Predicted Environmental Concentration (PEC) estimation using a three-dimensional numerical modelling system

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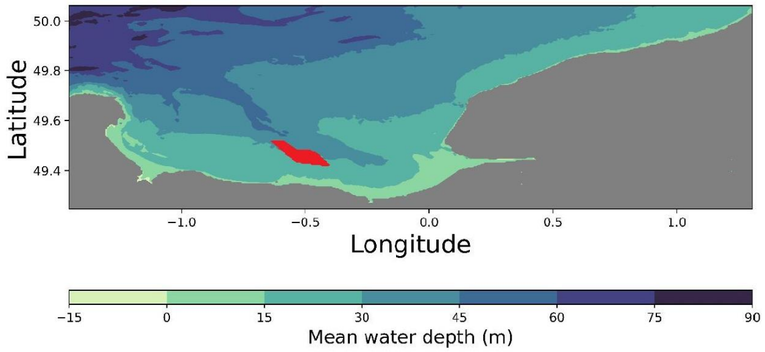
Modelling configurations

Seine Bay configuration

- 1 wind farm with 64 turbines
- Include the Seine river

Validation

- Tidal elevation (Le Havre & Balise A)
- Temperature (SMILE buoy)
- Salinity (SMILE buoy)
- Based on Ifremer configuration already validated

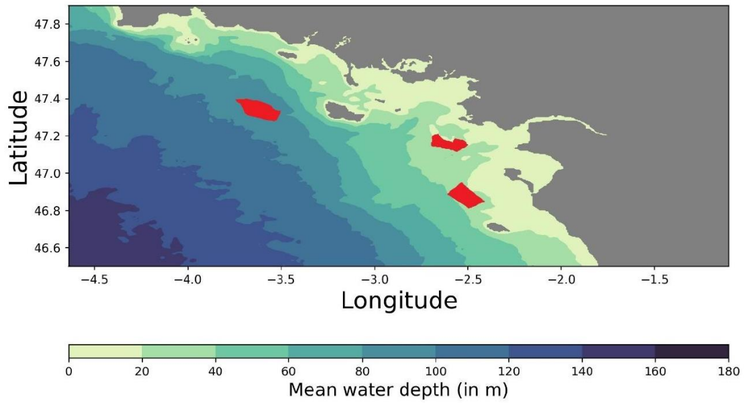


Bay of Biscay configuration

- 3 wind farms with 80 + 62 + 50 turbines
- Include the Loire river

Validation

- Tidal elevation (Port Tudy & Le Crouesty)
- Temperature (Belle-Ile)
- Current (Compared to MARC model)

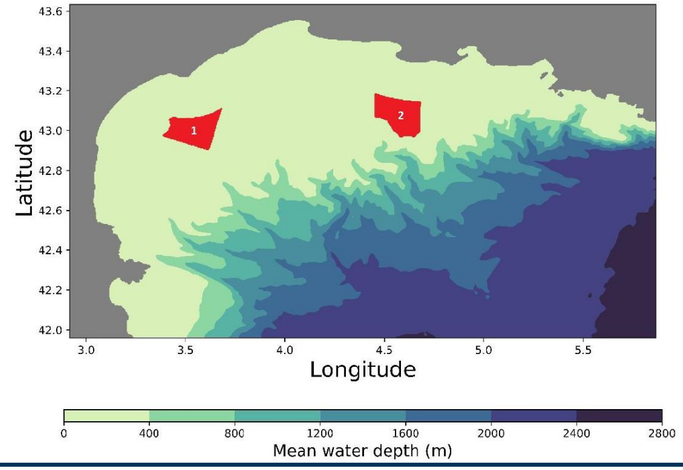


Gulf of Lion configuration

- 2 wind farms with 50 + 50 turbines
- Include the Rhone river

Validation

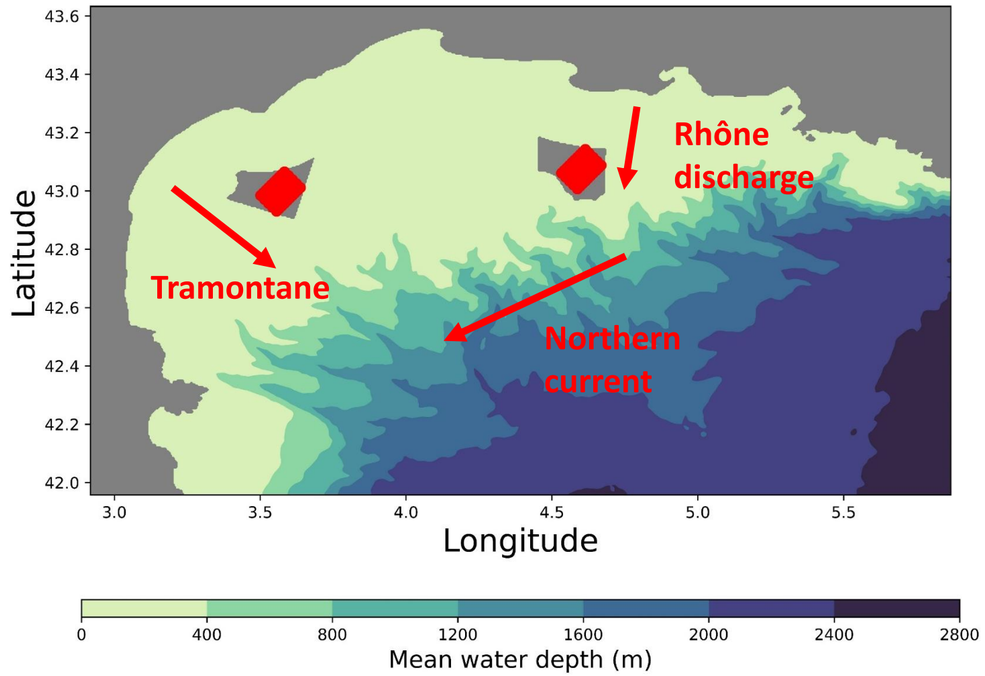
- Mesoscale current study
- LIW analysis
- Temperature & Salinity (Candhis buoy)
- Satellite comparison of SST

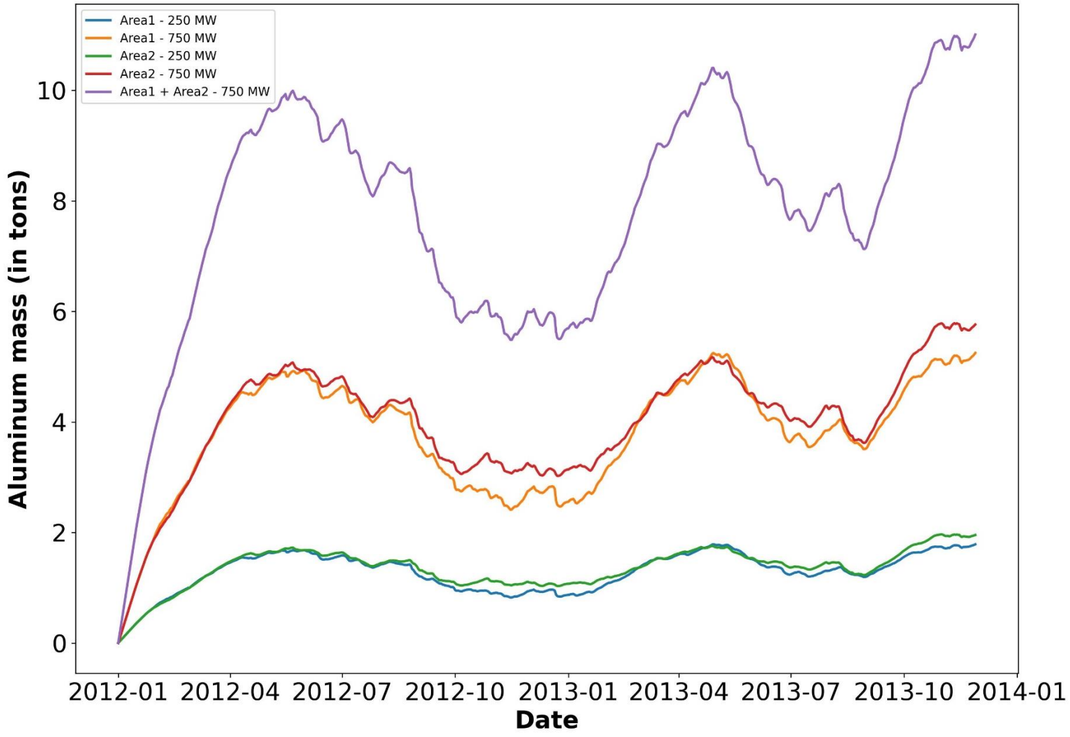


Gulf of Lion configuration

Modelling configurations

- Gulf of Lion configuration
  - Include AO6 wind farms with their extension
    - 750 MW = 50 turbines
  - Release of 161.61 mg every 10 s of aluminium at each wind turbine location

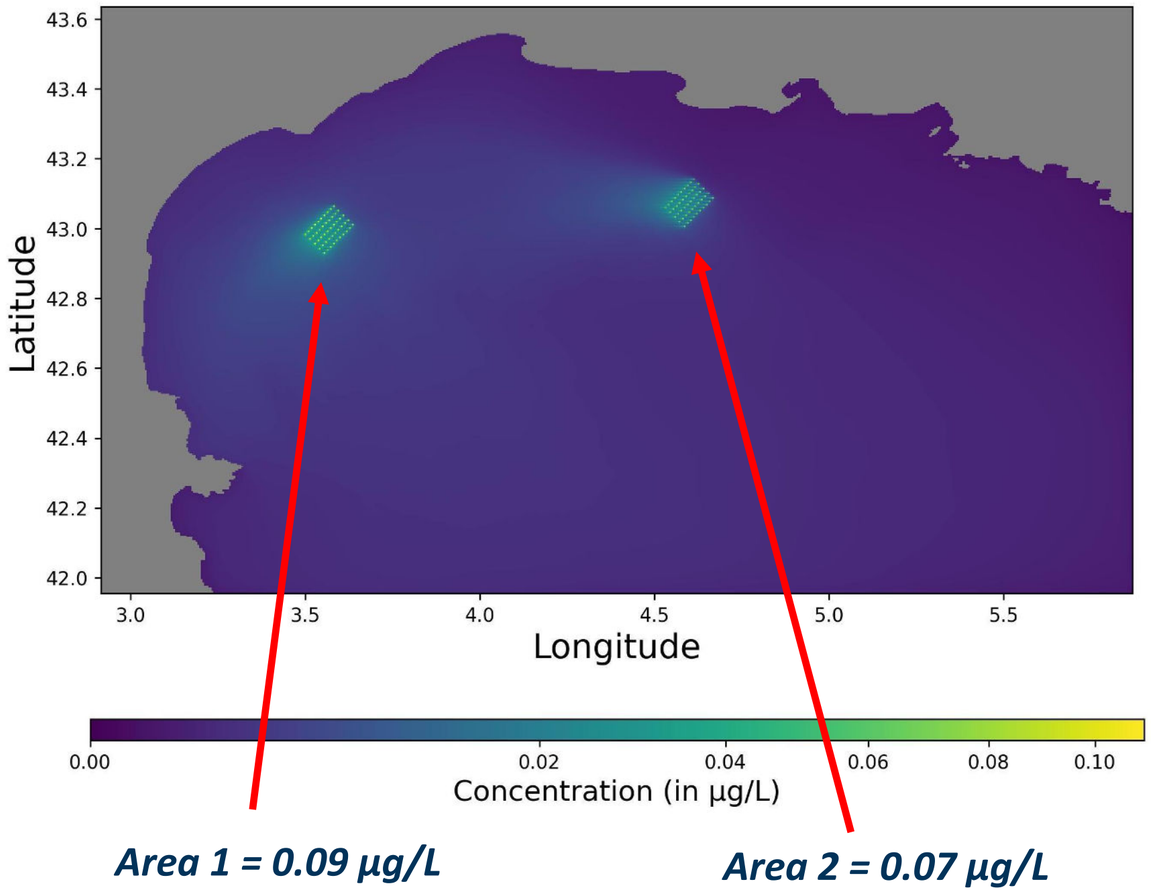




- Evolution of the total mass in the domain
  - No accumulation in the domain
  - Maximum = 10 tons

Anode influence

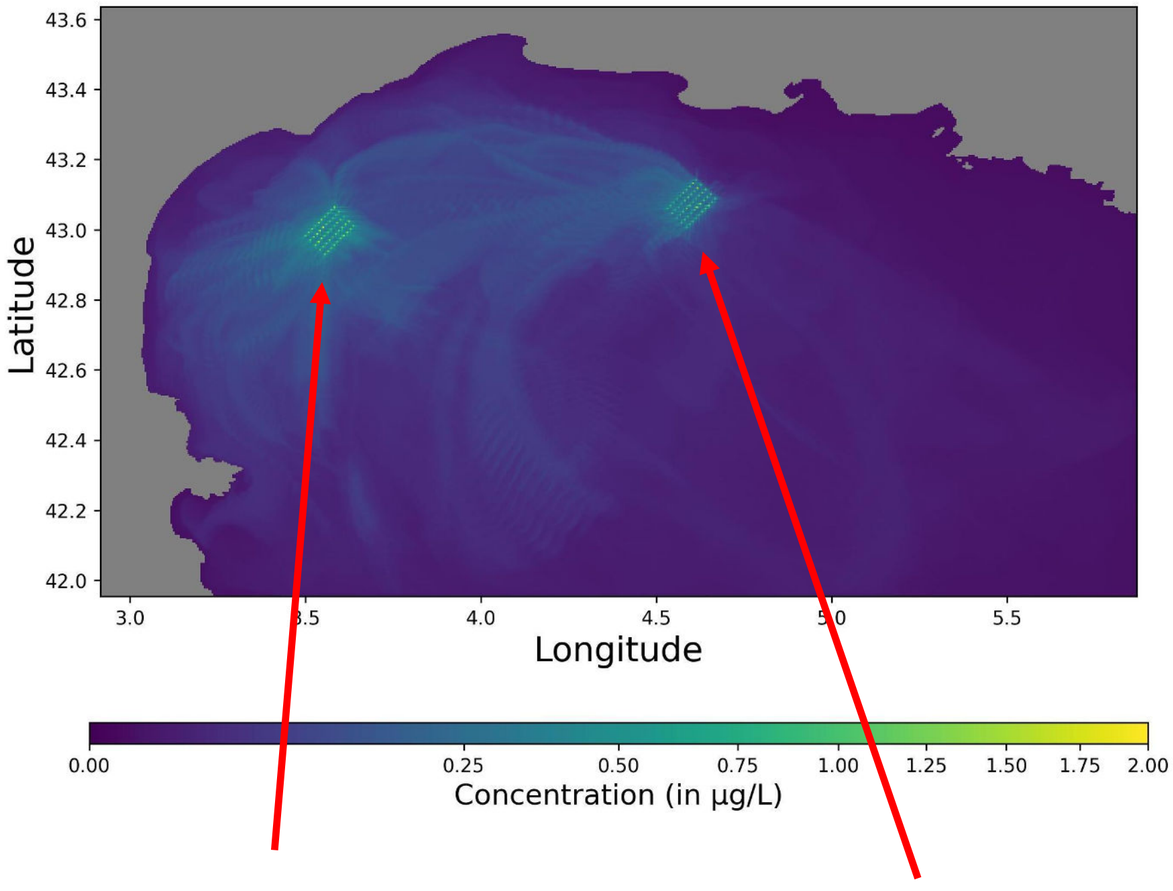
Average concentration



Area 1 = 0.09 µg/L

Area 2 = 0.07 µg/L

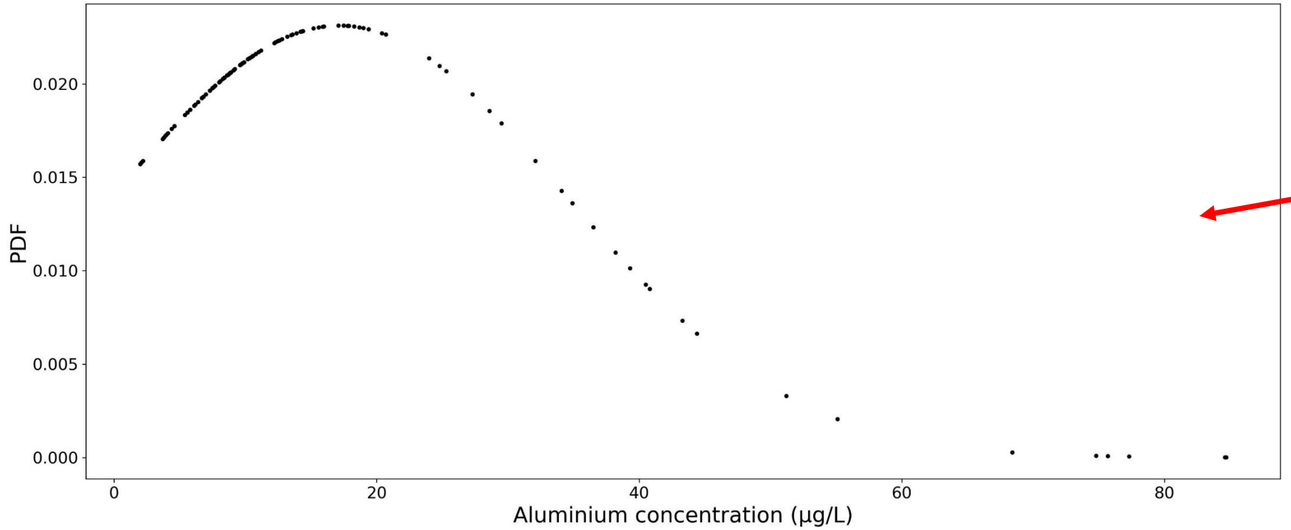
Maximum concentration



Area 1 = 1.83 µg/L

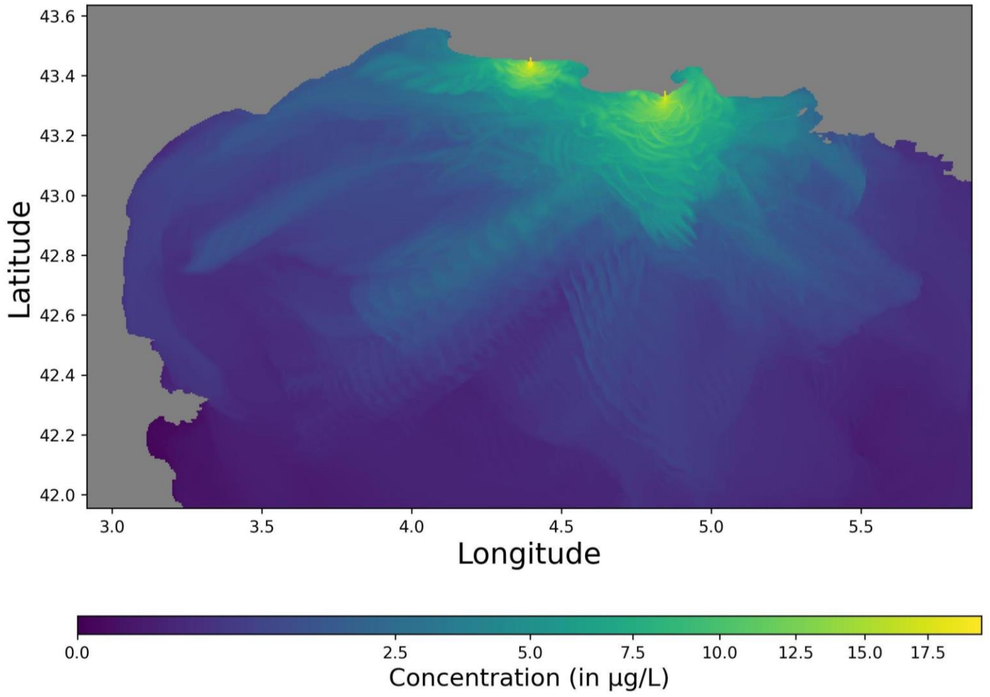
Area 2 = 1.54 µg/L

River influence



- Probability Density Function (PDF) on *in-situ* measurements
  - Maximum probability for a value of 17.1 µg/L

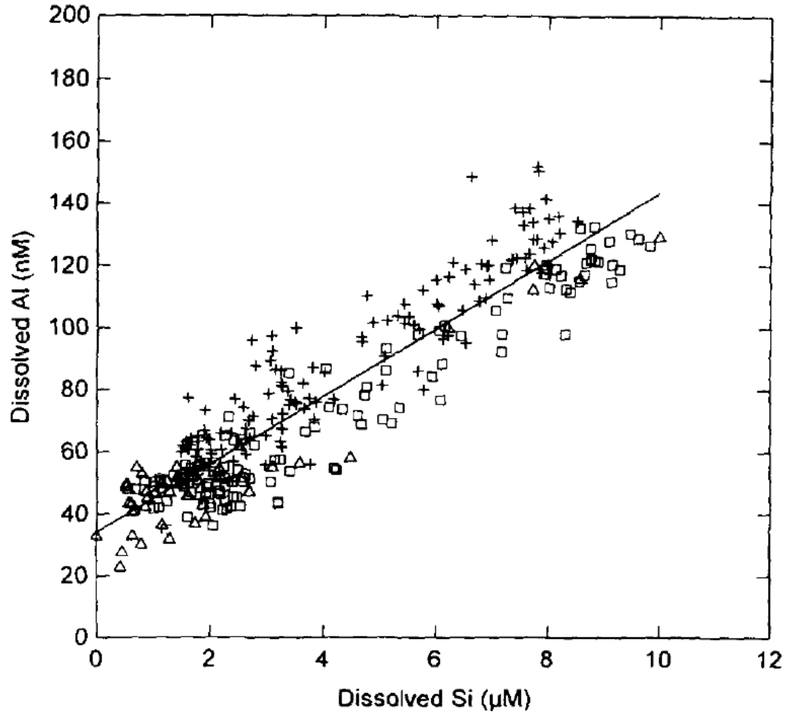
- Inputs from the Rhône River
  - Constant concentration : 17.1 µg/L
- Maximum concentration induced by the Rhône River discharge
  - In the dilution area : range between 10 and 17.1 µg/L
  - Area 1 : 1.12 µg/L
  - Area 2 : 4.2 µg/L

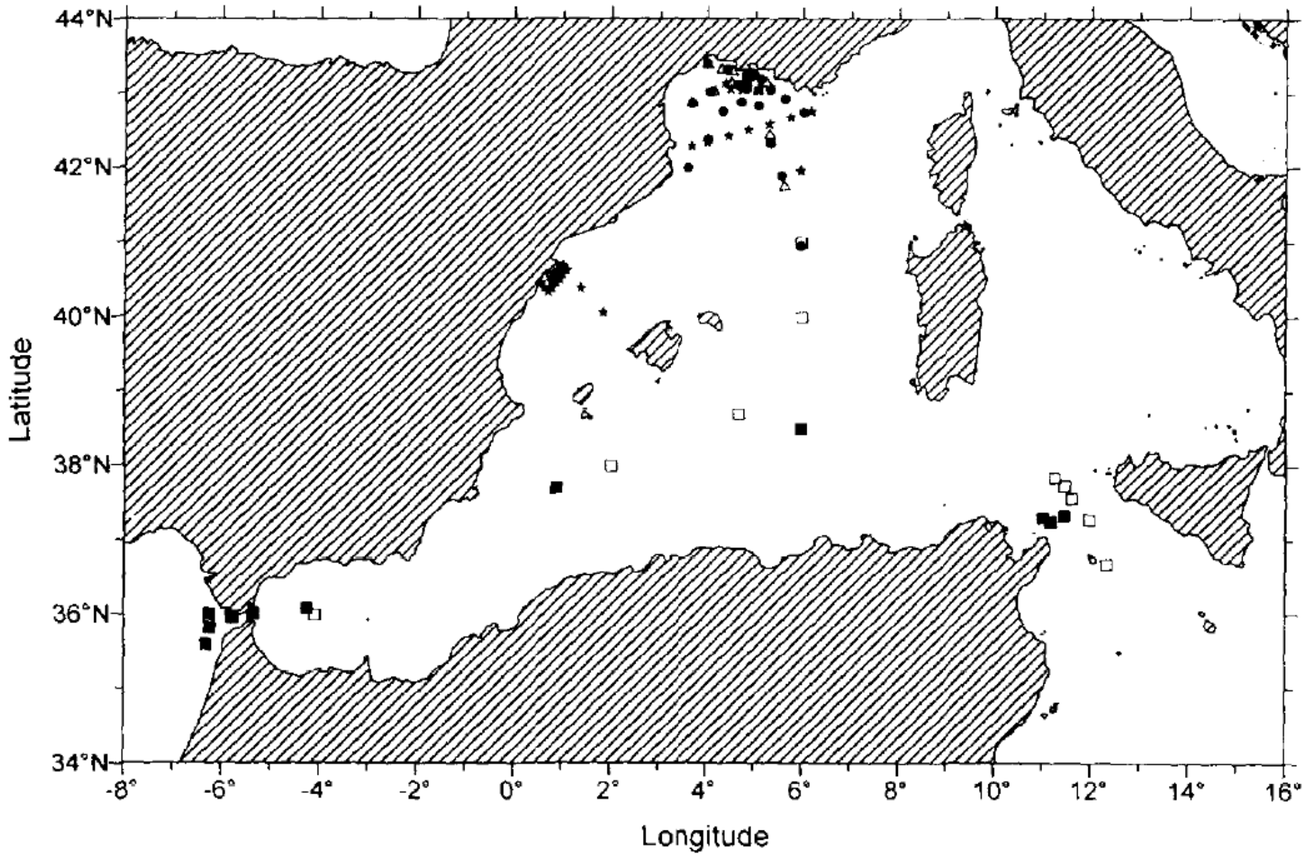


Ambient concentration

Chou and Wollast (1997)

- 20 – 150 nM = 0.54 – 4 µg/L

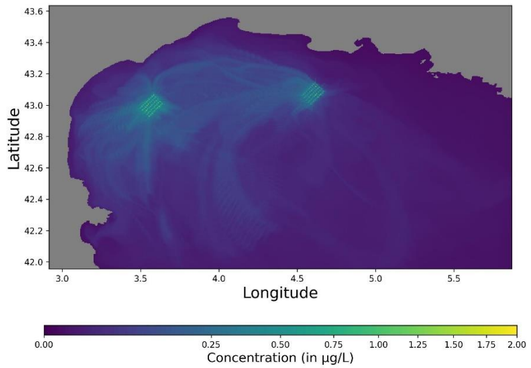




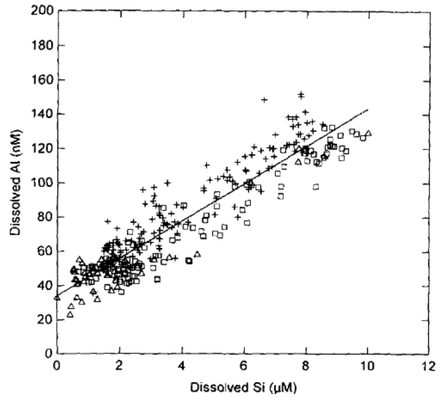
Maximum ambient concentration = 4 µg/L

PECcumulated

Anodes concentration



Maximum ambient concentration



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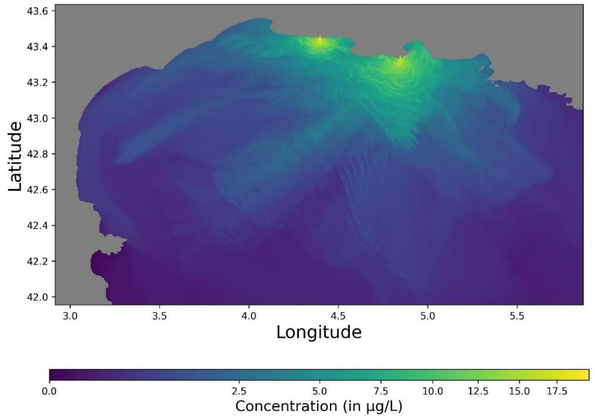
River concentration



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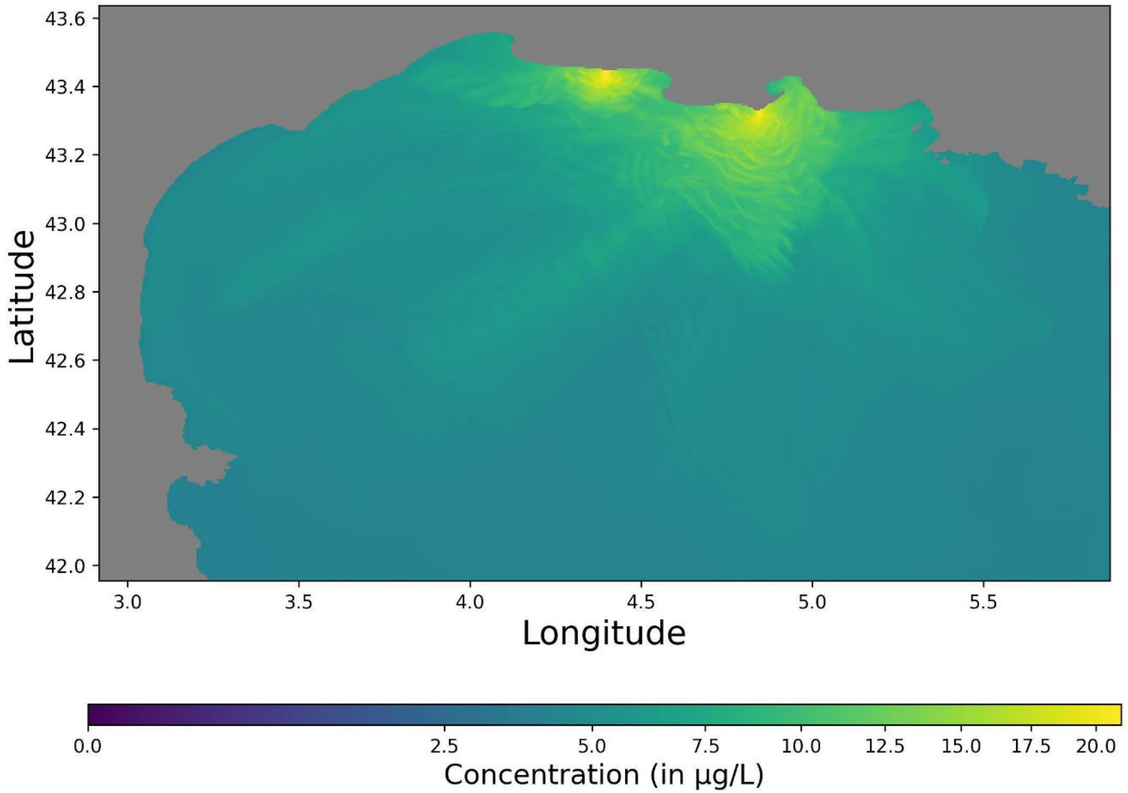
PECcumulated range from 4 to 21 µg/L



Area 1 -> 1.83 + 1.12 + 4 = 6.95 µg/L

Area 2 -> 1.54 + 4.2 + 4 = 9.74 µg/L

Conclusion

Major role of the main hydrodynamic processes in the Predicted Environmental Concentration cumulated (PECcumulated)

- The PECcumulated is defined based on the maximum concentration which depend on the hydrodynamic

PECcumulated concentrations

- Gulf of Lion : Area 1 = 6.95 µg/L | Area 2 = 9.74 µg/L
- Seine Bay : Courseulles-sur-Mer = 3.48 µg/L
- Bay of Biscay : St-Nazaire = 21.56 µg/L | Yeu-Noimoutier = 8.1 µg/L | Sud-Bretagne = 5.37 µg/L

Most part of the PECcumulated concentrations induced by the rivers or atmospheric inputs

- Rhône River : Area 1 = 1.12 µg/L | Area 2 = 4.2 µg/L
- Seine River : Courseulles-sur-Mer = 2 µg/L
- Loire River : St-Nazaire = 21 µg/L | Yeu-Noirmoutier = 7 µg/L | Sud-Bretagne = 4 µg/L

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Thank you for your attention