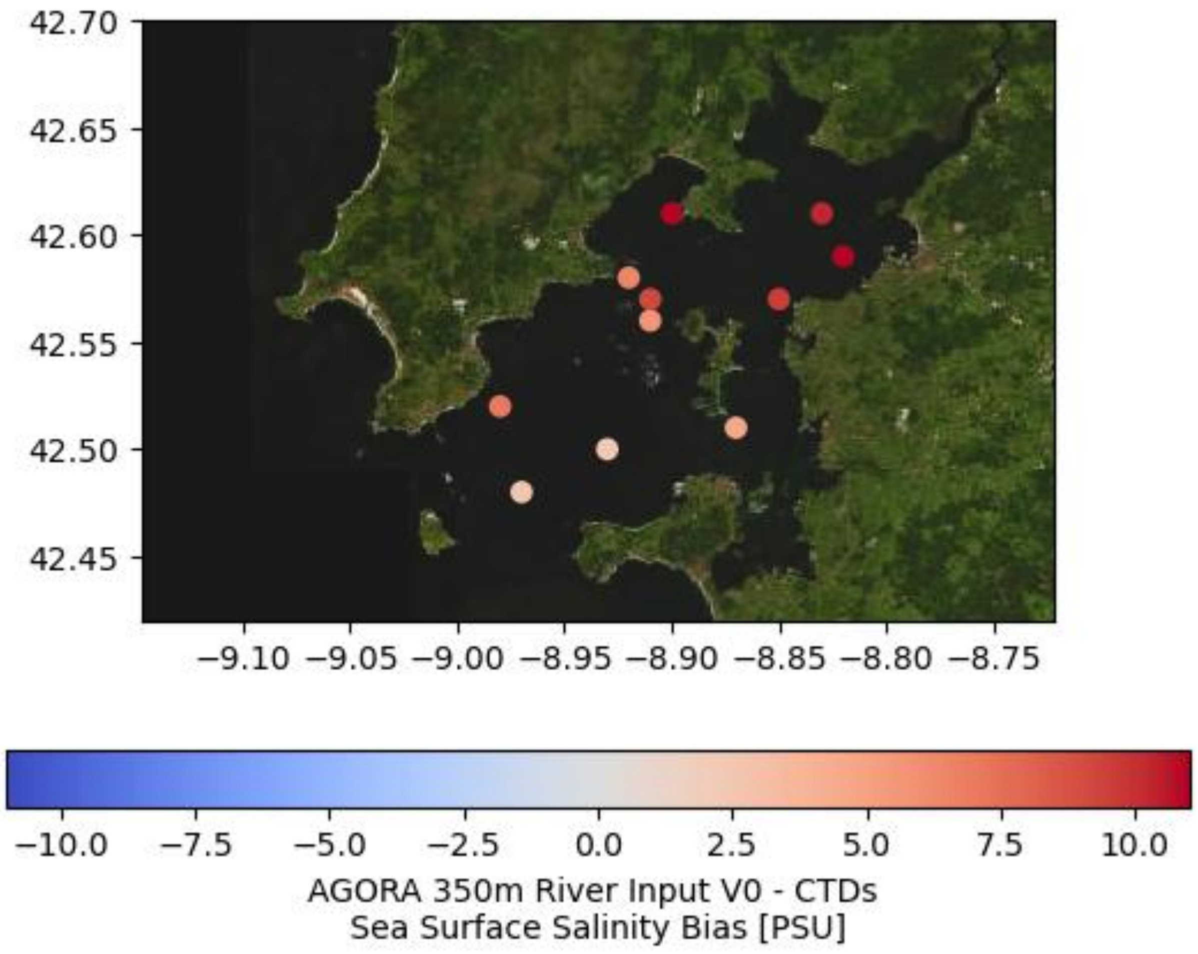


FRC_V2

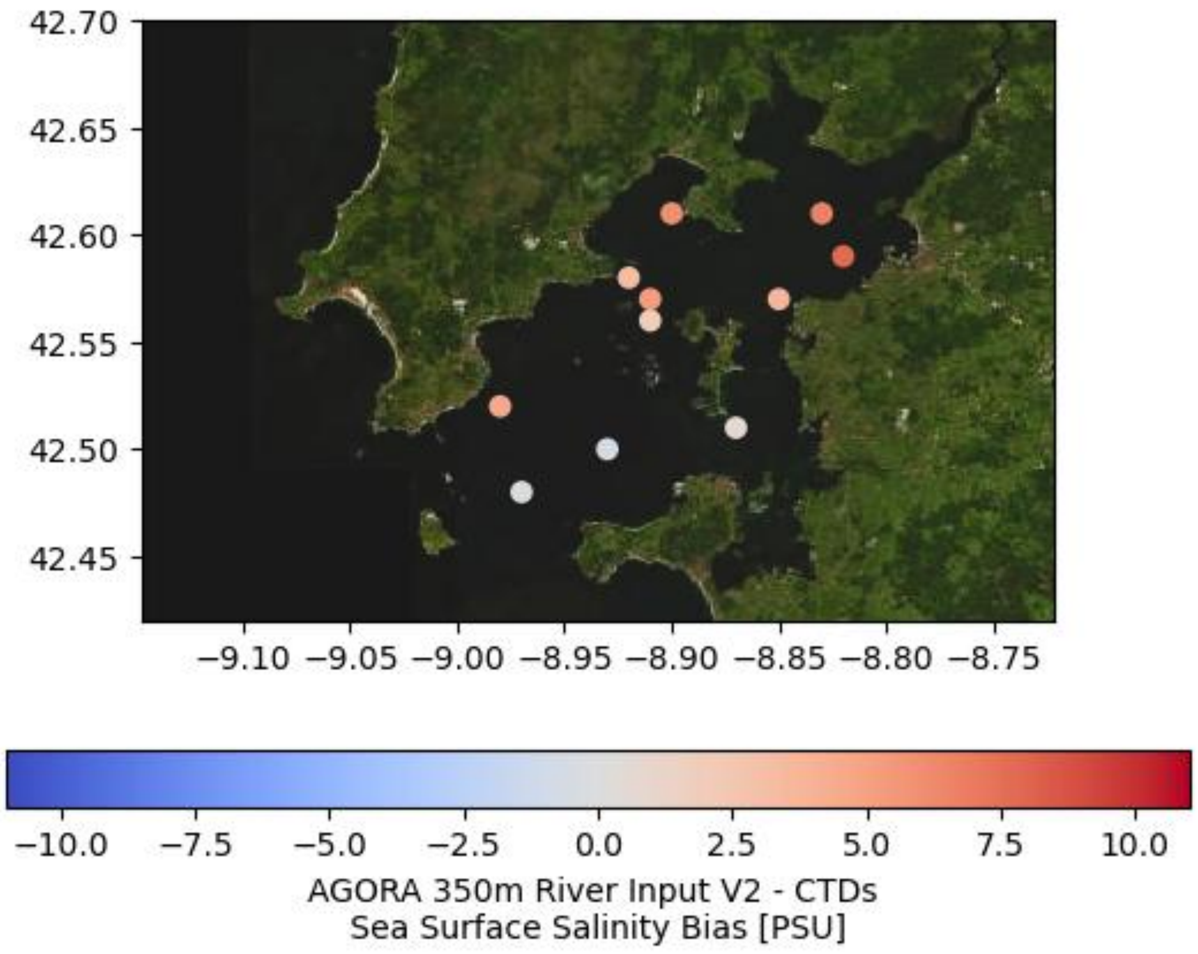


Impact of coastal runoff on SSS V2

FRC_V0



FRC_V2



Obrigada!