MOHIDING

Implementation of a hydrodynamic model to an aquaculture area in Sines, Portugal.

- Alexandre Correia, Lígia Pinto, Marcos Mateus

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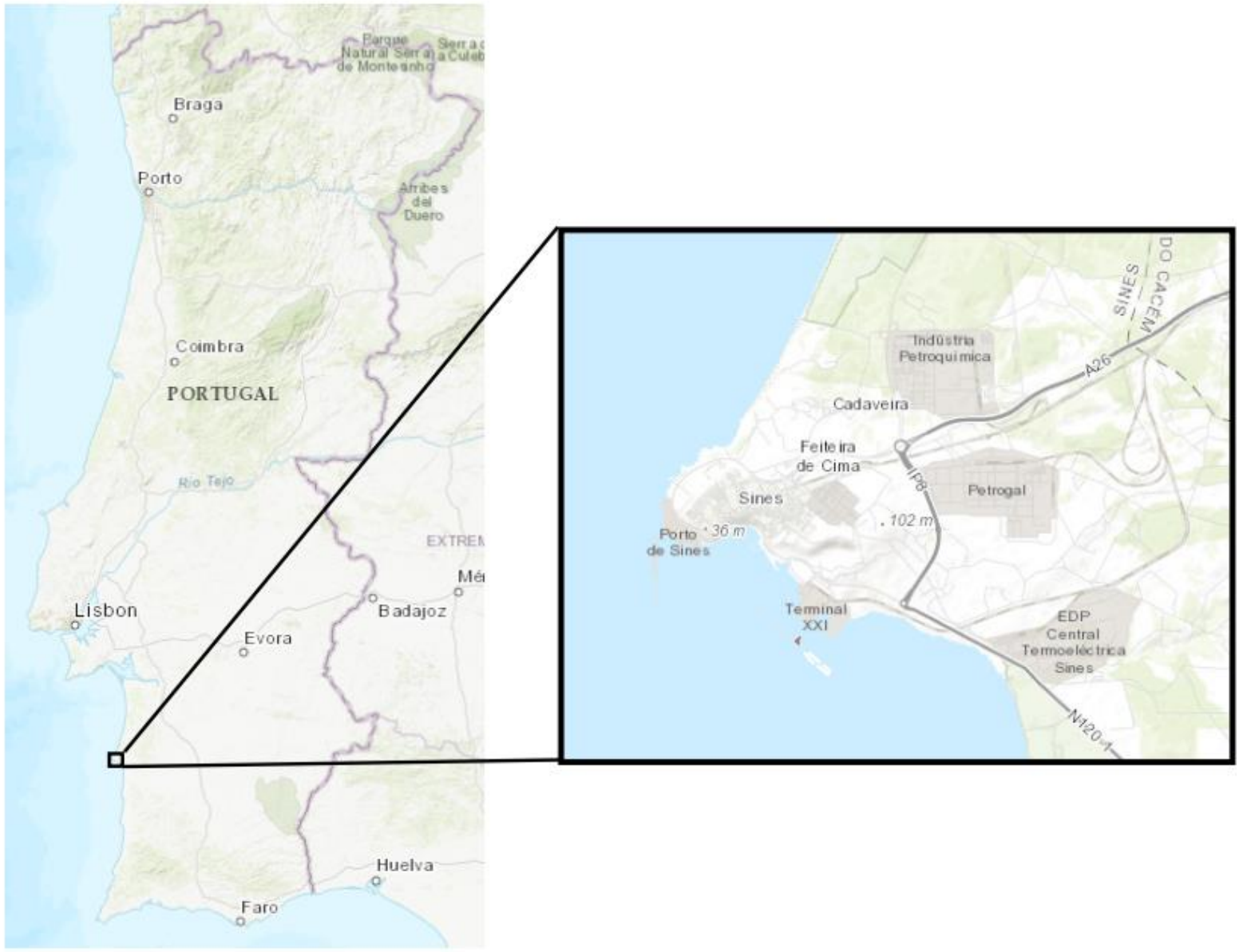
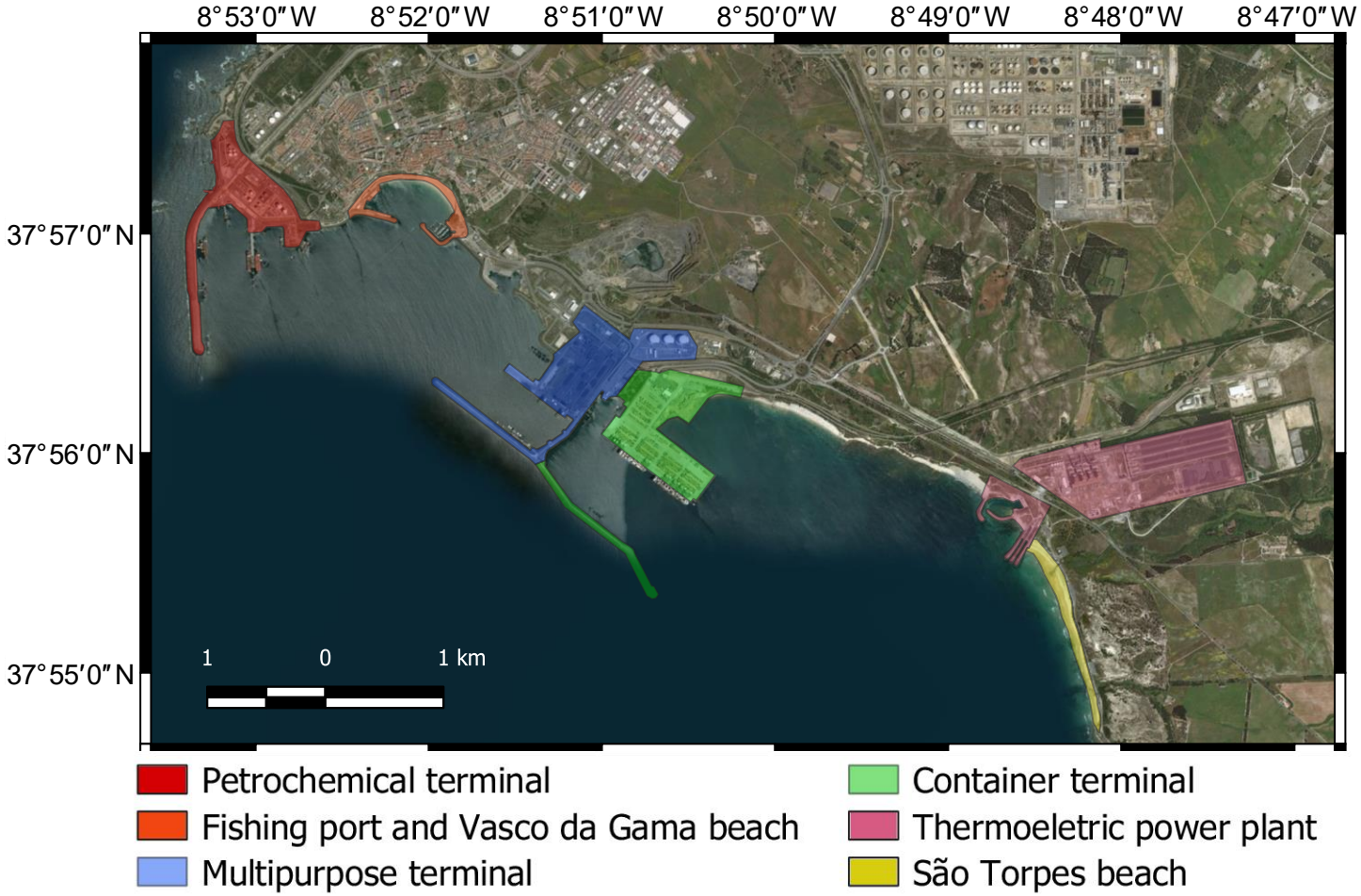
PROGRAMA OPERACIONAL MAR 2020
PiscisMod
TÉCNICO LISBOA
MARETEC
MARINE, ENVIRONMENT & TECHNOLOGY CENTER

Case Study

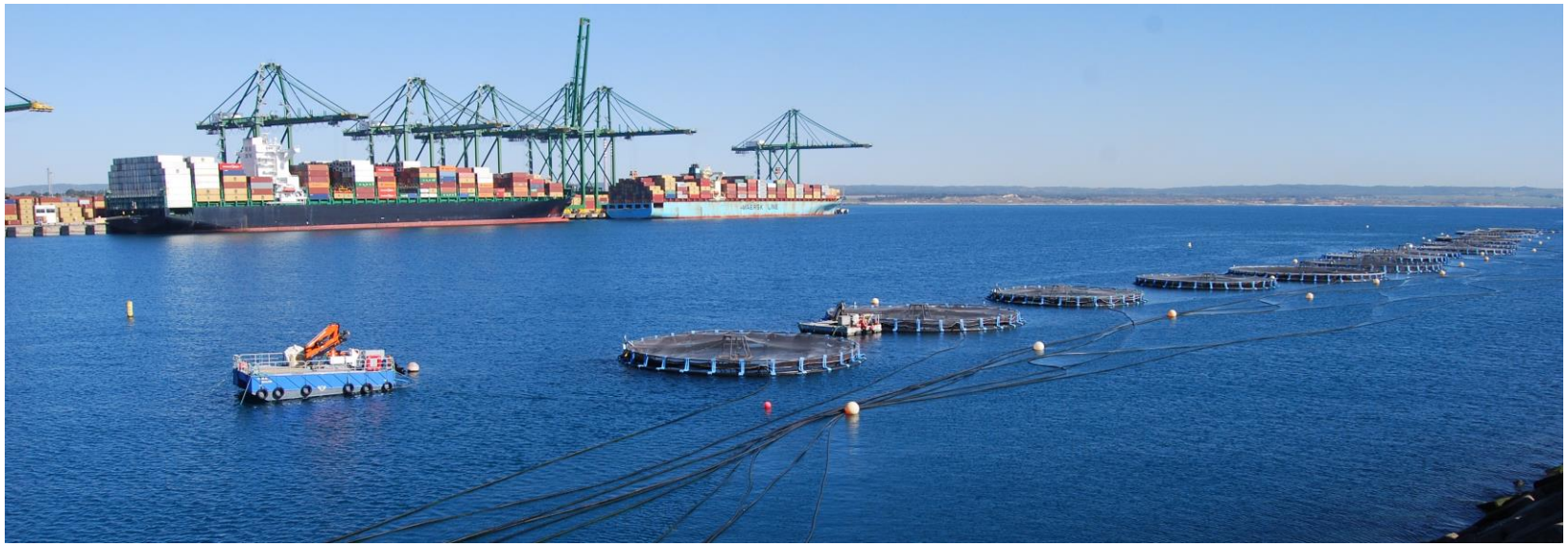

Braga
Porto
Coimbra
PORTUGAL
Rio Tejo
Lisbon
Evora
Badajoz
Huelva
Faro
Indústria Petroquímica
Cadaveira
Feiteira de Cima
Sines
Petrogal
Porto de Sines
36 m
102 m
Terminal XXI
EDP Central Termoeléctrica Sines
A26
N120-1

Case Study

- City of Sines:
  - More than 14 000 habitants
  - More than 300 km^2
  - Important for production and storage of energy in Portugal
  - Thermoelectric power plant
- Port of Sines:
  - Deep water port
  - Most important energy entrance in the country
  - Significant entrance of containers
  - Porous breakwater which allows water passage
  - Sea bass aquaculture (*Dicentrarchus labrax*)



Case Study



Objectives

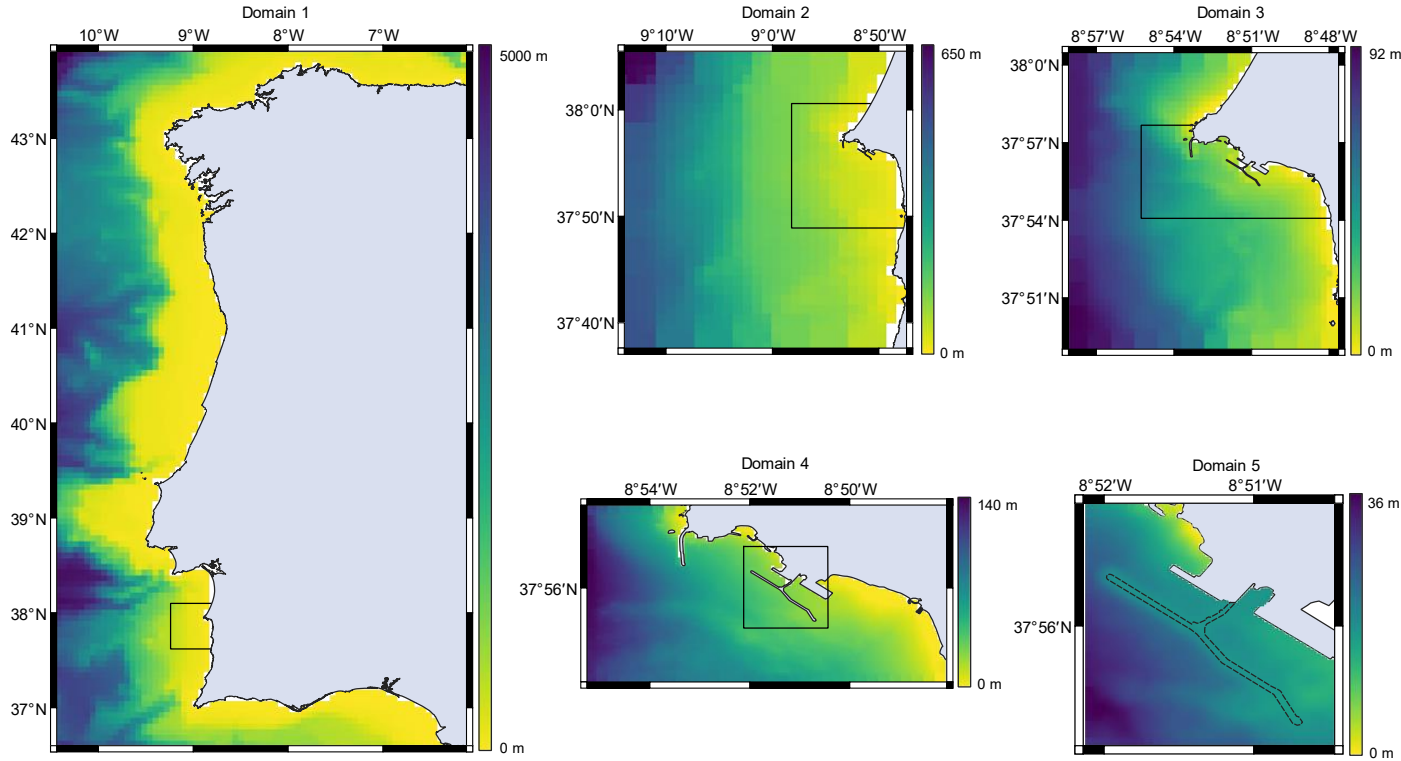
- Of this work:
  - Implementation of a 3D Hydrodynamic model with a high resolution in the port of Sines, focusing on the aquaculture
  - Implementation of the thermoelectric powerplant discharge
  - Implementation of the porous breakwater

- Of the PiscisMod project:
  - Development of a management tool for the aquaculture
  - Prediction of impacts of the aquaculture in the ecosystem
  - Optimization of the fish diet according to environmental conditions

Sines Model

- Model with 5 domains – *downscaling* from a regional model of the Portuguese coast
  - Highest horizontal resolution achieved: 25 meters

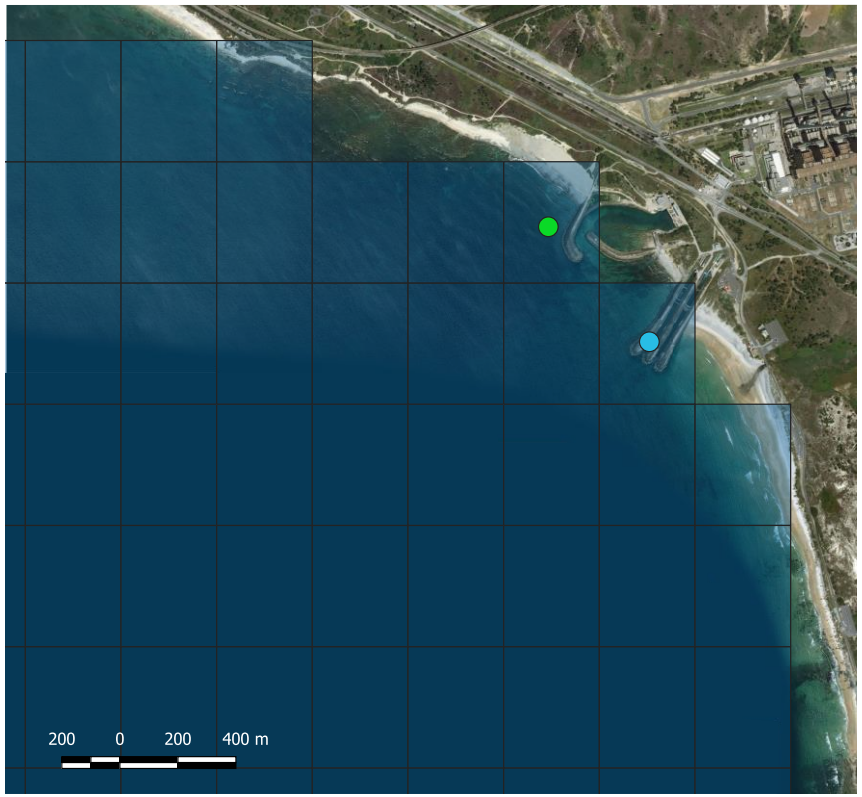
- Model boundary conditions:
  - Ocean – Portuguese coast regional model (6 km)
  - Atmosphere – WRF model for Portugal (3 km)



Sines Model

- Sines thermoelectric power plant:
  - Average intake and outtake of 40 m^3/s
  - Causes a rise of 10 °C on the water

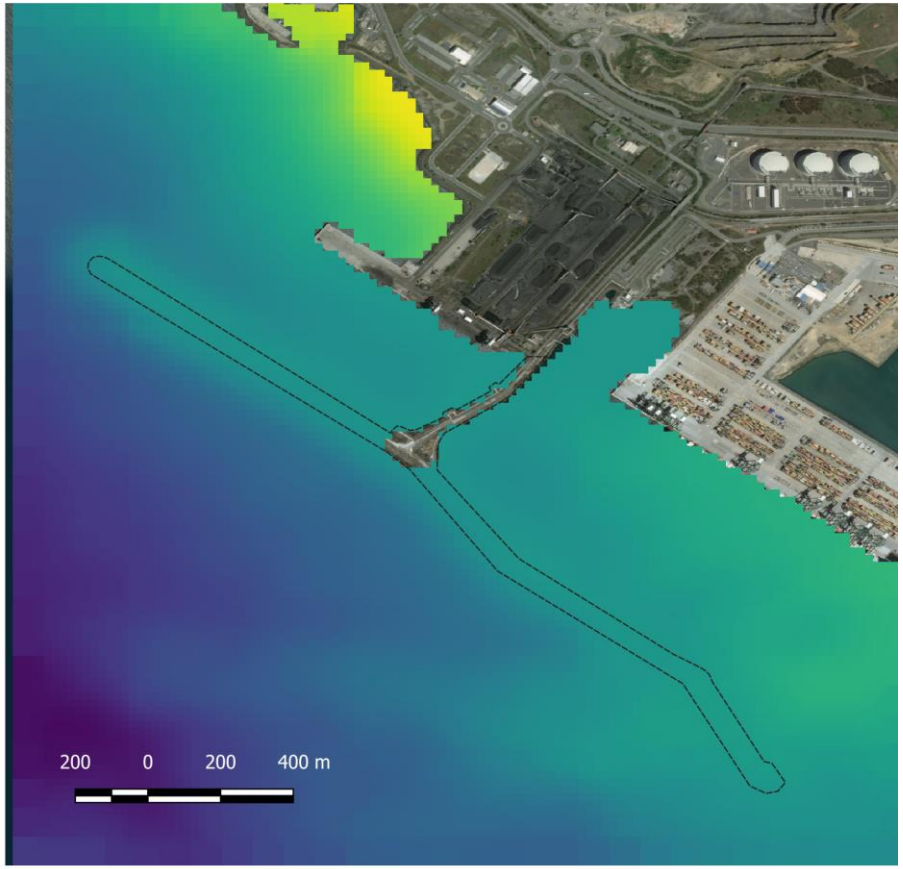
Domain 4



Domain 3

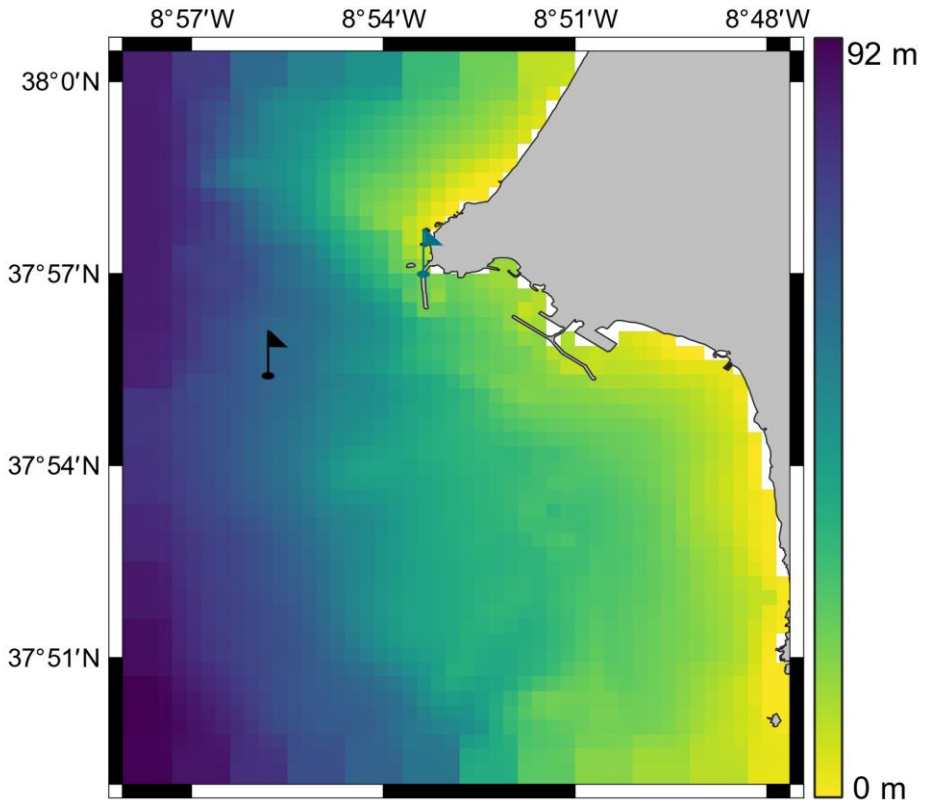
Sines Breakwater

- Permeability of the breakwater:
  - Modeled using a drag coefficient on the cells representing the breakwater

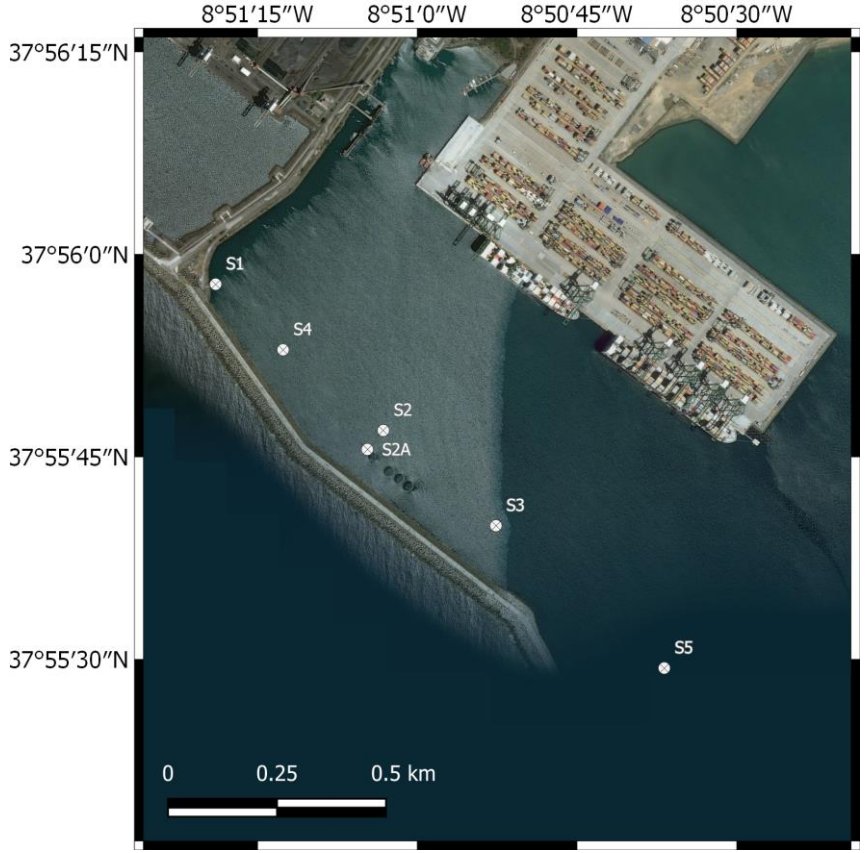


Model Validation

- Domain 3:
  - Temperature – Compared values with a moored buoy in Sines
  - Water level – Compared values with a tide gauge in Sines
- Domain 5:
  - Temperature, salinity and density profiles – Compared with data recorded during the PiscisMod project



Domain 3



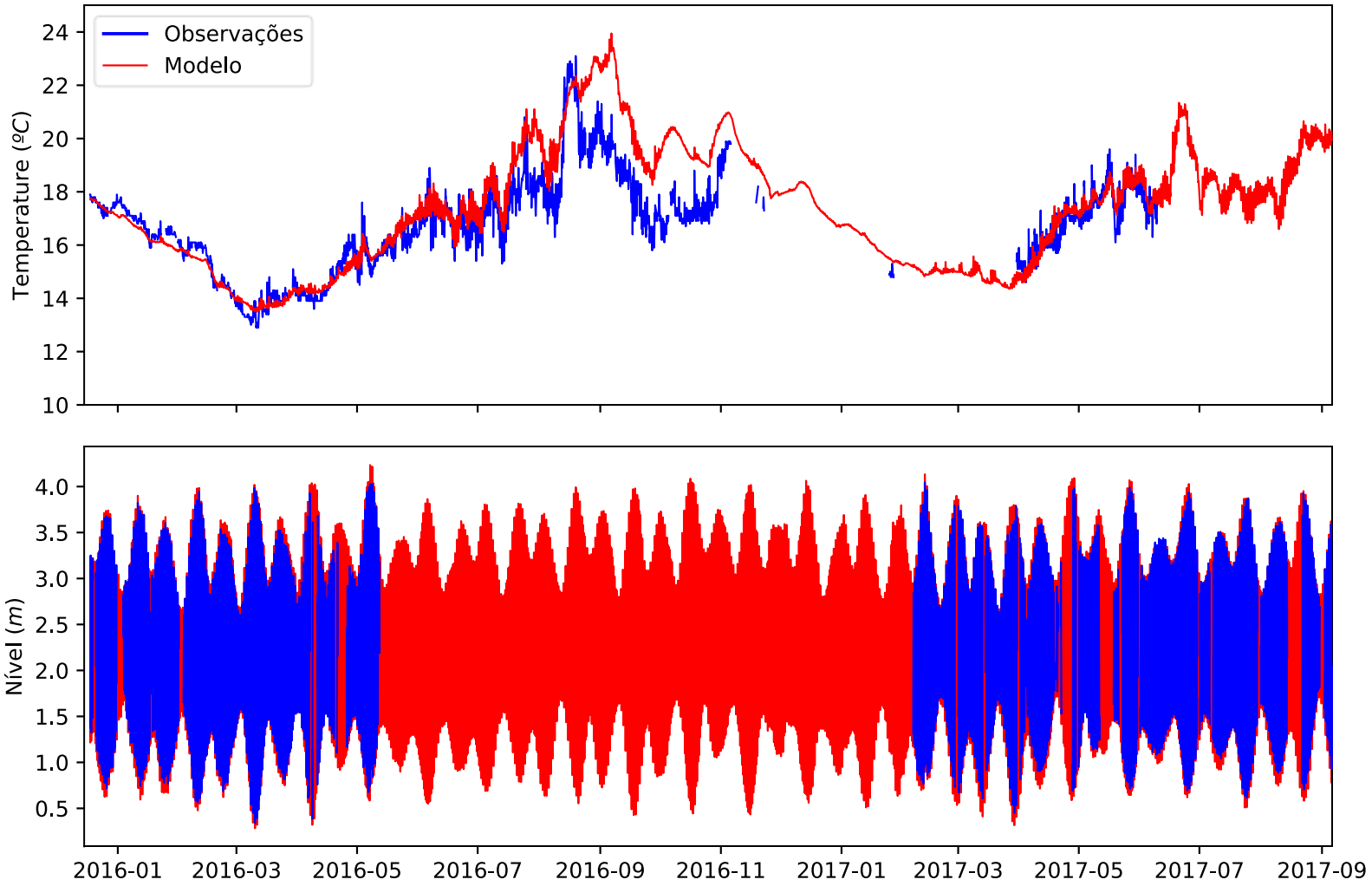
Validation – Domain 3

Temperature

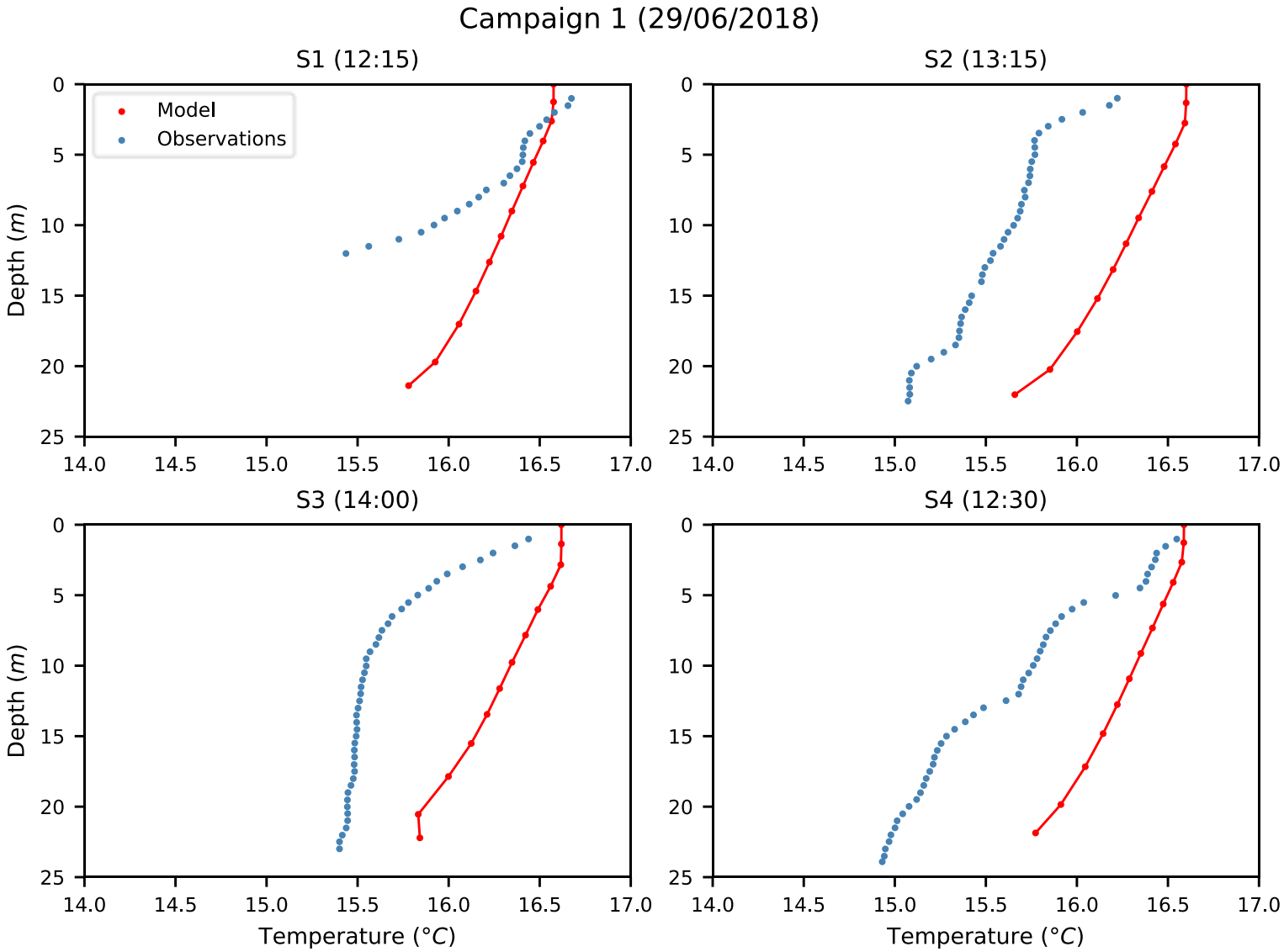
- RMSE: 1.15 °C
- BE : 0.53 °C
- r: 0.90

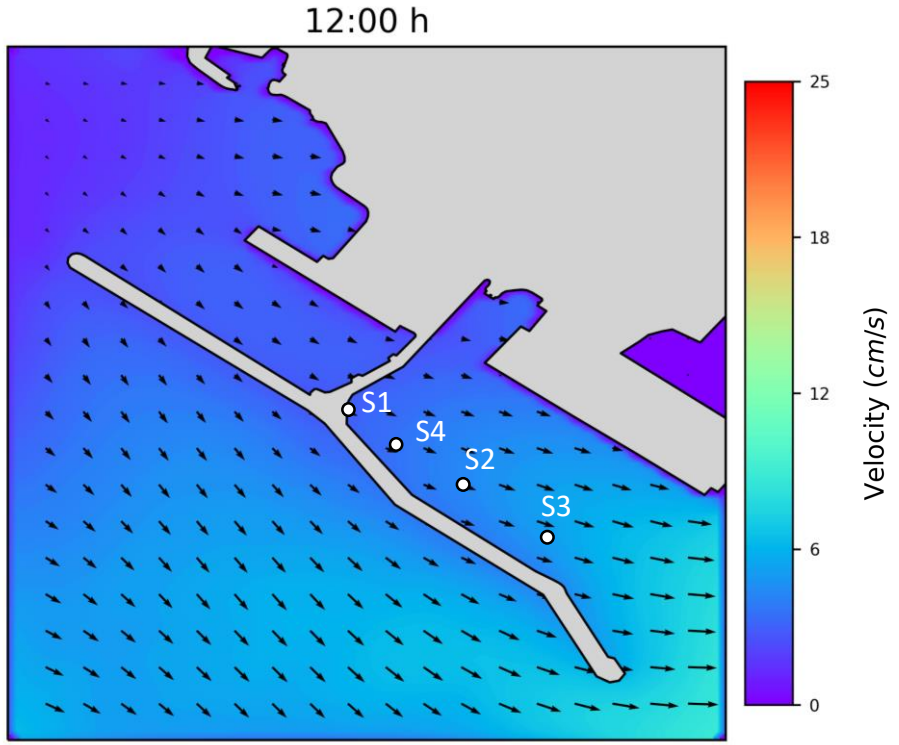
Tide

- RMSE: 0.08 m
- BE : 0.0 m
- r: 0.99



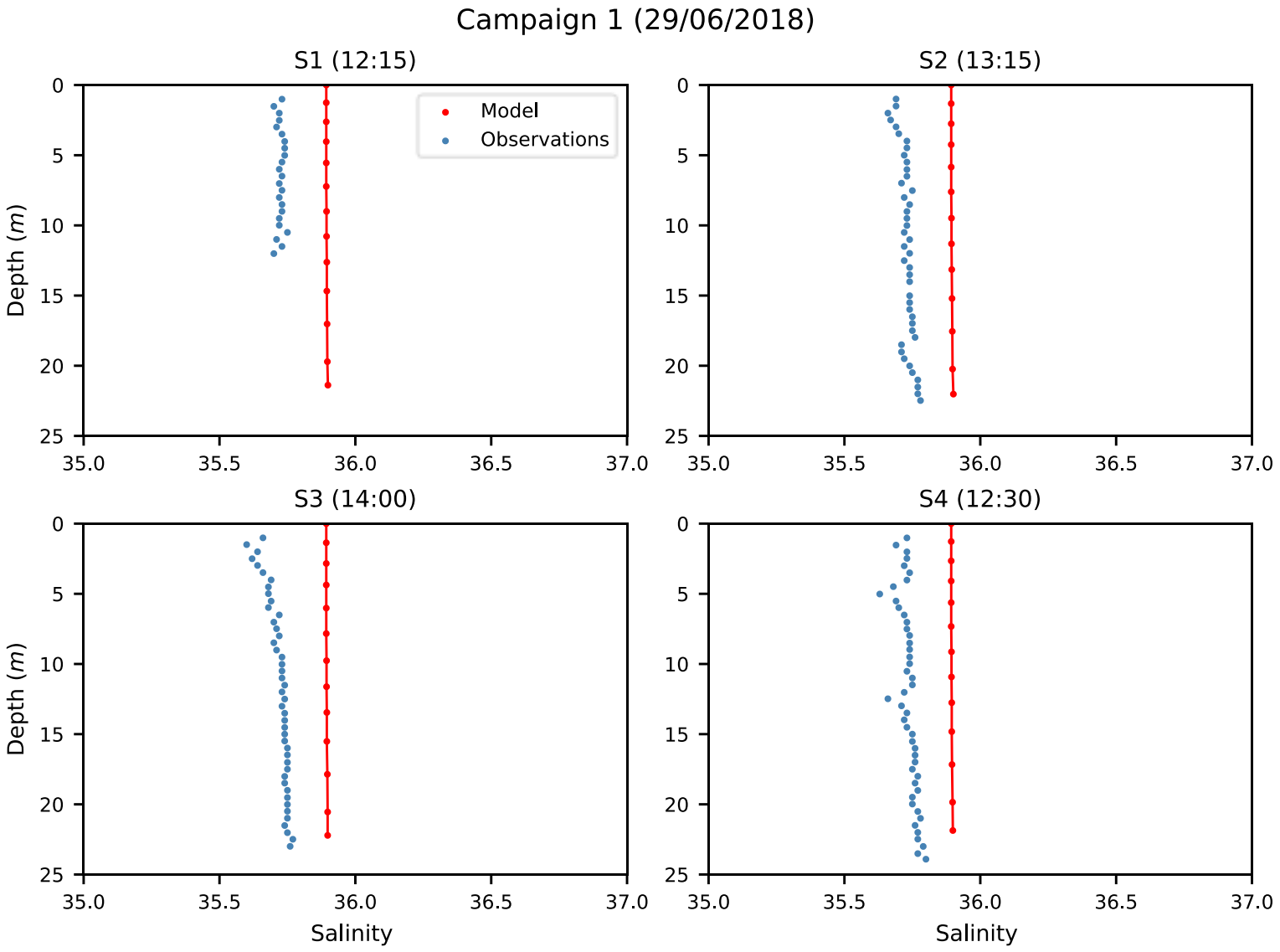
Validation – Domain 5

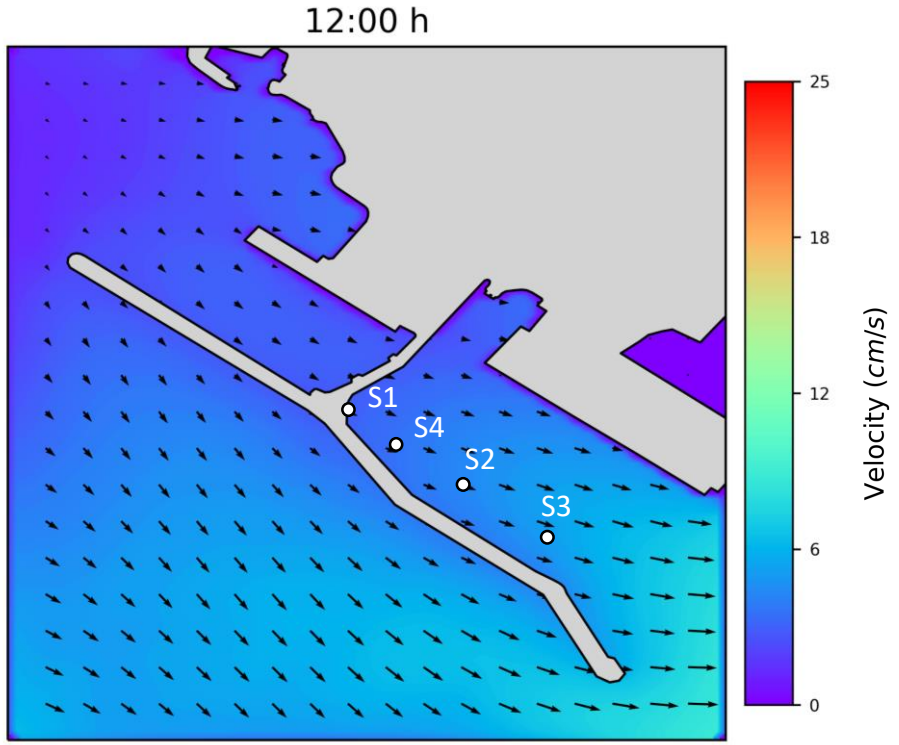




	Temperature	
	RMSE (°C)	BE (°C)
S1	0.31	0.21
S2	0.68	0.67
S3	0.63	0.61
S4	0.65	0.60

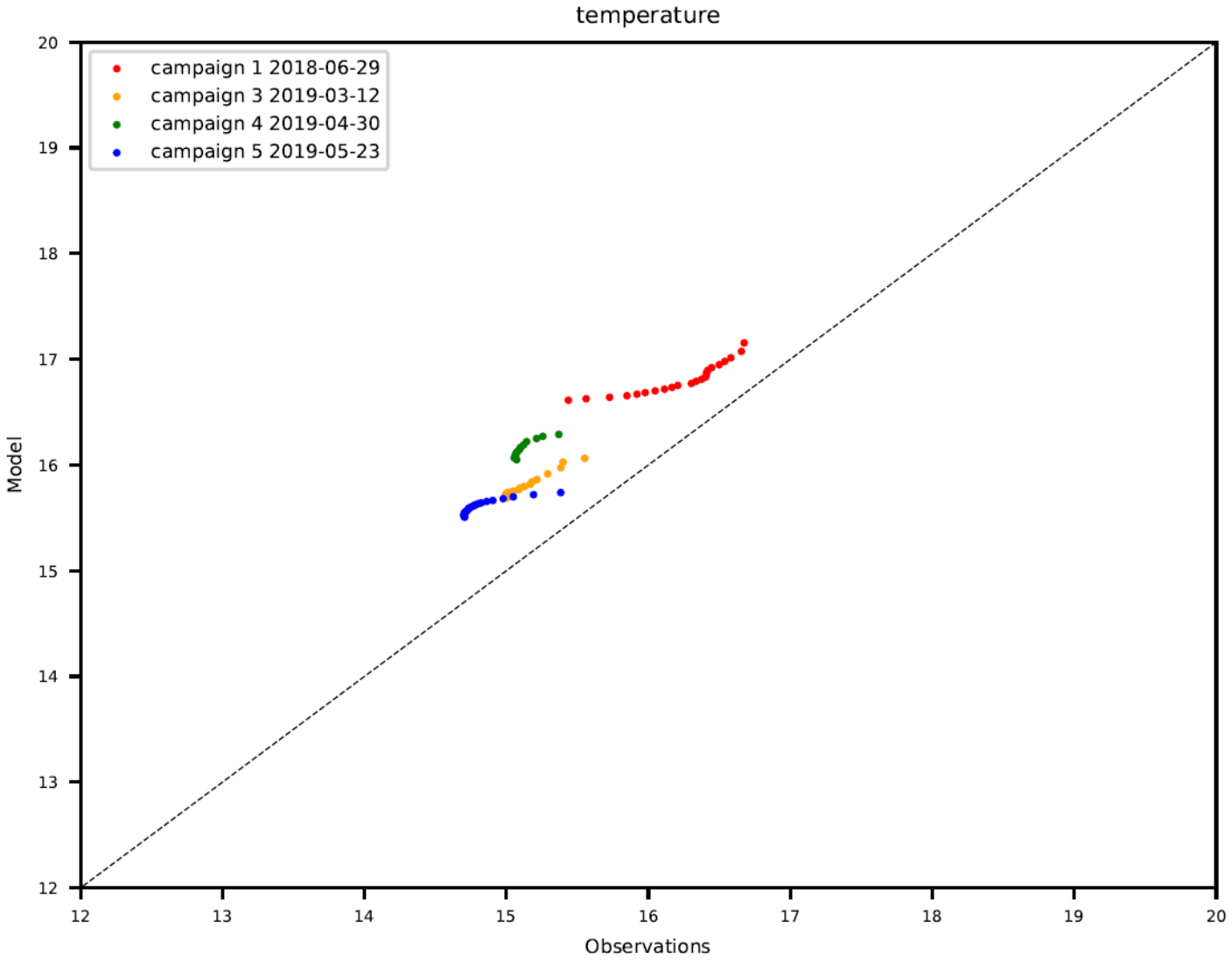
Validation – Domain 5





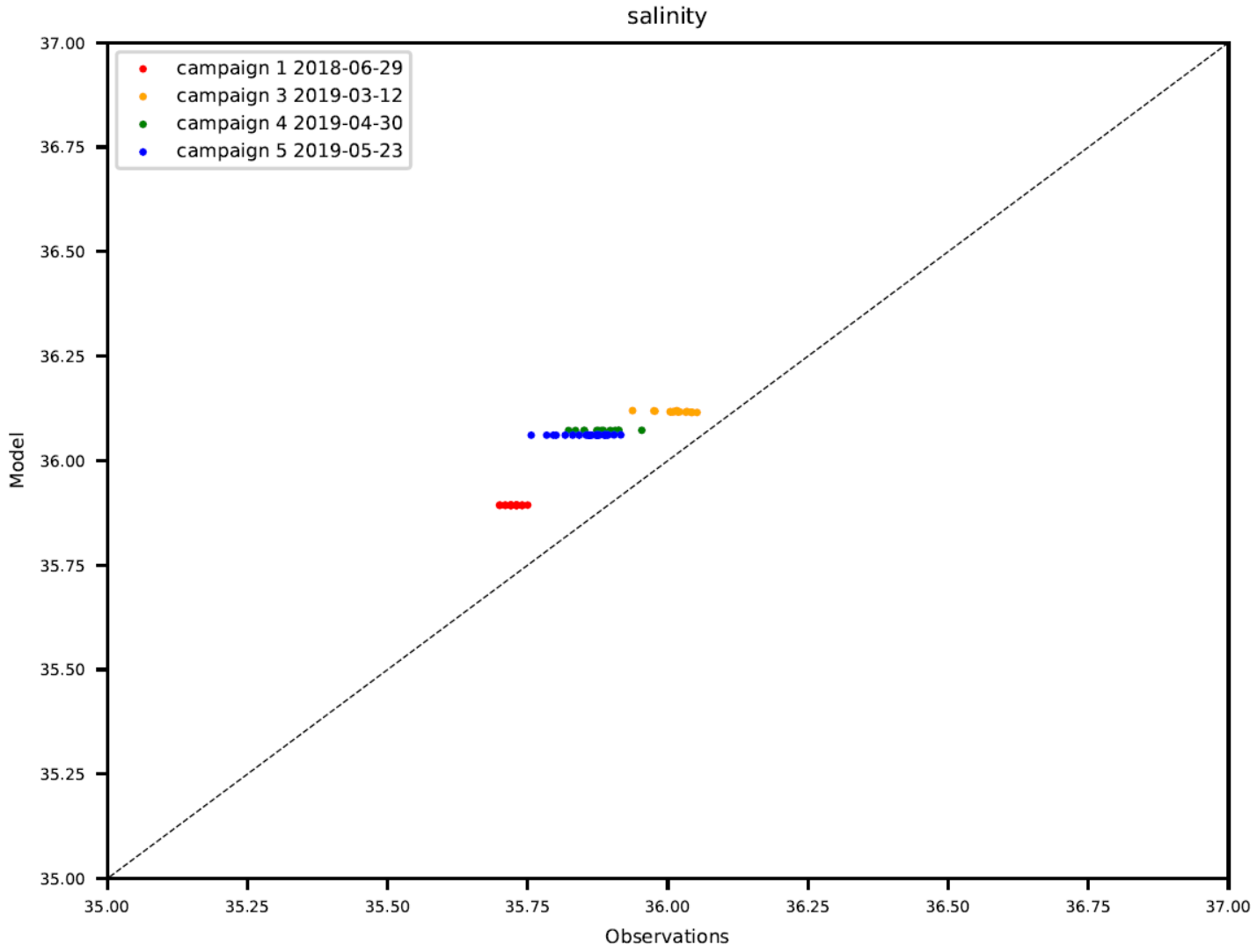
	Salinity	
	RMSE	BE
S1	0.17	0.17
S2	0.17	0.17
S3	0.18	0.18
S4	0.16	0.16

Validation – Domain 5



	Temperature	
	RMSE (°C)	BE (°C)
Global	0.89	0.86

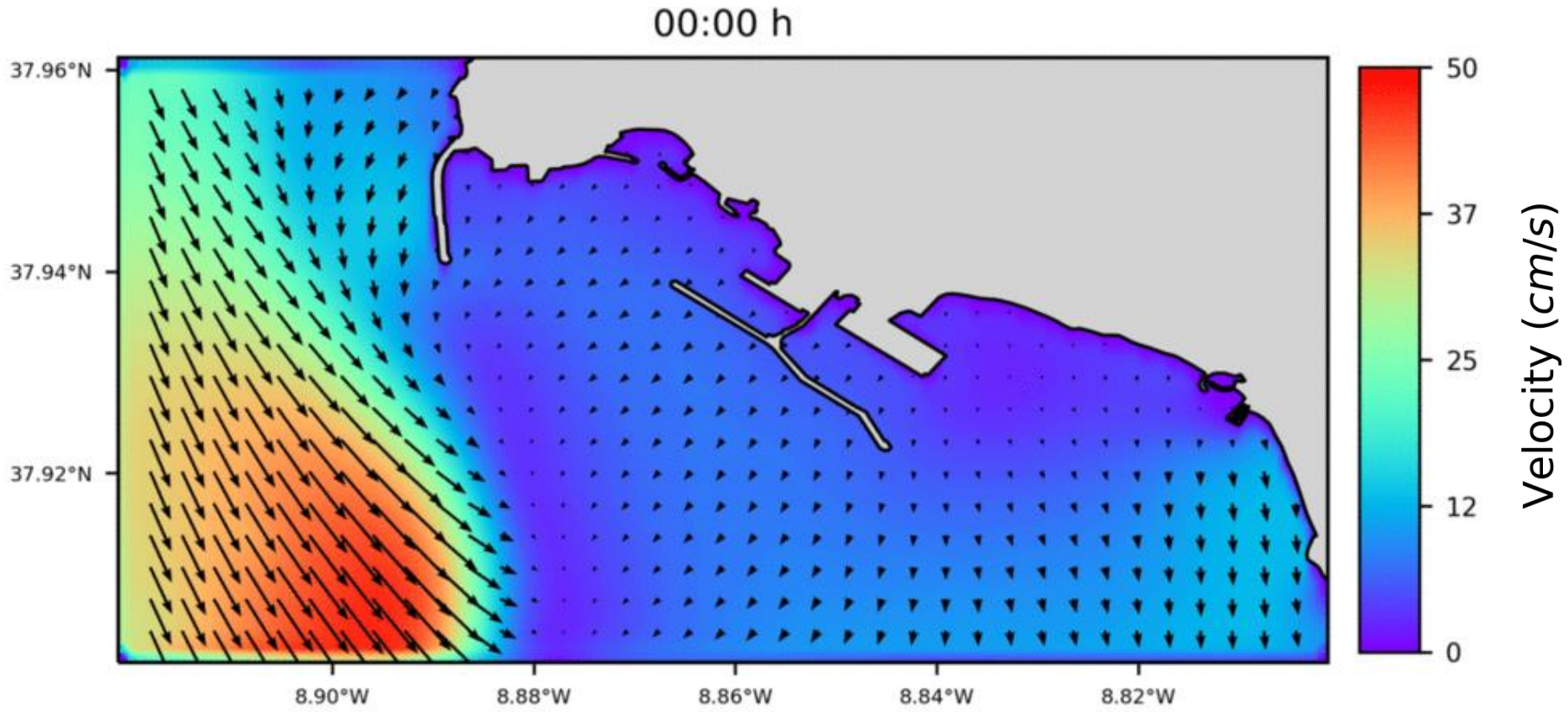
Validation – Domain 5



	Salinity	
	RMSE	BE
Global	0.15	0.14

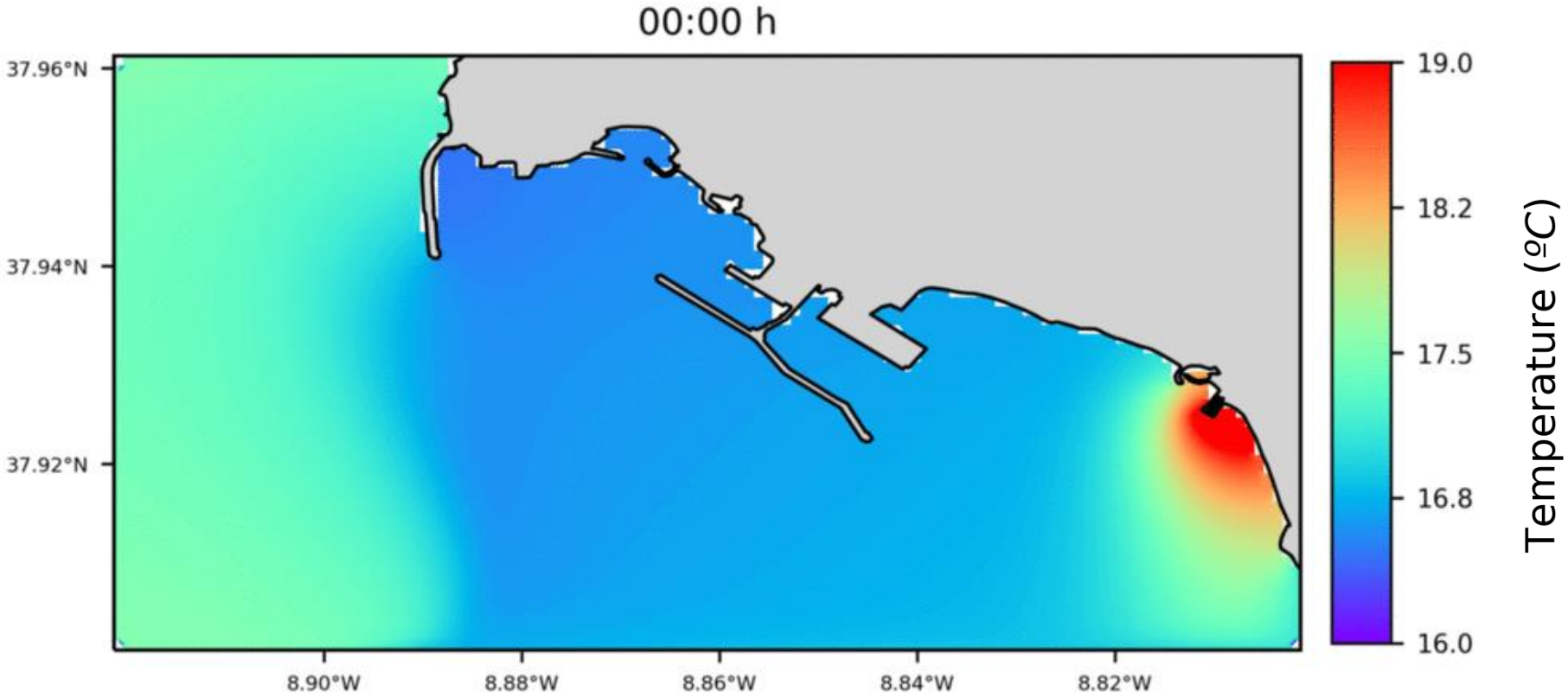
Campaign 1 – Results

- Day 29/06/2018
- Domain 4



Campaign 1 – Results

- Day 29/06/2018
- Domain 4



Future Work

- Validation of the water quality model in Sines
- Coupling of a fish bioenergetic growth model to the hydrodynamic and water quality model
  - Following the DEB (Dynamic Energy Budgets) theory
- Forecast fish energy needs as function of local environmental conditions
- Adjust the quantity of food given to the fish in the aquaculture

THANK YOU