EFFECT OF VARYING CALIBRATION SCENARIOS ON THE PERFORMANCE OF A HYDRODYNAMIC SEWER MODEL

Franz Tscheikner-Gratl

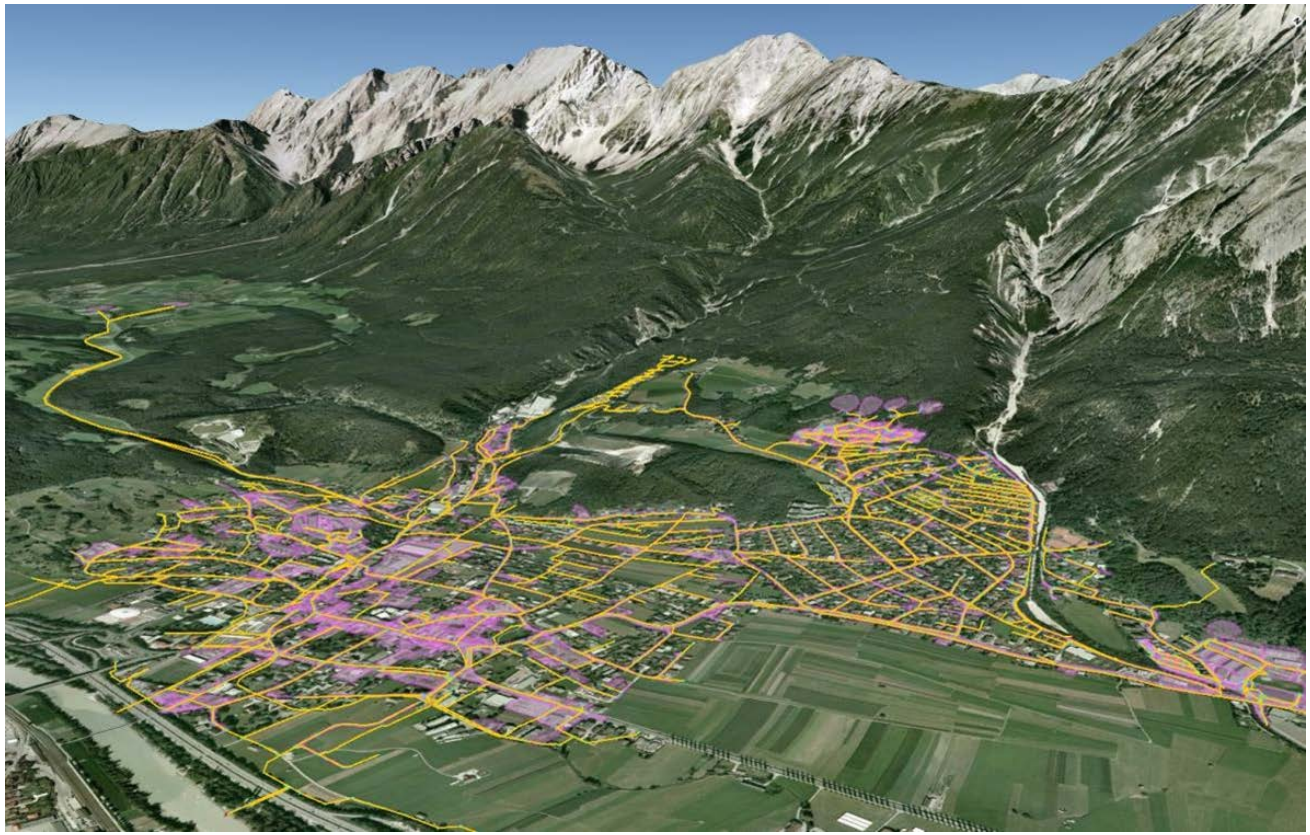
Peter Zeisl, Carolina Kinzel, Johannes Leimgruber, Thomas Ertl, Wolfgang Rauch, Manfred Kleidorfer

5-9 July 2017
Athens, Greece

Outline of the presentation

Outline of the presentation

- Case study



Outline of the presentation

- Case study
- Methodology

Source: NewGrowth Consulting (2015)

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- Case study
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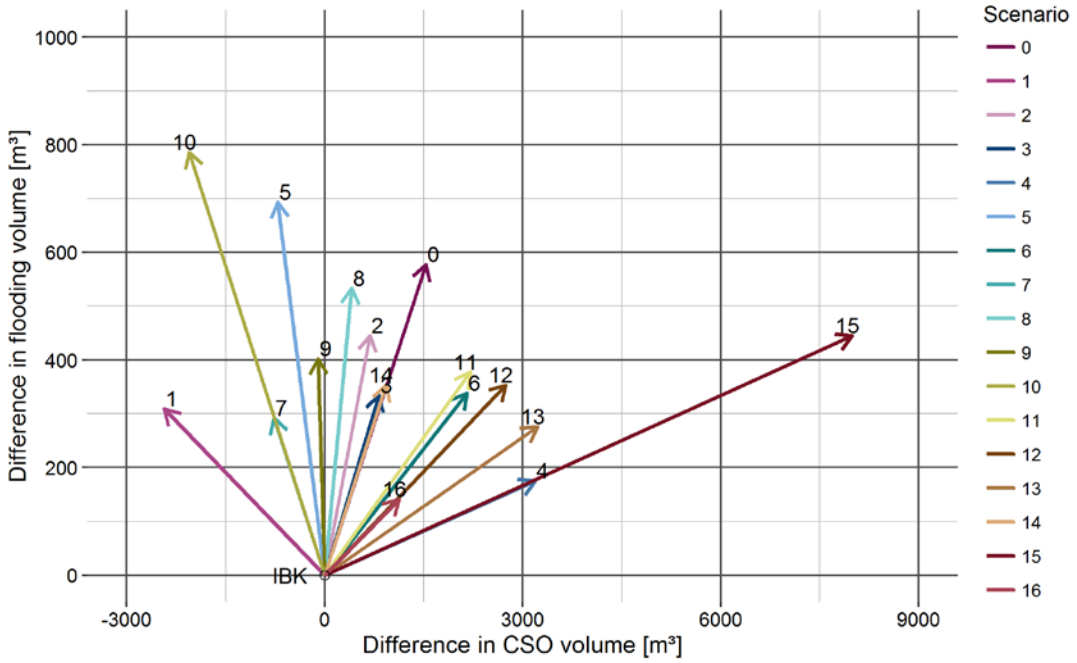
- Results



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- Case study
- Methodology
- Results
- Conclusion

Case study

- Case study: Telfs

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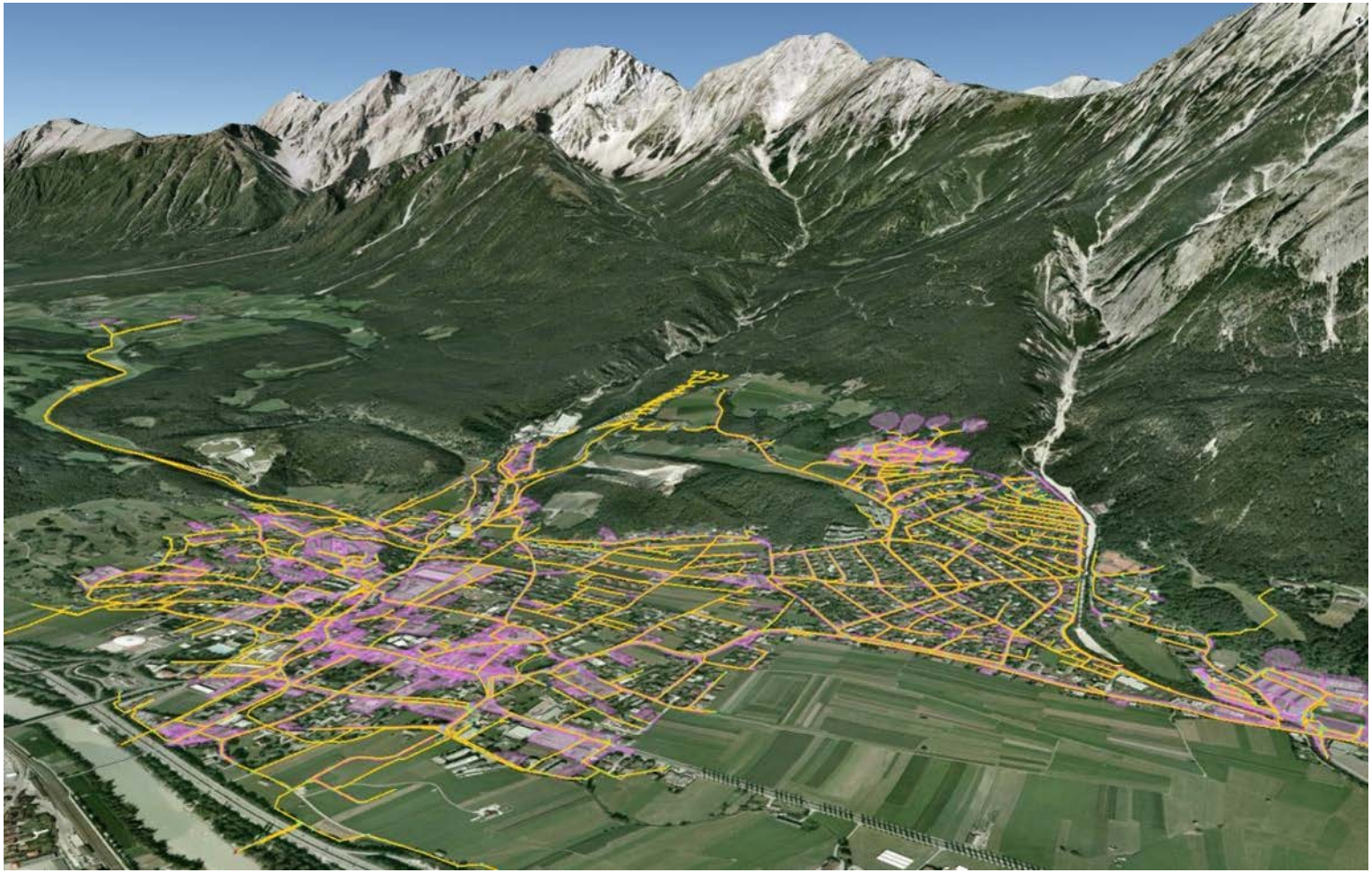
Case study

- Case study: Telfs
  - 15,000 inhabitants
  - alpine climatic conditions
  - 14 km of combined sewers, 67 km of wastewater sewers and 24 km of stormwater sewers.
  - Connected catchment area of 95.31 hectare
  - 3 combined sewer overflows
  - 11 pumping devices
  - Hydrodynamic model (SWMM)

Case study

- Case study: Telfs



Case study

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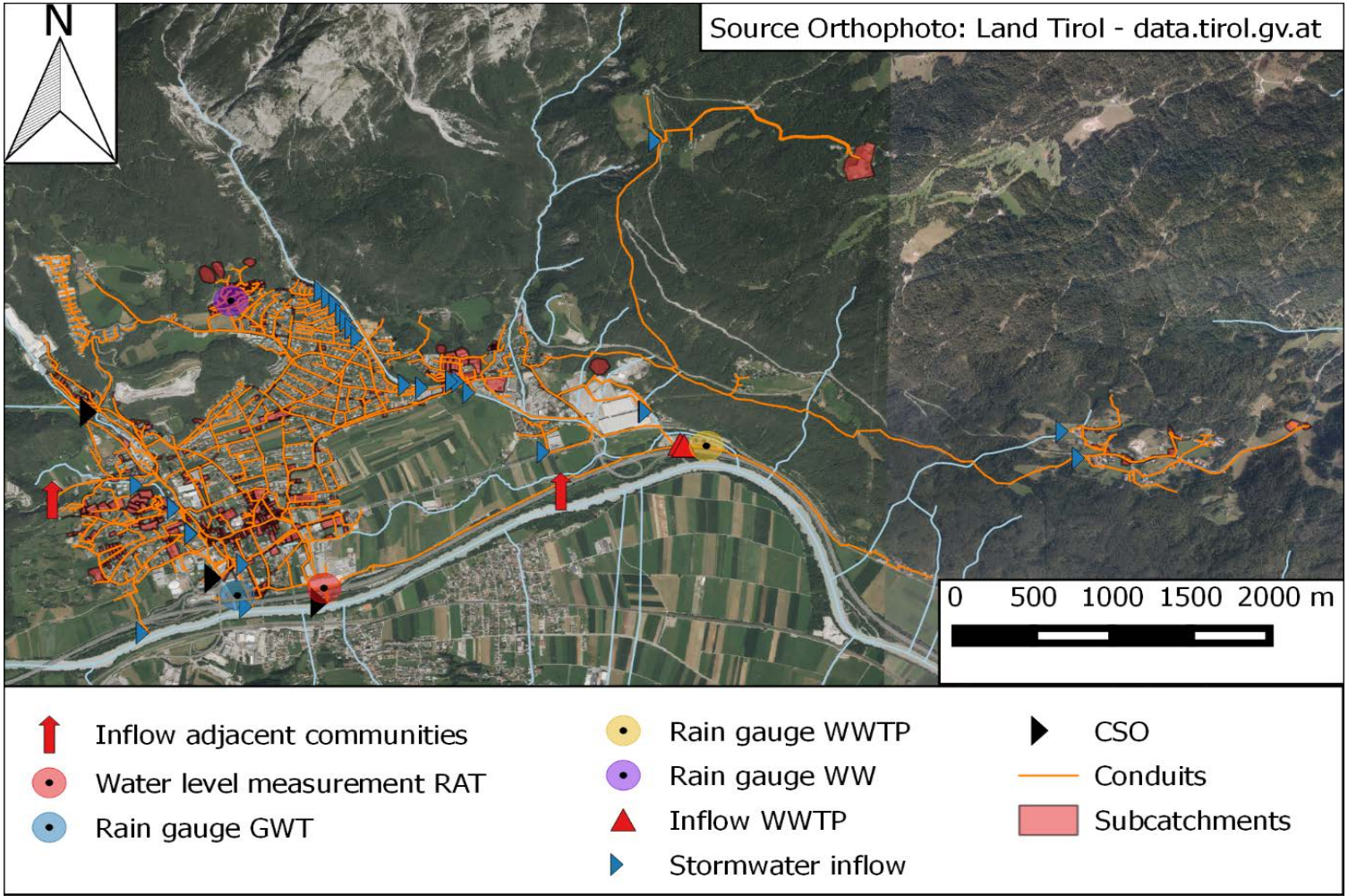

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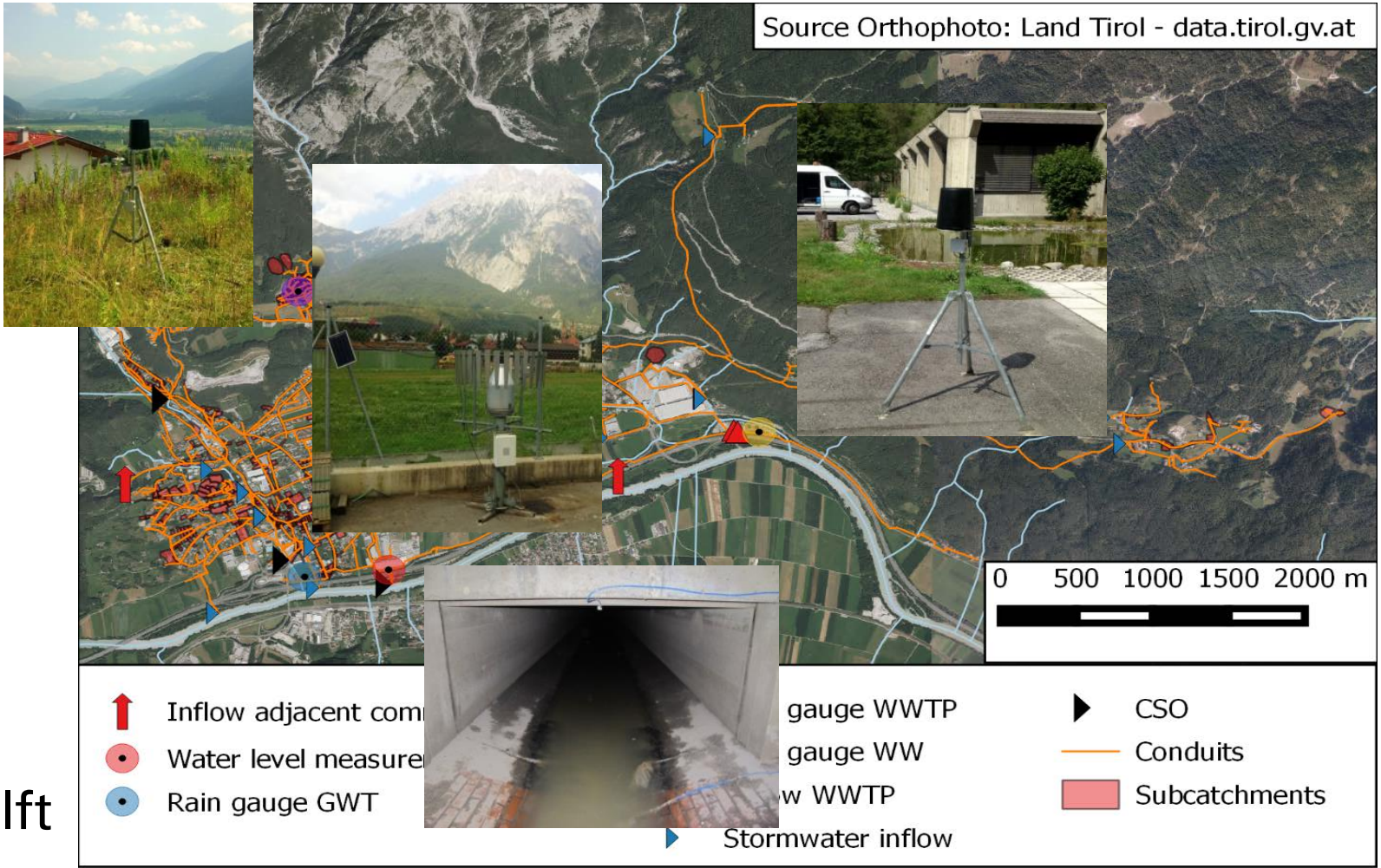

Case study

- Why Case study: Telfs
  - Focus on small and medium sized municipalities
    - 68% of inhabitants in Austria live in municipalities <50,000
    - network length per capita is longer
    - Limited resources
    - imperviousness of the drained area is lower
    - pipe diameters are smaller
    - Different pollutant characteristics in surface runoff (Brombach et al. 2005)

Methodology

- Catchment fragmentation analysis

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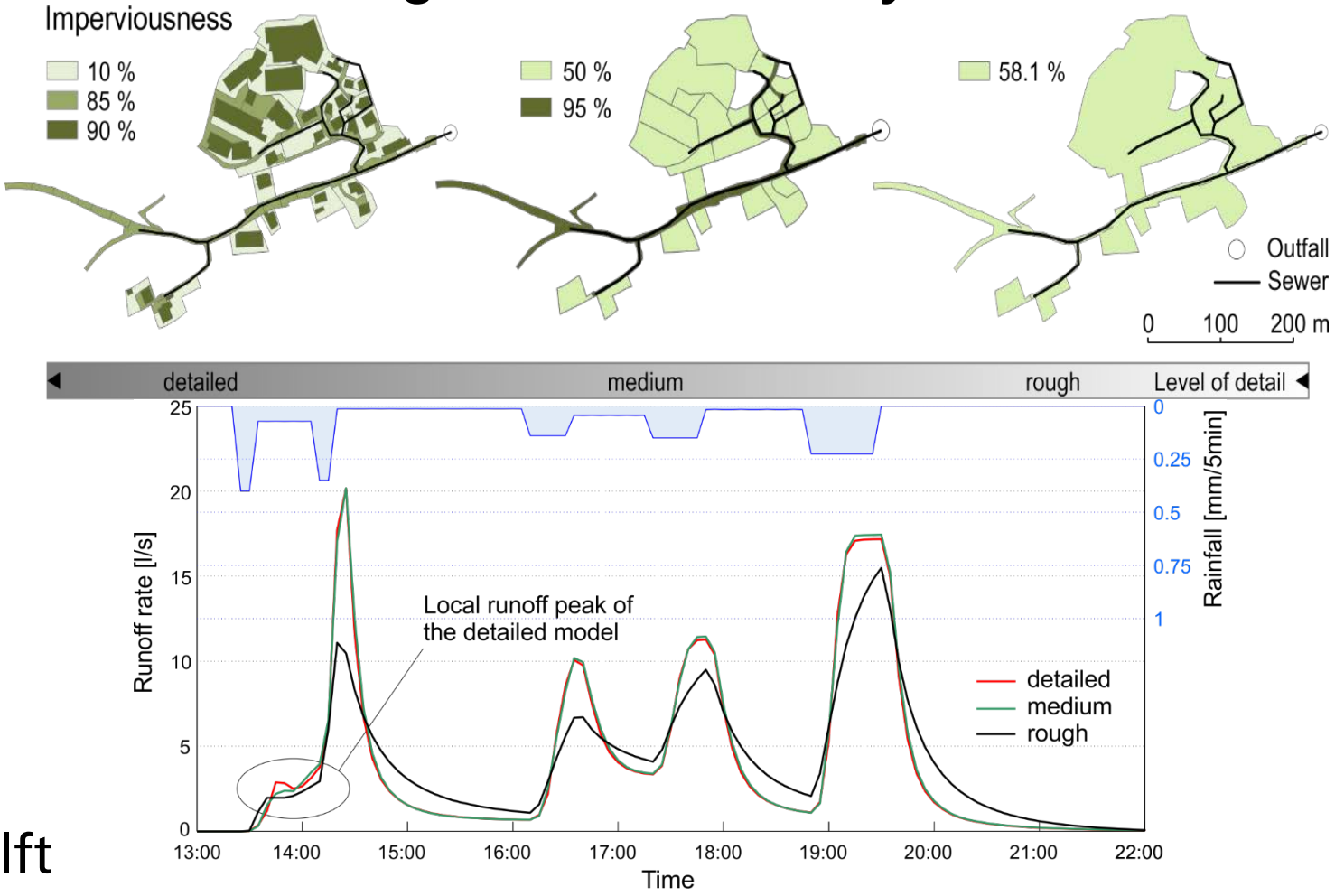
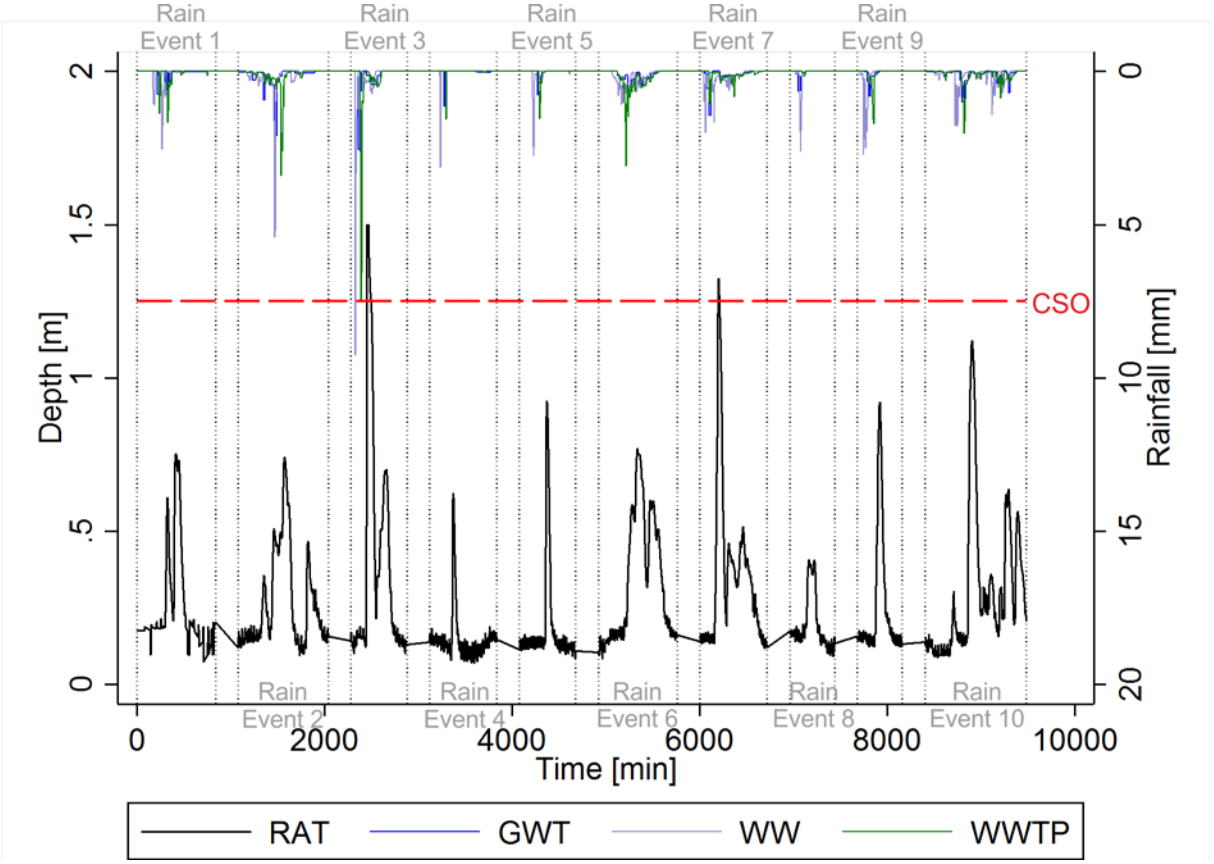


Methodology

- Calibration scenarios
  - Scenario 01-10: Calibration to one rain event

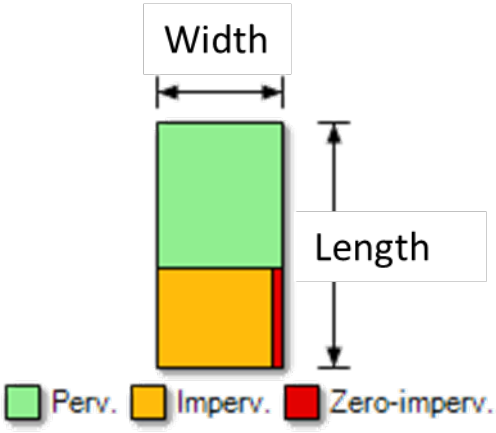


Methodology

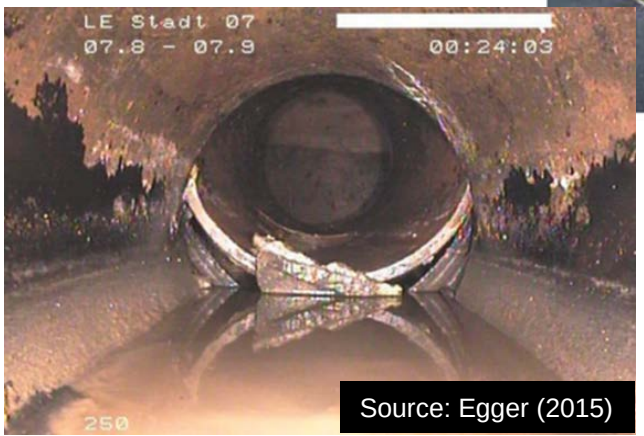
- Calibration scenarios
  - Scenario 01-10: Calibration to one rain event
  - Scenario 00: uncalibrated model
  - Scenario 11: Calibration to the entire rain series
  - Scenario 12, 13 and 14: Calibration to the entire rain series only using data from one rain gauge
  - Scenario 15 and 16: Systematic error in water level measurement of +-30%

Methodology

- Calibration parameters
  - Width
  - Imperviousness
  - Pipe roughness



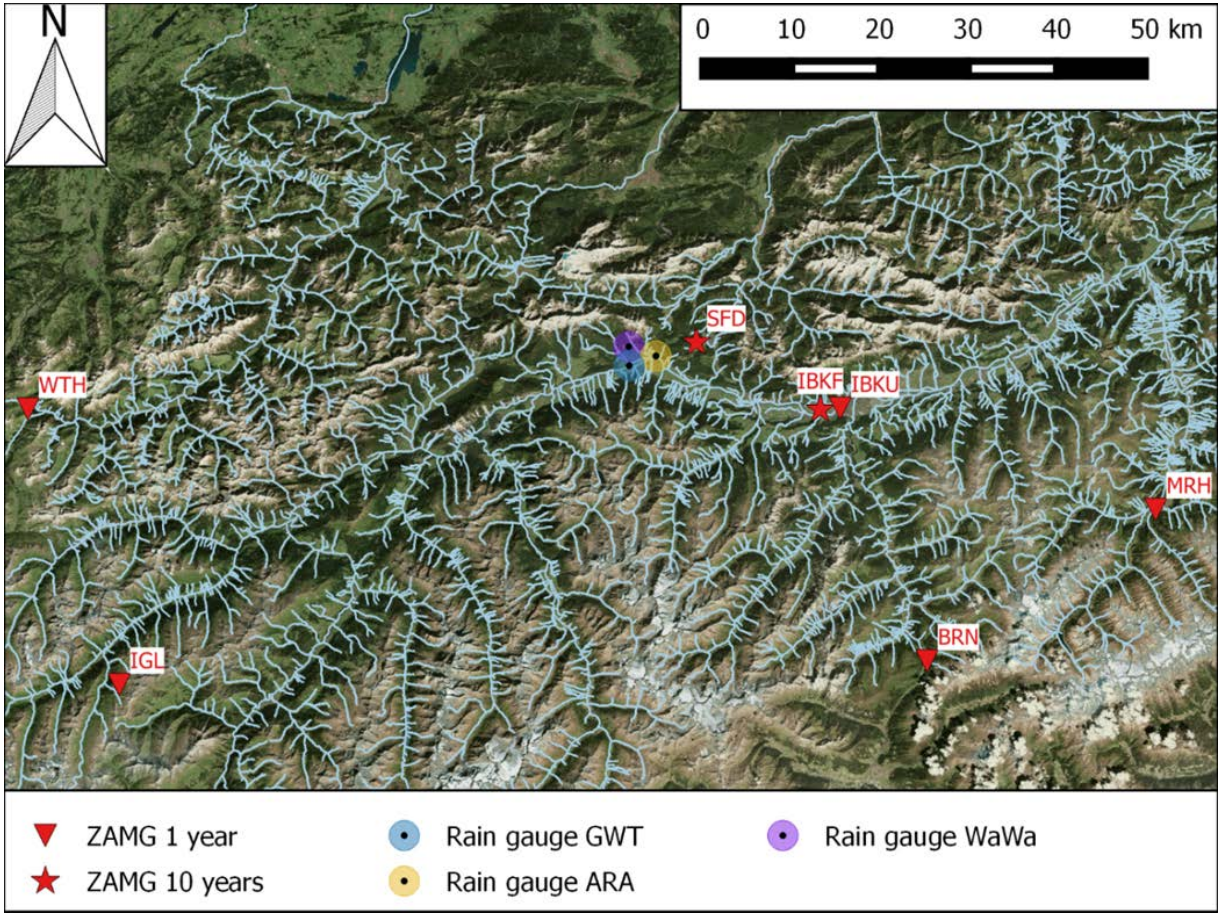

Source: Ballards-Wood et.al. (2010)



Source: Egger (2015)

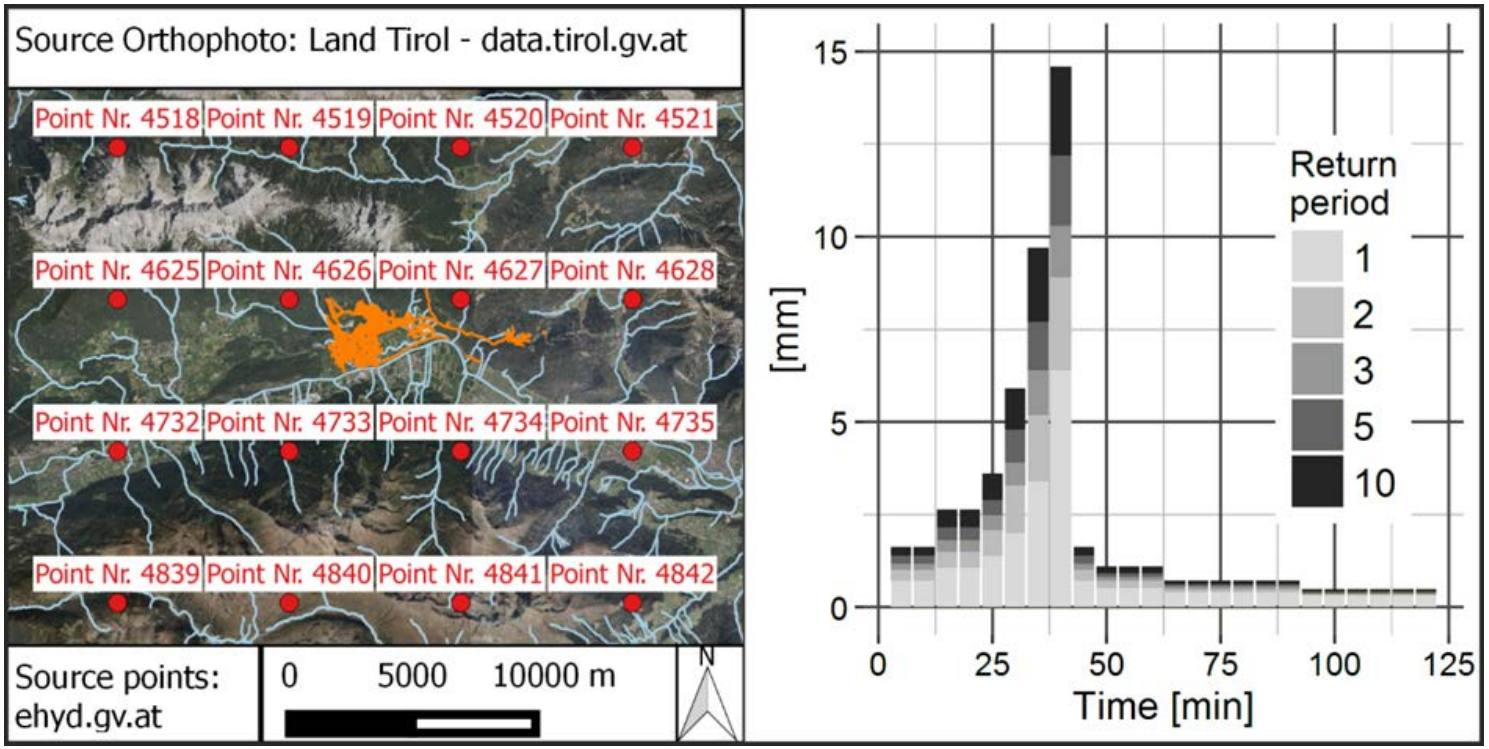
Methodology

- Different rainfall data
  - own and external rainfall measurements



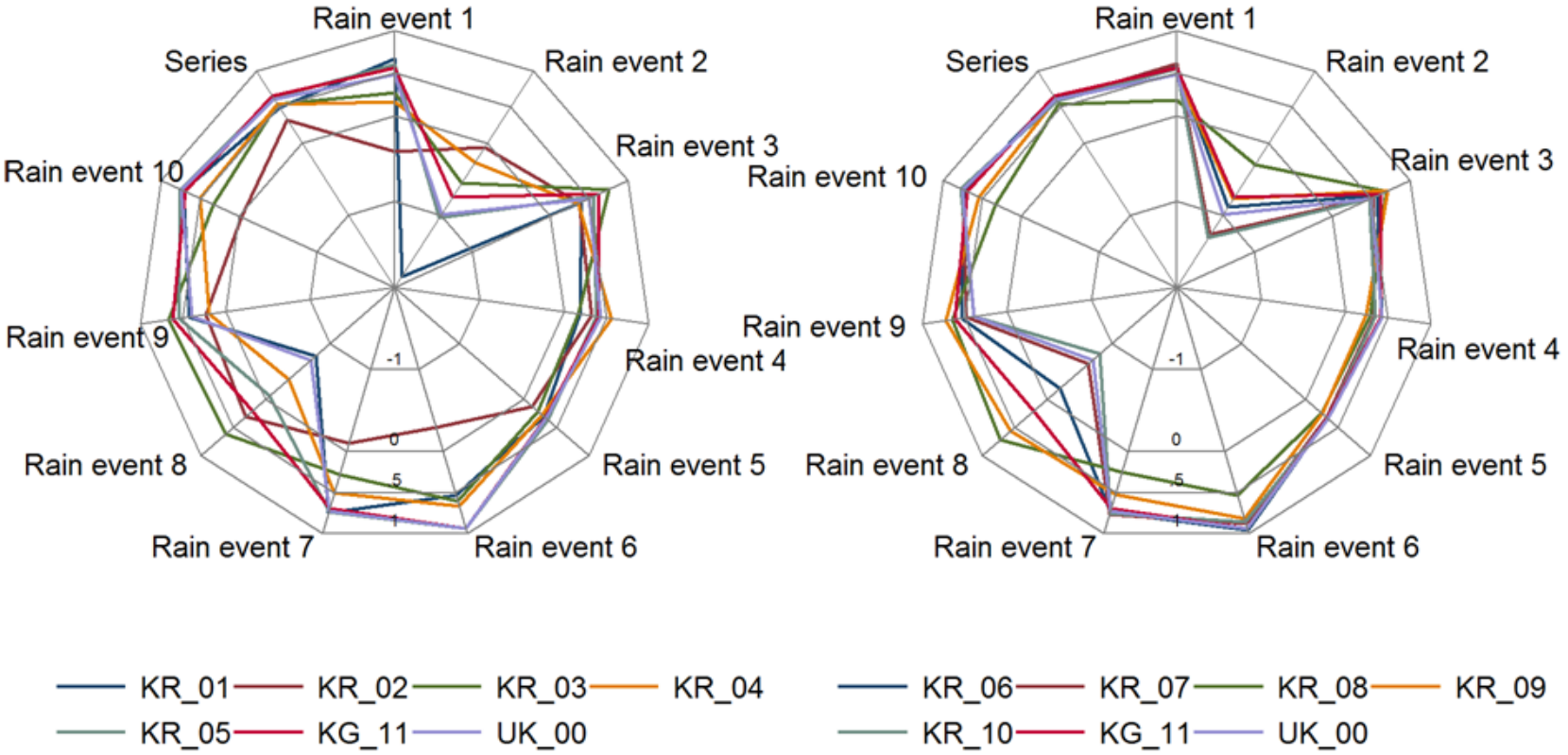
Methodology

- Different rainfall data
  - design rainfall events



Results

- Best performance of model for all rain events (NSE)



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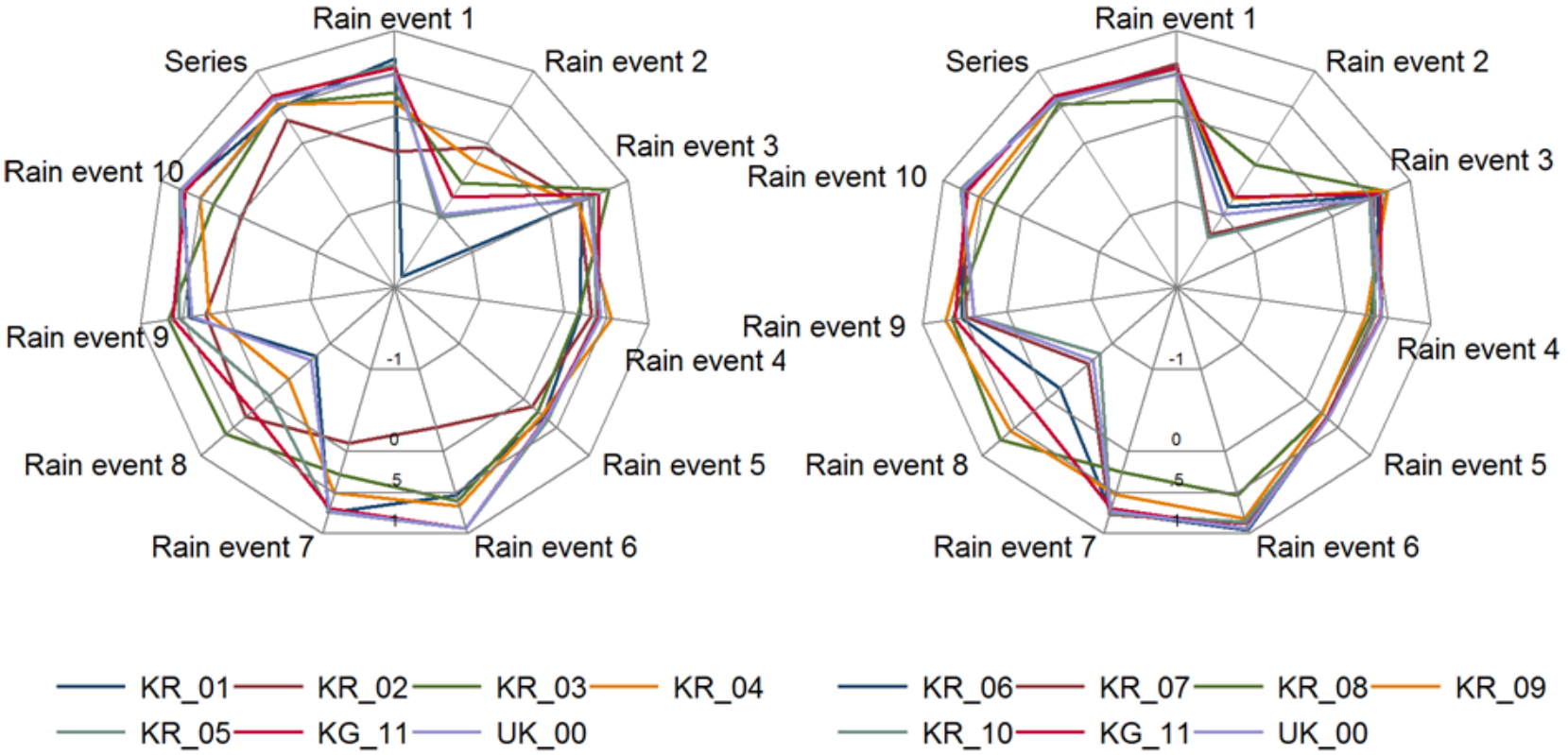


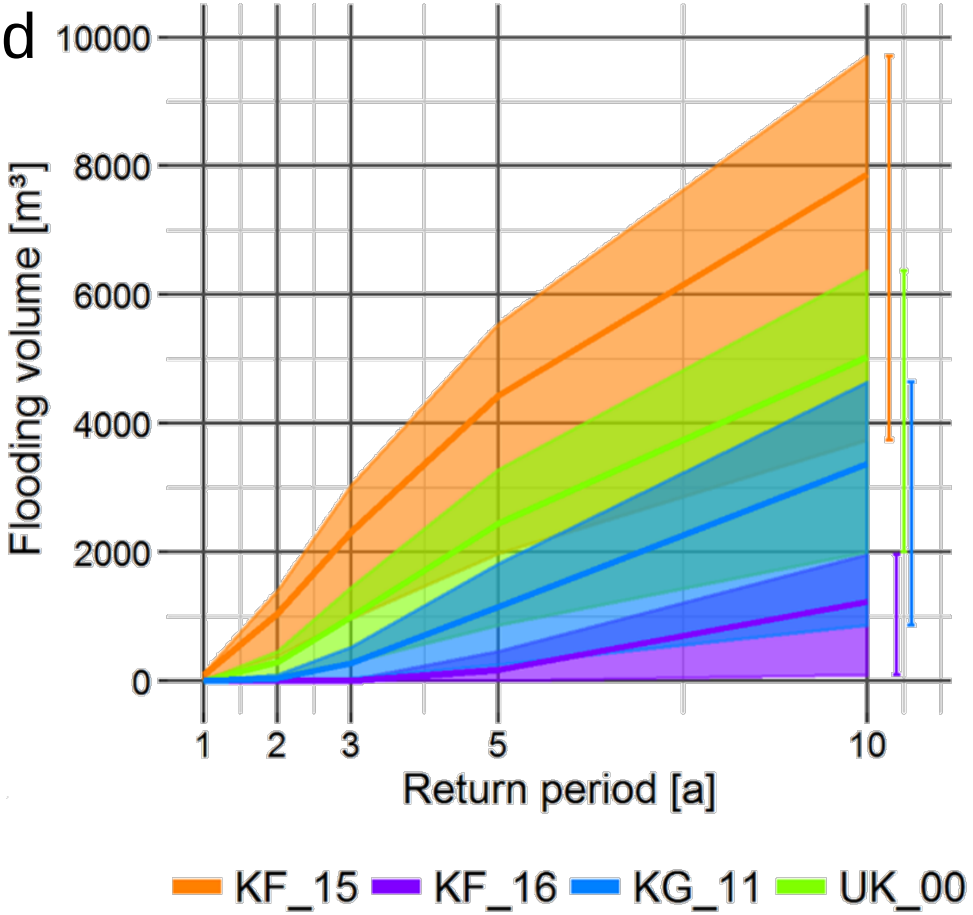
Best perfomance KG_11 – calibration on the entire rain series

Results

- Differences in flooding volume Design rainfall

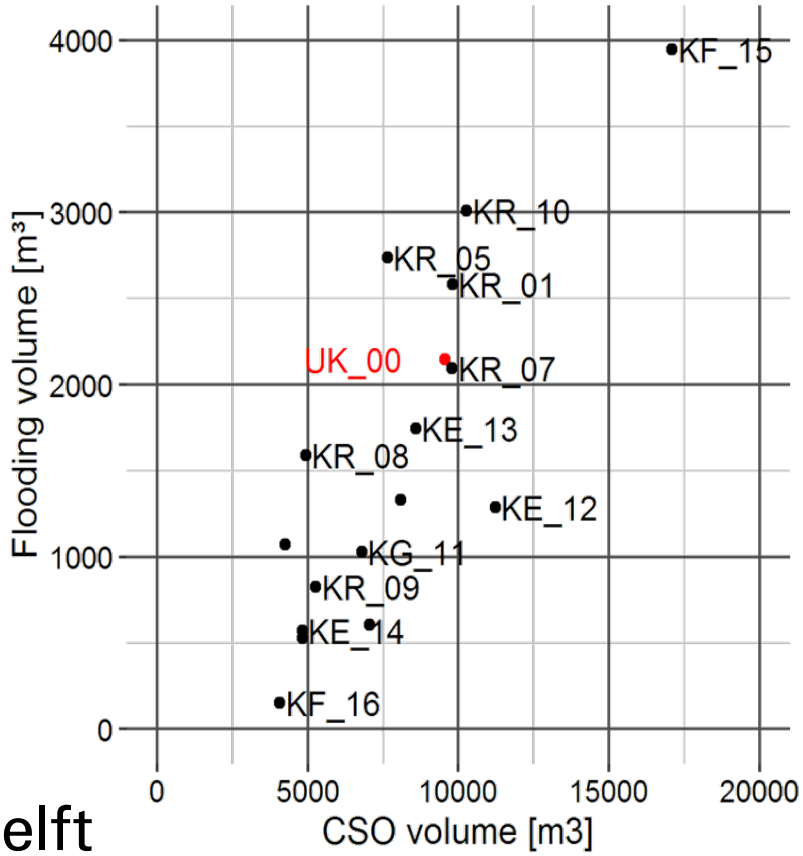
  Calibrated vs. uncalibrated

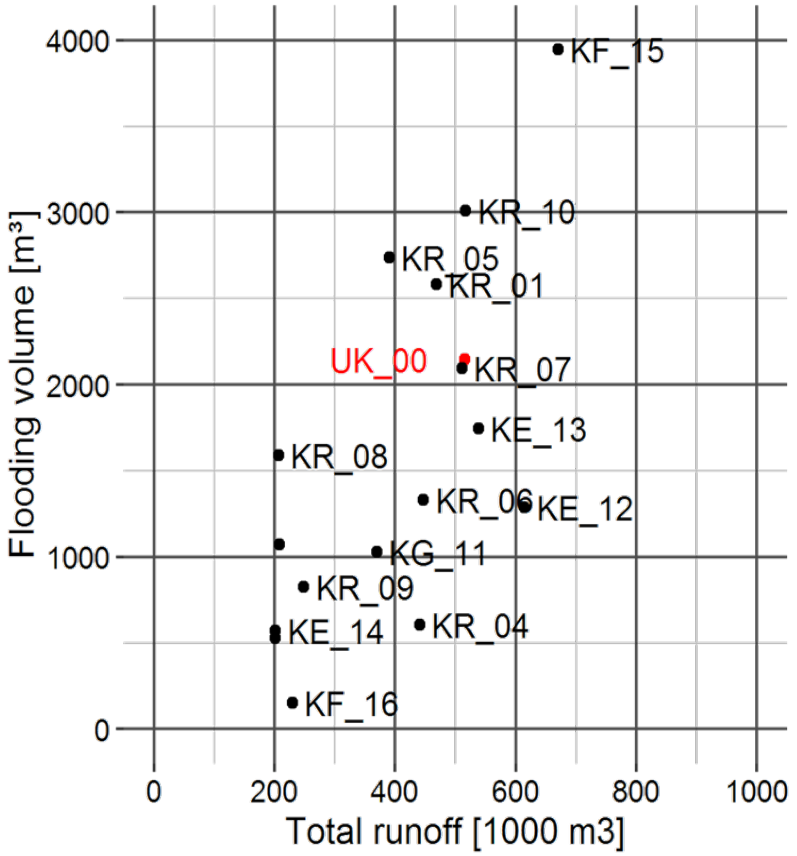
  →one return period



Results

- Flooding volume vs. CSO-Volume: 1-year rainfall series (SFD)





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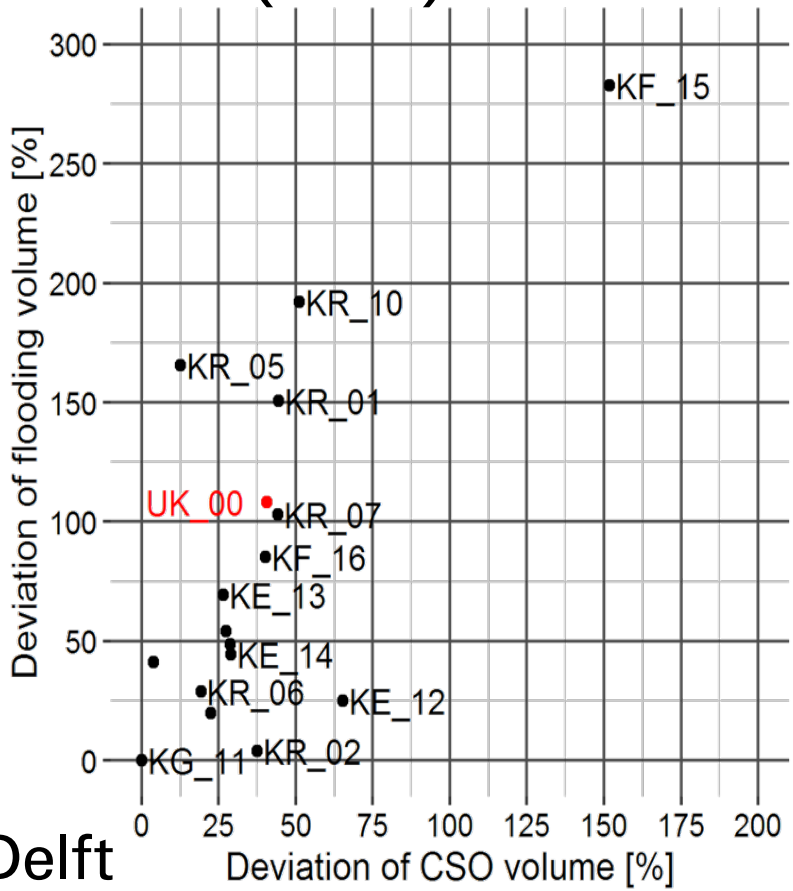
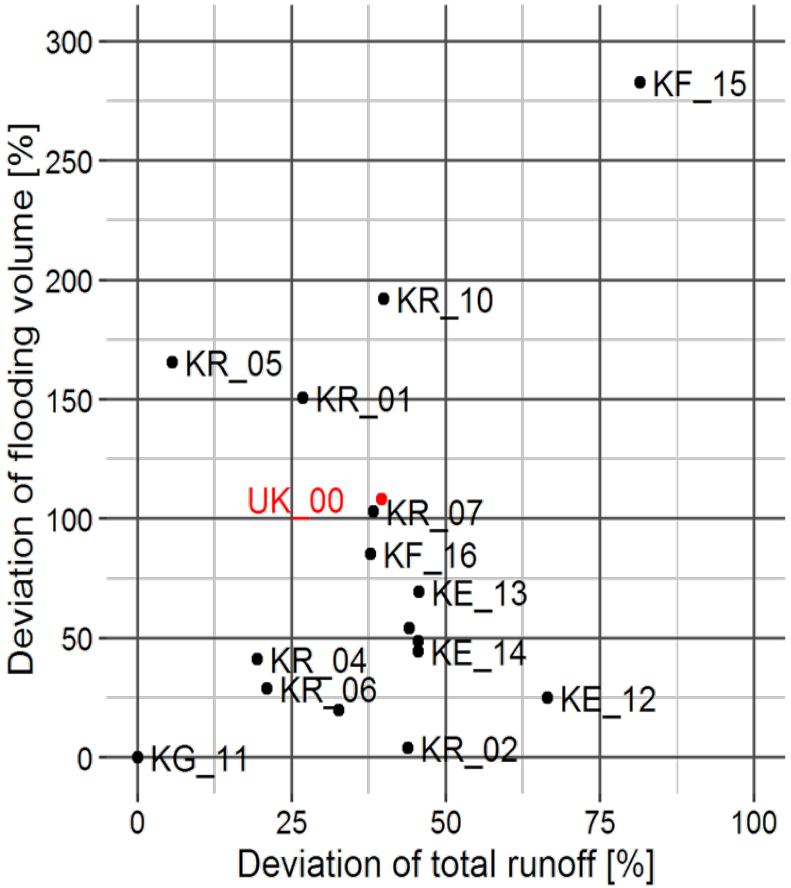
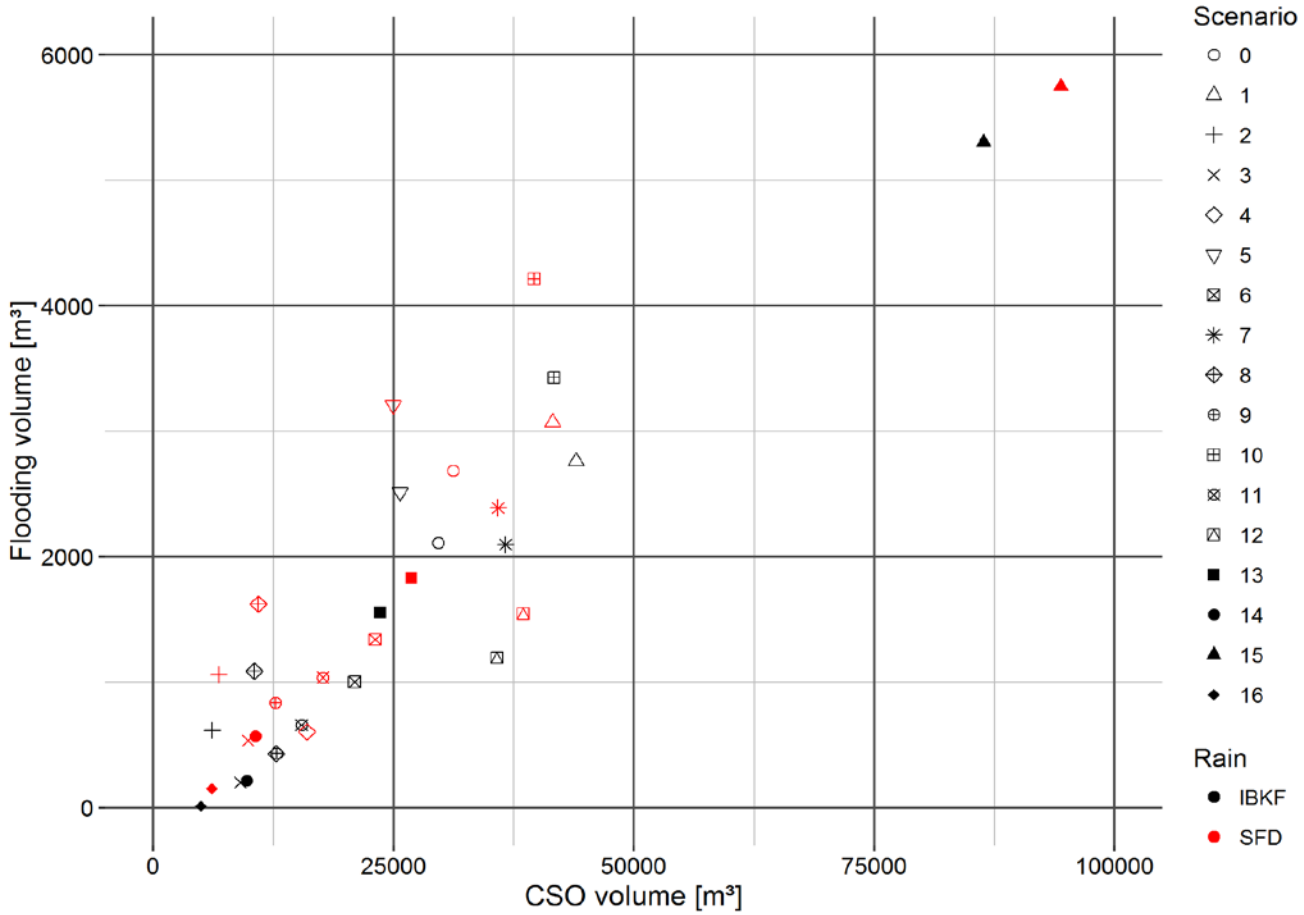




Results

- Flooding volume vs. CSO-Volume: 10-years rainfall series



Results

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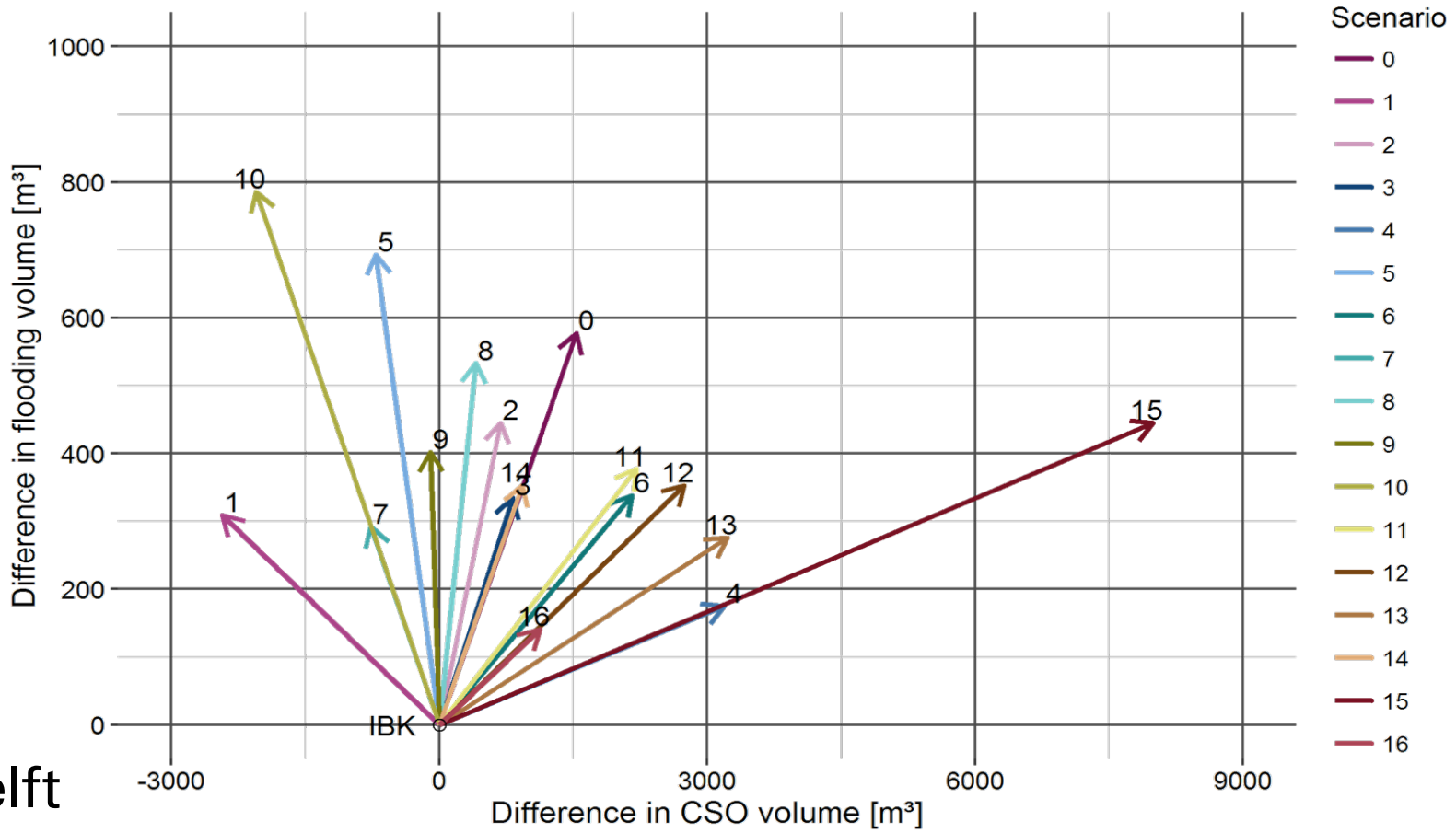

Conclusion

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- Uncalibrated model tended to overestimate flooding volume → influence on design of sewer systems (return period)

Conclusion

- Usage of a rain series is advantageous in comparison to the usage of single design events
- Spatial distributed rainfall measurement is advisable to minimize the uncertainties stemming from differences in intensities and distribution
- Uncalibrated models tended to overestimate flooding → influence on design of sewer system (return period)

Calibration of hydrodynamic models is advisable

Further Information

1 © IWA Publishing 2016 Water Science & Technology | in press | 2016

Lost in calibration: why people still don't calibrate their models, and why they still should – a case study from urban drainage modelling

Franz Tscheikner-Gratl, Peter Zeisl, Carolina Kinzel, Johannes Leimgruber, Thomas Ertl, Wolfgang Rauch and Manfred Kleidorfer

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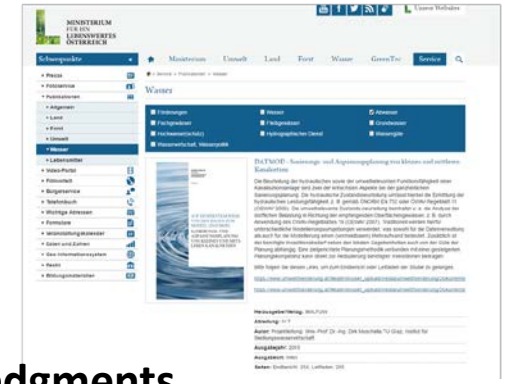
- https://www.bmlfuw.gv.at/service/publikationen/wasser/DATMOD.html



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Further Information

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Special Issue

Quantifying Uncertainty in Integrated Catchment Studies

Guest Editors:

Dr. Franz Tscheikner-Gratl
Section of Sanitary Engineering,
Delft University of Technology,
Stevinweg 1,
2628 CN Delft, The Netherlands

f.tscheikner-gratl@tudelft.nl

Dr. Vasilis Bellos
CH2M, Burderop Park,
Swindon SN4 0QD, UK

vasilis.bellos@ch2m.com

Deadline for manuscript submissions:
1 October 2017

Message from the Guest Editors

Integrated catchment modelling is defined as the simulation of the linkage between the several sub-models, simulating processes of the water cycle (rural and urban) starting from the meteorological input, until the final recipient. These integrated catchment studies can be used to plan projects, to optimise systems, as well as to evaluate the need of certain measures. However, the stepwise process of abstraction from reality to model representation with its simplifications and idealisations of the real systems comes with the unavoidable occurrence of uncertainties. The definition, recognition and consideration of these uncertainties is, therefore, of the utmost importance for applying such models and for the interpretation of model results, in real world problems.

In this Special Issue we would like to invite research on integrated catchment studies for both quantity and quality modelling, specially focusing on the quantification of the uncertainty. Manuscripts which are coping with the following topics are specifically invited:

- quantification and the propagation of uncertainty at significant temporal and spatial scales in catchments
- approaches for minimising uncertainties in integrated models
- techniques for model reduction of computationally expensive models
- real world case studies on integrated catchment modelling
- tools, which can be deployed by end users considering all aspects of modelling uncertainty and hence they are able to be used in the context of the decision-making process

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Thank you for your attention!

Contact:

Franz Tscheikner-Gratl

Delft University of Technology
Urban drainage group
Sanitary engineering
P.O. Box 5048, 2600 GA Delft
The Netherlands

F.Tscheikner-Gratl@tudelft.nl

TU Delft