Input Variable Selection and Calibration Data Selection for Storm Water Quality Regression Models

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Outline

- Problem statement
- Case and data
- Methods
- Results and discussion
- Conclusions

Problem statement

- Storm water quality models are a useful tool in storm water management.
- Interests grow in analyzing existing data to develop models.
- Regression for storm water quality modeling is a common method.

Problem statement

Context: Regression model for modeling storm water quality.

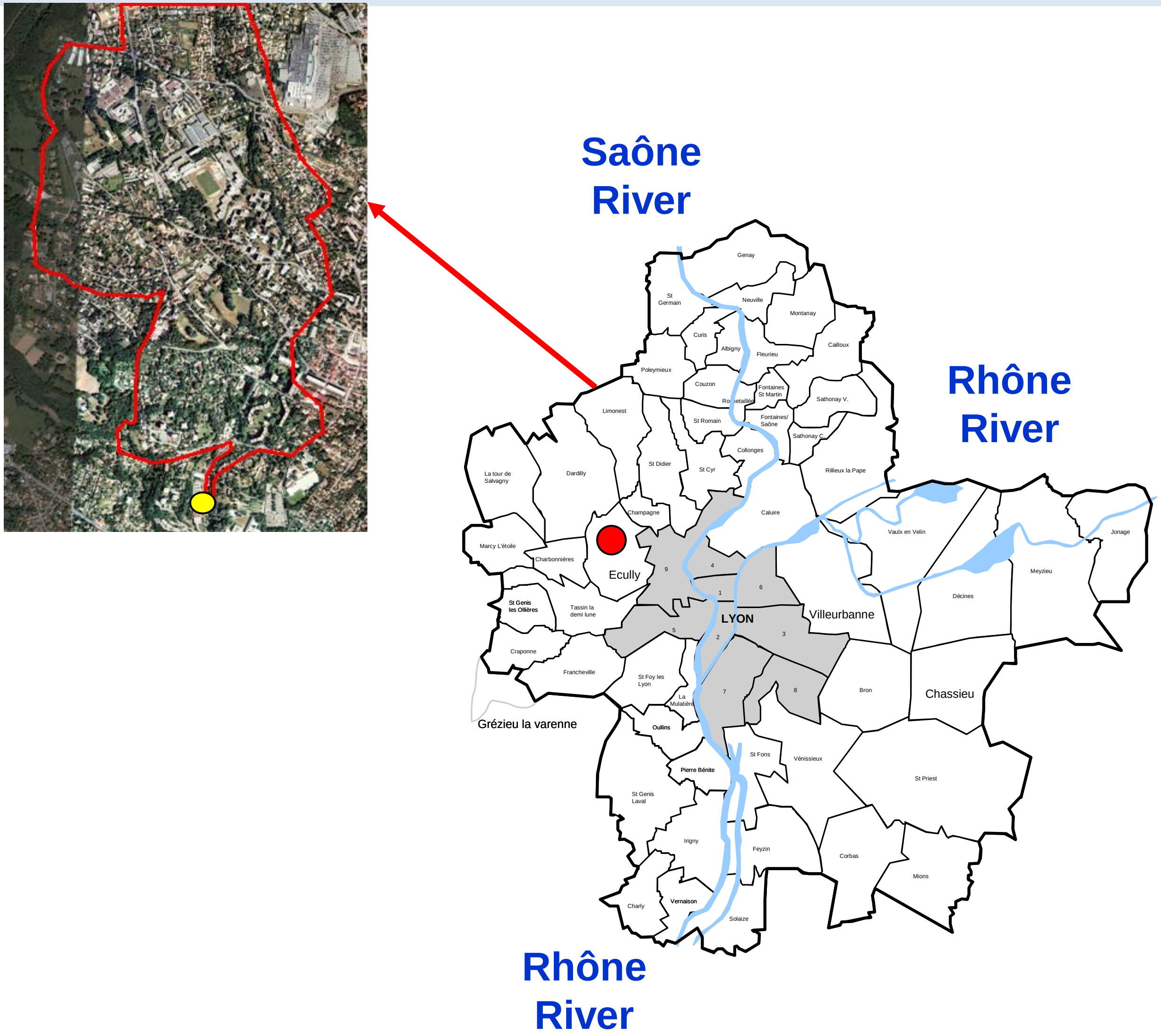
With numerous measured events, questions are:

1) Inputs selection

2) Calibration data selection

Case and data

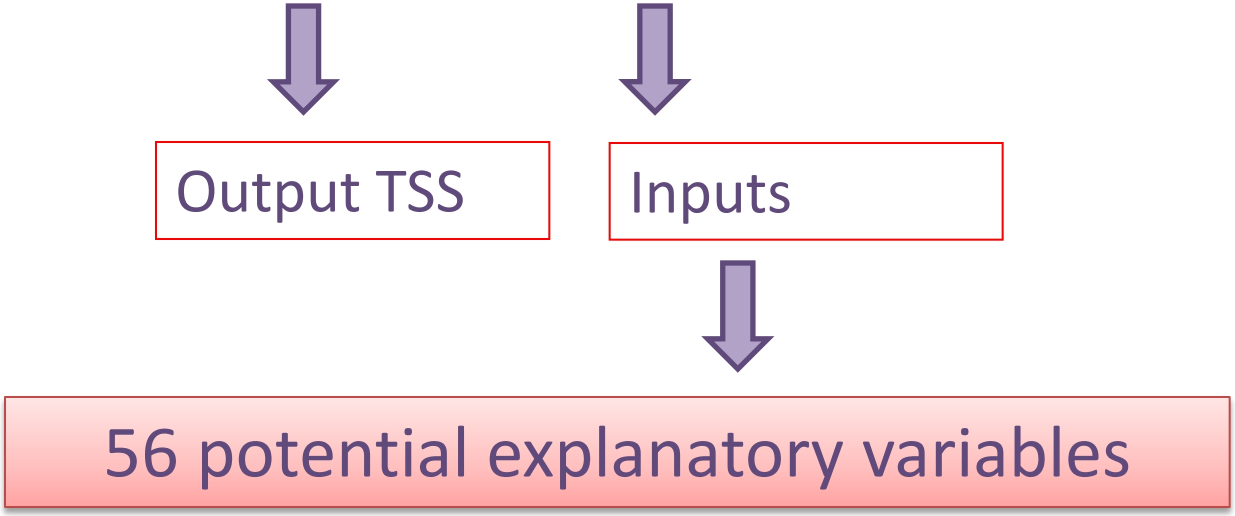
Case and data



- **Ecully catchment**
  - ✓ Residential
  - ✓ Combined sewer
  - ✓ 245 ha
  - ✓ 60 active ha
  - ✓ 42 % impervious

Case and data

- 239 storm events between 2004-2008
- Event TSS load (kg) as storm water quality index
- Regression model $y = \sum_{i=1}^{N} b_i x_i + b_0 + e$



Output TSS

Inputs

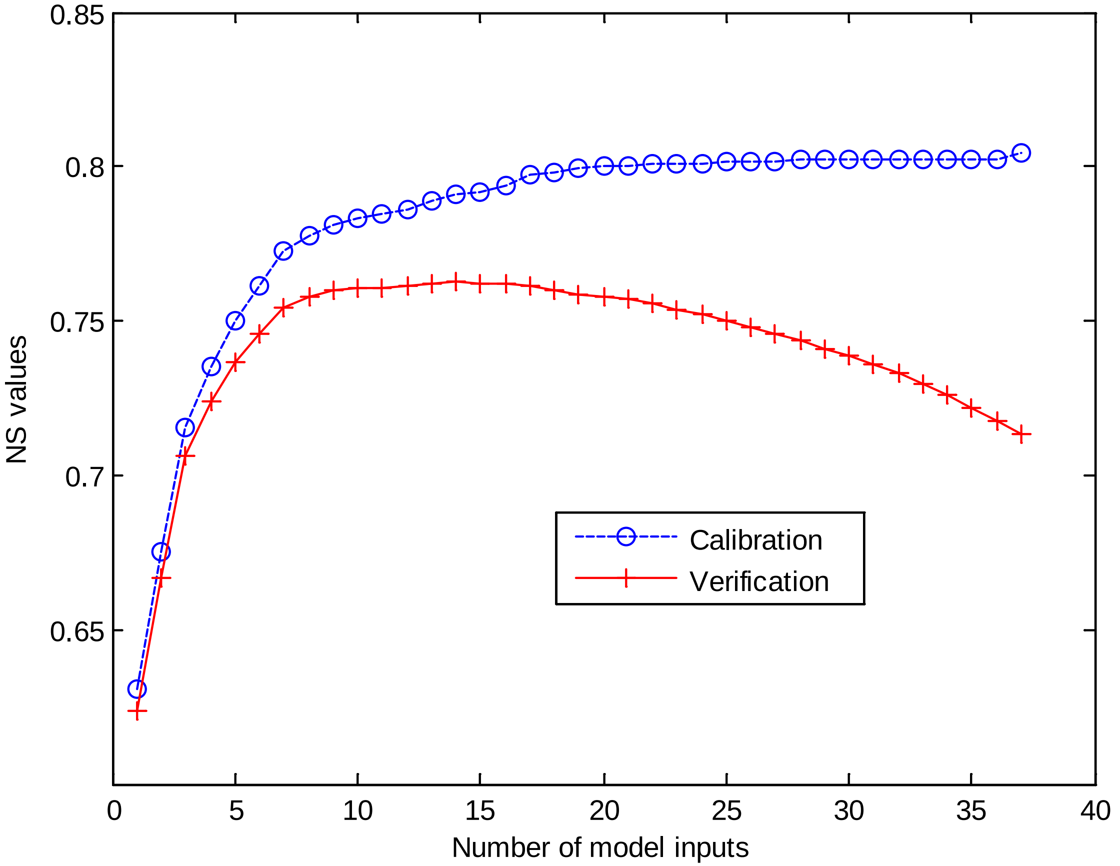
56 potential explanatory variables

Methodology - Input selection

Shall we use all 56 variables as model inputs?

- Calibration (simulation ability) and verification (prediction ability) were performed.
- When splitting data, uncertainty due to calibration data selection exists.
- Cross validation was used.

Results - Input selection



7 variables are selected

Results - Input selection

7 variables are selected

- Antecedent dry period from the last rainfall event exceeding *5* mm
- Antecedent dry period from the last rainfall event exceeding *30* mm
- Maximum rain intensity in *10* minutes during 12 hours before the event
- Maximum rain intensity in *10* minutes during *72* hours before the event
- Maximum rain intensity in *30* minutes during *4* hours before the event
- Maximum flow rate
- Total flow volume

Methodology - Calibration data selection

- **Random selection**

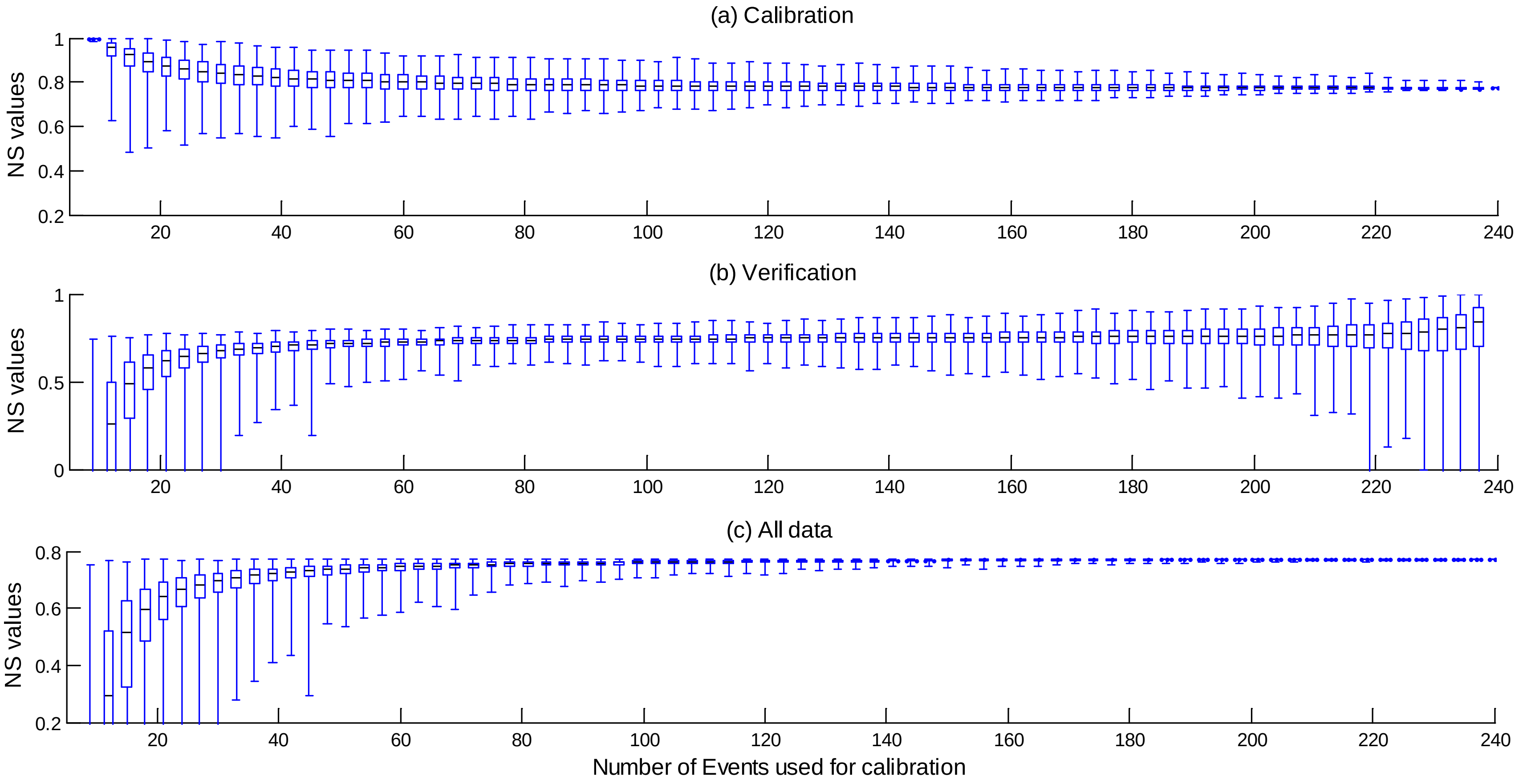
➢ *The number of calibration events: 8-239*

➢ *For each number, calibration events are randomly selected for many times to study the uncertainty due to calibration data selection*

➢ *A calibrated model is evaluated by calibration data sets, verification data sets and all data sets*

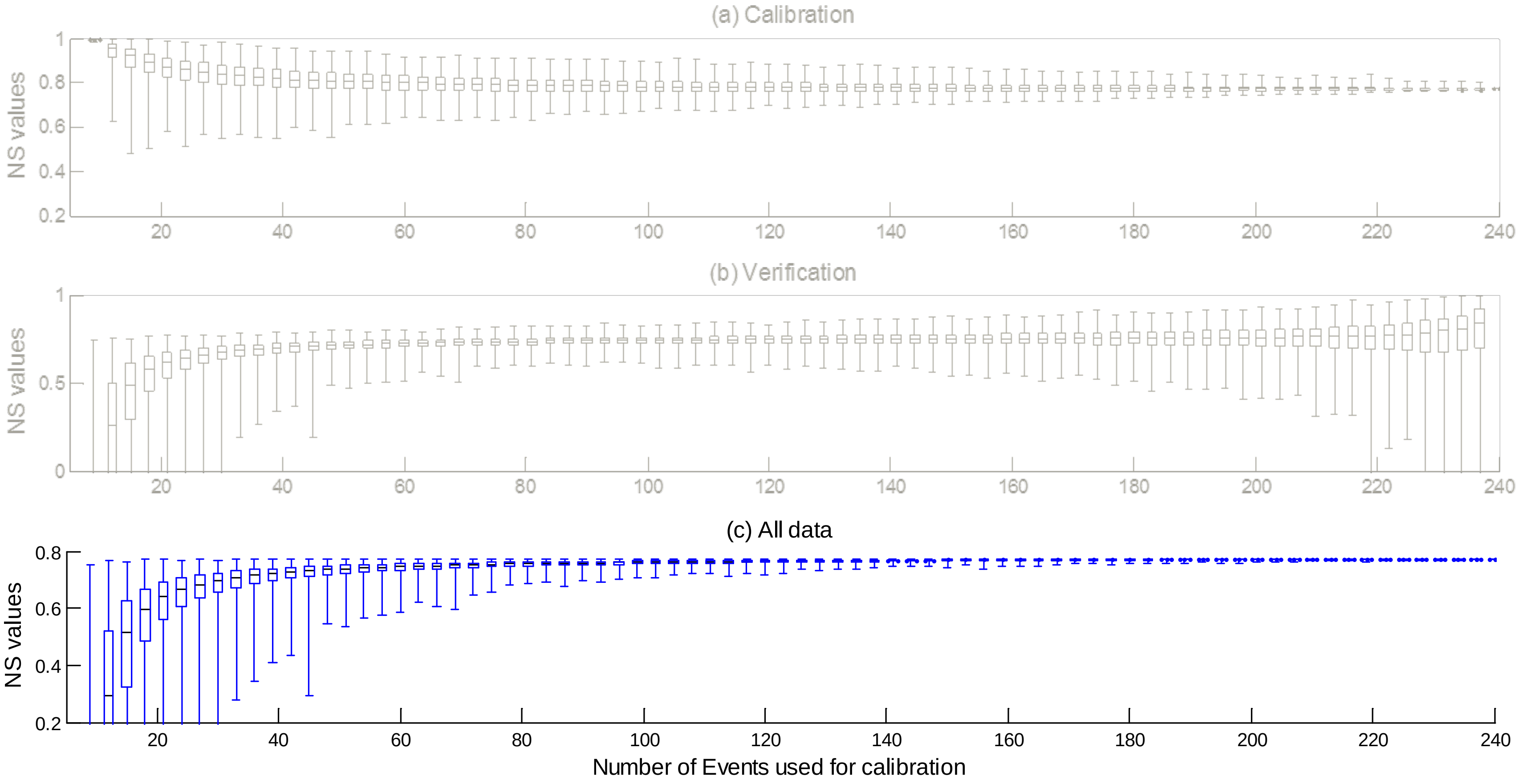
Results - Calibration data selection

- Random selection



Results - Calibration data selection

- Random selection



Methodology - Calibration data selection

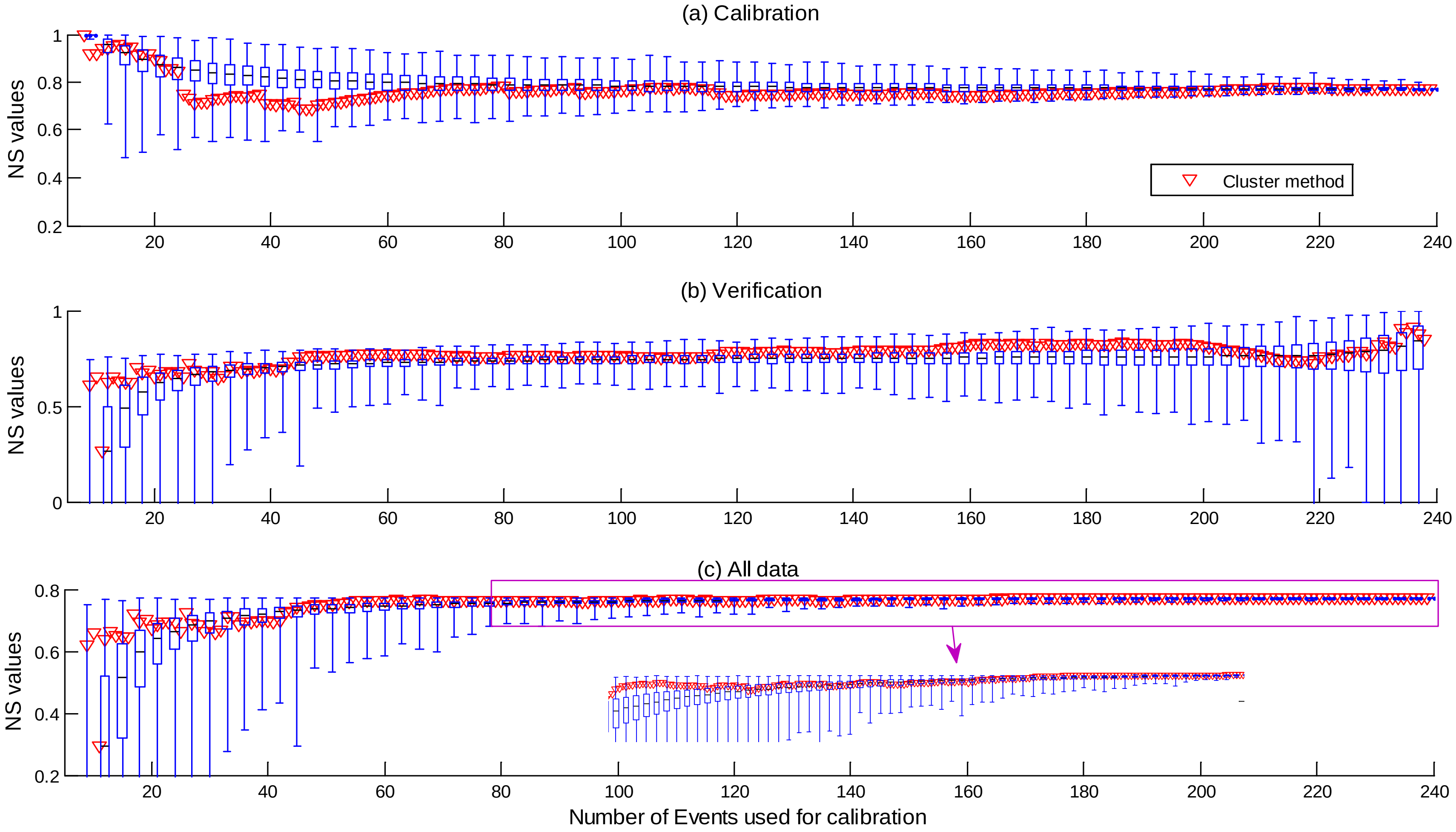
- **Select representative data for calibration using cluster method**

- ➢ *Divide all events into n clusters if n events is wanted for calibration*
    - ❖ A cluster contains data sets of similarity according to standardized Euclidean distance between data sets

- ➢ *One data set is selected from a cluster to represent the cluster*

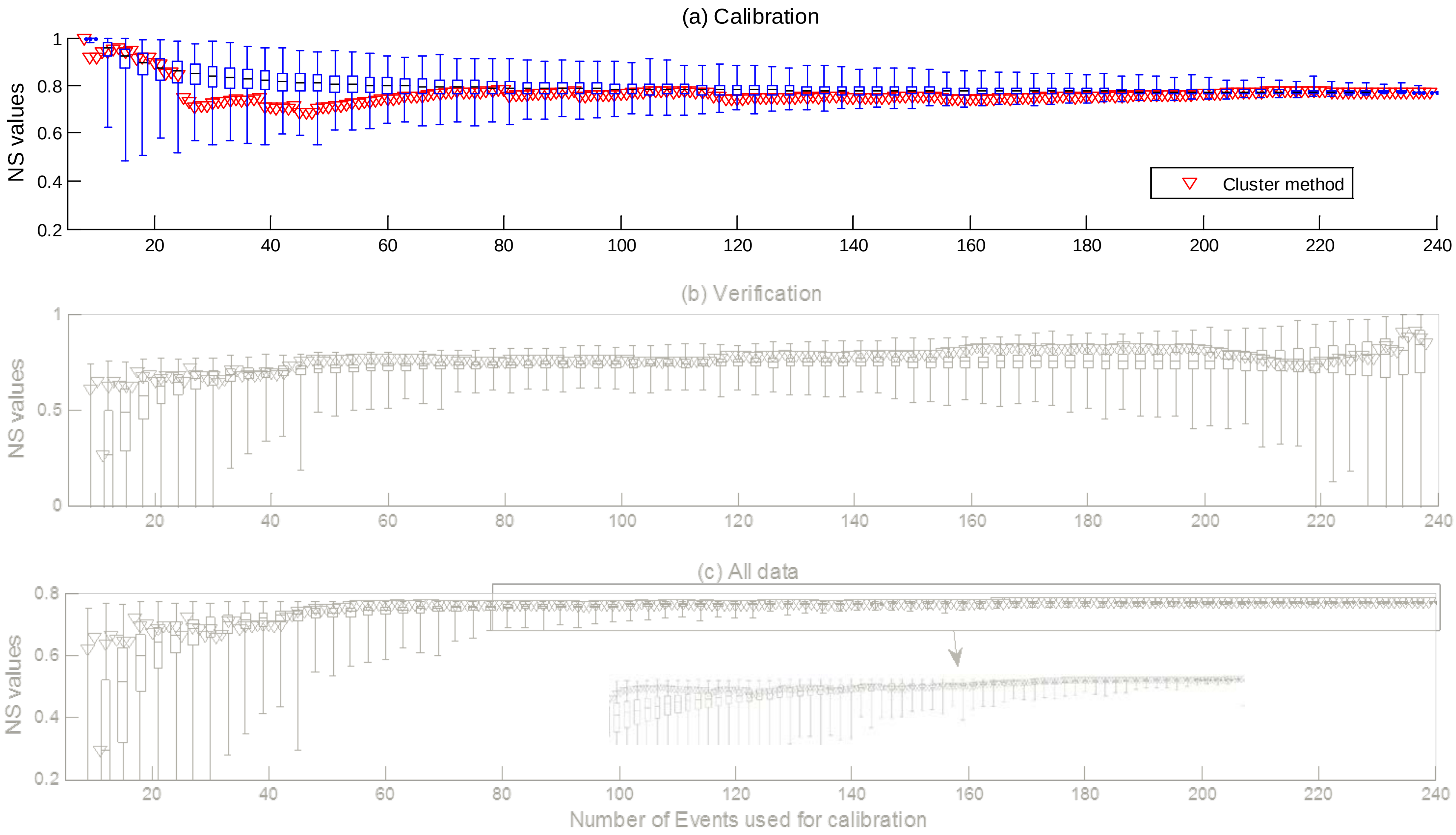
Results - Calibration data selection

- Cluster selection



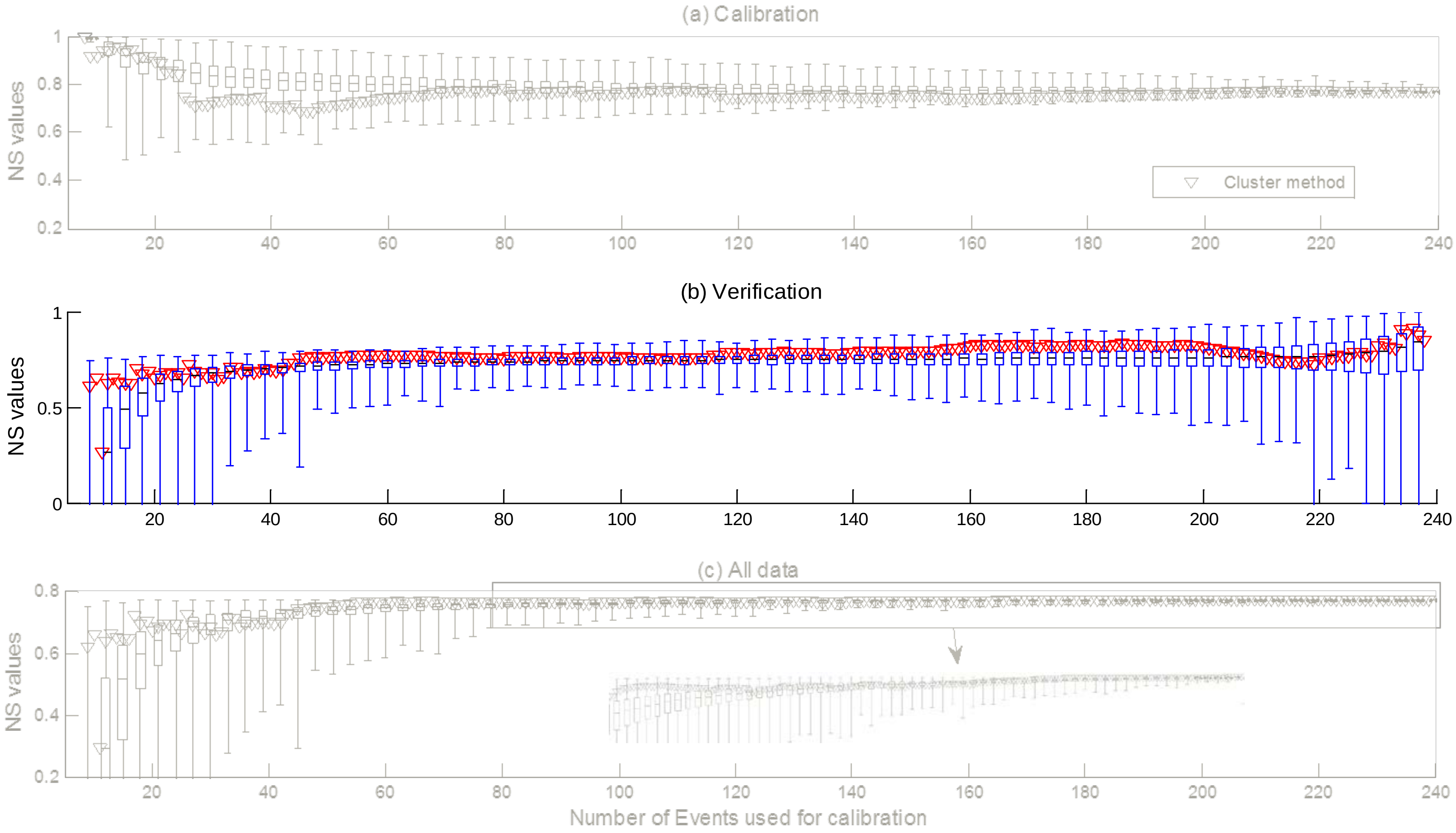
Results - Calibration data selection

- Cluster selection



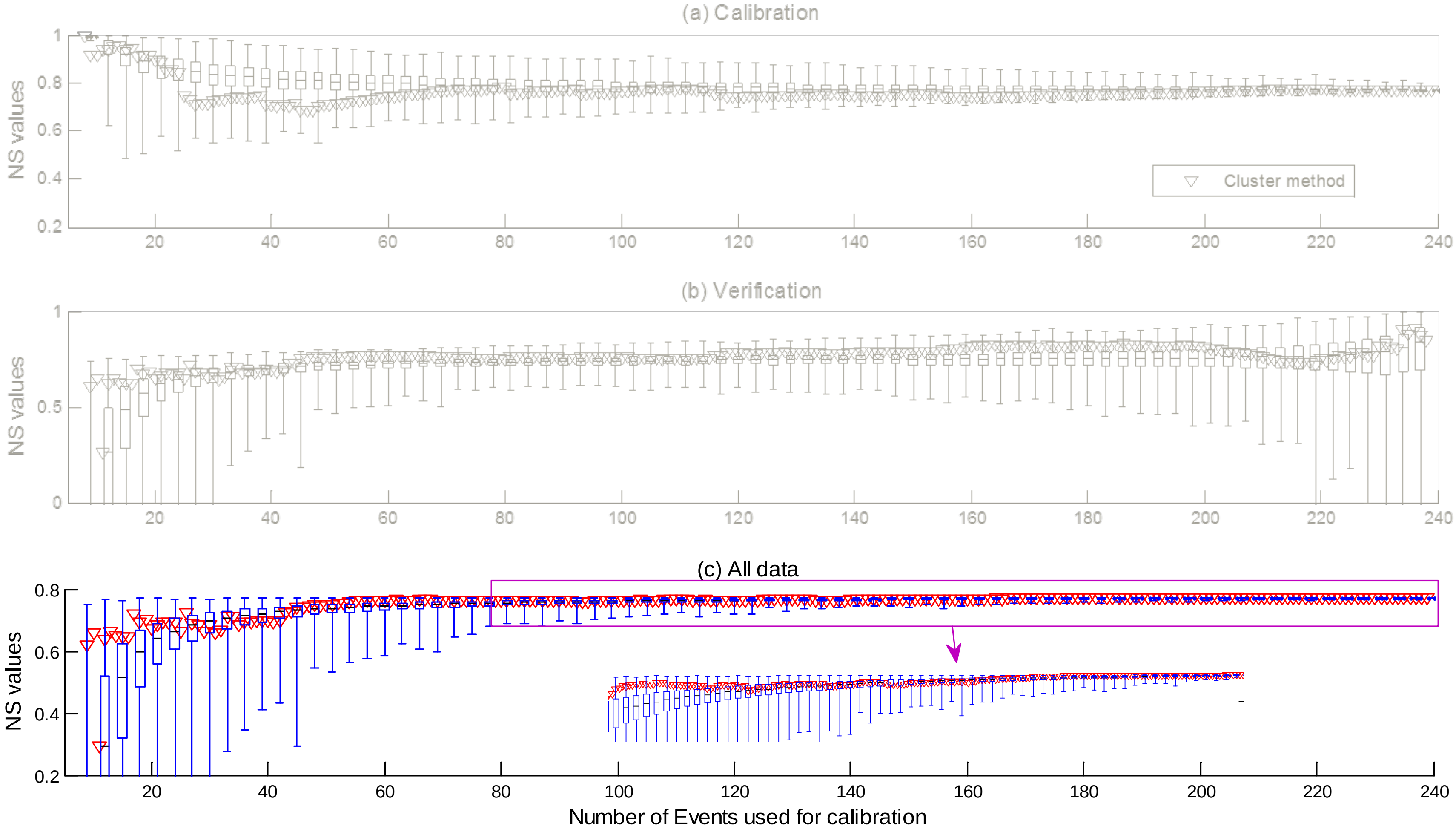
Results - Calibration data selection

- Cluster selection



Results - Calibration data selection

- Cluster selection



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Conclusions

1. Overfitting occurs when too many inputs are considered in a model

2. Data used for calibration can affect model behaviors

3. A cluster method can effectively aid choosing representative calibration data

Thank you for your attention!

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