

ECCCLIPSE

assEssment of CLimate change
in Ports of Southwest Europe





Threats to the Port of
Bordeaux

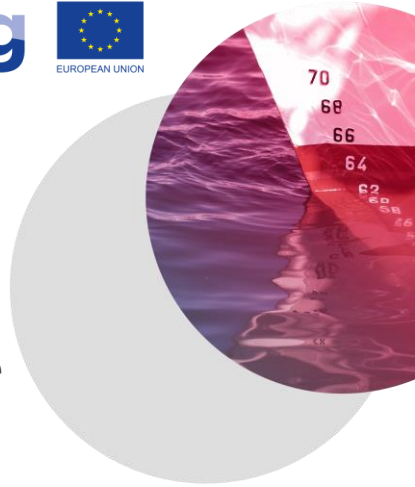
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The Port of Bordeaux

02

Impacts of the climate
change – context

01



1. Impacts of the climate change – context of the project

- RCP scenarios – risks and consequences

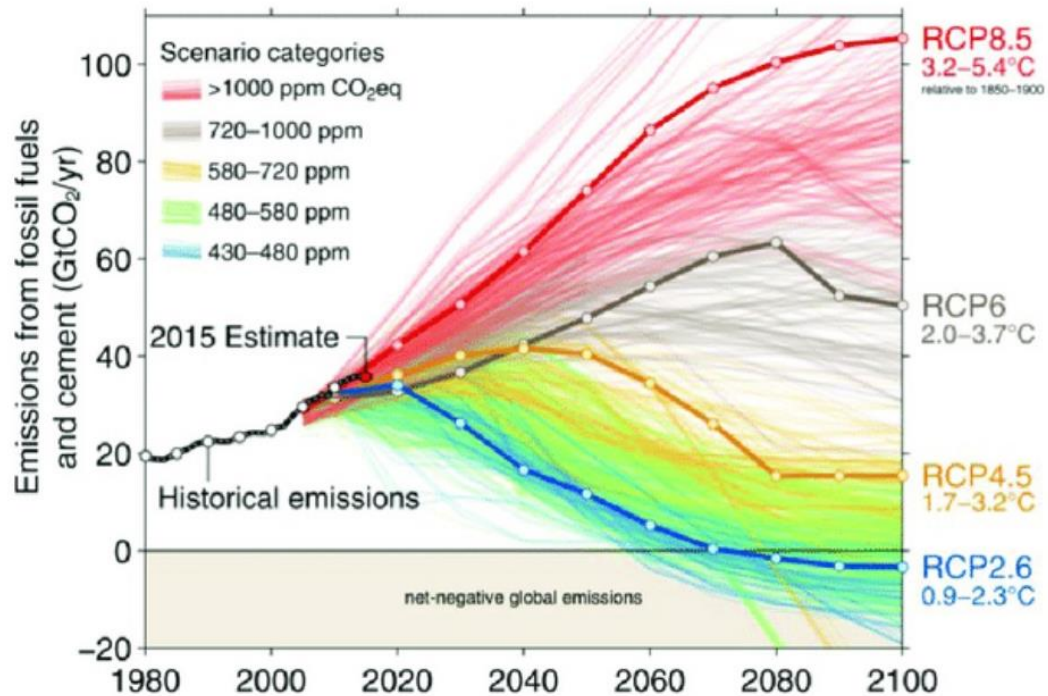
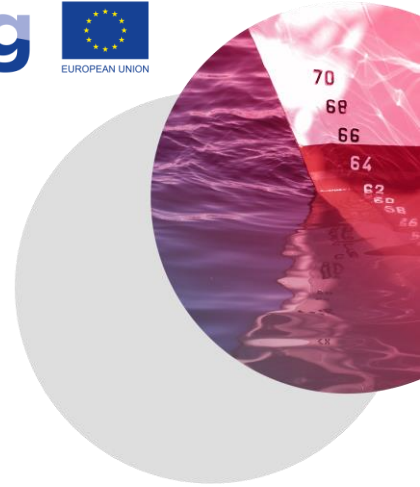
2. The Port of Bordeaux

- Context
- Activities

3. Impacts of the climate change on the Port of Bordeaux

- Assessment of risks and impacts
- Strategy and prevention plan

RCP scenarios – risks and consequences



RCP 8.5

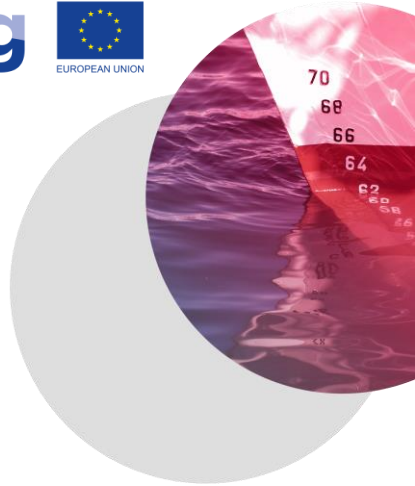
By the end of the century, CO₂ emissions will be three times higher than present. There is a large increase in methane emissions. Energy use will further increase, mostly using fossil fuels. Uptake of renewables is very limited and there is hardly any implementation of climate policies.

RCP 4.5

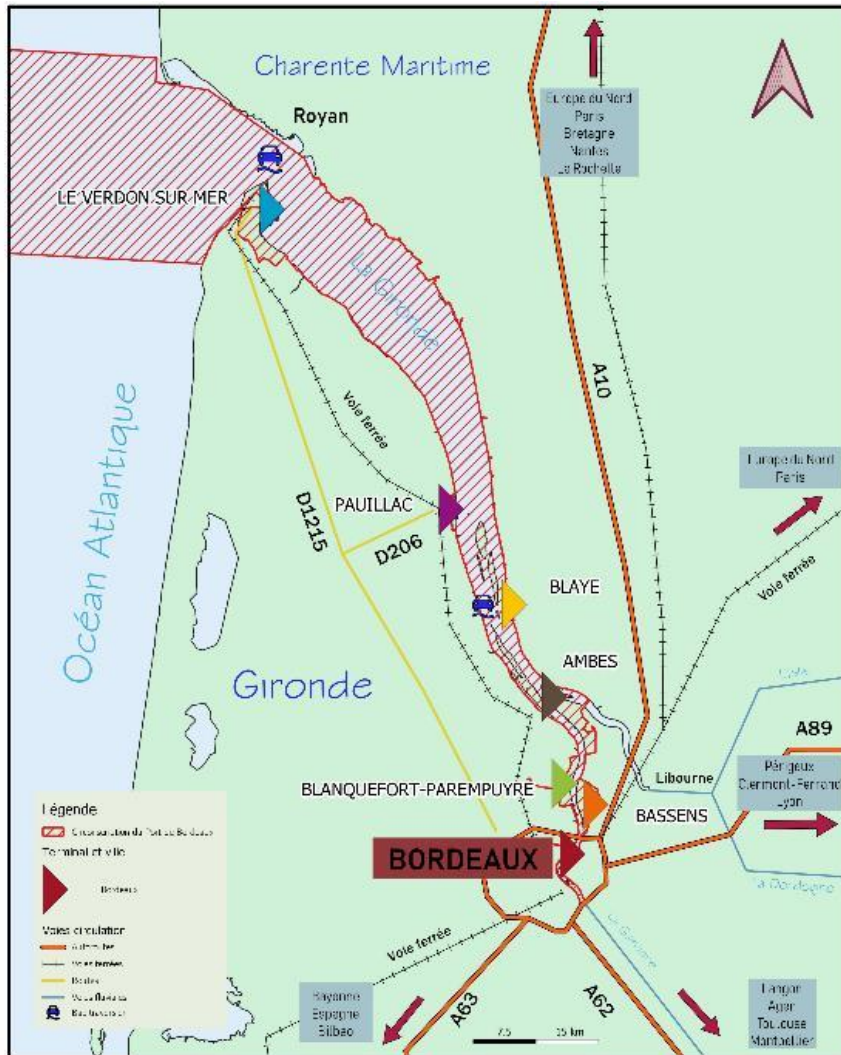
There is a slight increase in CO₂ emissions until mid-century, then it declines. Energy use sharply declines and there is a large scale reforestation. The size of agricultural land is reduced due to increased yield and much lower meat consumption. Strict new climate policies will be introduced and methane emissions stabilize.

The Port of Bordeaux

- State public establishment
- 7th largest French seaport
- 320 employees - Turnover of €40 million
- 7 specialized port terminals
- 7 million tons of goods+
- More than 800 calls per year
- 60 cruise calls
- A 100 km access channel
- 8,000 direct jobs in the ZIP area



The terminals of the port of Bordeaux



Connected to the main transport networks of the territory, the 7 port terminals of the Port of Bordeaux can process **all types of merchandise** :

- Bordeaux** Refit and ship repair, cruising and yachting
- Bassens** Multivrac, containers, maintenance and ship repair
- Blanquefort Parempuyre** Versatile terminal
- Ambès** Chemistry and energy terminal
- Blaye** Cereals, heavy packages and chemicals
- Pauillac** Oil depot and cruise development potential
- Le Verdon** Versatile terminal

Traffic in the port of Bordeaux

Core activities

Representing over 70% of current traffic

Energy :

- Diesel, gasoline, other petroleum products
- coal and coke, crude petrol

Agro-industrial bulk

- Rapeseed, sunflower, corn, wheat, other cereals, oilseeds
- Oil cakes, peat
- Oil, glycerine, molasses
- Urea, other solid and liquid fertilizers

Industrial raw materials

- Ammonia, methanol, butadiene, salt

Activities of the Territory

Assets for the local growth

Container

Cruise

Forestry products

- Wood and derivatives, tall oil
-

Construction and Building

- Aggregates, cements, clinker, bitumen

Mineral materials

- Talc, refractory earth, chamottes, quartz

Naval pole

Activities of the Future

Emerging today, structuring tomorrow

Bio-fuels

- Additives to fossil fuels: bioethanol, methyl ester
- Fuels : hydrogenated vegetable oils, green ammonia, green hydrogen

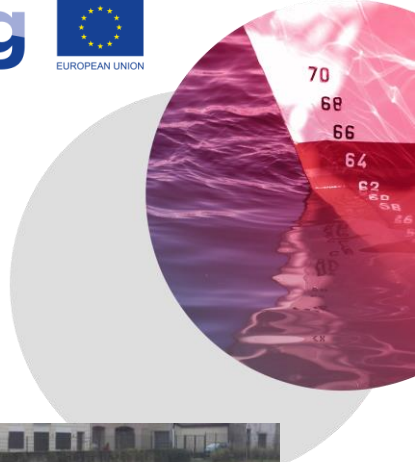
Second life materials:

- Scrap metal
- Shredded tires
- Crushed glass
- Solid fuels and recovery

Green chemistry

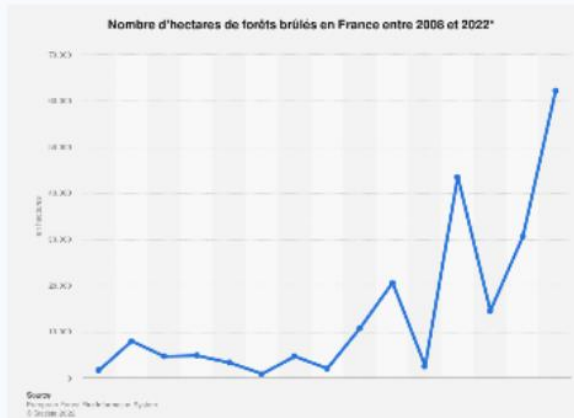
- Green ammonia

Impacts of the climate change in the Gironde region



New Aquitaine is one of the regions most affected by climate change:

- Temperature increase of 1.4°C during the 20th century
- Extreme climatic phenomena more and more frequent (floods, storms, erosion, drought, ...)



2022

- 3 heat waves
- 33 days of heat waves
- 15000 deaths in Europe
- 2816 additional deaths in France
- Relative excess mortality of +16.7%

2009 : storm Klaus

- 21/01 - 25/01
- Winds up to 200 km/h
- 12 deaths
- 1.2 milliards € (estimation for France)



2010 : storm Xynthia

- 26/02 - 01/03
- Winds up to 200 km/h
- Tides with high coefficients
- Major flooding
- 53 deaths
- 1.2 to 3 milliards €

The GPMB's contribution to ECCLIPSE



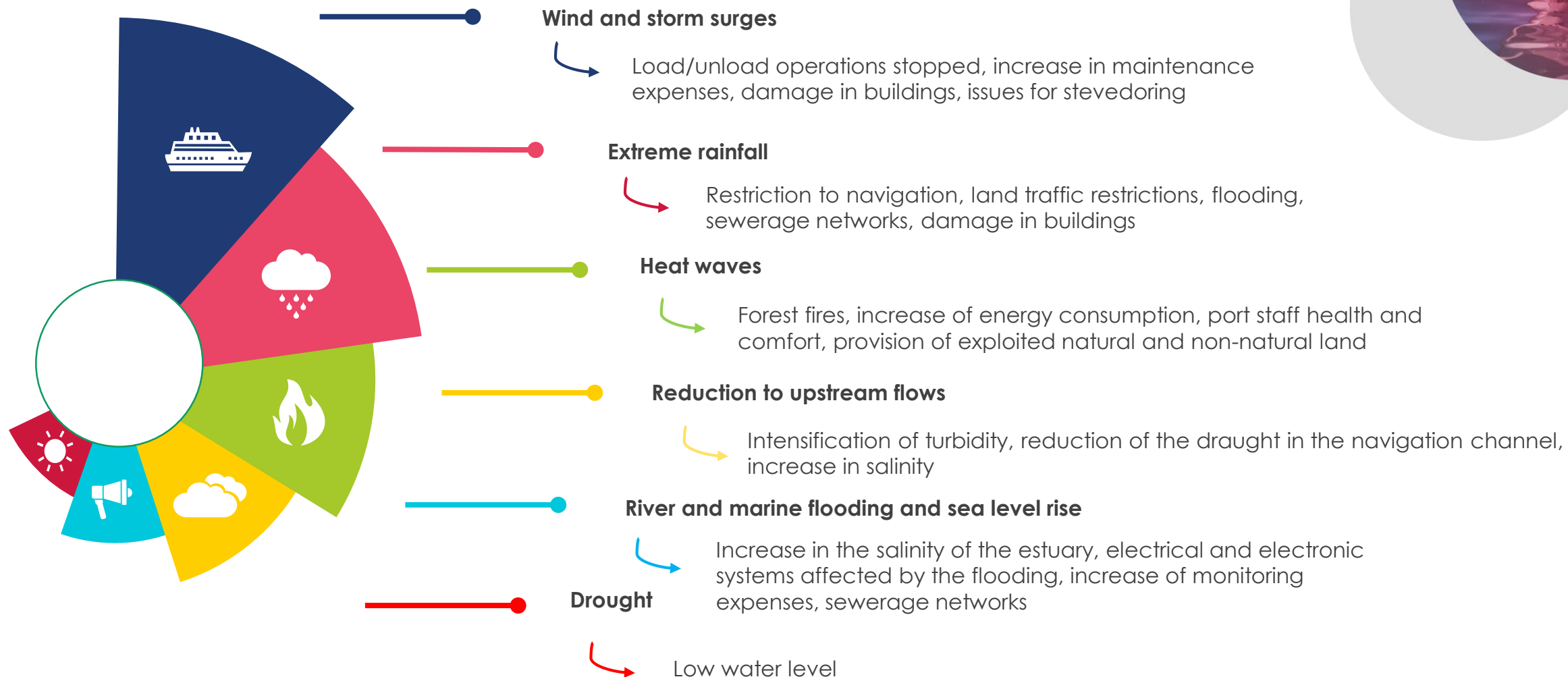
- **WP1** – Co-creation of the methodologies for impact assessment
- **WP2** – Analysis of the impacts of climate change on the port of Bordeaux
- **WP4** – Pilot experiences in the area of the Bordeaux port in terms of climate change : training, sensibilization, economic analysis
- **WP5** – Definition of a strategy for adaptation to climate change for the port of Bordeaux



Flood in Bordeaux, 2014

Adapting to climate change is part of the GPMB's sustainable development strategy

ASSESSMENT OF RISKS AND IMPACTS

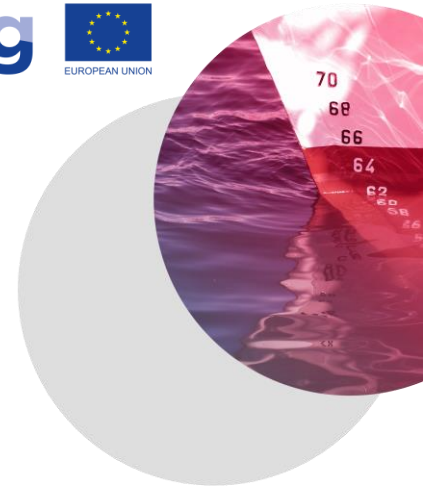


Impacts of the climate change on the port of Bordeaux



	RCP 4.5	RCP 8.5
EVOLUTION OF TEMPERATURES AND HEAT WAVES	+2°C by 2100	+ 4.5°C by 2100
RAINFALL DEVELOPMENT		+13%
AVERAGE SEA LEVEL CHANGE	Rise by up to 1.3 m by 2100	Rise by up to 1.3 m by 2100
EVOLUTION OF UPSTREAM FLOWS	Drop between 15% and 35%, up to 60% in summer	
EVOLUTION OF FLOOD	Storms lasting 5 to 8 hours in 2100, which favors floods	
EVOLUTION OF THE SALINITY	Rise of salinity in the estuary – salty water for 70 days more in 2070.	
EVOLUTION OF TURBIDITY AND SLUDGE CAP	The sludge plug will become stronger and increase the precariousness of aquatic life. Impact on dredging and navigation.	
EVOLUTION OF WIND	No significant changes	
EVOLUTION IN RAINFALL	Increase of extreme rainfalls + 50 % in 2100	
EVOLUTION OF FOG	Increase of 10 to 20 %	

Evaluation of risks and impacts on the GPMB – **processes** view – Horizon 2100



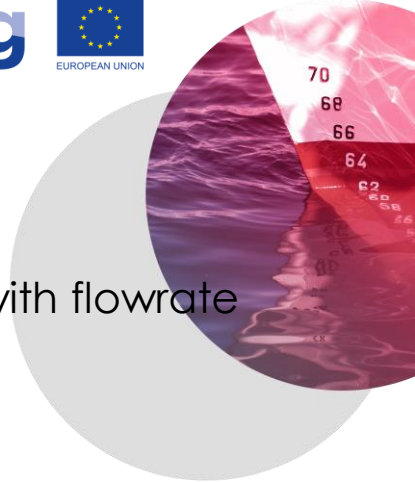
	Risk level	Main climate variable	Cost of possible damage
River and maritime traffic, including maneuvering	3	EXTREME RAINFALL/ RUNOFF FLOODING	€
Docking / mooring	3	EXTREME RAINFALL/ RUNOFF FLOODING	€
Ship loading/unloading	4	HEAT WAVES / EXTREME TEMPERATURE	€€
Land traffic in the port, including rail	3	EXTREME RAINFALL/ RUNOFF FLOODING	€
Container storage	3	EXTREME RAINFALL/ RUNOFF FLOODING	
Liquid bulk storage	1	EXTREME RAINFALL/ RUNOFF FLOODING	
Dry bulk storage on land	3	EXTREME RAINFALL/ RUNOFF FLOODING	€
Sheltered dry bulk storage (building or silo)	3	EXTREME RAINFALL/ RUNOFF FLOODING	€
Embarkation/disembarkation of passengers	1	EXTREME RAINFALL/ RUNOFF FLOODING	
Channel maintenance - Dredging	4	REDUCTION OF UPSTREAM FLOW (turbidity increase)	€€€
Indoor work (workshops and buildings)	2	EXTREME RAINFALL/ RUNOFF FLOODING	
Outdoor work, including walking	4	HEAT WAVES / EXTREME TEMPERATURE	€€
Provision of exploited natural land (terrestrial or aquatic: agriculture and aquaculture)	3	HEAT WAVES / EXTREME TEMPERATURE	€
Unused natural land (terrestrial, aquatic): preservation of species and natural environments, water quality	4	REDUCTION OF UPSTREAM FLOW	-
Provision of non-natural port land for users (including marina and forms of refit for ship repairs)	1	EXTREME RAINFALL/ RUNOFF FLOODING	

Evaluation of risks and impacts on the GPMB – **infrastructure** view – Horizon 2100



	Risk level	Main climate variable	Cost of possible damage
Electrical systems	1	EXTREME RAINFALL/ RUNOFF FLOODING	€
Gantry rails and railway rails	1	EXTREME RAINFALL/ RUNOFF FLOODING	
Locks and movable bridges	1	EXTREME RAINFALL/ RUNOFF FLOODING	€
Sewerage networks	2	EXTREME RAINFALL/ RUNOFF FLOODING	
Roads	1	EXTREME RAINFALL/ RUNOFF FLOODING	
Equipment: lighting masts and panels	1	EXTREME RAINFALL/ RUNOFF FLOODING	
port infrastructure (terminals, piles, sheet piling, concrete, etc.)	2	REDUCTION OF UPSTREAM FLOW (Salinity increase)	€€
Channel	4	REDUCTION OF UPSTREAM FLOW (turbidity increase)	€€€
Buildings and sheds	1	EXTREME RAINFALL/ RUNOFF FLOODING	

Major impacts of the climate change on the activity of the port of Bordeaux

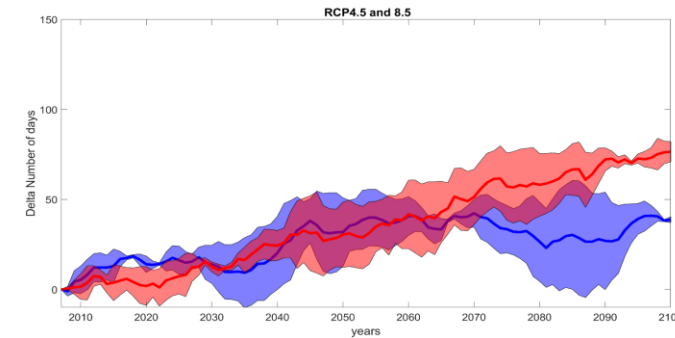


Evolution of the flow of the Garonne

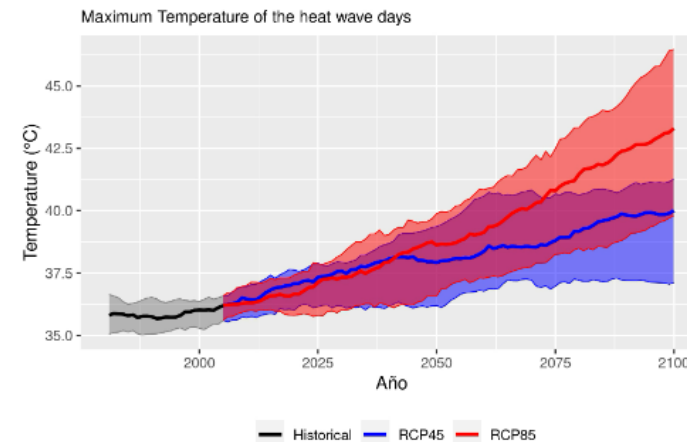


- Lower flows,
- More turbidity,
- Reduced vessel capacity,
- Increased dredging costs

Evolution of the the numbers of days with flowrate lower than 400 m³/s.



Evolution of the temperature during the heat waves



Strategy adopted by the GPMB



- Adaptation of the work rhythm to **heat waves**
- Anticipation of floods : alerts and adaptation of the pace of work with the floods (tide level)
- Integration of **ECCLIPSE works** done by CEREMA (GIRONDE XL 3D digital model) in a project of creation of Open source **digital twins of the river**



The river's digital twins.



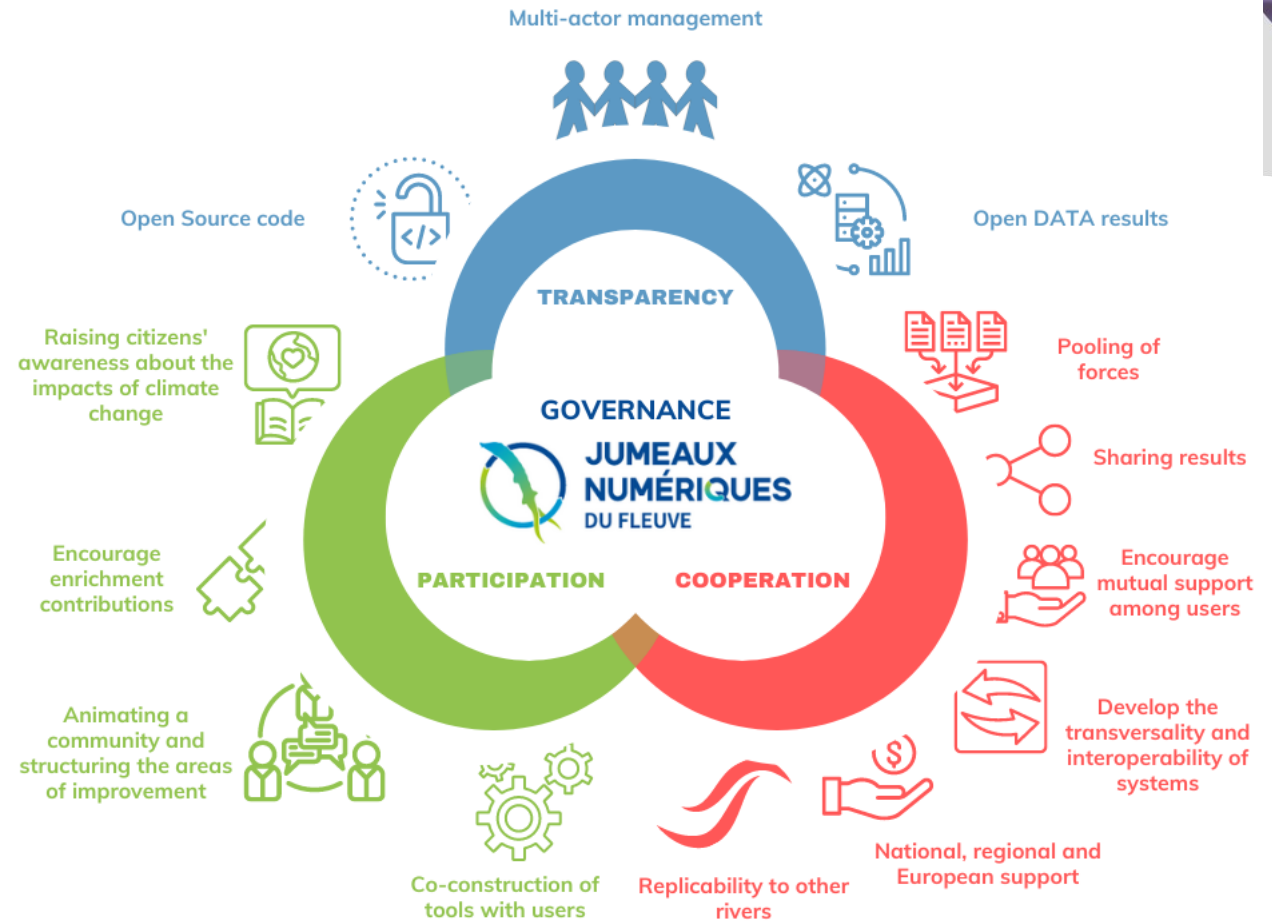
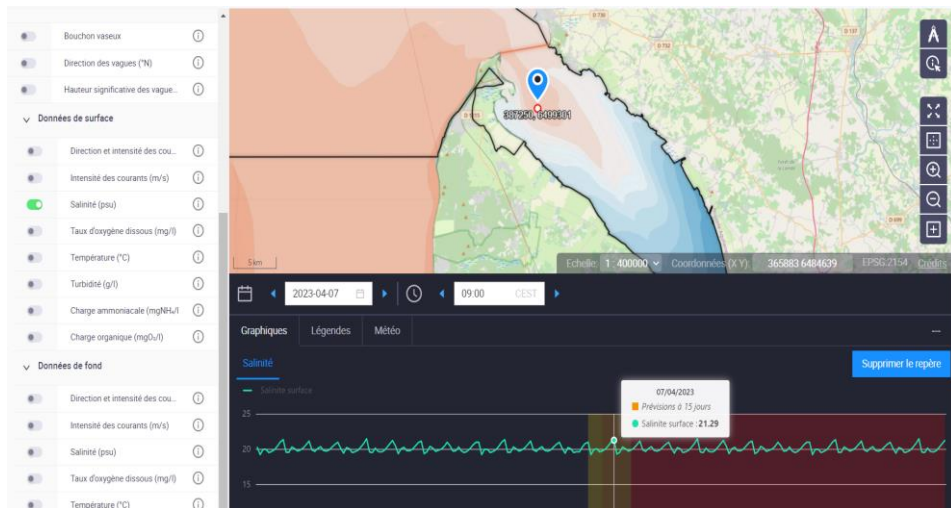
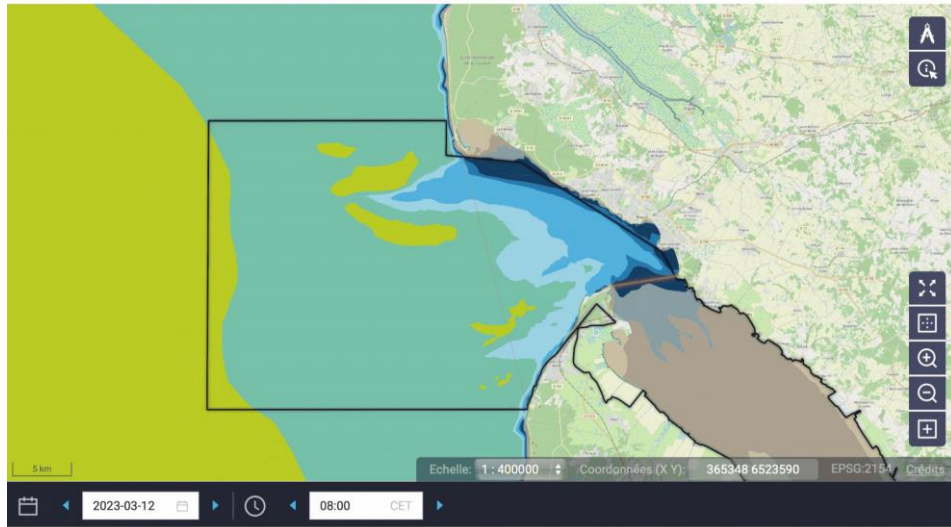
Creation of Digital Twins of the River accelerated thanks to Ecclipse work



- An Open source ecosystem developed during 2022
- Several interconnected platforms for daily forecasts and specific simulations :
 - Analysis of historical data
 - Forecasts and trend indicators (up to 3 months)
 - Alert management
 - Advanced scientific tools for the analysis of physico-chemical phenomenon
 - Easy-to-use decision support modules
 - A geographical representation (GIS) to visualize the results of forecasts or studies carried out : navigation, dredging, environmental characteristics, studies, Garonne 2050.
- **Official launch on April 25, 2023 !**
- A project integrated into the regional digital heritage where the project code is available for use and enrichment : <https://jumeaux-fleuve.naos-cluster.tech/>

ECCLIPSE and EU support are mentioned

The port unifying an open source community around the Digital Twins of the River



Lasts dissemination actions



- The Digital Twins of the River were the winner of the **digital twins trophy** (BIM WORLD Paris) – “City and territories” category



Une nouvelle collaboration Européenne

2020 : Le projet Européen ECCLIPSE démarre

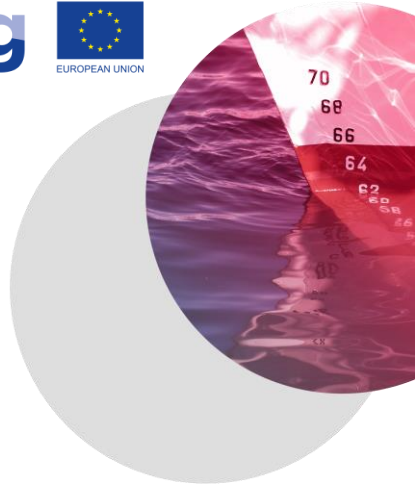
- Projet Interreg SUDOE : Evaluation des impacts du changement climatique dans les ports

• Version **Gironde XL 3D 2022** (by CEREMA)

- Ouverte à tous
- Simulation de l'évolution de l'estuaire de la Gironde jusqu'en 2100
- Paramètres : marée, température, salinité, turbidité, ...
- CEREMA : premier membre de la communauté de partage des efforts et résultats



Lasts dissemination actions



• Presentation of the Ecclipse project coming this week (GPMB –

F. Klein), with :

- The 4 regional ports of Nouvelle-Aquitaine
 - La Rochelle,
 - Bayonne,
 - Bordeaux,
 - Rochefort Tonnay Charente
- Nouvelle-Aquitaine Region (who organizes this event in in their premises)
- SGAR Occitanie (prefecture)





Thank you for your attention!

Do you have any questions?

Fabrice Klein

GPMB

F-Klein@bordeaux-port.fr