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# A physically-based and data-driven hydrological model for CSO mitigation through stormwater disconnection strategies

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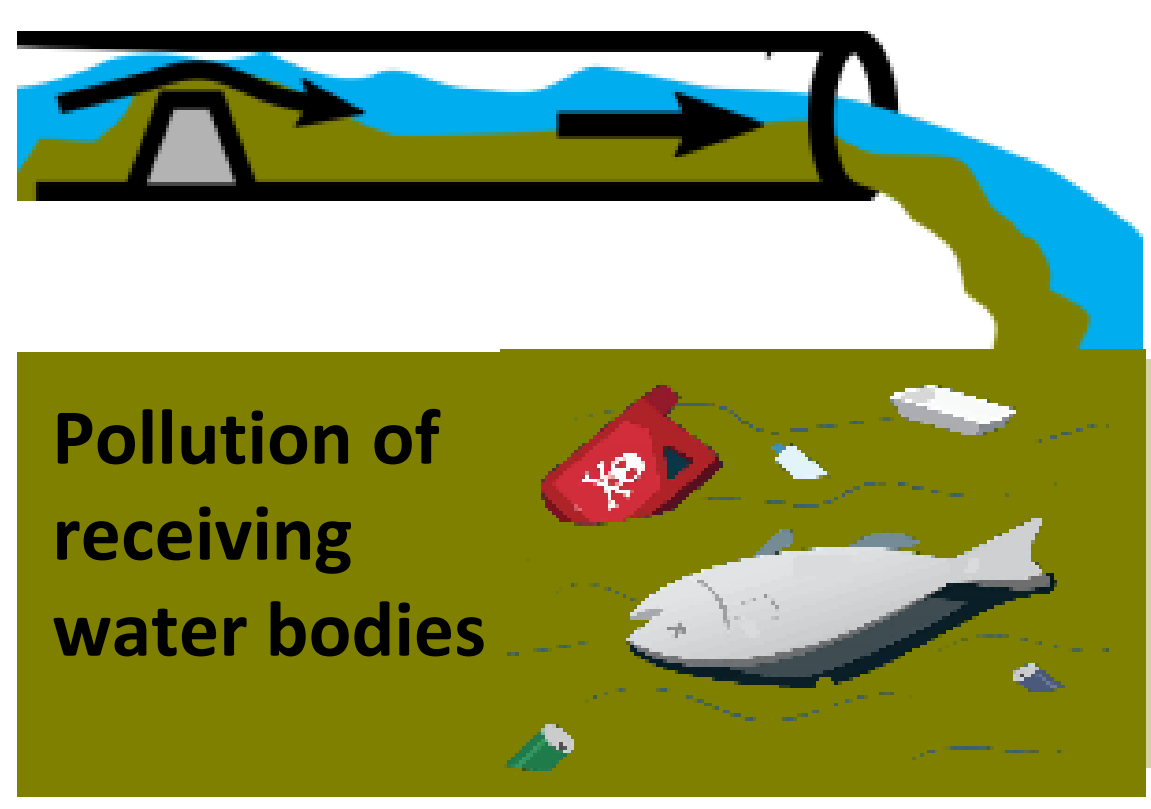
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# Un modèle hydrologique basé sur les données physiques pour la réduction des déversements par des stratégies de déconnexion des eaux pluviales

## A physically-based and data driven hydrological model for CSO mitigation through stormwater disconnection strategies

Context

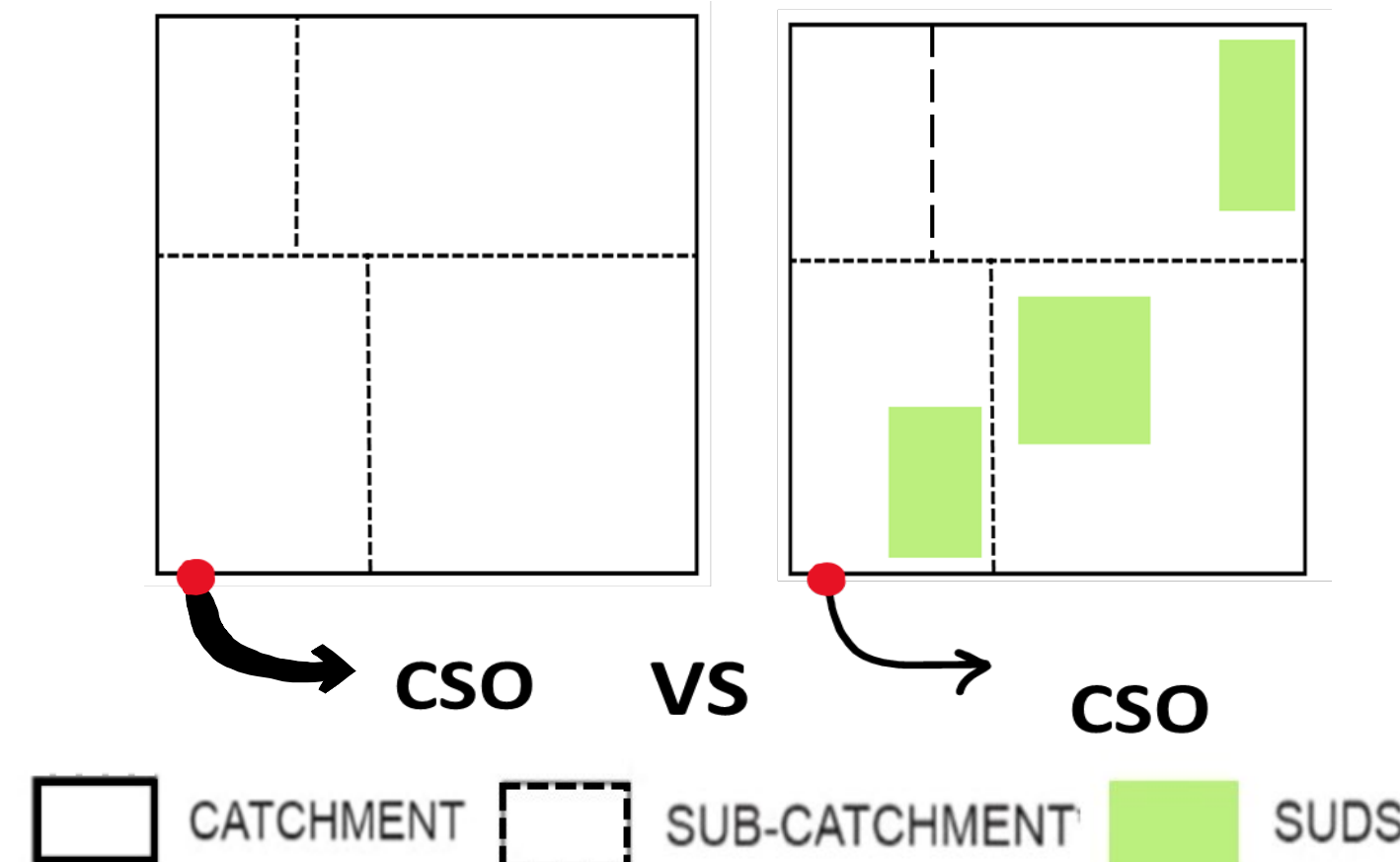
### Combined Sewer Overflow (CSO) impacts



### CSO mitigation through Sustainable Urban Drainage Systems (SUDS)



### Modelling the effects of spatially distributed SUDS



### Need for methods and knowledge to develop planning tools for CSO mitigation

- Which model of the key processes involved to enable scenario exploration
- How to build and feed the model in a context of data scarcity
- Practically, which improvement can be expected depending on the SUDS configuration?

ISSUES

## Objectives

**#1** Development of a physically-based parsimonious model for mitigating CSO volume through SUDS

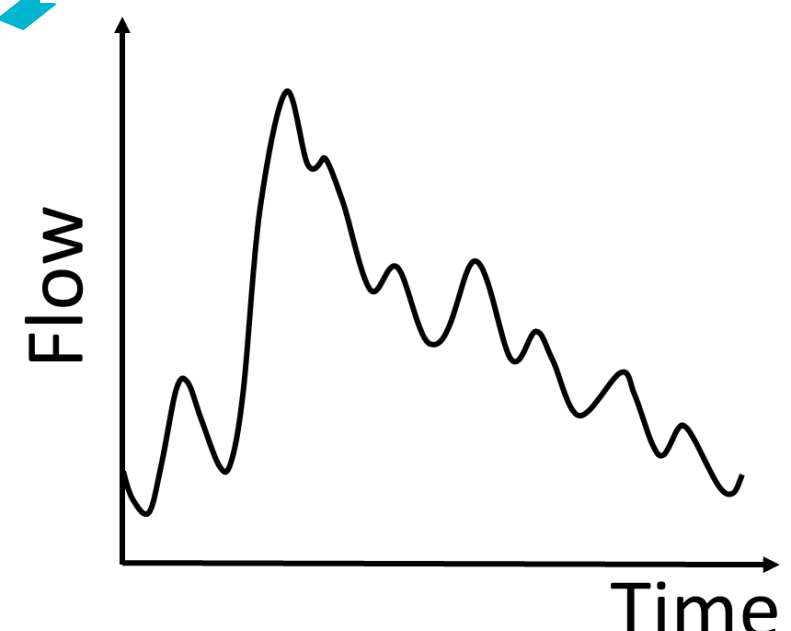
**#2** Account for infiltration inflow and quantify its contribution to CSO

**#3** Test the performance of global disconnection strategies to mitigate CSO volumes

Methodology

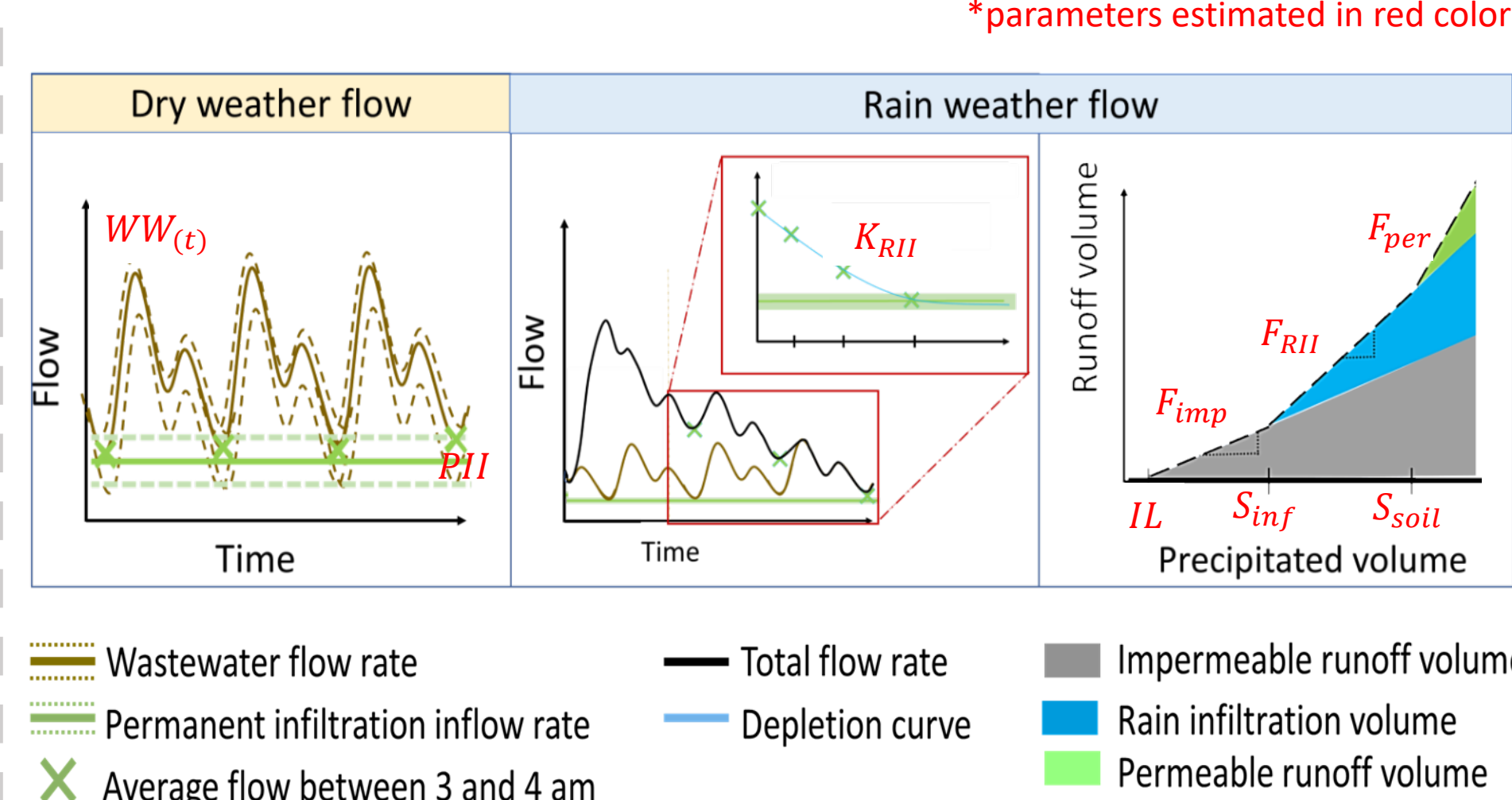
### Data-driven model

#### Available data used to build the model

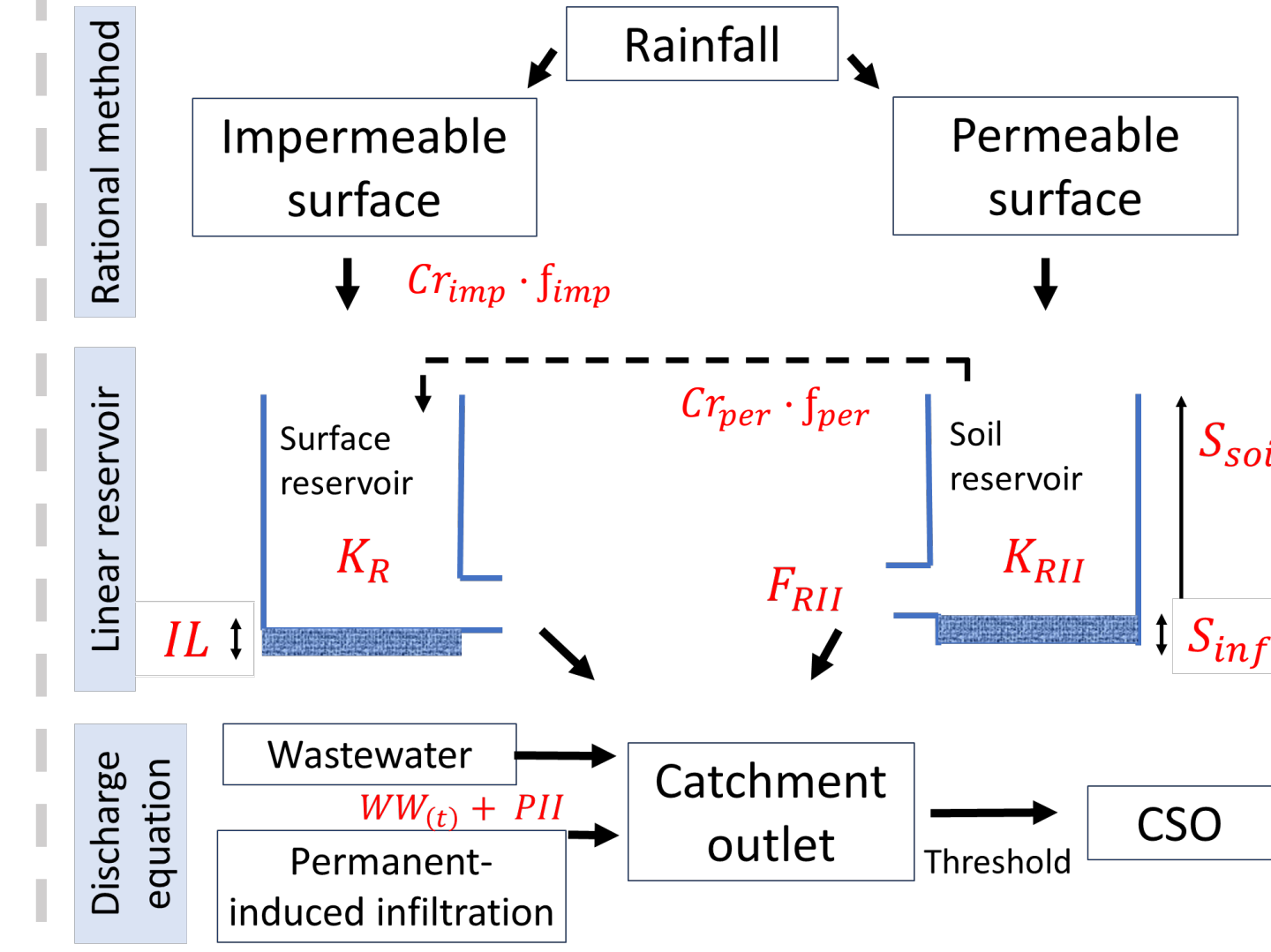


- Monitored flow rate at the catchment outlet
- Monitored rainfall
- Catchment characteristics

#### Extraction of information



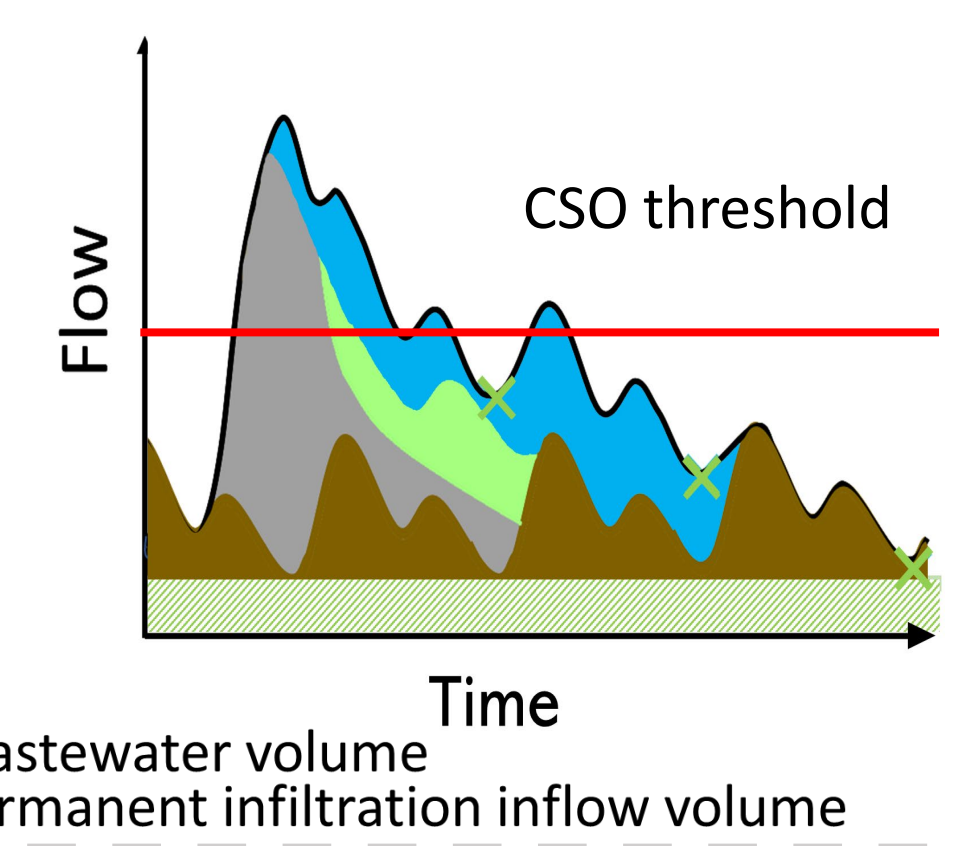
#### Conceptual model



#1 ✓

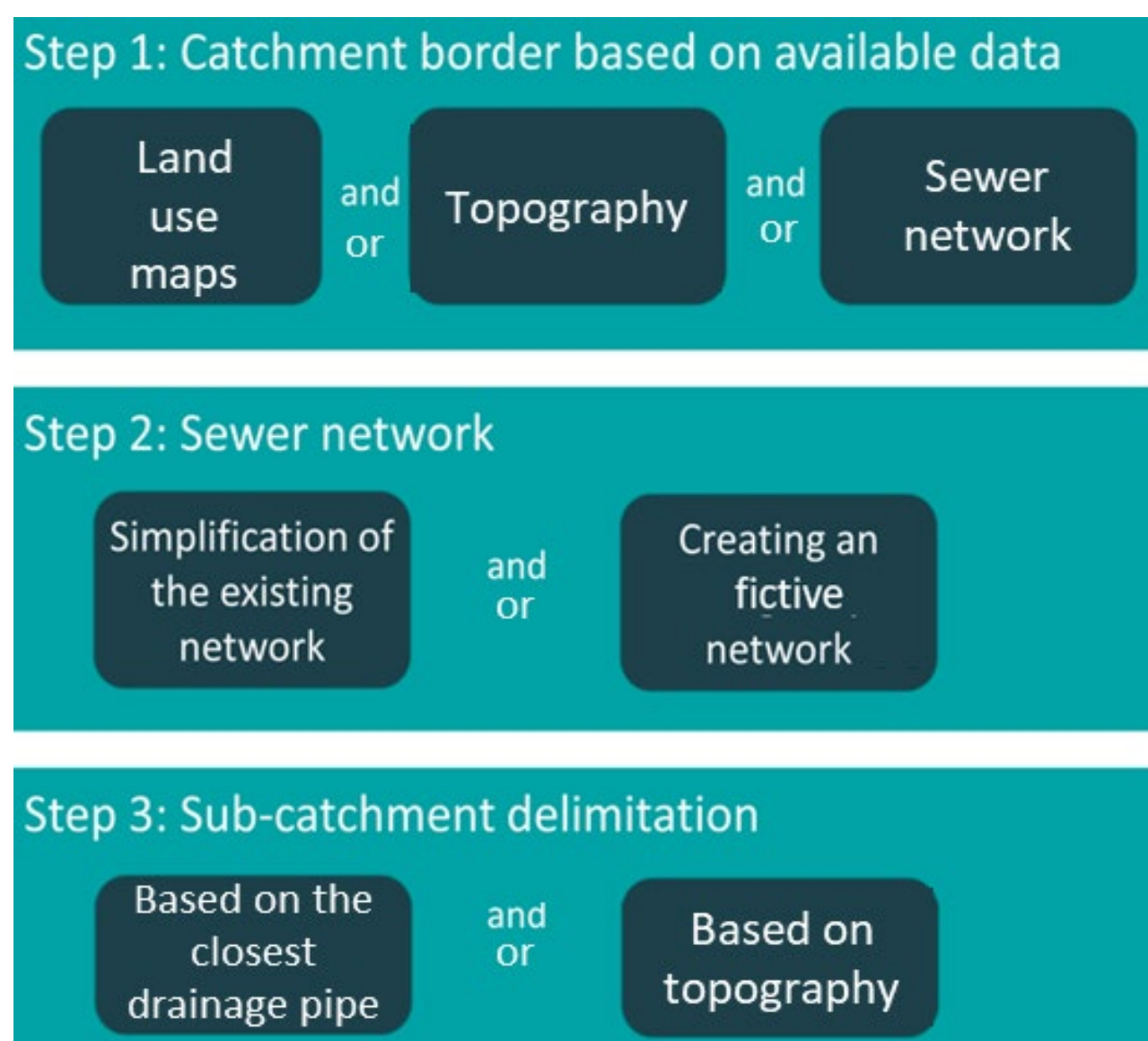
#### Outputs

- Decomposition of the hydrograph
- Global parameters calibrated
- CSO volumes and frequencies

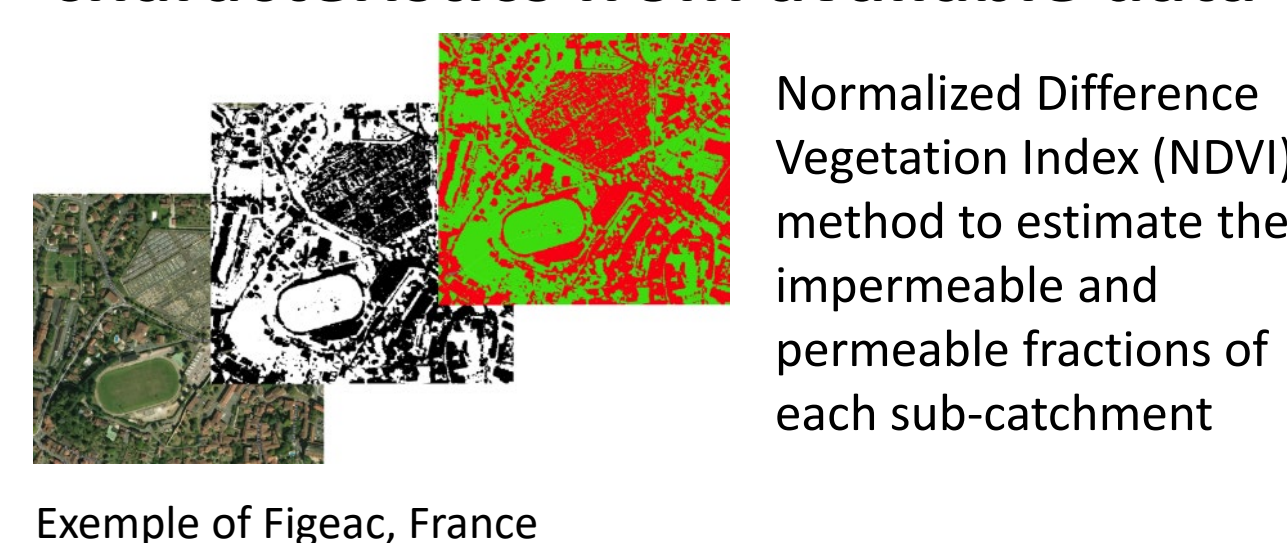


### Spatial discretization

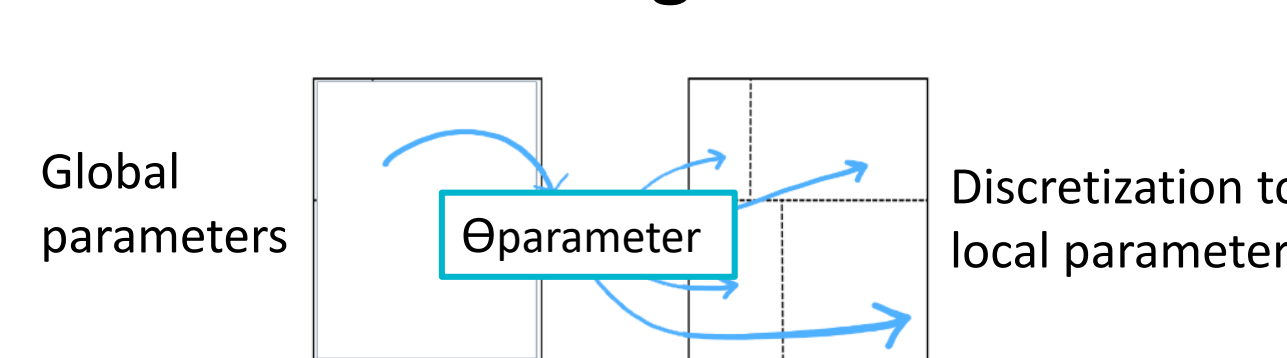
#### Procedure for the delimitation of the sub-catchment area



#### Getting sub-catchment land use characteristics from available data



#### Distribution of parameters based on their global estimation



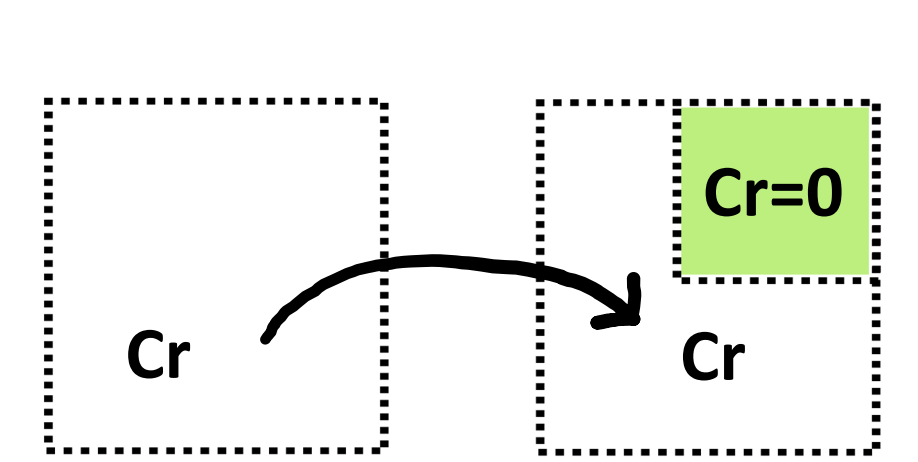
#### Calibration & evaluation

- Parameters distributed in each sub-catchment
- Two remaining parameters to be calibrated
- KGE criteria for the flow rate upstream the CSO
- Relative error of the total CSO volume

### Global disconnection scenarios

#### Two approaches

Merge SUDS into an equivalent sub-catchment with specific properties

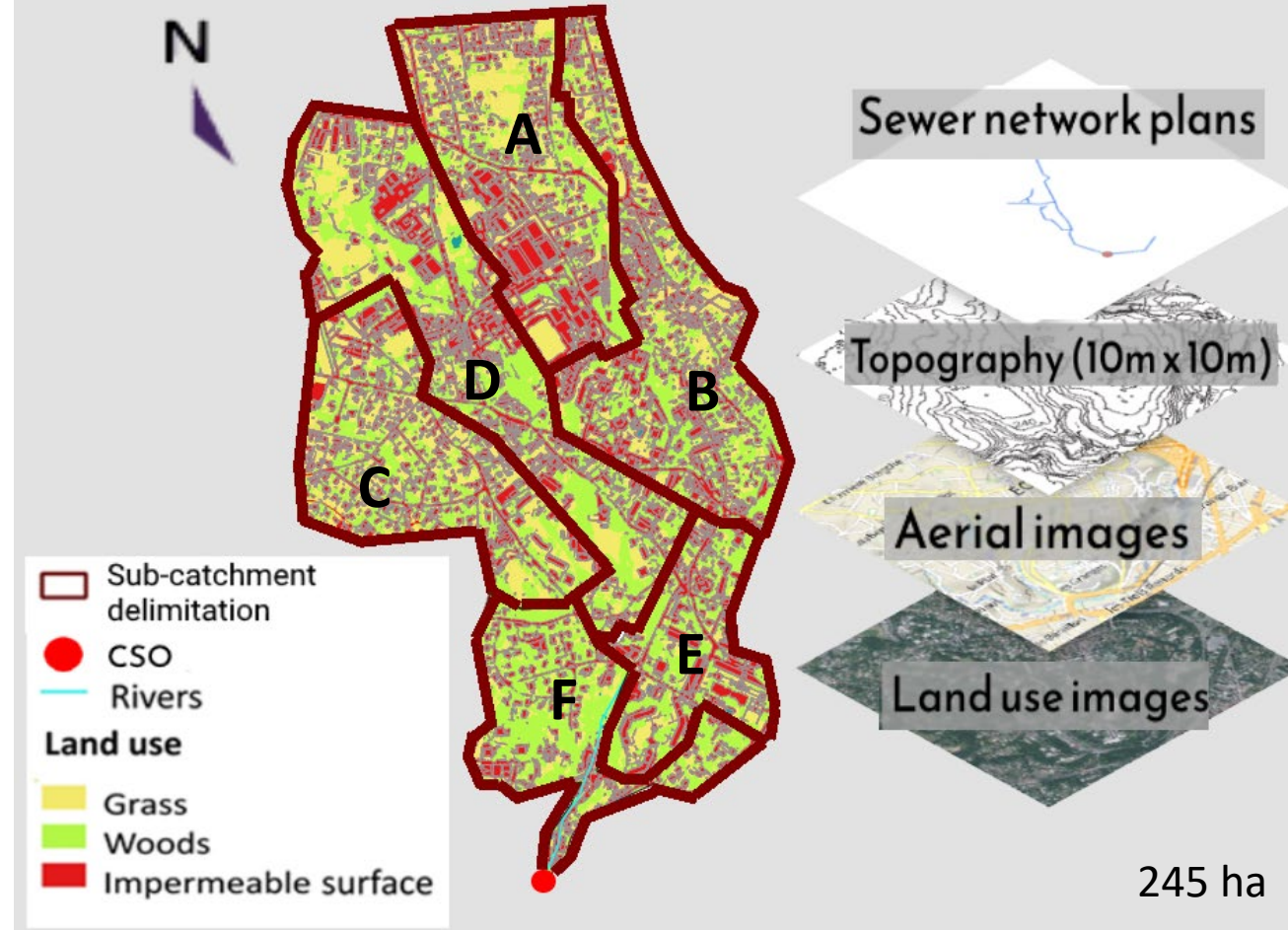


Modify the initial losses (IL)

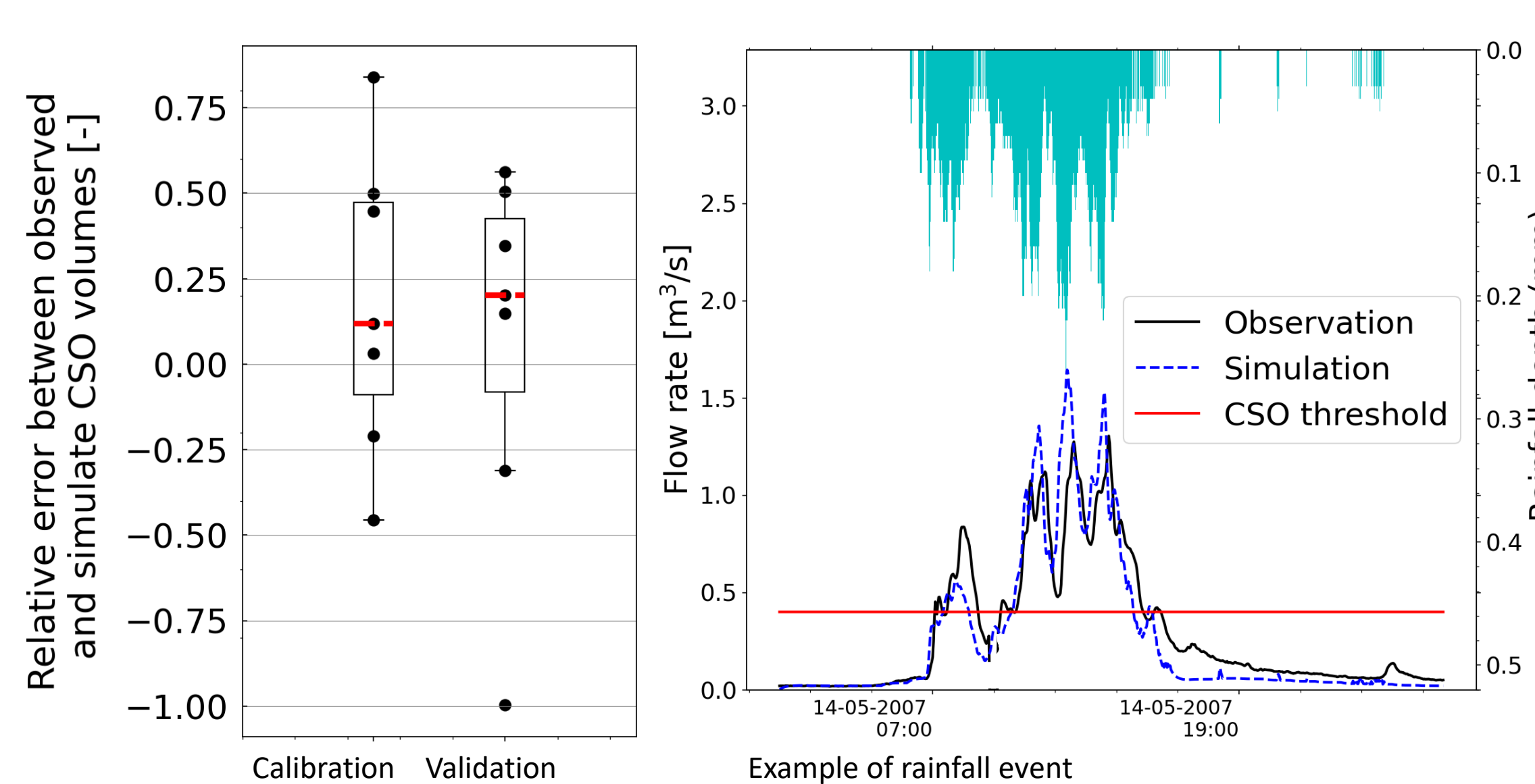


Results

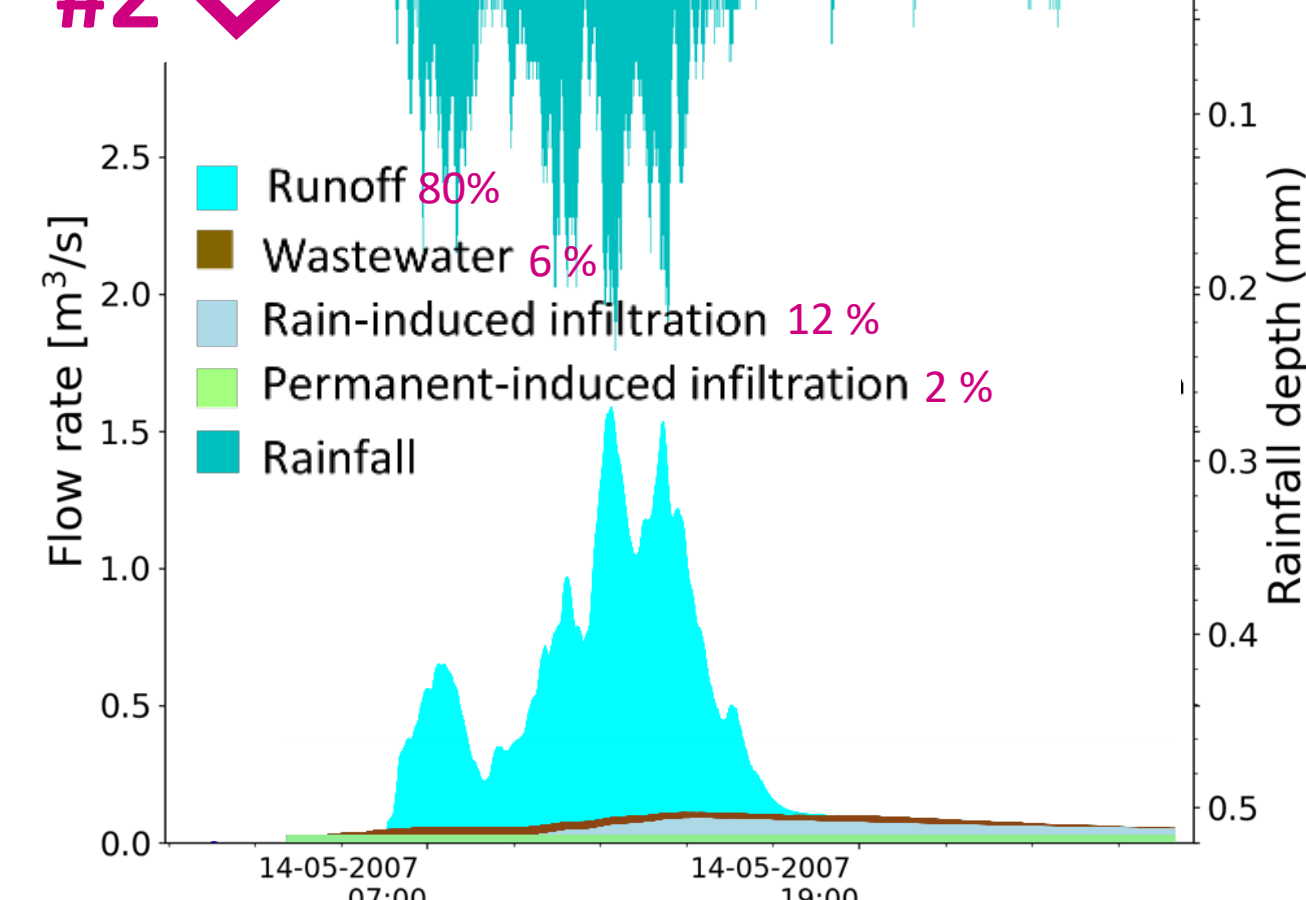
### Sub-catchment delineation according to available geographic information



### Calibration and validation

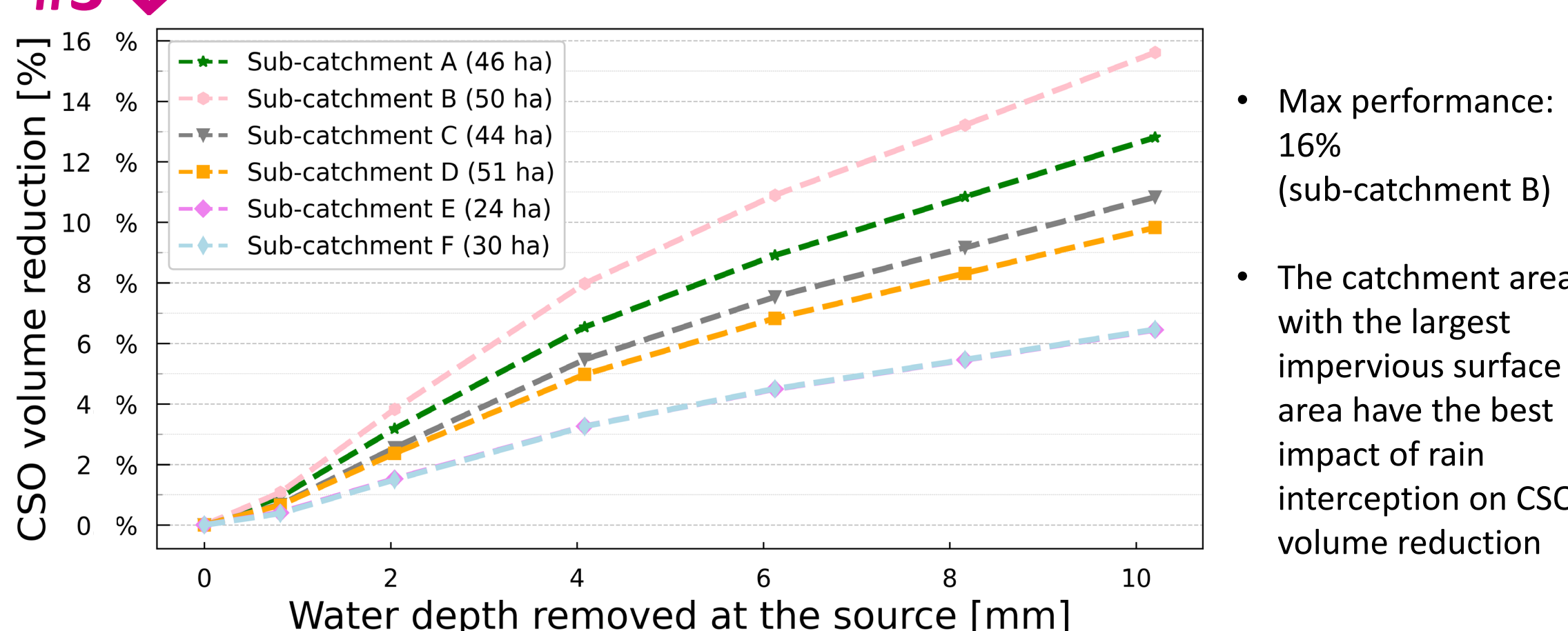


#2 ✓



#3 ✓

### Performance of SUDS



- Max performance: 16% (sub-catchment B)
- The catchment areas with the largest impervious surface area have the best impact of rain interception on CSO volume reduction

Conclusions & perspectives

- The observations of each component's behaviors guided the construction of a **simple and parsimonious model**
  - Nine parameters** have been calibrated from data pretreatment using observed data
  - An approach was propose for **catchment discretization** (even in case of scarce data)
  - The model shows the **capability to replicate the observed hydrograph and the proportion of each component that reached the CSO structure**
  - The different **scenarios tested within each sub-catchment indicate the effort required to reduce CSO volumes by sub-catchment**
- Perspectives :**
- Identify and characterize the priority sub-catchment to disconnect
  - Implement of simplified infiltration models to simulate SUDS at catchment scale