Understanding the Tordera storm (2022)
La Tordera catchment

- TEAM 12 -

- OUALID
- IBRAHIM
- AYMANE
- ERNESTO
- MARTA
- AMADOU
- LAMINE
- BORIS
- SARAH

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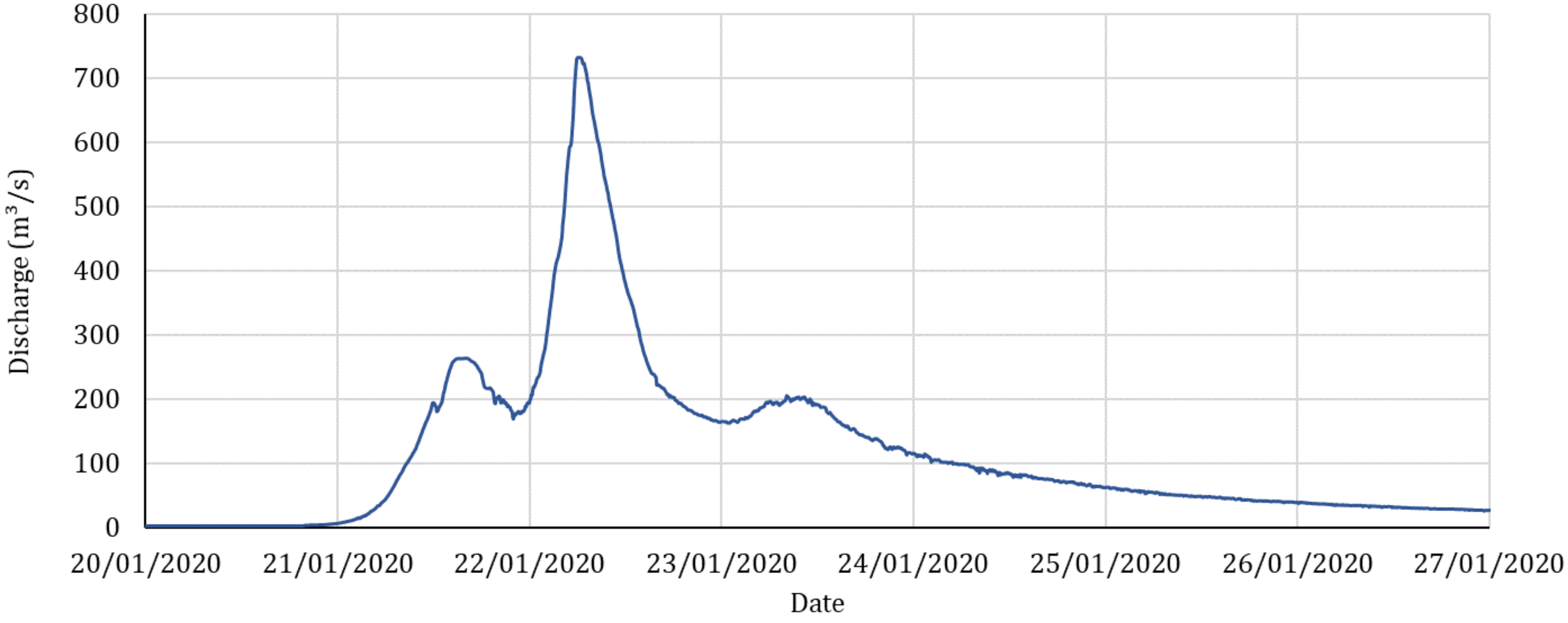
Study area

- Mainly forestry
- Accentuated orographic gradient
- Soil already saturated before the event

Tordera river

- Torrentuous nature
- Precipitation seasonality
- Prone to flash floods ("*torderades*")

Discharge of La Tordera river during the event



Rain gauge analysis (1)

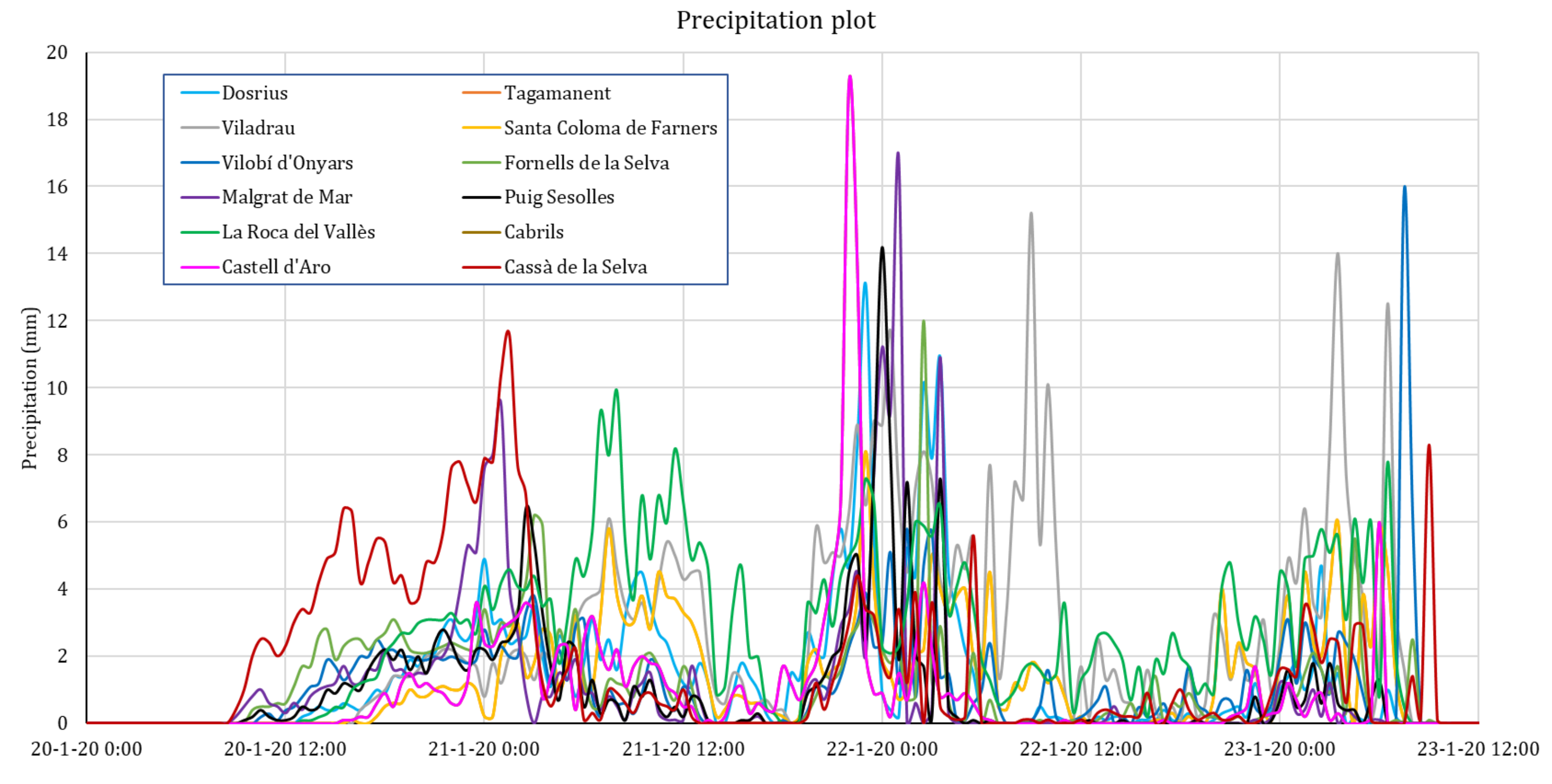
Methodology:

1. Statistical analysis

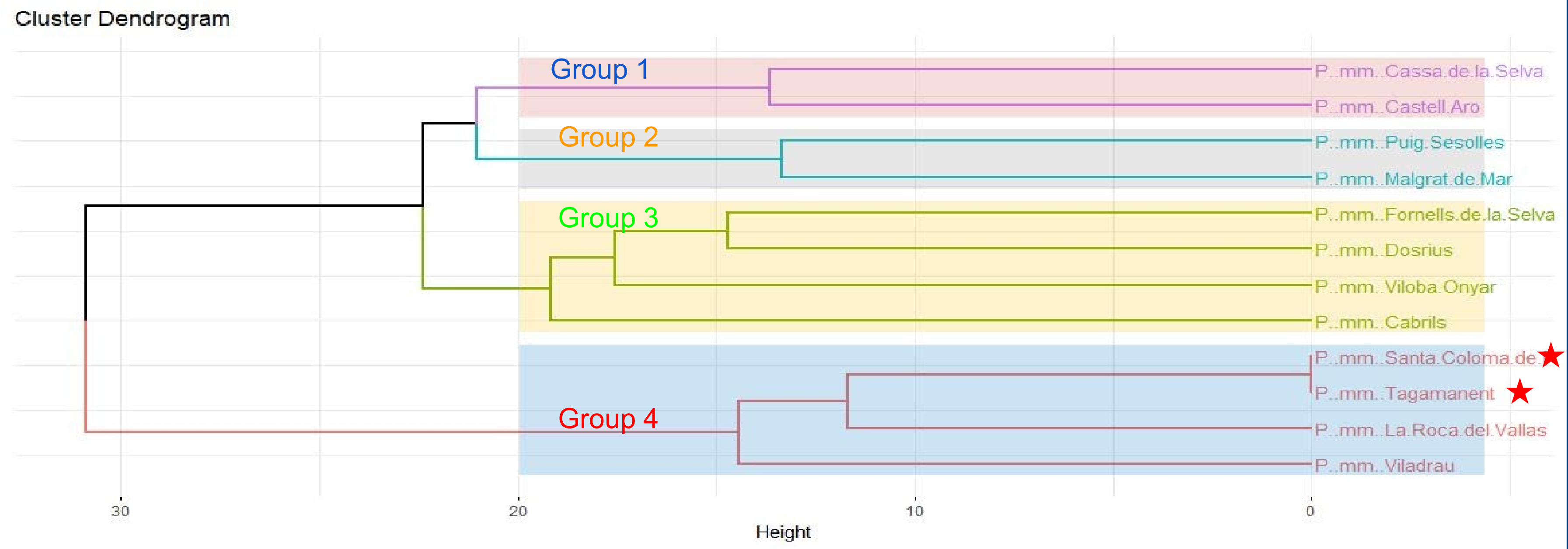
1. Hierarchical bottom-up clustering

1. Geographical analysis

Rain gauge analysis (2)

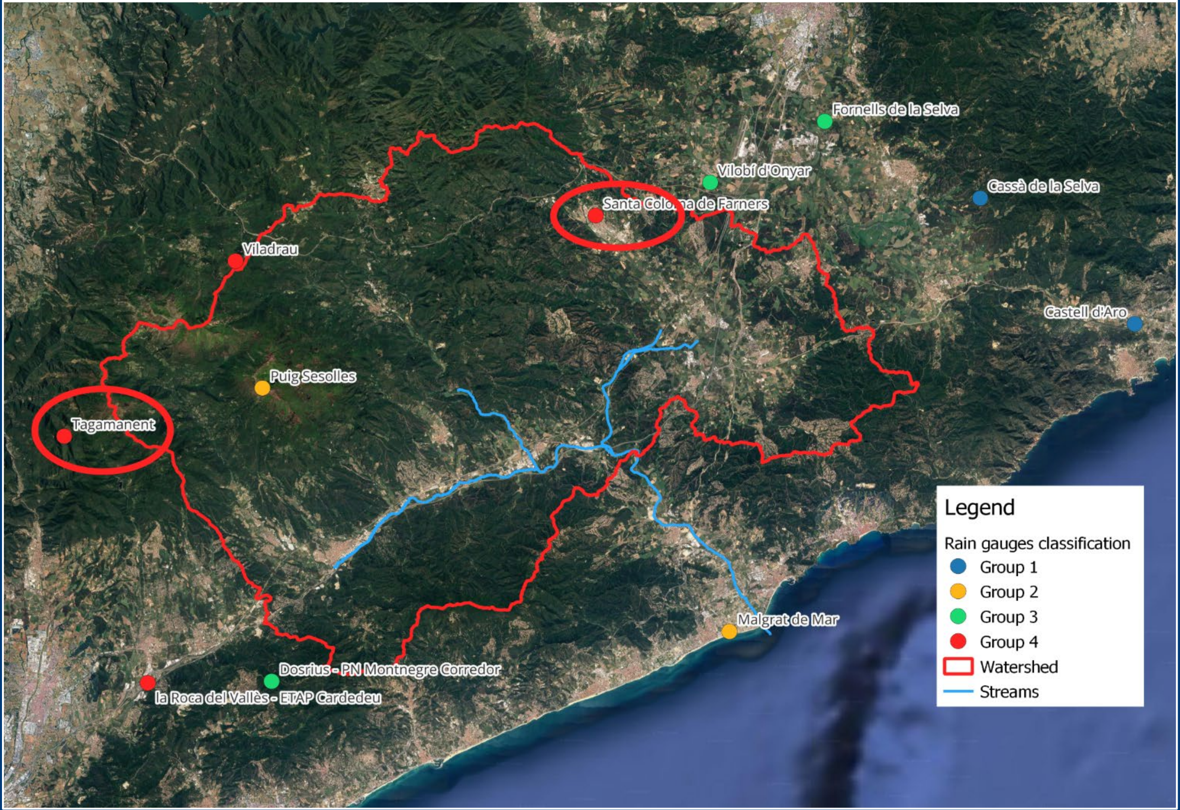


Rain gauge analysis (3)

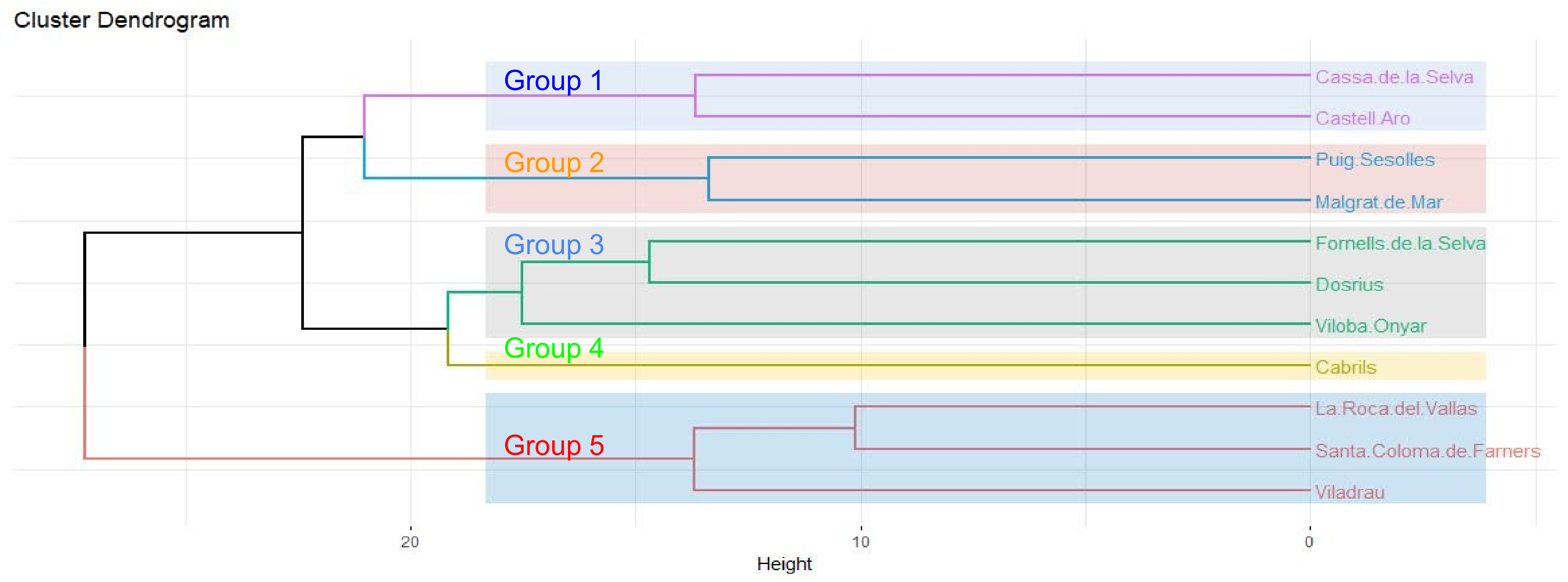


We notice the same rainfall series for the two stations: Santa Coloma and Tagamanent

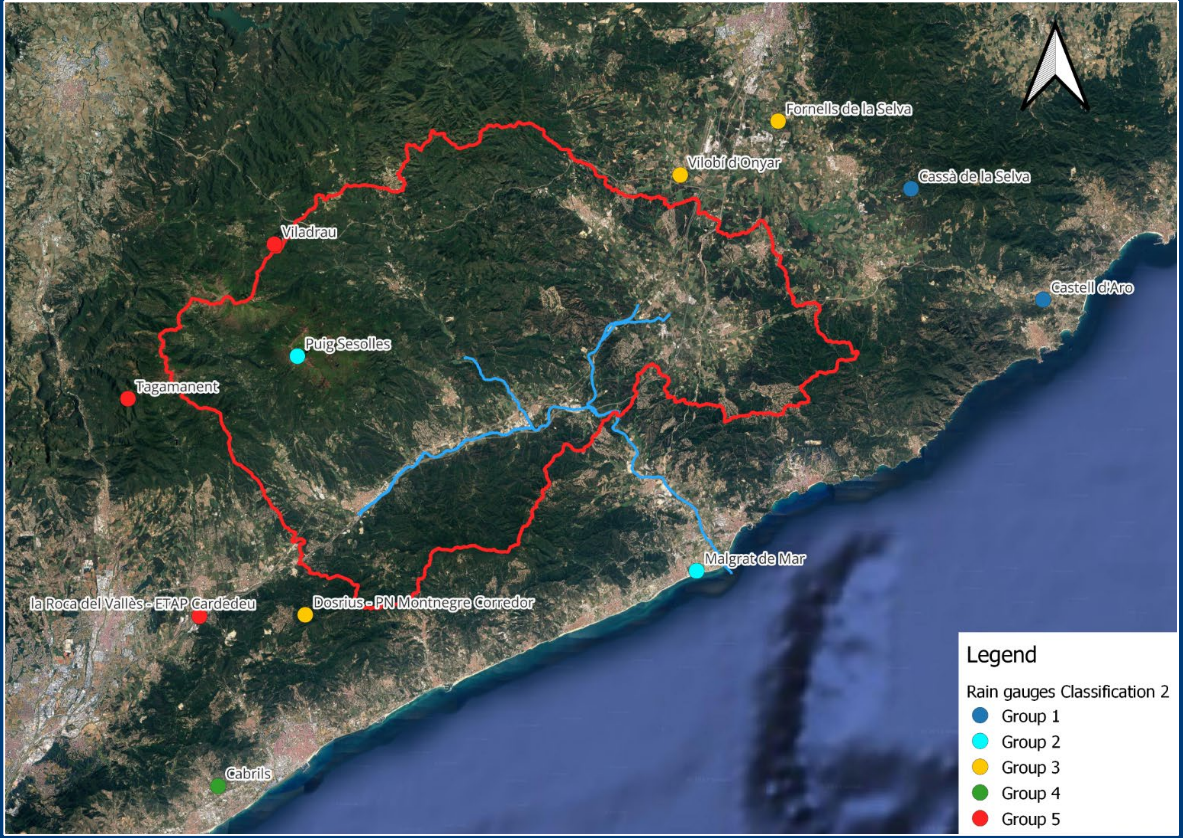
Rain gauge analysis (4)



Rain gauge analysis (5)



Rain gauge analysis (6)



Selected rain gauges

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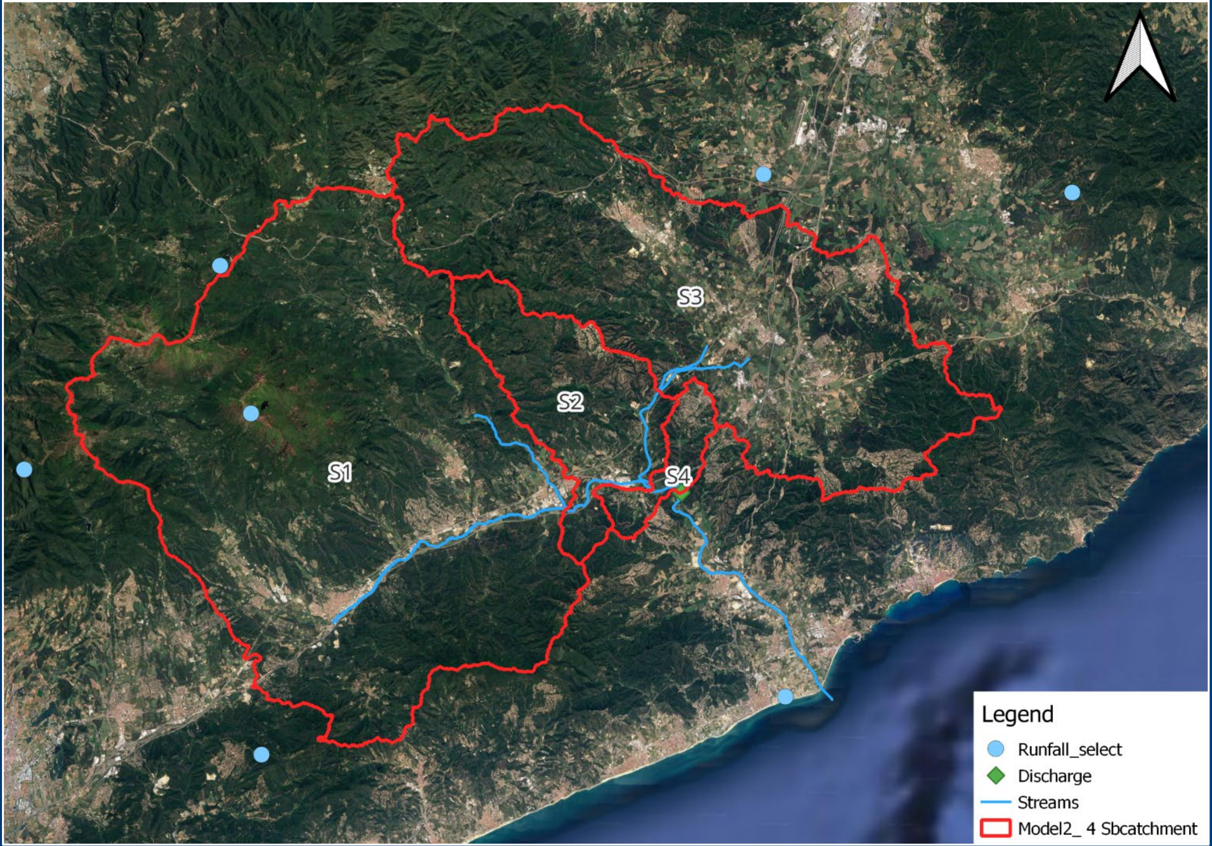
Hydrologic model

- Created 3 hydrologic models using **HEC-HMS** with:
  - **3 subcatchments**
  - **4 subcatchments**
  - **5 subcatchments**

- We chose the model that presented the best results after several tests, which is the one with **4 subcatchments.**

Hydrologic model



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Model Parameters

Before Calibration

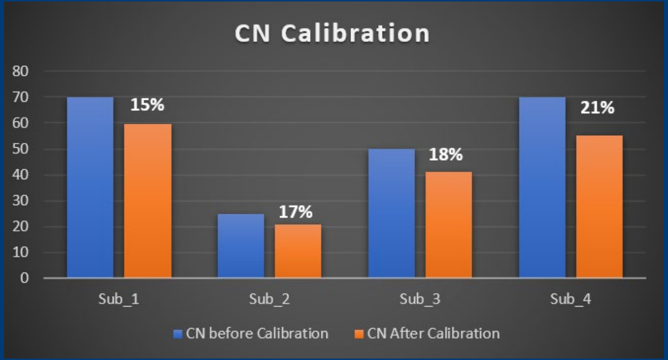
- Loss Method - SCS Curve Number
- Transform Method - SCS Unit Hydrograph
- Routing - Muskingum Method

After Calibration

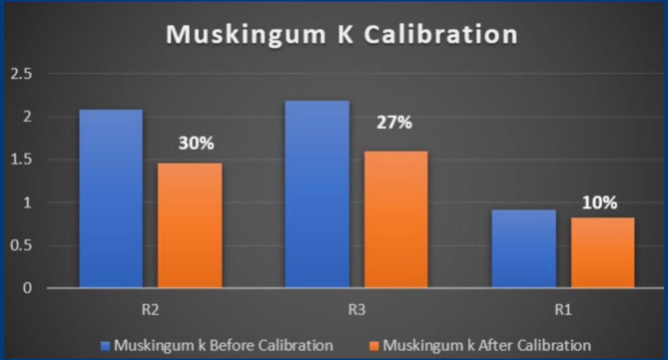
- Loss Method - SCS Curve Number
- Transform Method - SCS Unit Hydrograph
- Routing - Muskingum Method
- Baseflow method - Recession Constant - Initial discharge

Model Parameters - Calibration

- **Curve Number**



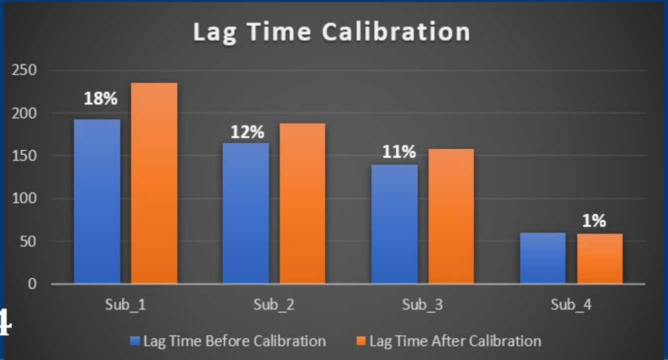
- **Routing - Muskingum**



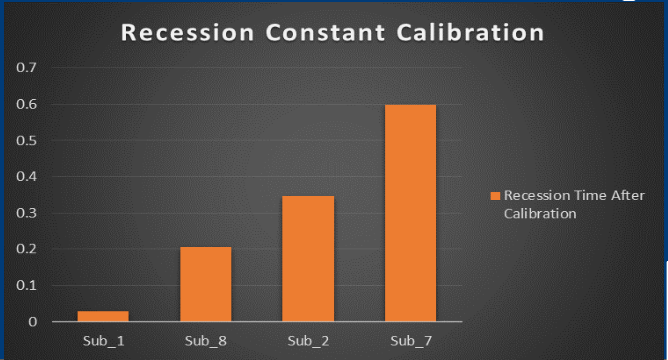
Before Calibration

After Calibration

- **Lag Time**



- **Recession-Initial discharge**



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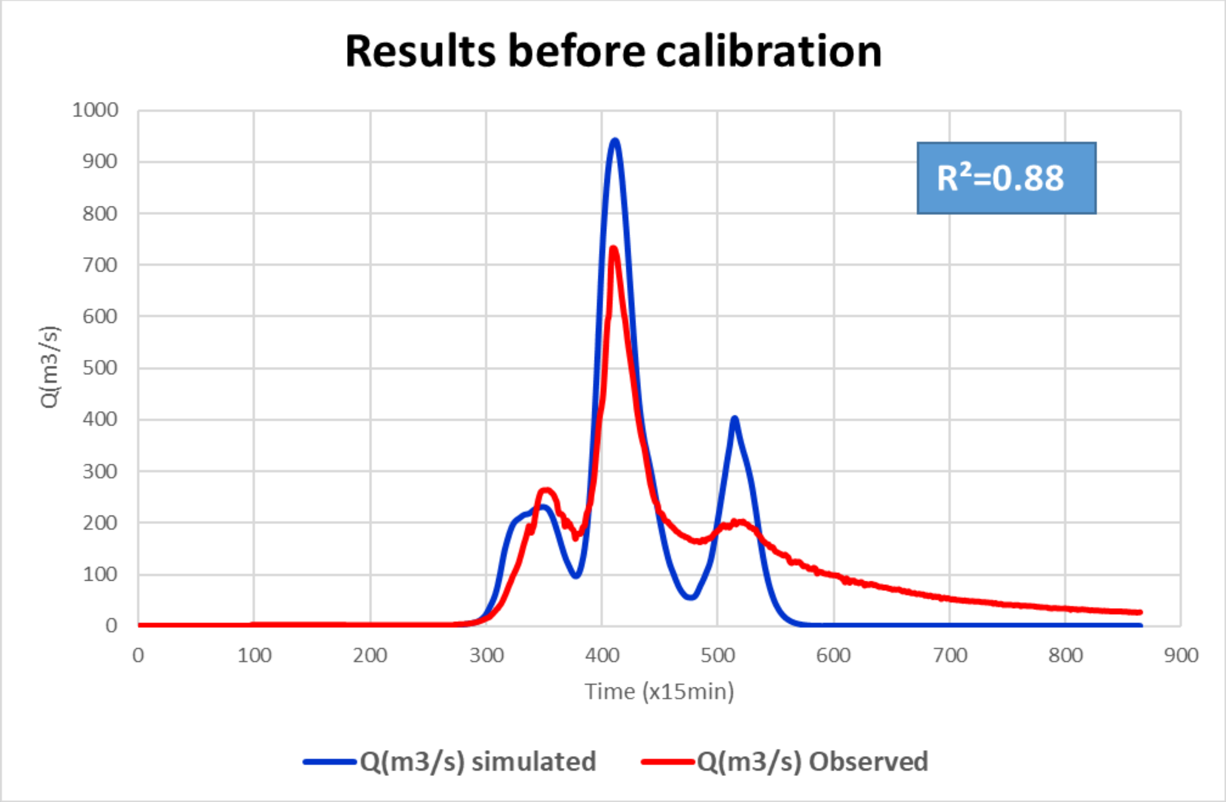
Results - Before Calibration



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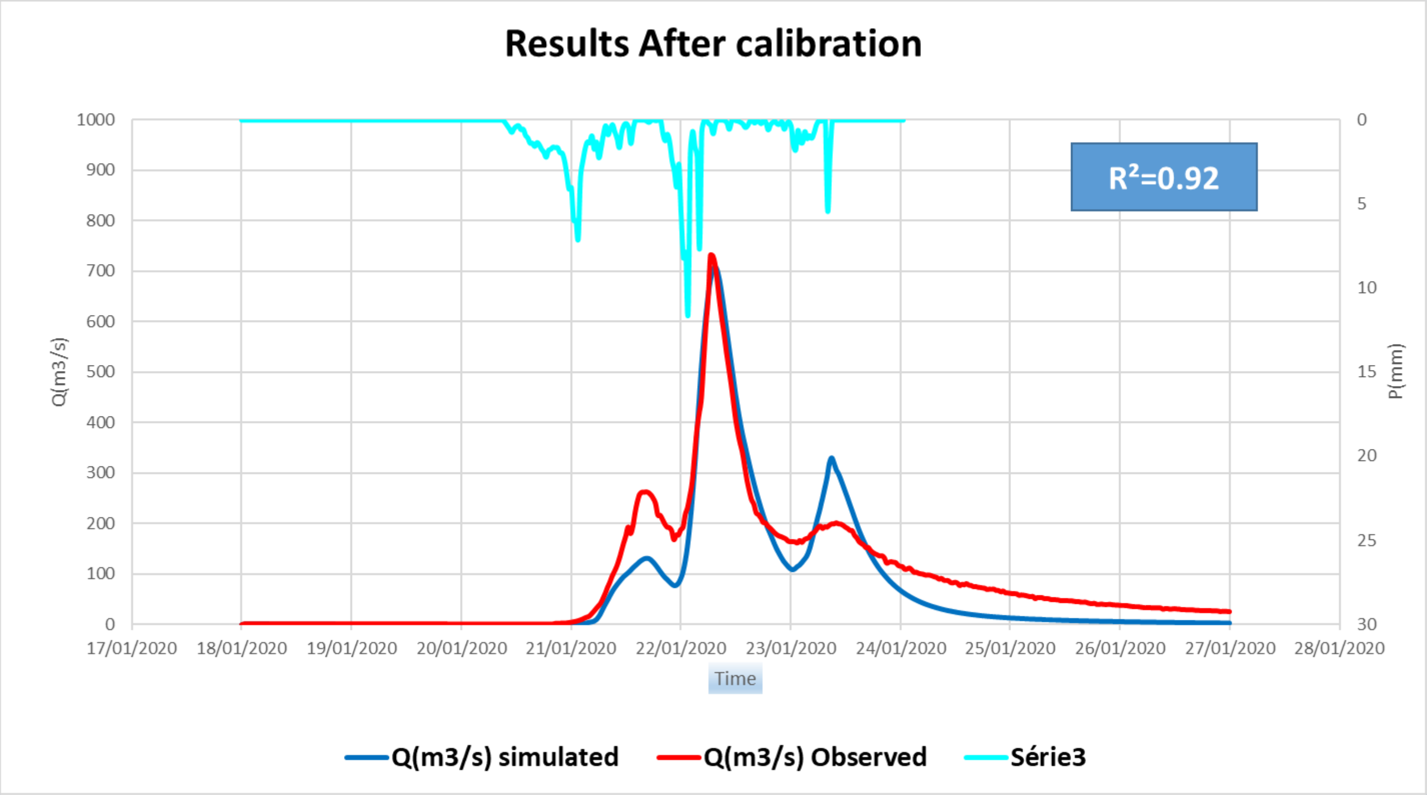
Results - Before Calibration

diffence between intense peak	22%
time to peak difference	Same time
Volume difference	33%

Results - After Calibration



Results - After Calibration

Summary

Intense Peak discharge ☑

Secondary Peak discharge ☒

Time to peak ☑

Volume of water ☒

Volume difference	25%
diffence between intense peak	3%
time to peak difference	At the same time

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Uncertainty analysis

The two biggest sources of uncertainty in this case are :

- The structure of the model, in particular the assumptions made in estimating the parameters of the methods used and the ability of these methods to reproduce real field conditions.
- The reliability of the data: especially the accuracy of measurements in extreme weather conditions

How to reduce uncertainty ?

- Change the methods used in the model
- Establish more rain gauges inside the catchment
- Establish more discharge stations to get finer measurements
- Take into account solid transport which can affect flow measurements

Conclusions

- Despite the uncertainty problems involved in this case, the reproduction of flood rise time and peak discharge are relatively reliable and have shown very good results.
- Hydrological models should be used with caution, and the results should be interpreted with a degree of caution and care.
- Hydrological models are sensitive to climatic variations, such as precipitation patterns. These variations can be difficult to predict accurately, which can lead to uncertainties in hydrological models.

Thank you for your attention

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