

Team 01 Presentation 3

Presentation 3: Results of the 2nd week, climate changes



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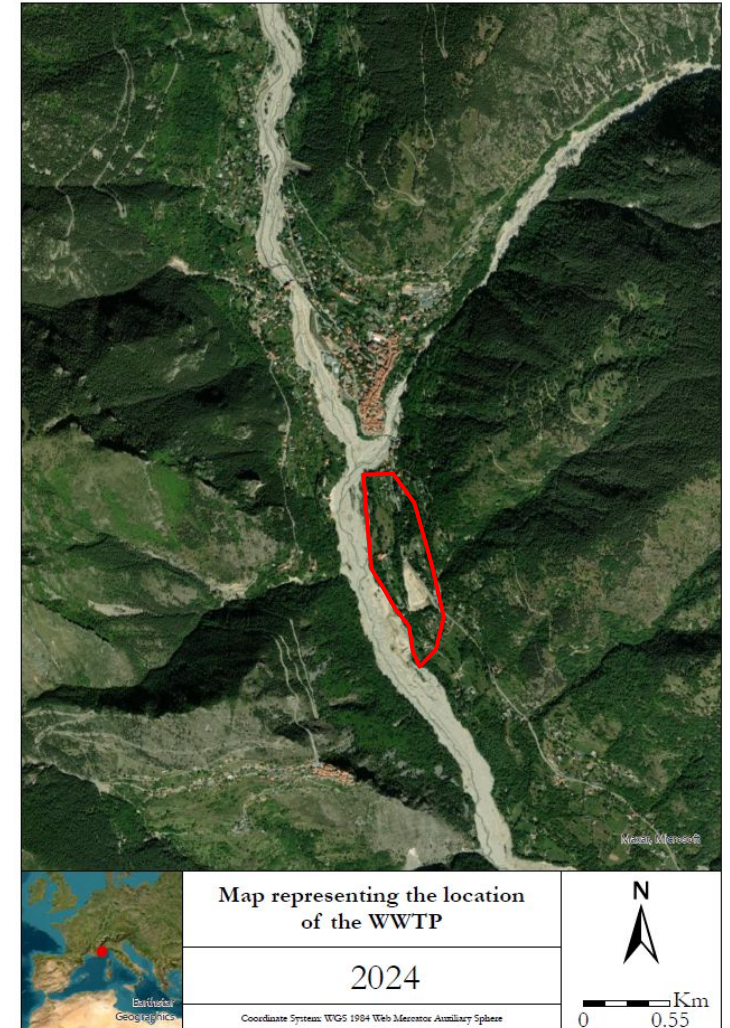
Var Catchment - Summary of week 1



The Models

- HEC-HMS: hydrologic
- Telemac: 2D hydraulic
- MIKE-11: 1D hydraulic

Where should we build the WWTP that was previously destroyed?



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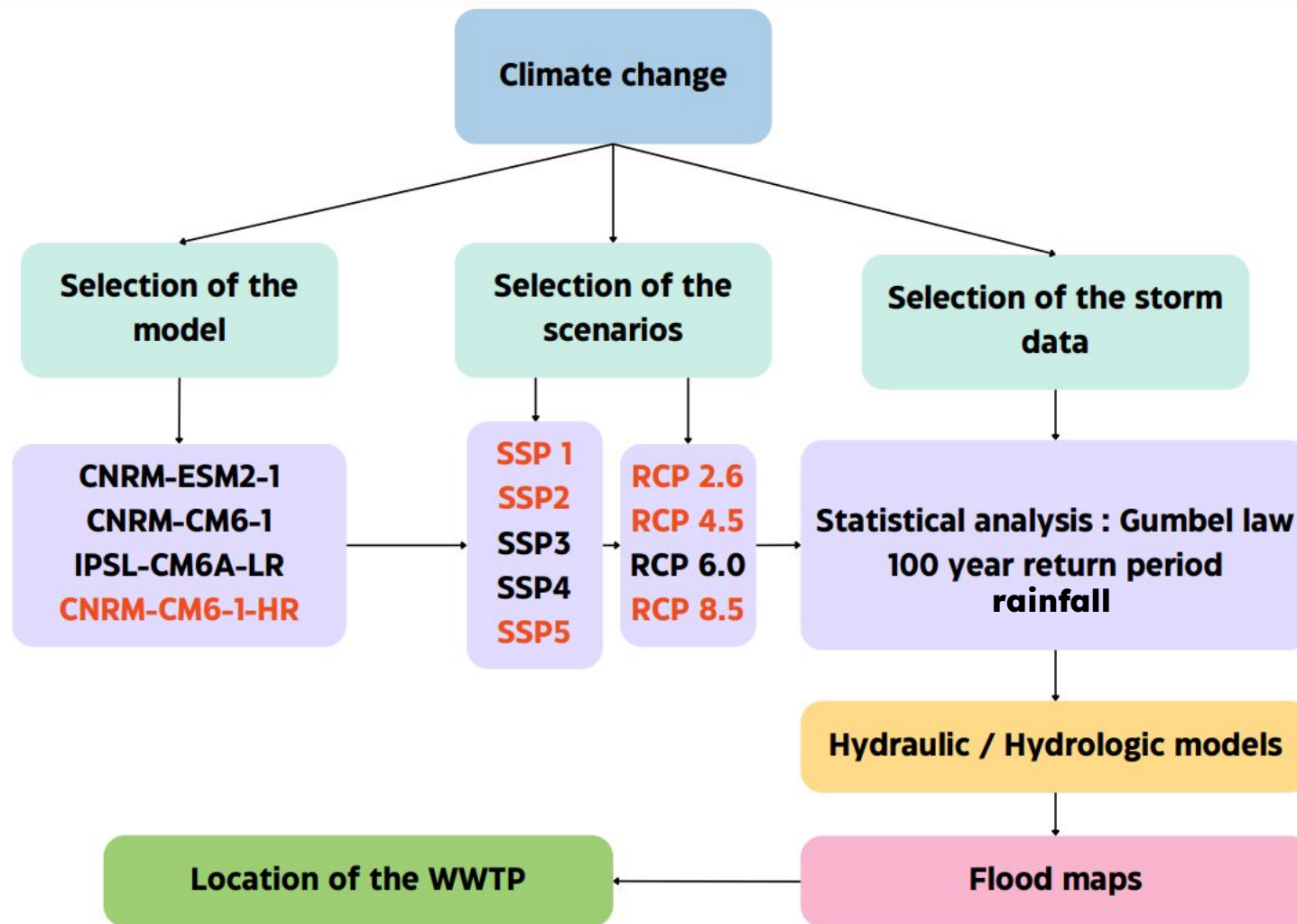


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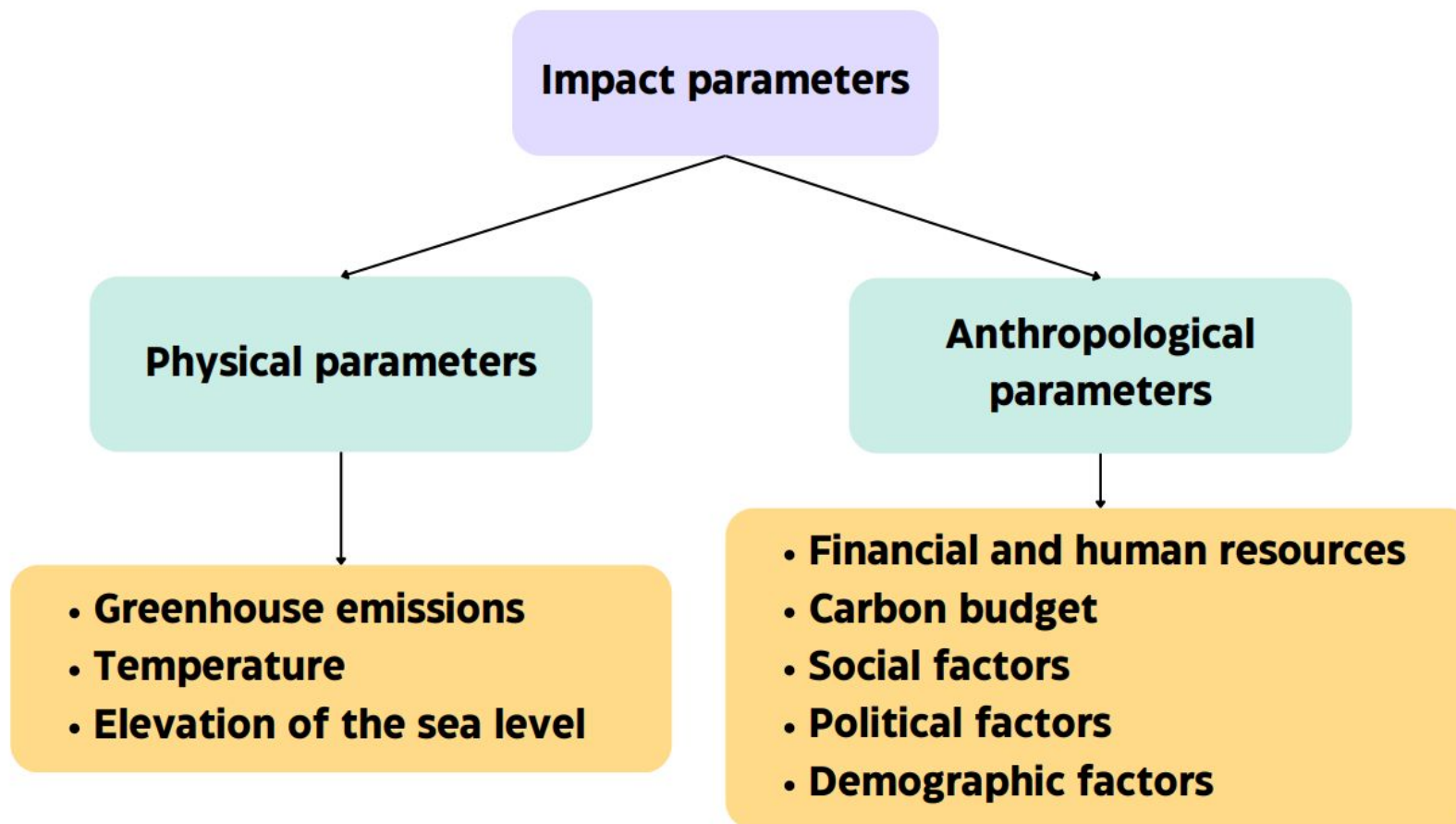


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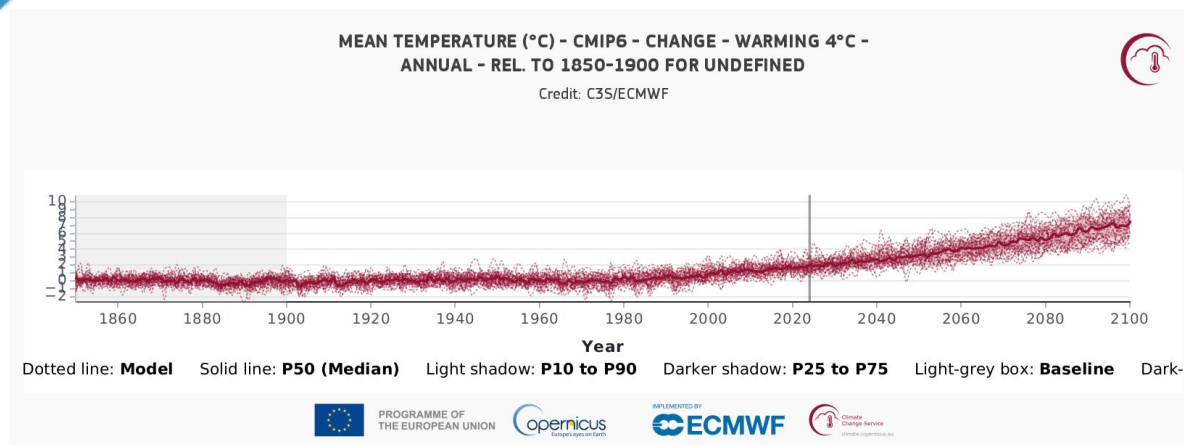
Var Catchment - This week's workflow



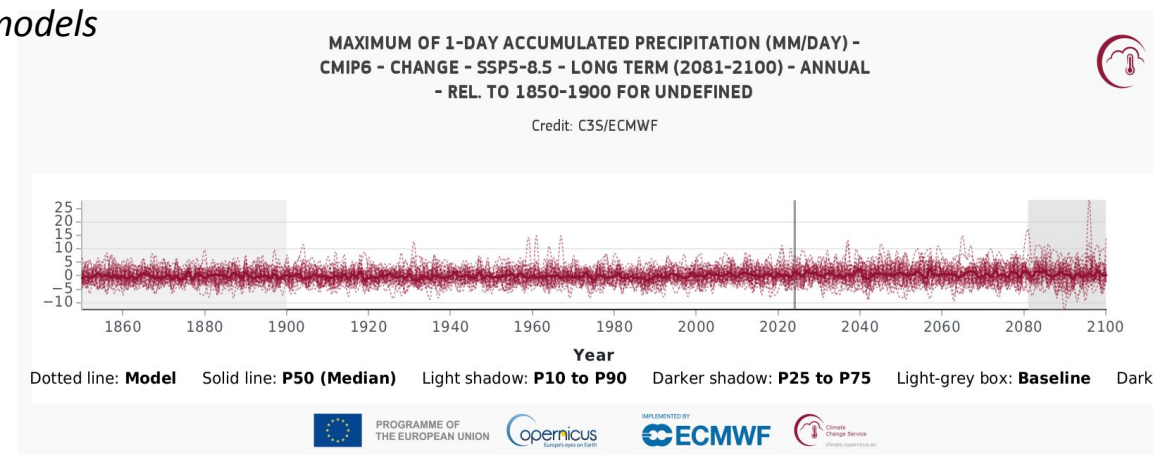
Var Catchment - Affecting parameters



Var Catchment - Impact of Climate Change



Projections of the annual temperature according to different models (Copernicus)



Projections of 1 day accumulated precipitations according to different models (Copernicus)

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Vésubie Catchment - Selection of the model



Model	Advantages	Disadvantages
CNRM-ESM2-1	Effective for modeling terrestrial and oceanic processes . Assessment of long-term impacts (biosphere-atmosphere interaction).	Less precise locally (CNRM-CM6-1-HR). Less accurate for extreme events. Underestimation of output parameters
IPSL-CM6A-LR	Effective for modeling climatic processes . Good performance for overall precipitation and temperatures . Suitable for varied scenarios .	Less precise locally (CNRM-CM6-1-HR). Less accurate for clouds and extreme precipitation. Overestimation of output parameters.
CNRM-CM6-1-HR	Effective for modeling precipitation and extreme events . High spatial resolution: locally accurate .	High computational cost. Underestimation of output parameters.
CNRM-CM6-1	Suitable for modeling a wide range of climate variables . Good general balance between performance and computational cost.	Less precise locally (CNRM-CM6-1-HR). May require downscaling for accurate local-scale analysis. Underestimation of output parameters.

CNRM-CM6-1-HR



- **Flash floods**
- **Extreme precipitations**
- **Resolution : locally accurate**

Var Catchment - Selection of the scenarios



SSP1(2.5)

SSP2(4.5)

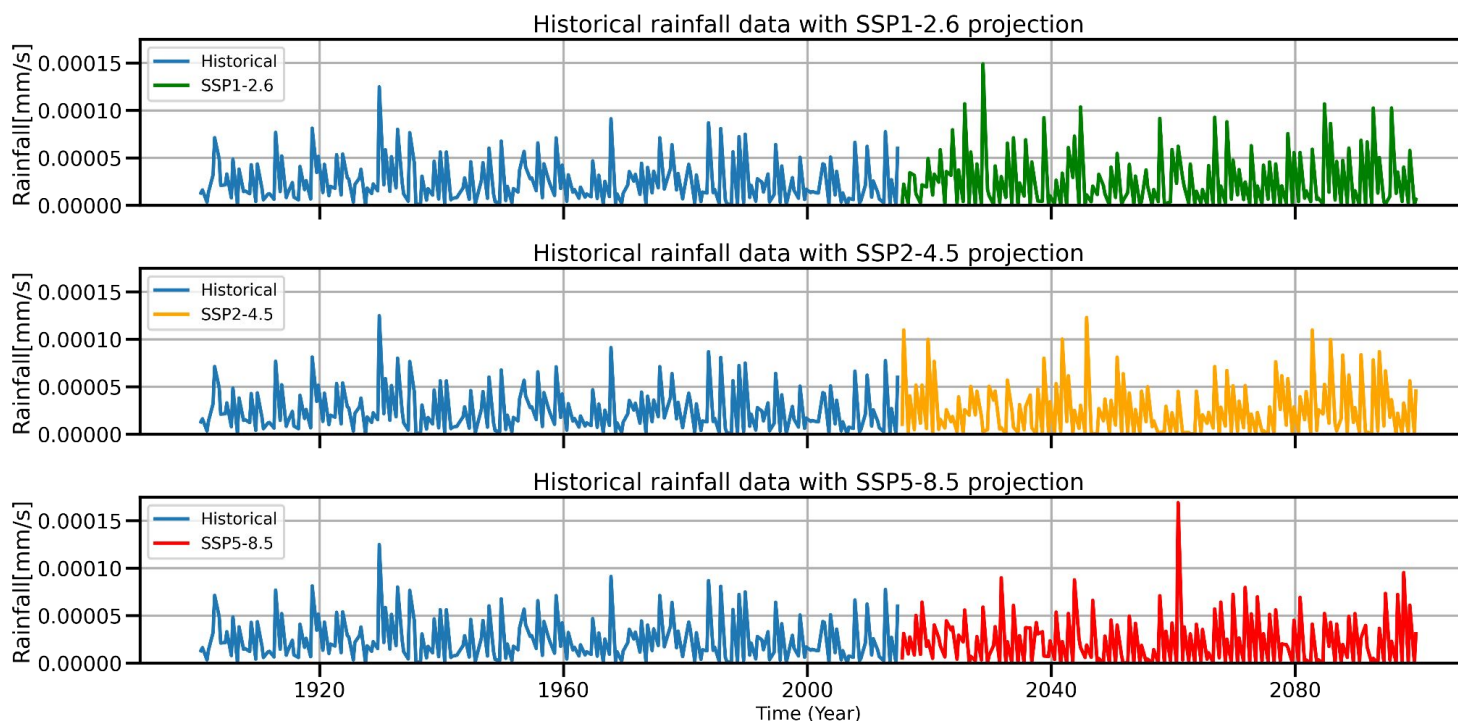
SSP3

SSP4

SSP5(8.5)

Utopic
Mass sustainability
effort and
environment
conservation

Distopic
Fossil-fuel
dependant society
with limited
sustainability efforts



Visualisation of the rainfall data results of CNRM-CM6-1-HR model in the three scenarios

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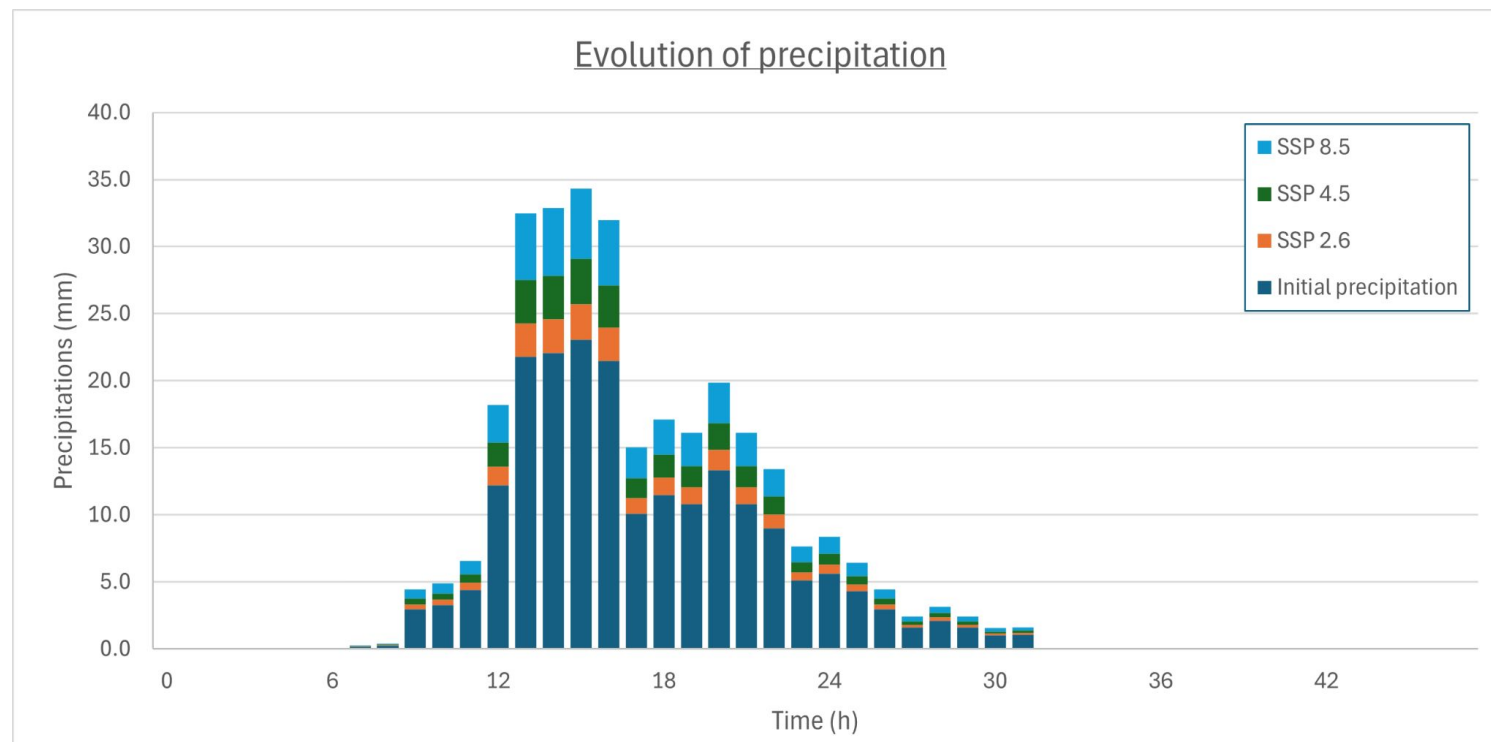
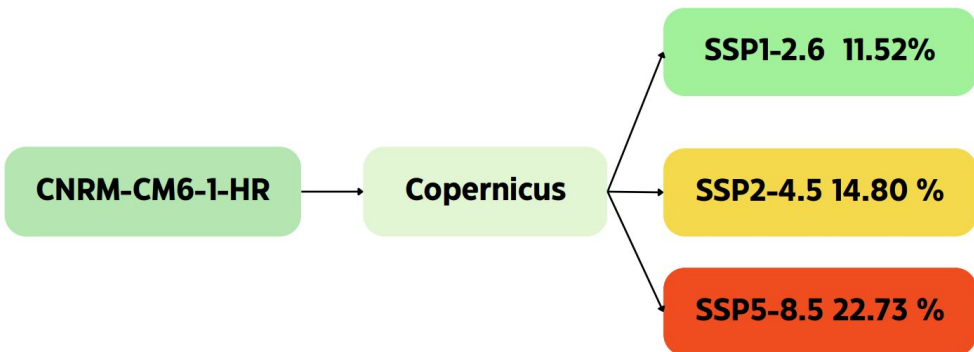
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Var Catchment - Input DATA

"Gumbel Method \Rightarrow 100-year return event yields 202mm
 \Rightarrow initial hydrograph for climate change scenarios."



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Var Catchment - Hydraulic model

TELEMAC 2D

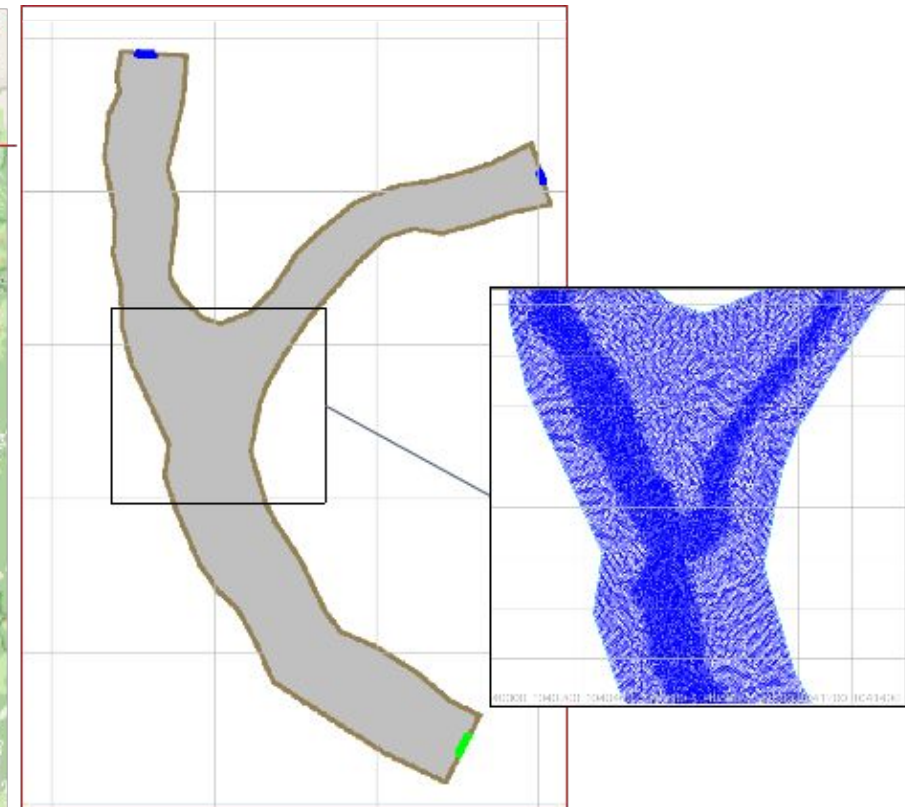
Situation

- Nearest station at 20 km
- DEM from Lidar 1 m
- Numbers of nodes = 100085
- Number of elements = 198111
- Strickler's law
- 4 bridges on the model zone
- $Z_{min} = 735.9$ m
- $Z_{max} = 1485.9$ m

Parameters	Value
CFL	0.5
Time step (s)	0.8
dx mesh size (m)	5



Localisation of the station



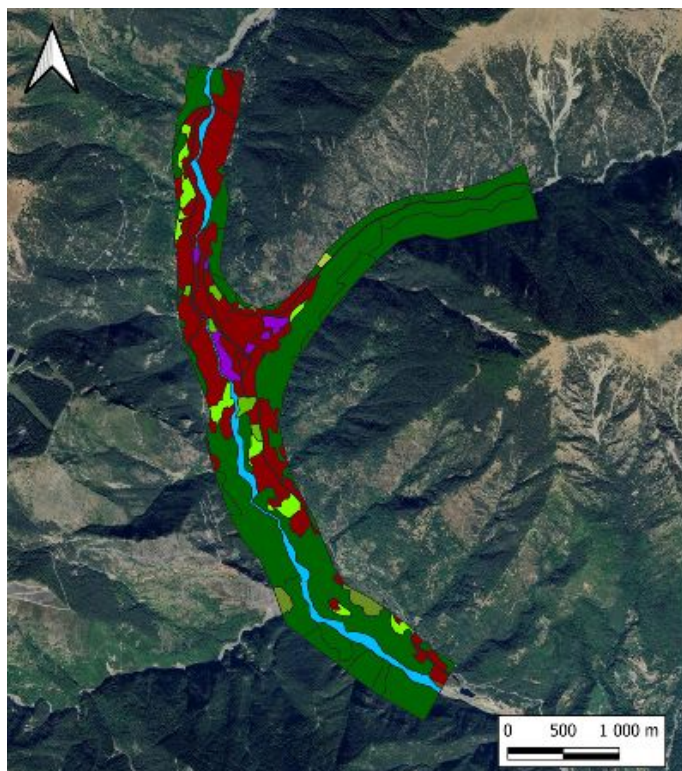
Visualisation of the mesh and the boundaries conditions



Var Catchment - Hydraulic model

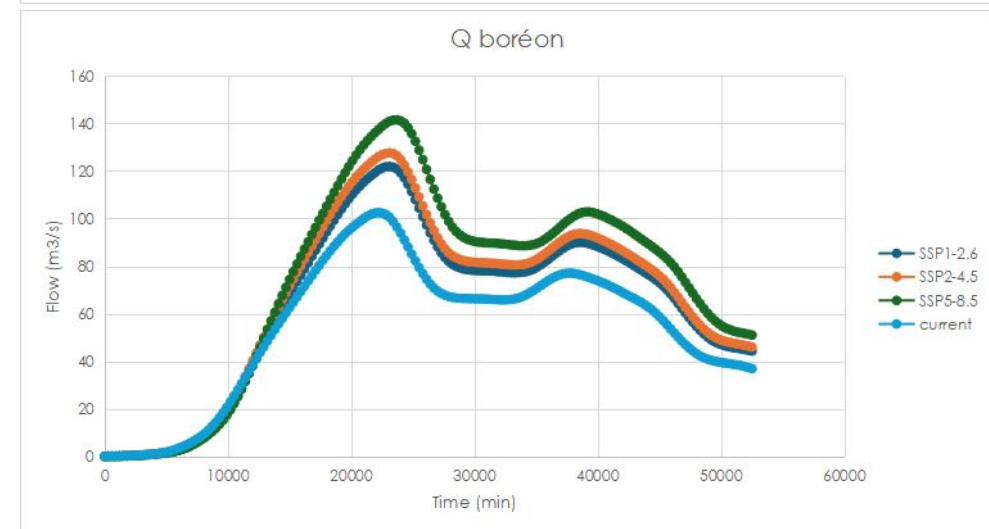
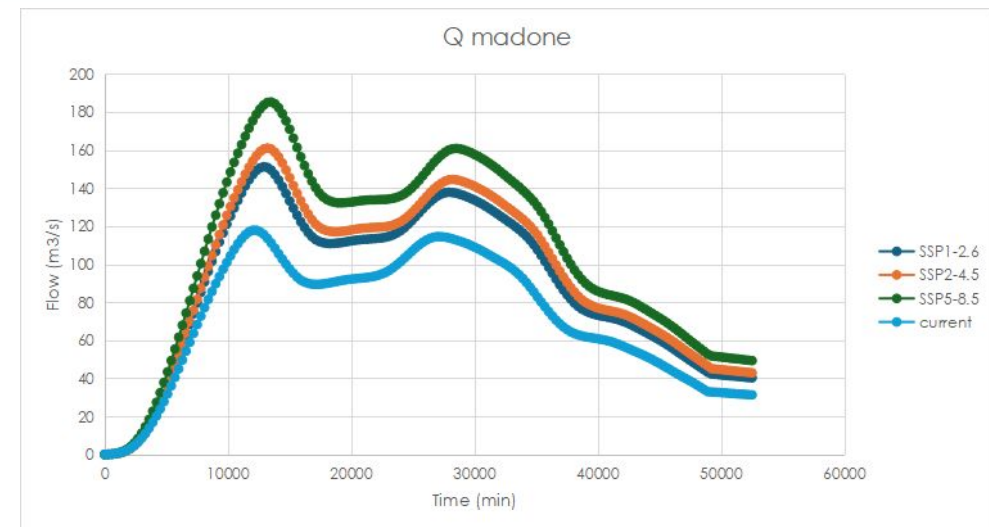
TELEMAC 2D

Landuse Saint Martin de Vésubie



Nature	K Strickler
Artificialized zone	65
Agriculture zone	35
Forest	15
River bed	27

- River bed
- Urban open spaces and recreational areas
- Open spaces with little or no vegetation
- Forests
- Herbaceous vegetation environments
- Mines, landfills and construction sites
- Grasslands
- Industrial or commercial zones and equipment
- Urbanized areas



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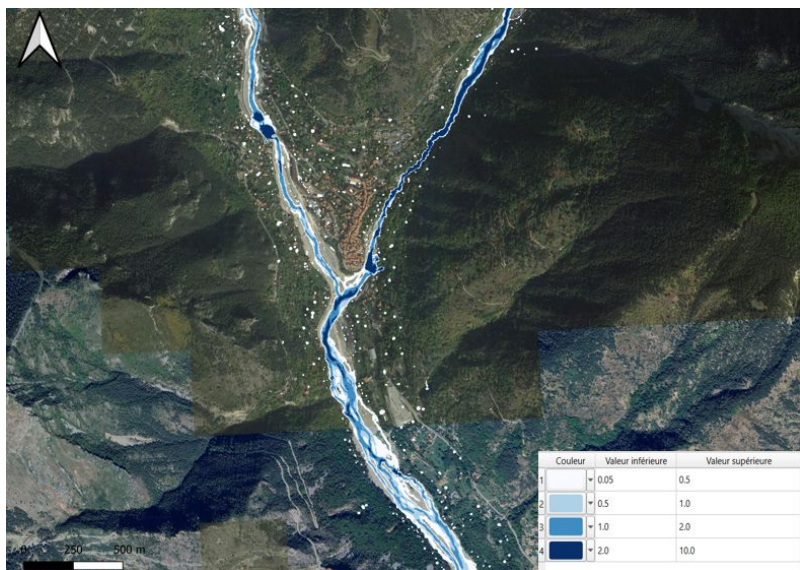


Var Catchment - Hydraulic model

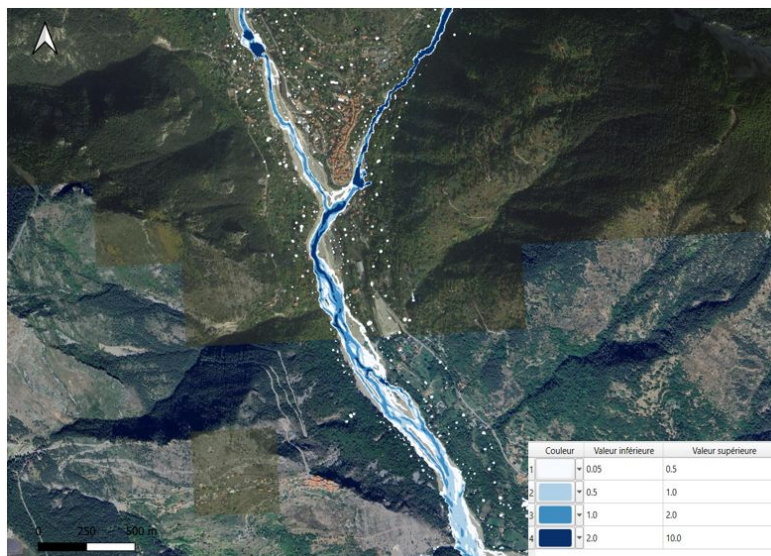
TELEMAC 2D

Result: map flooding (Hmax)

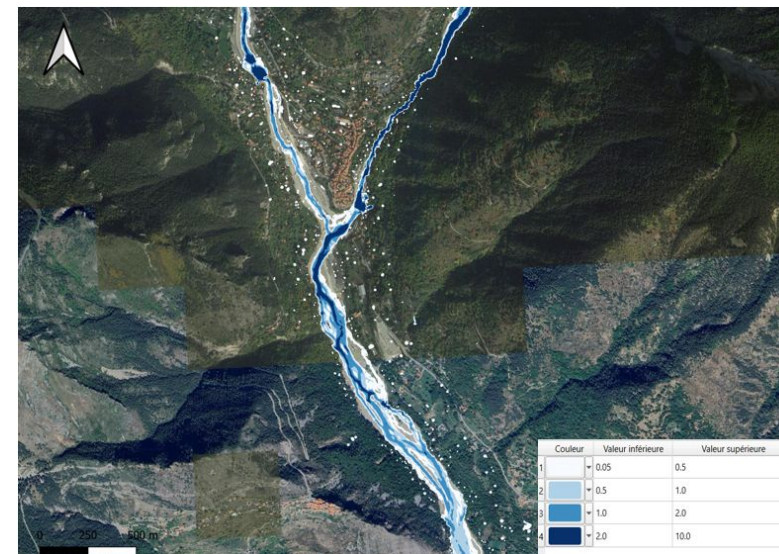
- Water accumulation upstream of bridges,
- Possibility of installing the wwtp: Boréon (less vulnerable), eastern side of Vésubie



Scenario SSP1-2.6



Scenario SSP2-4.5



Scenario SSP5-8.5

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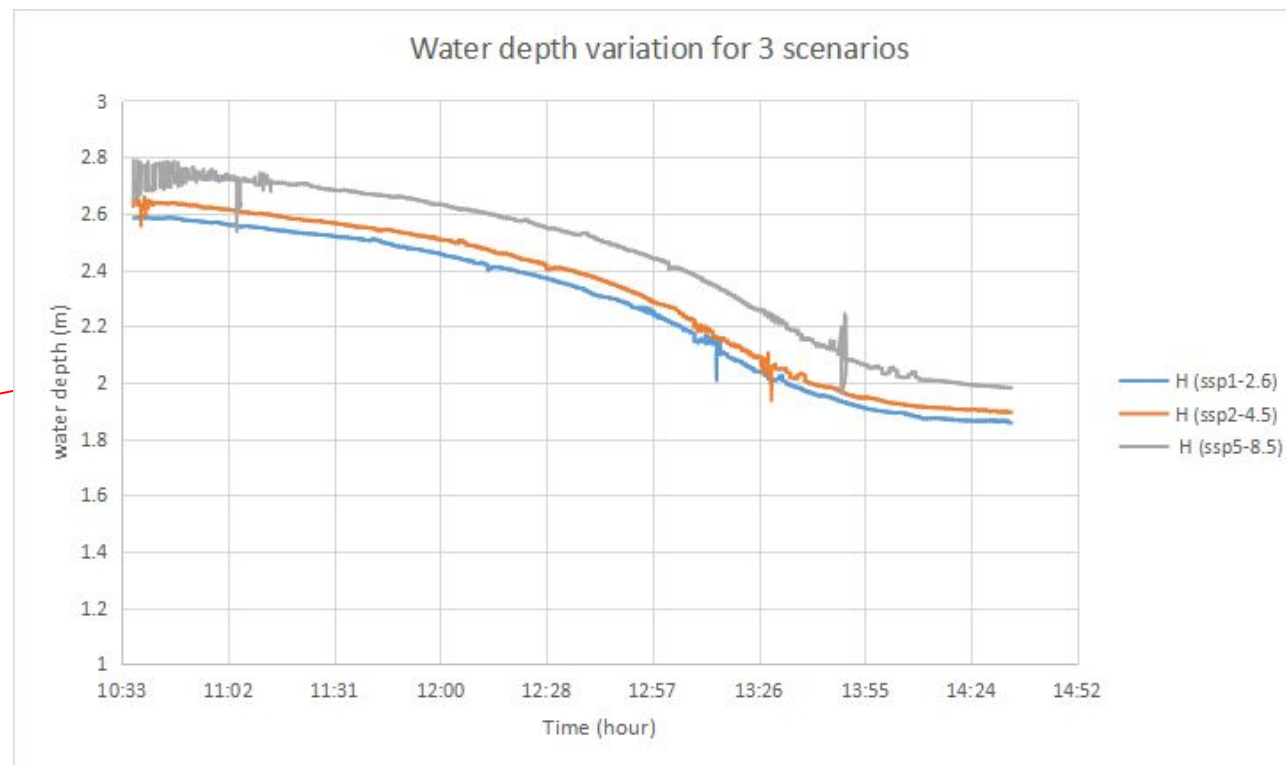
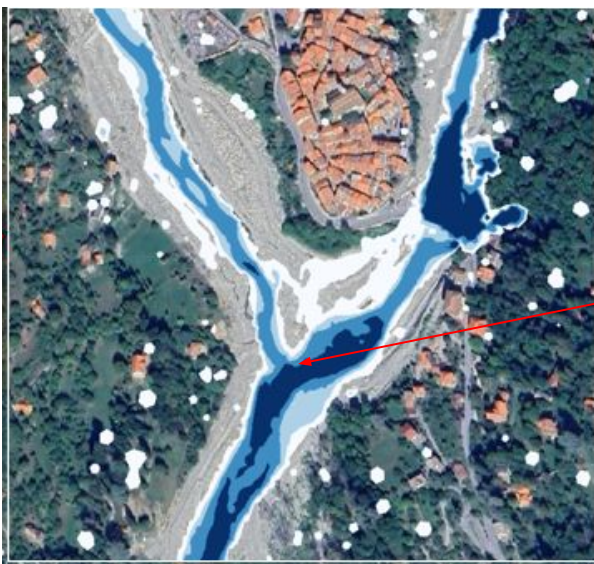
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Var Catchment - Hydraulic model

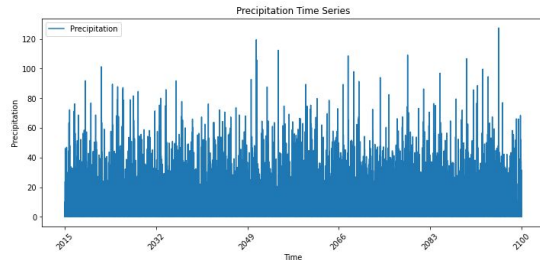
TELEMAC 2D

Result: variation of water depth on the intersection Madone and Boréon



MIKE11 - verification for WWTP location

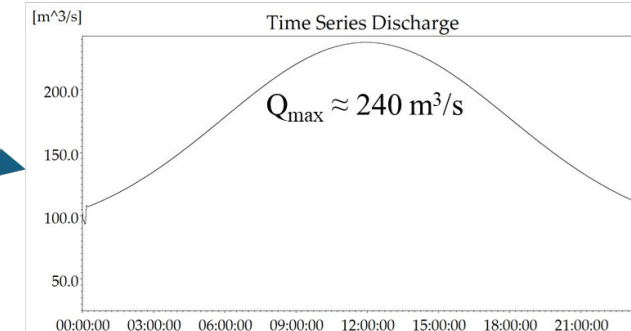
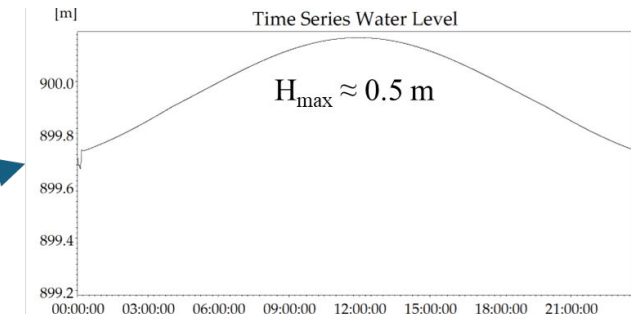
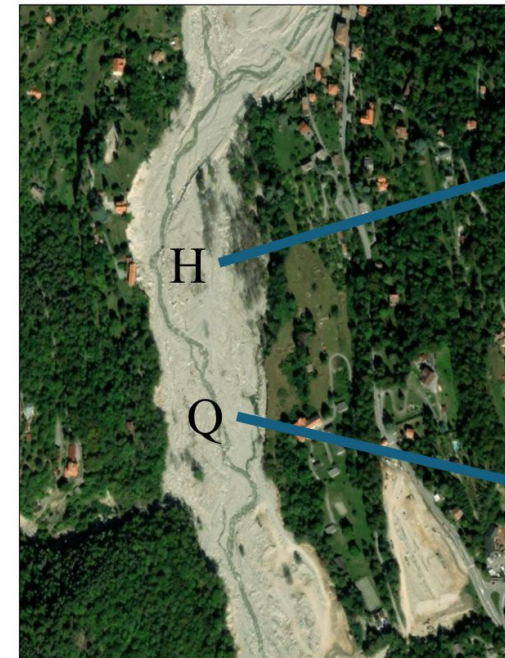
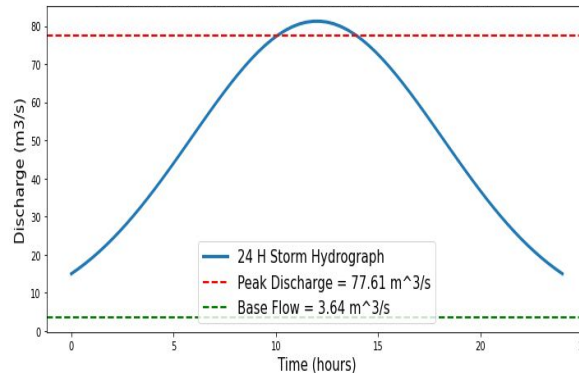
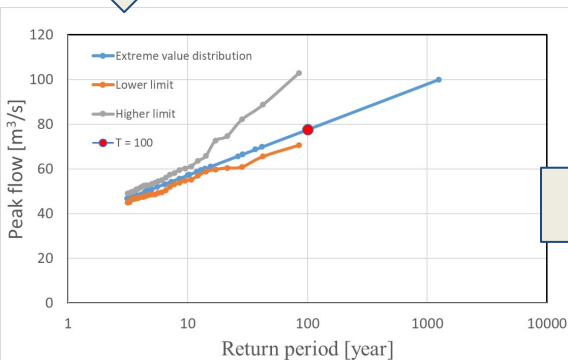
CMIP6 climate projections :
SSP1-2.6, CNRM-CM6-1-HR (France)
Daily precipitation 2015-2100.



Conclusion:

In this context, in the area where the WWTP is located, during a storm event with a return period of 100 years and lasting for 24 hours, the discharge and water level of the river in that area can reach up to 240 cubic meter per second and 0.5 meter, respectively. This level of impact is similar to that experienced during the Aline storm in October 2020.

Precipitation to Surface runoff via HEC-HMS.
Hydrological extreme value analysis via WETSPRO.
[<https://bwk.kuleuven.be/hydr/pwtools.htm>]



Normal distribution + T100yr Peak flow

→ Input hydrograph for MIKE 11

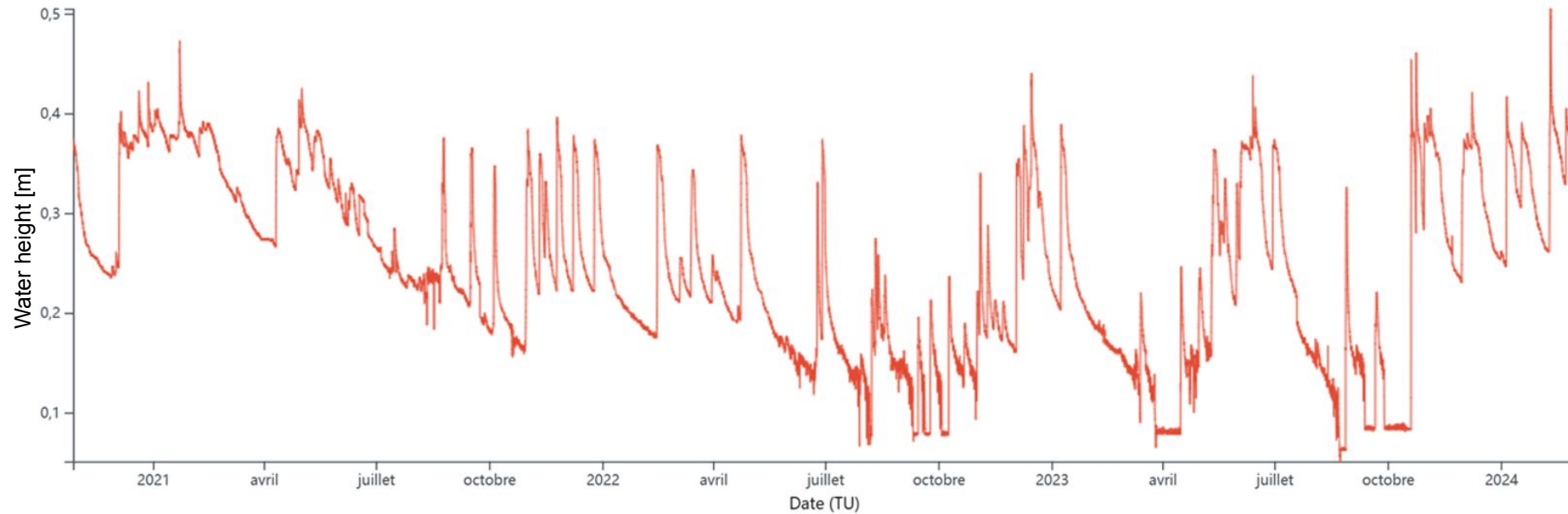
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MIKE11 - verification for WWTP location



Potential risk Δ

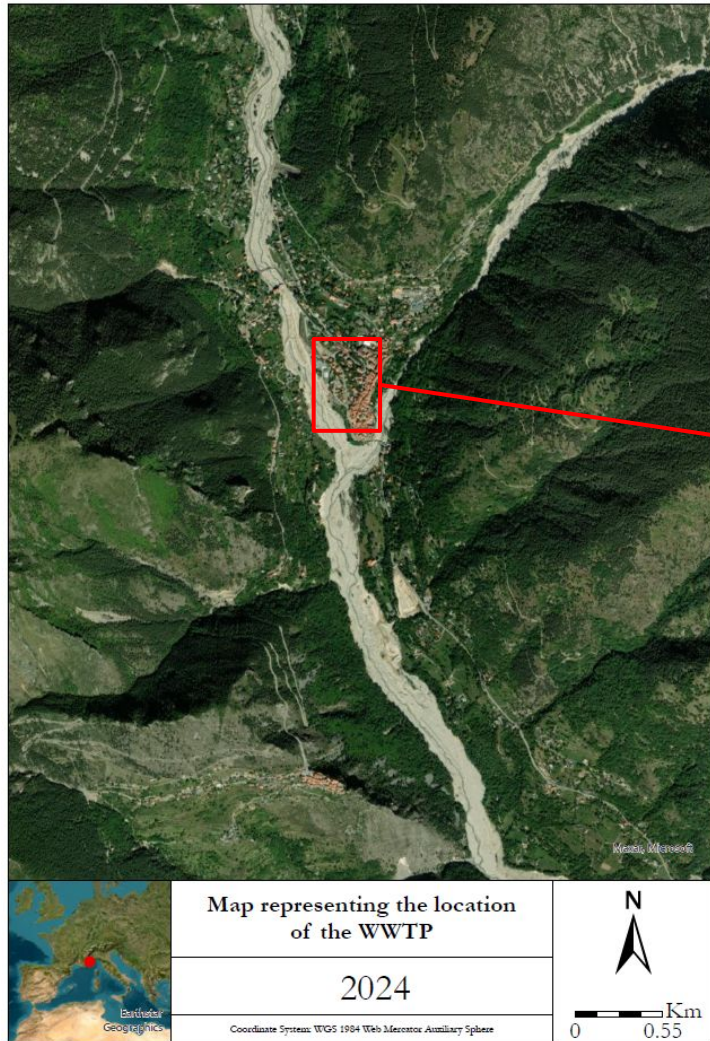
H_{\max} 0.45~0.65 m

Q_{\max} 219.6~309.8 m³/s

Number of gauge station : Y651-7010

- Minimum observed the 23/08/2023 : 0.051 m
- Maximum observed the 10/02/2024 : 0.505 m

Var Catchment - Locations of the WWTP



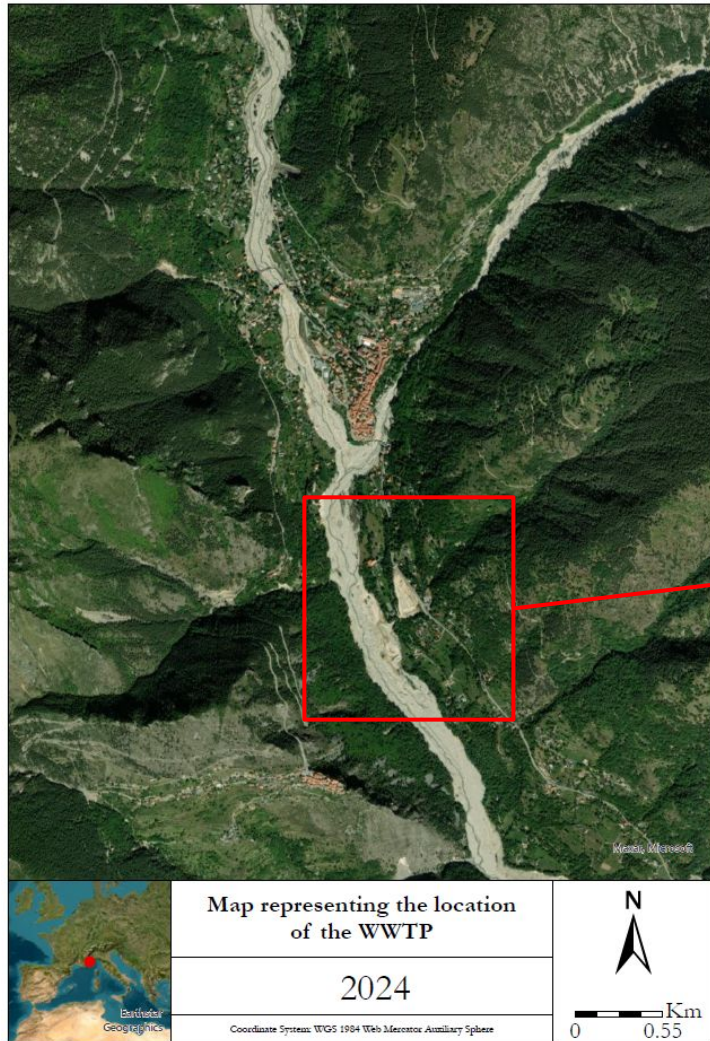
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Var Catchment - Locations of the WWTP



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Thanks for your attention !

Any questions ?