Impacts of Climate Change on Flash floods in Tordera catchment, Catalonia

Team 04 Presentation 3

HYDROEUROPE

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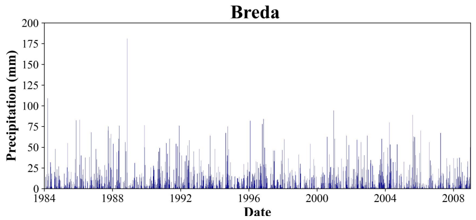
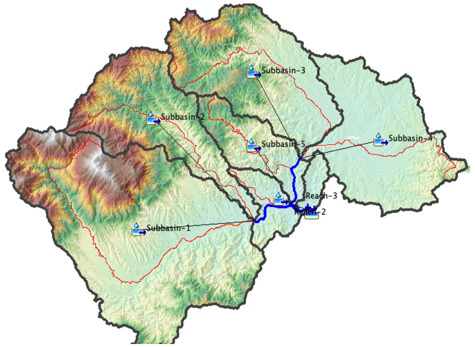


Hydrological Continuous Simulation



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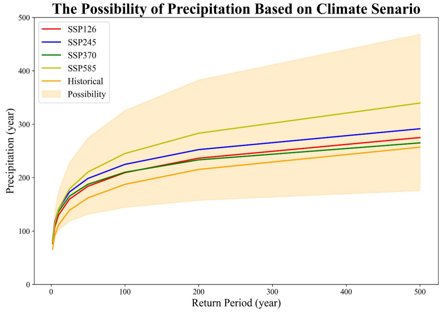
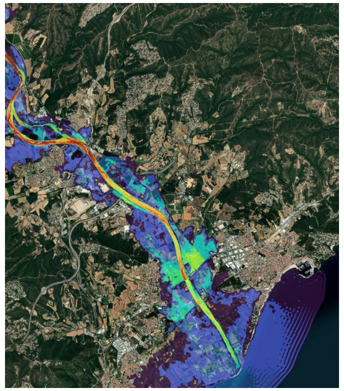
Peak Frequency Analysis (Return Period T_{500})



Hydraulic Model Creation

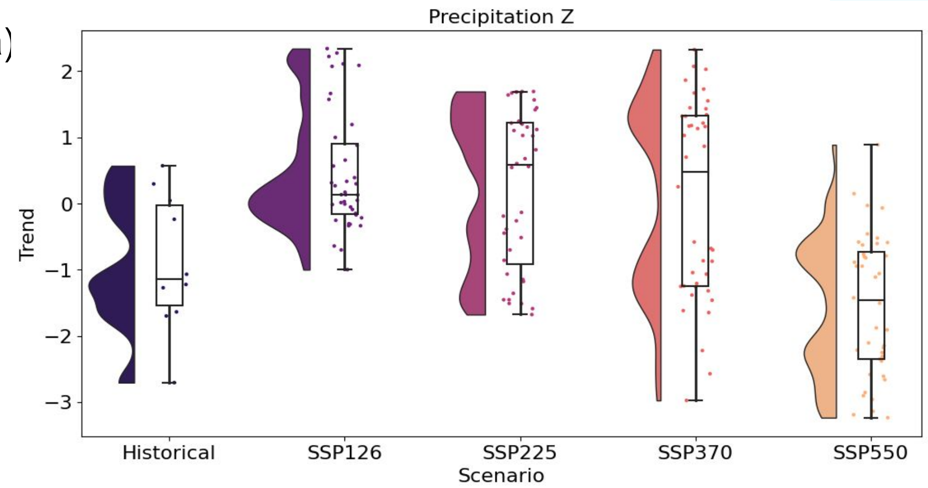


Comparison of Results and Uncertainty Assessment

CLIMATE ANALYSIS

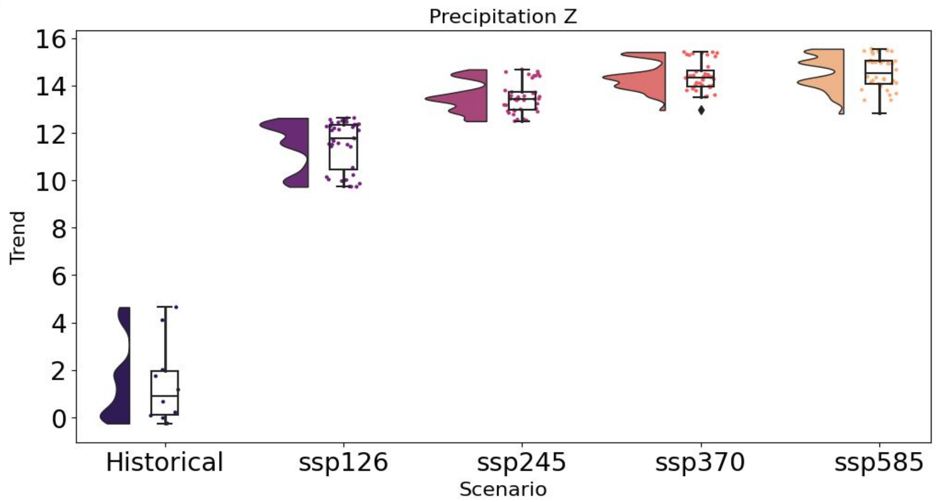
Climate Analysis

a)



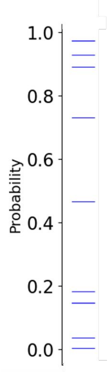
Mann-Kendall Z test for Precipitation

c)



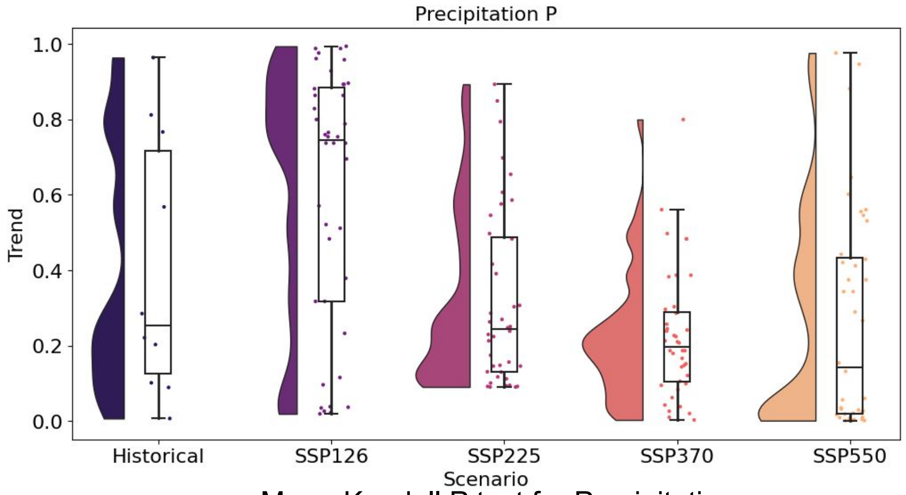
Mann-Kendall Temperature trend

d)



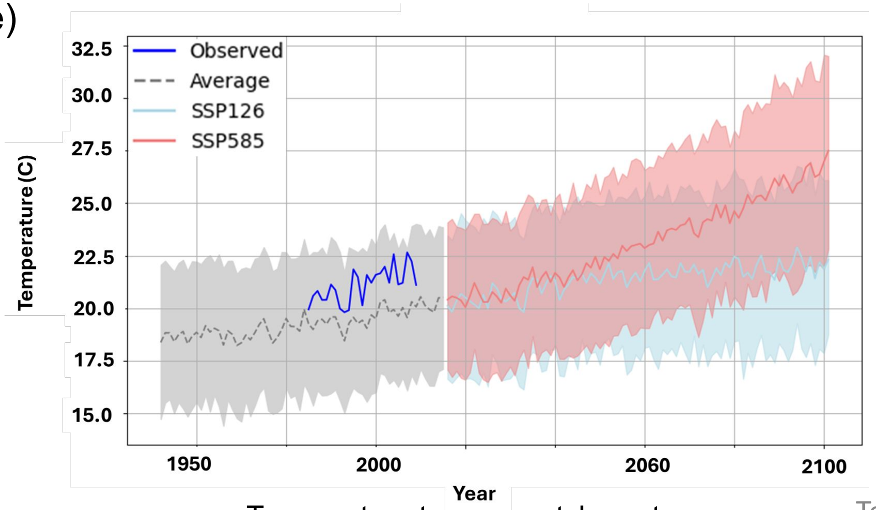
Mann-Kendall P for Temperature

b)



Mann-Kendall P test for Precipitation

e)



Temperature trend in catchment

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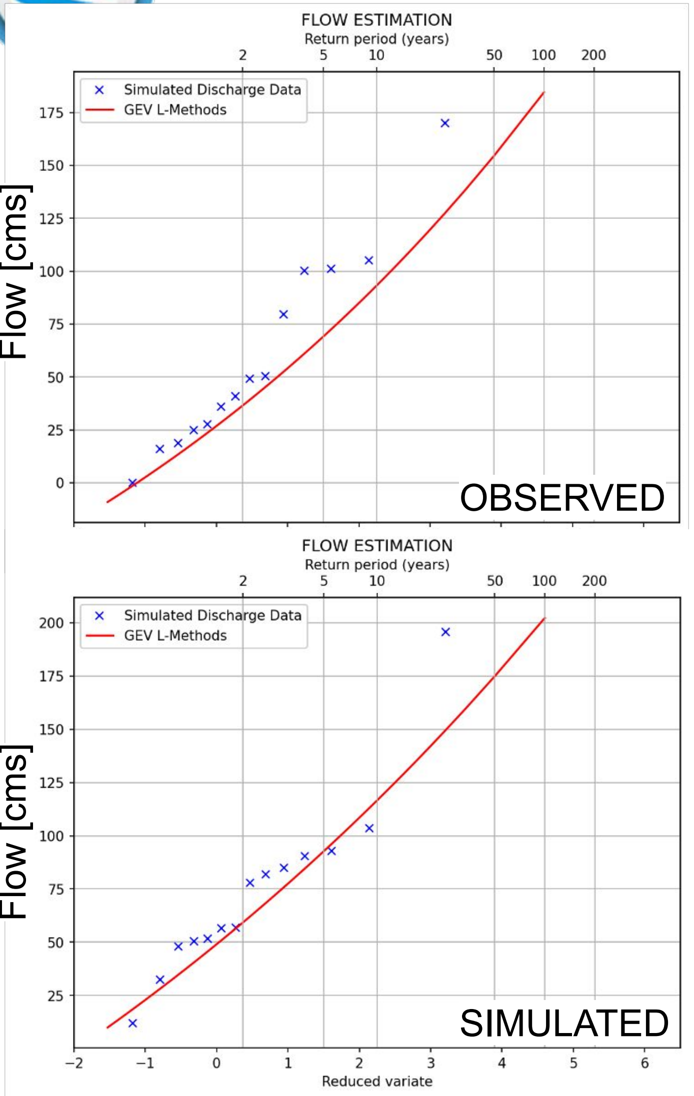
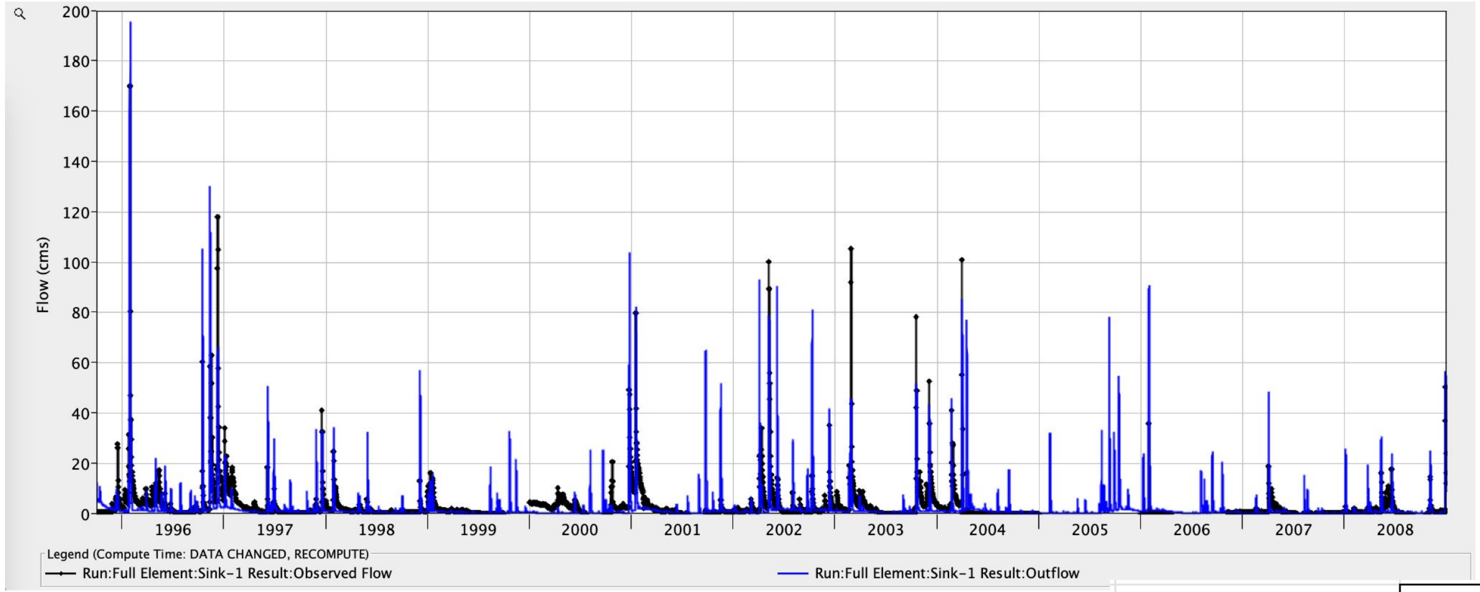
Hirsch, Robert M., and James R. Slack. "A nonparametric trend test for seasonal data with serial dependence." *Water resources research* 20.6 (1984): 727-732.
Karmeshu, Neha. "Trend detection in annual temperature & precipitation using the Mann Kendall test–a case study to assess climate change on select states in the northeastern United States." (2012).

HYDROLOGICAL MODEL RESULTS

Hydrological Model Calibration and Validation





Discharge (cms)	Observed	Simulated
T100	183	202
T500	264	271

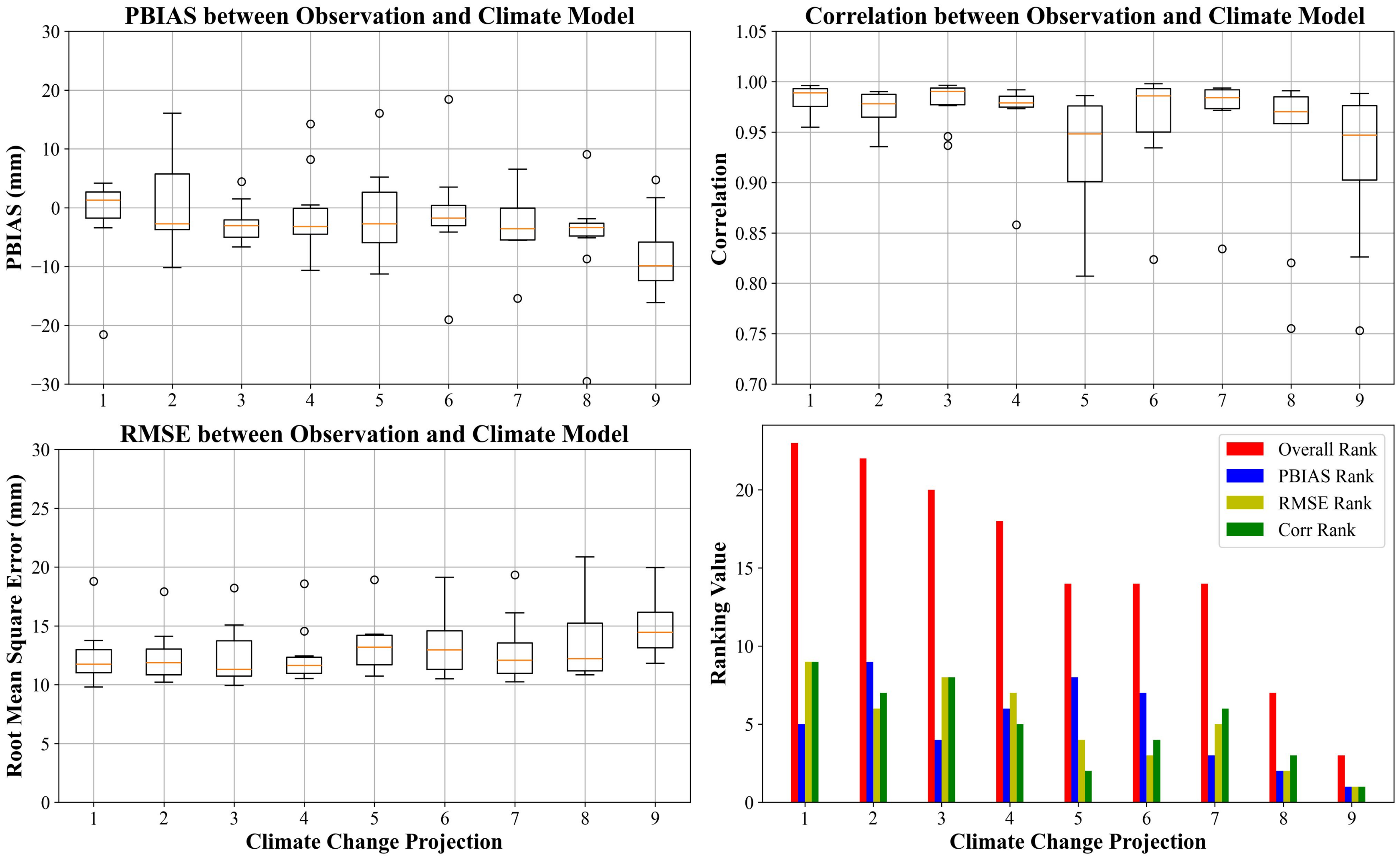
Return Periods calculated with 13 years of data*

	Calibration	Validation
Period Simulated	1996 - 1997	2002 - 2004
Nash-Sutcliffe	0.238	0.17
Volume Simulated [ML]	327,832	327,832
Volume Observed [ML]	338,799	340,551
Volume Variation	3.24%	3.73%

Climate change projection analysis

Projection choice

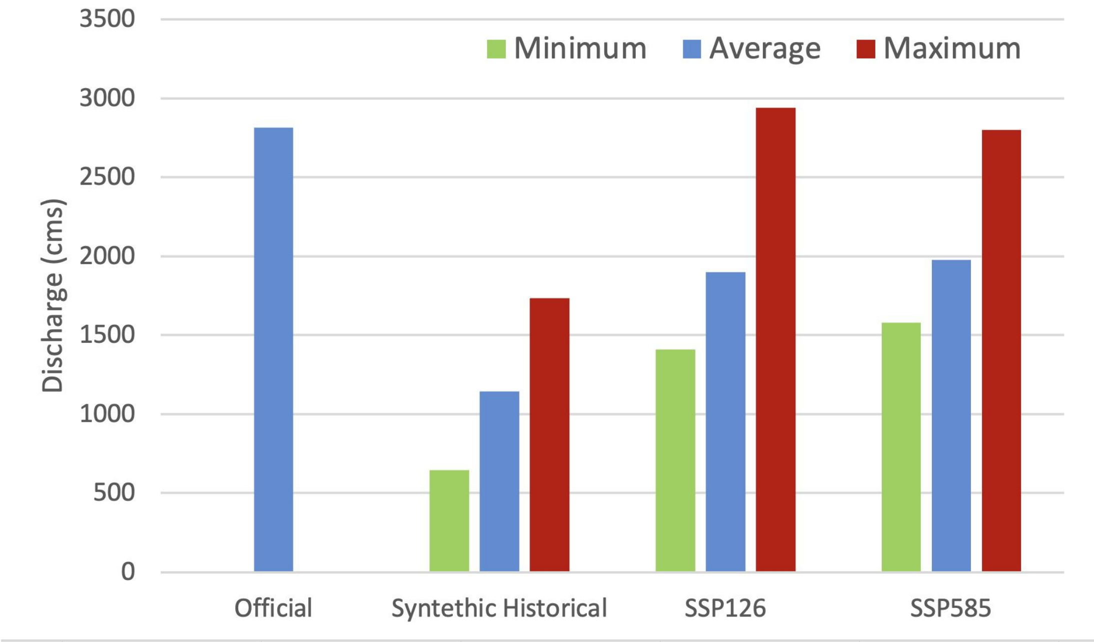
No.	Climate Change Projection
1	BCC-CSM2-MR
2	EC-EARTH3
3	CNRM-ESM2-1
4	MRI-ESM2-0
5	MPI-ESM1-2-HR
6	ACCESS-CM2
7	CMCC-ESM2
8	CanESM5
9	NorESM2-MM



4 CCP models in HEC-HMS for SSP126 and SSP585

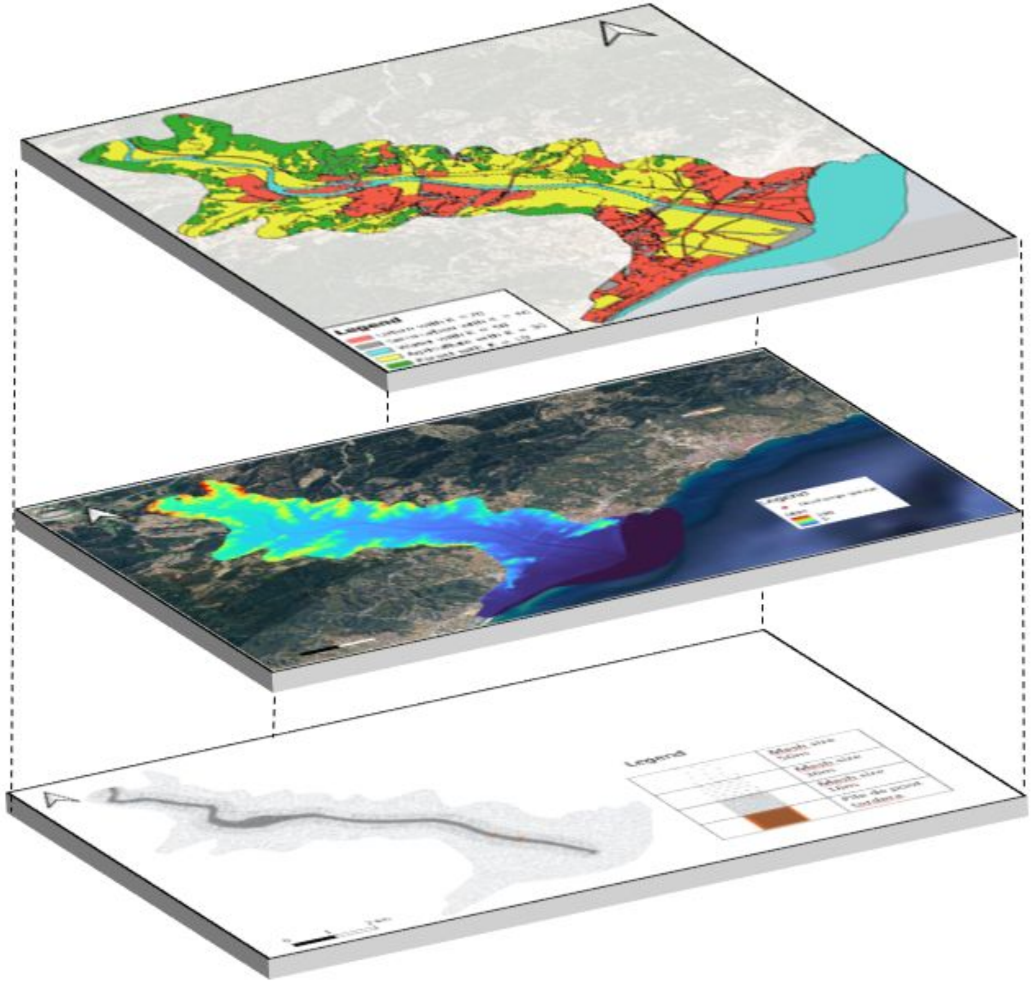
Results :

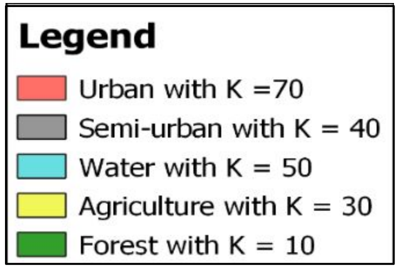
Discharge for T =500 years (m3/s)	Average	Minimum	Maximum
Official	2815		
Synthetic Historical	1142	647	1732
SSP126_HMS	1900	1410	2940
SSP585_HMS	1977	1577	2800

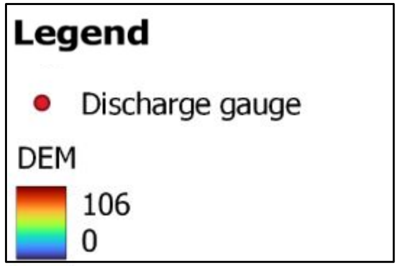


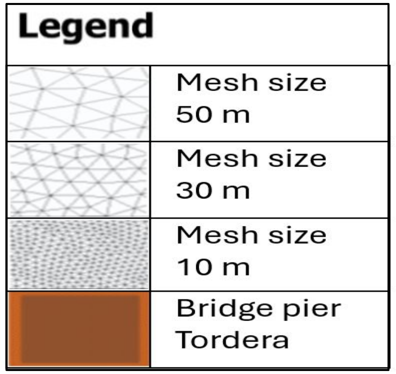
HYDRAULIC MODEL

Model Setup, Data meshing and interpolation



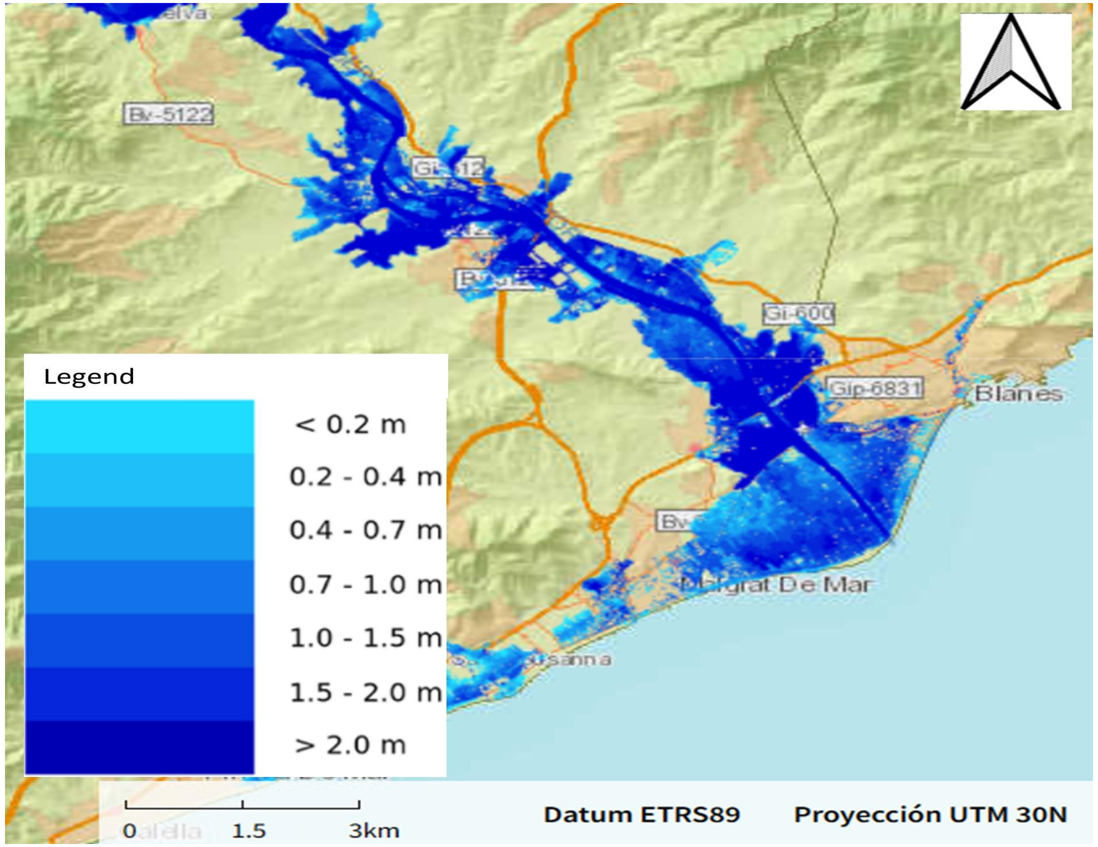




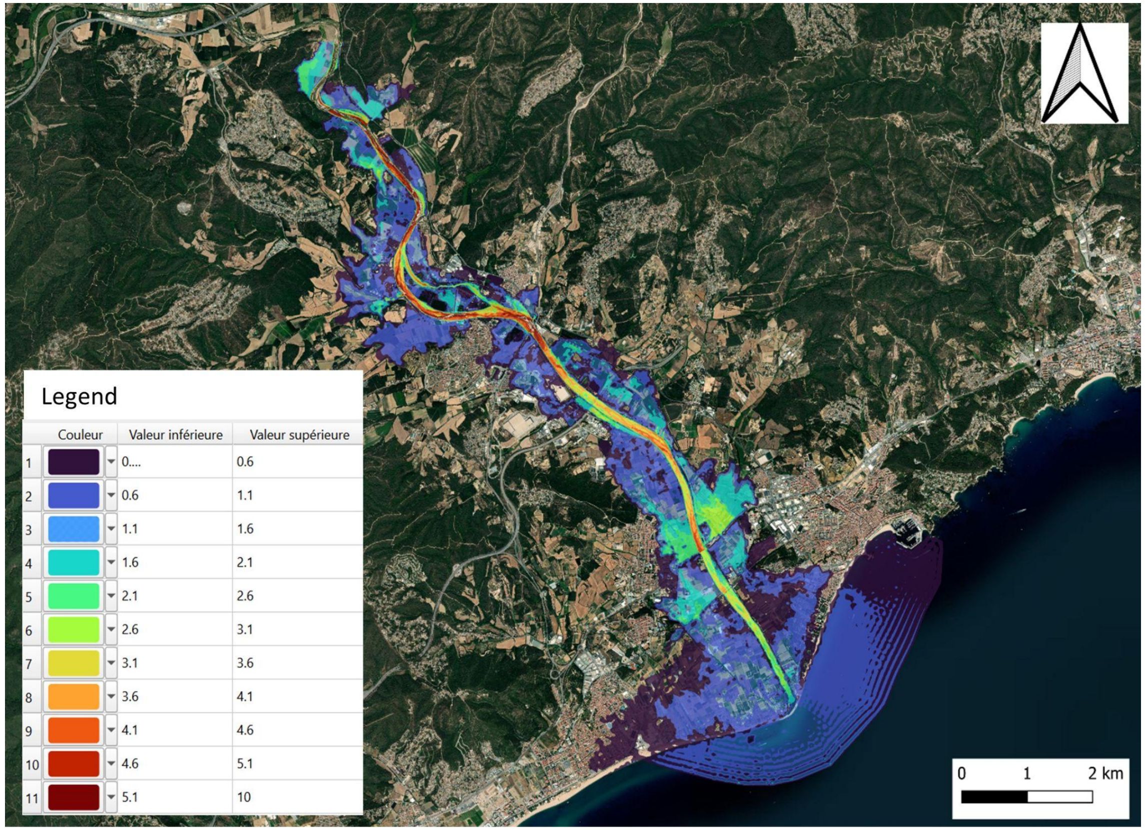


Model calibration using the flow rate obtained from the website

Q= 2815m^3/s T= 500 years



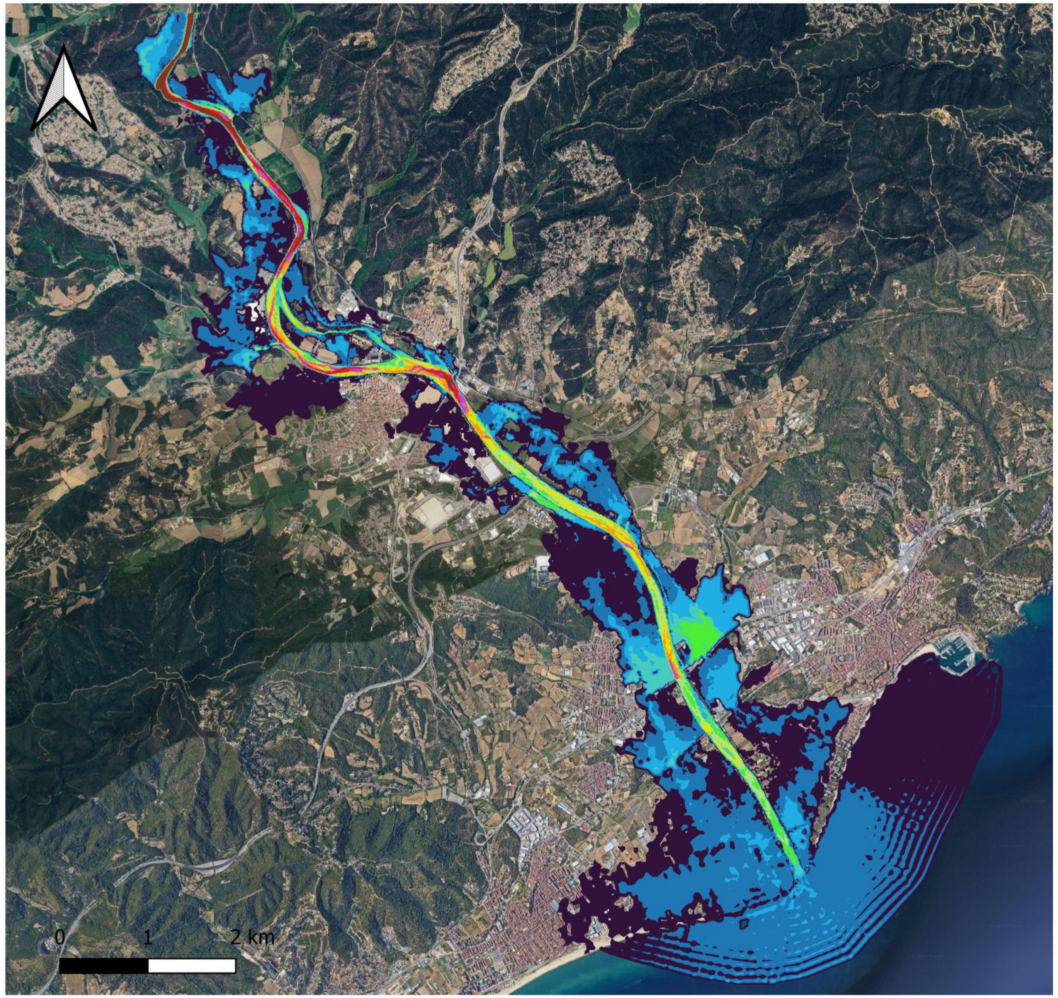
Flood map obtained from government website for T=500 (HEC-RAS 2D)



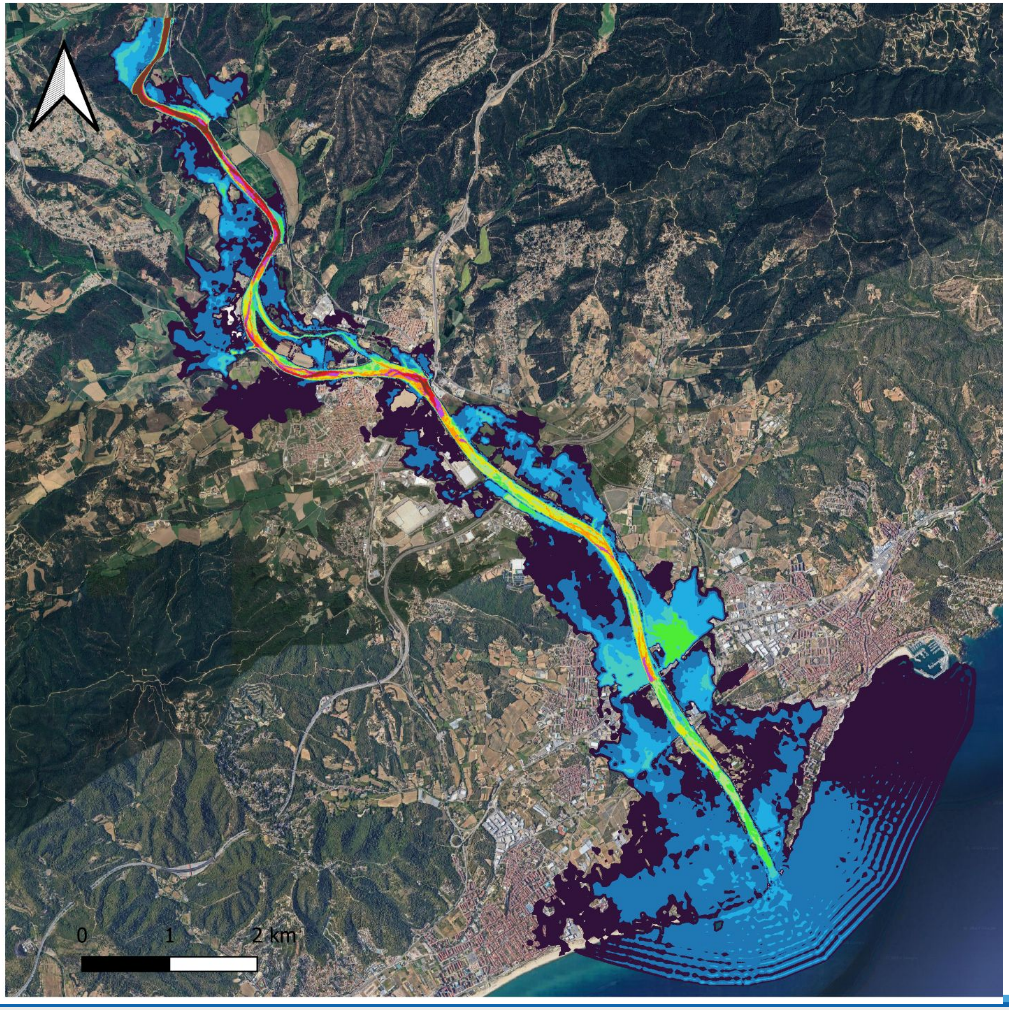
Flood map simulated with observed discharge for T=500 (Telemac 2D)

Simulation of average return period for SSP 126 & SSP 585

Flood map showing water depth for SSP 126 (Q= 1900m^3/s)



Flood map showing water depth for SSP 585 (Q= 1977m^3/s)

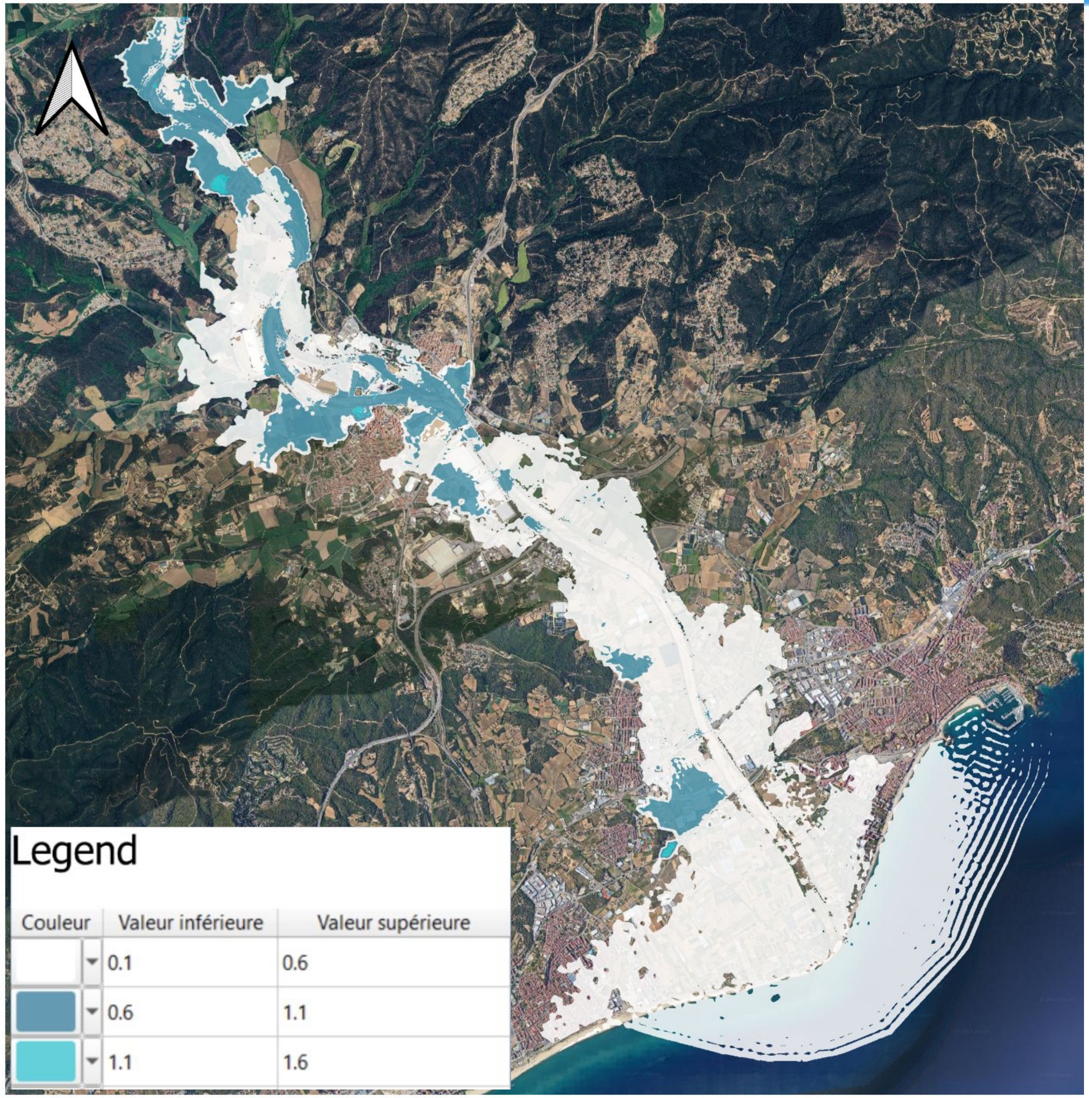


Legend

	Couleur	Valeur inférieure	Valeur supérieure
1		0.1	0.6
2		0.6	1.1
3		1.1	1.6
4		1.6	2.1
5		2.1	2.6
6		2.6	3.1
7		3.1	3.6
8		3.6	4.1
9		4.1	4.6
10		4.6	5.1
11		5.1	10.0

Presentation 3

Comparison between Official T500 discharge and SSP 126 results



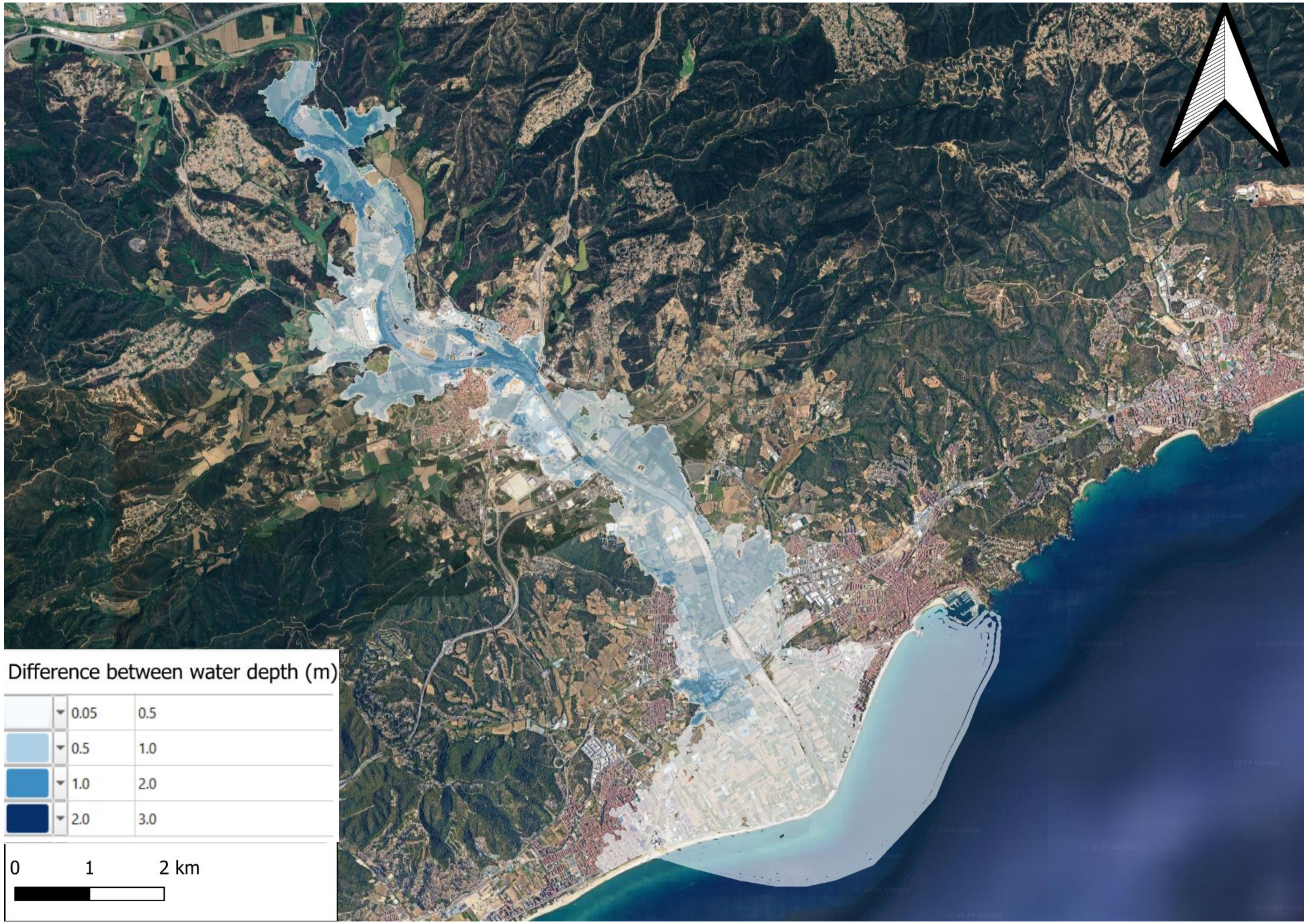
Map representing the difference in water level between the official and the SSP126 Return Period (T500)

Changes in water level are up to 1.6 meters

Uncertainties on SSP 585 Projection Return Period

Map representing the difference in water level between the maximum and minimum of the SSP 585 station

Changes in water level are up to 3 meters



Conclusion

- Uncertainty is a key factor dealing with Climate Change Projections
- Hydrological and Hydraulic Models have many limitations and assumptions that must be taken into consideration

After saying this, our data showed a future scenario with

- Higher temperatures
- Lower Total Rainfall, however with an
- Increase in extreme rainfall events,
- And similar return period discharges between scenarios (T = 500 years)

Recommendations

- **Increase of data, specially regarding time resolution**
- **Properly estimating the coefficient of friction and considering it in the simulation allows for a better and more realistic simulation of the flooding.**
- **A finer mesh allows for a more accurate simulation, as it displays flooded areas that are not visible**
- **In addition, there are uncertainties about the accuracy of the DEM, about the hydrologic modeling, estimation of friction coefficient.**