Interreg

North-West Europe

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Institute of Hydraulic Engineering and Water Resources Management

RWTH AACHEN UNIVERSITY

FlashFloodBreaker

Climate and environment

Optimization of 2D simulations in urban areas with Telemac-2D

FlashFloodBreaker
Integrated simulation of pluvial fluvial flood events

Influence of buildings on 2D simulations in urban areas

The aim was to analyze various methods for building representation in hydrodynamic simulations and assess their advantages and disadvantages.
The simulation was prepared in QGIS and BlueKenue and subsequently executed with Telemac-2D. To obtain a comprehensive understanding, different precipitation scenarios were considered. Three methods for building representation were applied: Building Block (BB), Building Hole (BH), and Building Resistance (BR), see also (Iliadis, 2024). For the simulation, a grid size of 2 meters was selected:

- In the **BB method**, the digital terrain model was elevated by **3 meters**. Additionally, the partially available Level of Detail 2 (LoD2) dataset was integrated.
- The **BH method** modeled buildings as **voids** within the model, not allowing water to flow through these areas.
- The **BR method** represented buildings as resistance zones by setting the **roughness coefficient** to **10** $[s/m^{\frac{1}{3}}]$.

The study area was mainly focused on urban areas with varying characteristics, with a specific focus on the metropolitan area of Dortmund. As part of the analysis, flow and velocity were particularly examined to assess the impact on hydraulic processes.

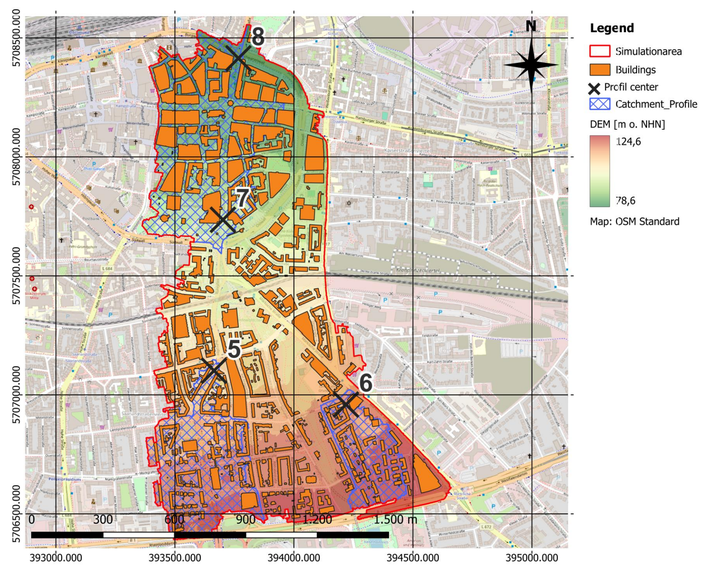

Fig. 1: Position and catchment area for the profiles 5 to 8 in the inner area of the city Dortmund

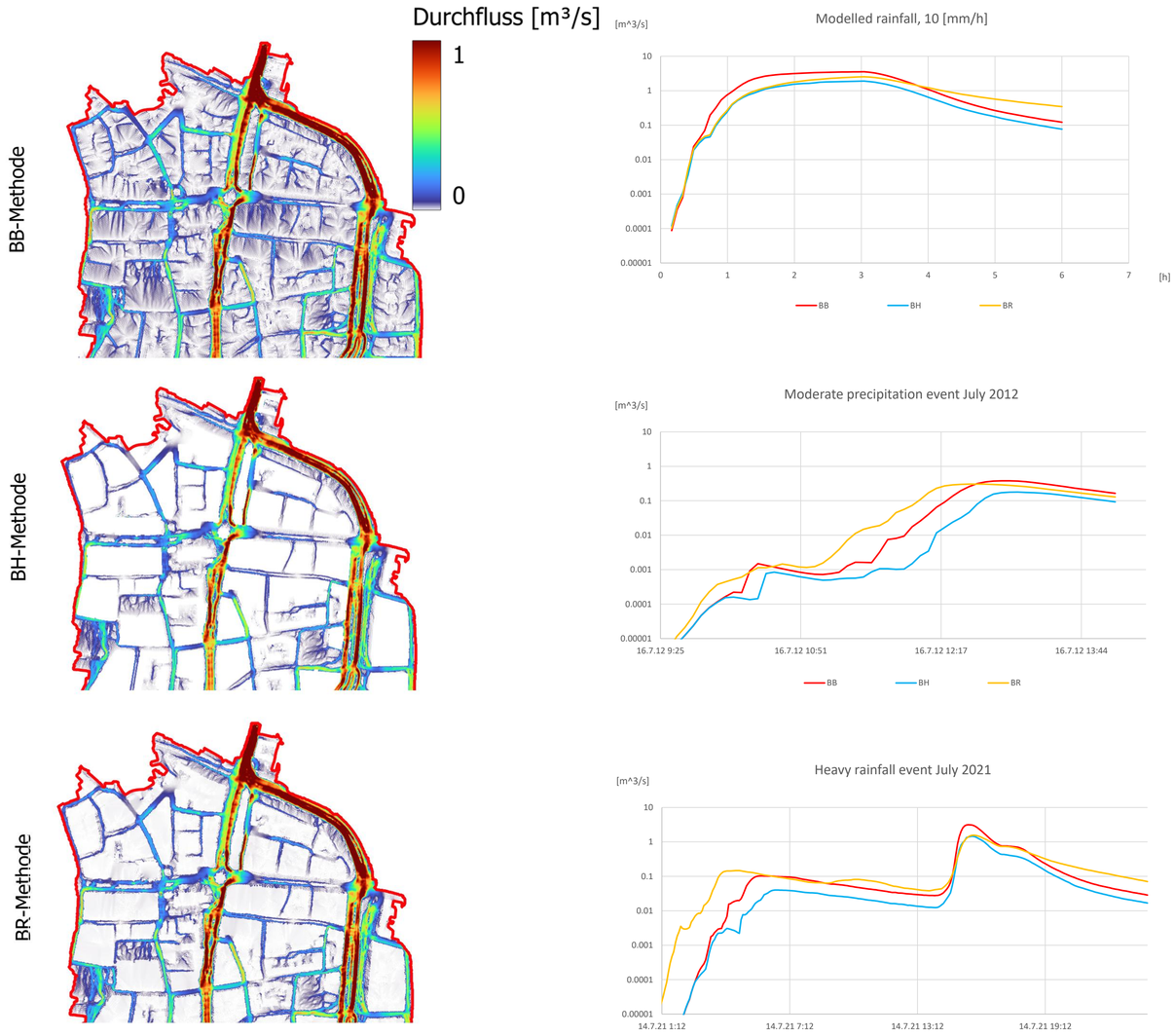

Fig. 2: Discharge for BB-, BH- and BR-method

The methods differ and directly influence the simulation. The flow rate is more significantly affected by the method change than the flow velocity.

BB Method: Typically, **increased flow rates**; minimal noticeable impact from LoD2; building surfaces fully contribute to runoff; lowest effort compared to other methods.

BH Method: More **realistic flow paths** in densely urbanized areas; high preparation effort; no precipitation induced on building surfaces, resulting in **lower simulated flow rates**; **shorter computation time** compared to other methods.

BR Method: Complex conditions in densely urbanized areas; precise analysis of runoff behavior is challenging; more suitable for open areas.

It can be concluded that there is no universally optimal method, and the choice depends on the modeler. A combination of methods cannot be ruled out. A compromise between model accuracy, computational effort, and applicability is necessary in practice.

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