

Houses as reservoirs in urban flood modelling

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Houses as reservoirs in urban flood modelling

Introduction

- Buildings can flood during urban floods.
- The storage effect of flooded buildings may not be insignificant in pluvial flash floods.
- If that is the case, it should be a process that is taken into account when modelling [1].

Materials & Methods

A model of an idealized neighborhood, comprised of 25 buildings with basements and adjustable openings, was built for testing different scenarios using an artificial rainfall simulator (Figure 1) [2]. The ground slope, rainfall intensities and durations were designed to replicate flash flood conditions in the catchment.

Objectives

- Quantify the storage effect of flooded buildings on flash flood dynamics.
- Investigate how overlooking this effect limits our models.



Figure 1 Experiment setup at CITEEC

No buildings flooded 0.6 All buildings flooded 0.5 (s/J) 0.4 Outflow F 0.2 0.1 0.0 Sensor between buildings Sensor downstream of buildings Nater Depth (mm) 3 100 200 300 Time (sec)

Figure 2 Outflow hydrograph (top) water level measurements (bottom)

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Results

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Measured timeseries from two scenarios, one from each end of the flood vulnerability spectrum, are presented in Figure 2.

A 5-minute, 80 mm/h rain event was used in both cases. The peak discharge and the water depth at the outflow are significantly higher in the case where there is no storage effect (no openings on the buildings). This effect is less pronounced in the streets between the buildings.

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We observed that on the scale of а neighborhood, the storage effect of buildings can affect the characteristics of a flash flood, both by attenuating the peak values and by dampening the flood onset.

Bibliography

[1] Bellos, V. et al (2020)
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[2] Naves, J. et al (2020)
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