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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].

Objectives

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

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.

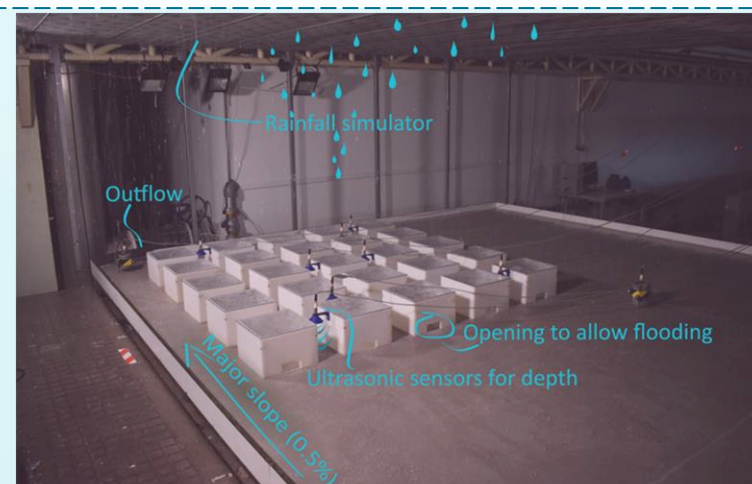


Figure 1 Experiment setup at CITEEC

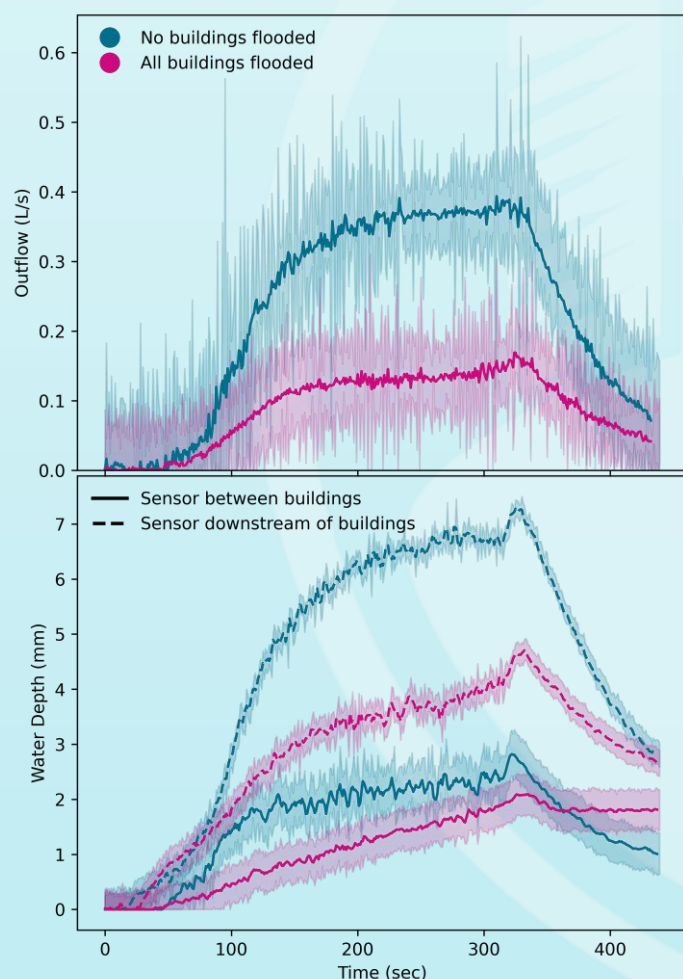


Figure 2 Outflow hydrograph (top) water level measurements (bottom)

Results

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.

Conclusions

We observed that on the scale of a 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) "Reconstruction of a flash flood event using a 2D hydrodynamic model under spatial and temporal variability of storm", Natural Hazards.
- [2] Naves, J. et al (2020) "Hydraulic, wash-off and sediment transport experiments in a full-scale urban drainage physical model", Scientific Data.

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