



Climat change : why go beyond data ?

*An exemple with the digital
twins of the river*

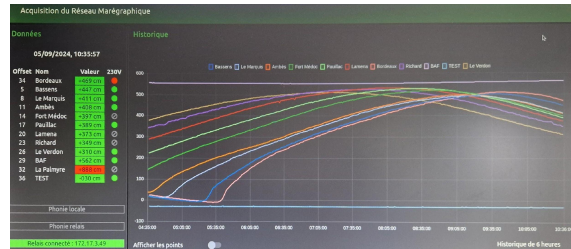
Collecting data: a long story

2000

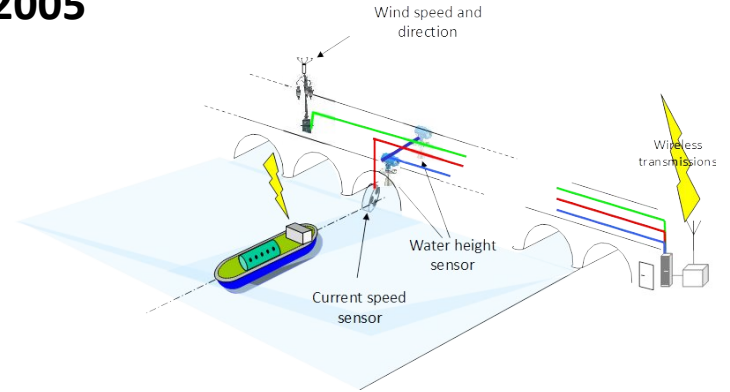


Monitoring station

Tide level monitoring system



2005



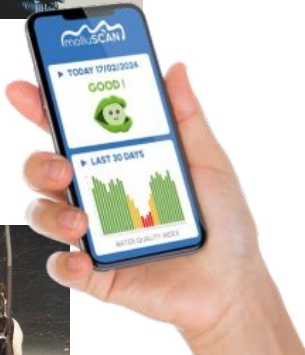
Collecting data: always improving



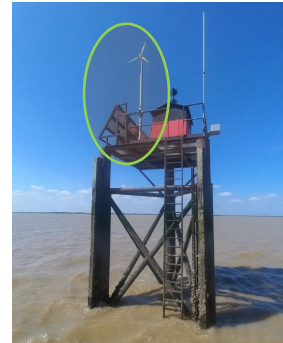
Biologic water quality sensors



a startup incubated by the port

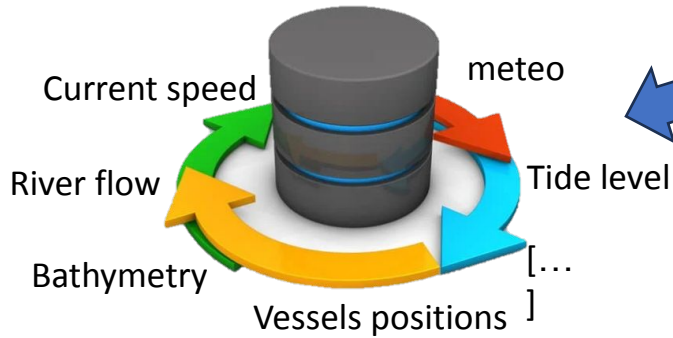


Shift from motherboards to automaton
to cope with **extreme conditions** and improve **reliability**
Ex: temperature resistance from -40 to $+70$ °C (-40 ... $+158$ °F)



Green electricity supply : solar panel, wind turbine and battery

Why data is not enough ?



datawarehouse
[2005 – 2024]

NOW

Navigation ?



Industrial usages (H₂) ?

Drinking water ?

Hydro-electricity ?

Agricultural usages ?

TOMORROW (2050)

What is missing ?

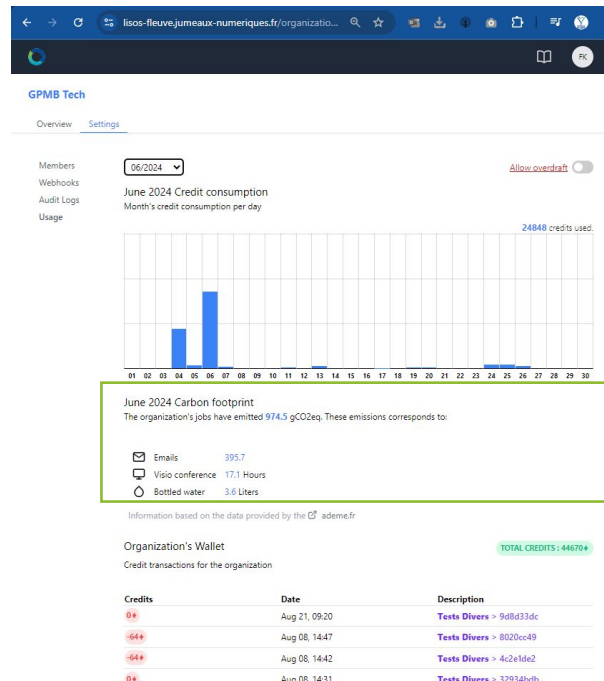
- Data from other existing sensors (temperature, salinity, dissolved oxygen, etc)
- New sensors to deploy
- Mathematical models & algorithms
- Forecasts
- Data center / cloud computing
- Digital platform to host data, to ensure their property rights, and to operate models
- Community of stakeholders
- etc

Digital twins of the river so far

Data from other existing sensors	✓	<i>Partially</i> because the acquisition process is still not fully automated and interoperability must be improved
New sensors to deploy	✓	Data from the Copernicus satellites constellation are used but not sufficient. Molluscan on-going
Mathematical models & algorithms	✓	Open Telemac from EDF and CEREMA ; this is an Open Source model but still limited to the Estuary of Gironde Other models must be integrated : in progress.
Forecasts	✓	Weather forecasts and Garonne 2050 scenarios from <i>Agence de l'Eau</i> integrated
Data center / cloud computing	✓	Google Cloud chosen : low carbon footprint
Digital platform to host data, to operate models and to ensure the property rights	✓	LISOS™ generic platform created by the port released in January 2023
Community of stakeholders	✓	In construction: the port is the main architect

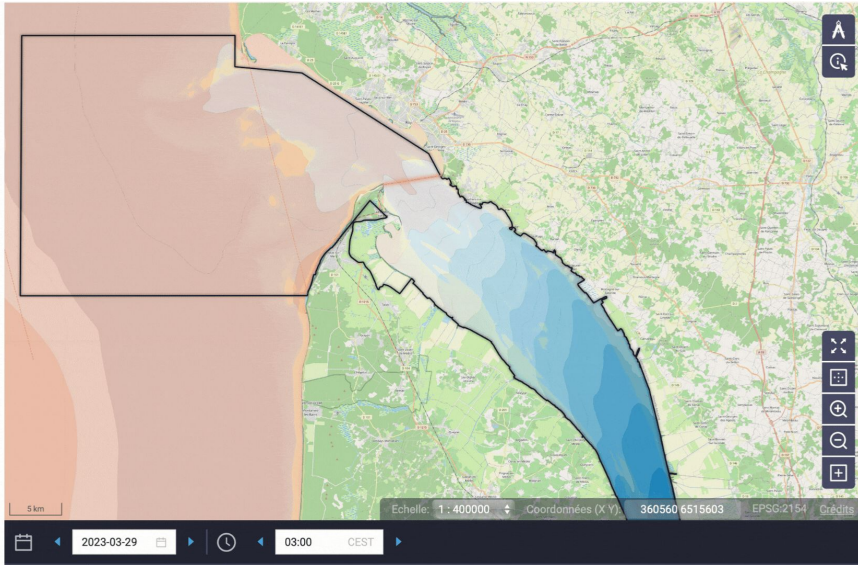
Digital twins of the river: achievements

- LISOS, a **generic digital twin platform**, hosted on a low carbon footprint cloud

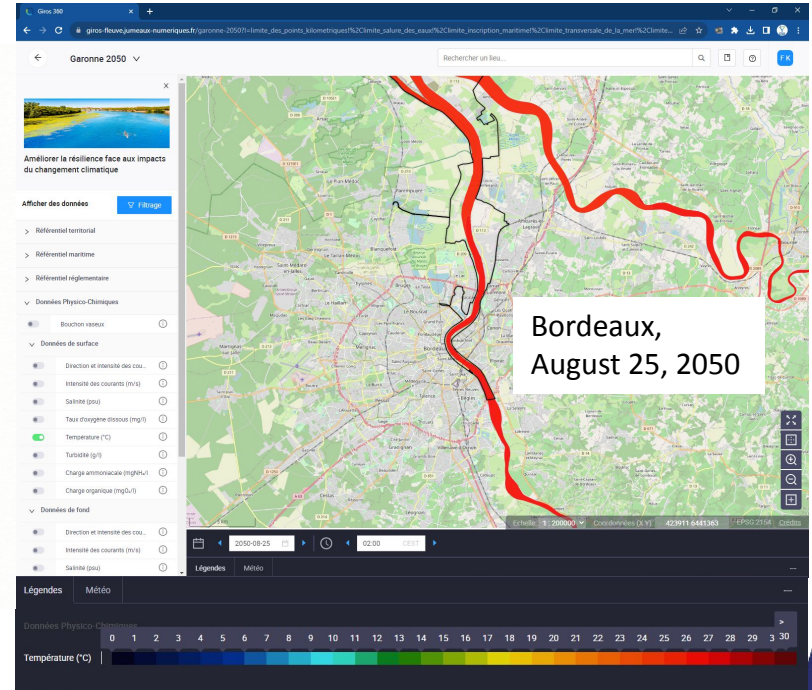


LISOS dashboard to promote responsible digital usages

- Forecasts for a few days, even until 2050

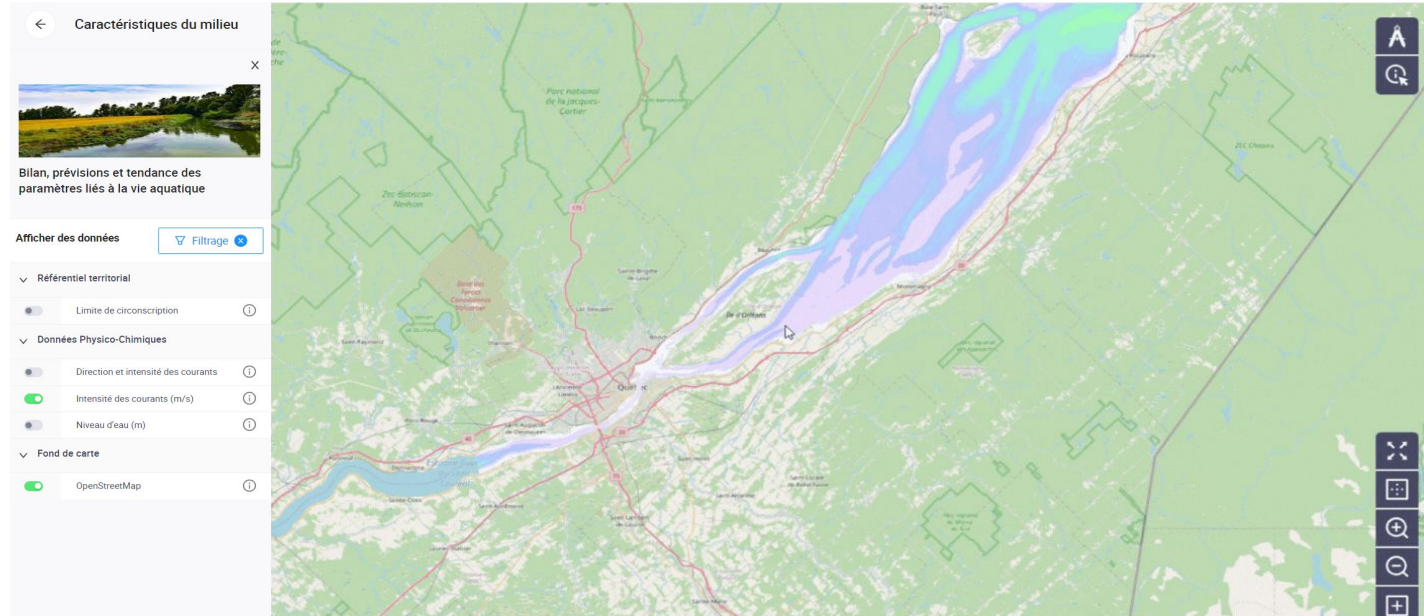


Forecast for a few days
Example with the penetration of the salt front
depending on the tide



Trend to 2050 (IPCC 4.5 projection)

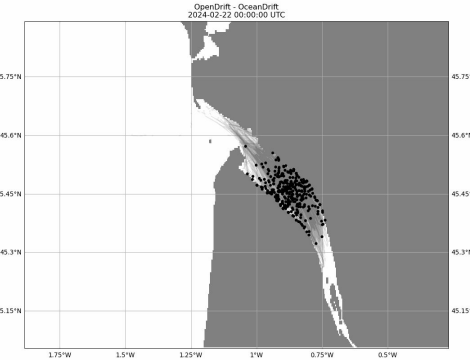
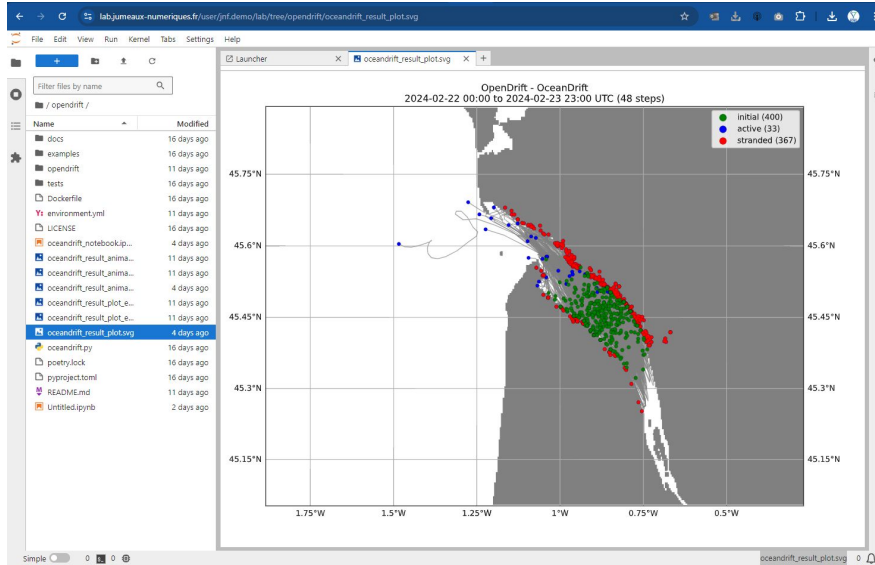
- A first replication in Canada 



St Lawrence River demonstrator
(in collaboration with )

Digital twins of the river: achievements

- A results analysis LAB with open-source tools



Example of modeling trajectories and fate of objects drifting in the river



Geothermal project simulation

Digital Twin Lab



powered by LISOS



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