Review of "Hydrodynamics of long-duration urban floods: experiments and numerical modelling"

The paper deals with flood propagation in urban areas. Authors performed laboratory experiments in a typical urban district, containing 7 streets along each direction (in total 49 intersections). In total, 16 tests were conducted (i.e. 16 inflow conditions). The authors apply a 2D shallow-water model to simulate the experimental set-up and investigate the role of roughness and turbulence model. They also discuss the up-scaling of the laboratory observations to the field.

The topic of the paper is of interest for NNES readers. The paper is well structured and generally well-written. The laboratory experiments are new and complete the existing ones, although I regret that neither velocity nor flow depth in street intersections were measured, which would provide a nice assessment of the performance of numerical models. Many researchers have provided empirical equations giving the flow partition in street-intersections, but authors cannot use their laboratory measurements to assess some equations (which are actually useful when 1D models are used for simulating urban floods) because the experimental flow partition between is not avaialble in-between all the intersections. The 2D numerical simulations and comparisons with the laboratory observations are sound. I particularly appreciated the discussion section.

I would recommend acceptation of the paper with minor revisions. There are still some issues to be addressed by the authors. The most important are:

Abstract

- Please, complete the abstract by giving the most the most important results of the work.
- Specify that the used numerical model is two-dimensional.

Introduction

- Water marks are sometimes available but with very high uncertainty. Also, validation of 2D models should be performed on velocity fields, which are not usually available. Authors are invited to comment these two issues (uncertainty and flow velocity fields) in the introduction.
- Authors do not evoke the need of an accurate estimate of the roughness in urban areas (which is, indeed, spatially variable).
- The laboratory work by Paquier et al. (2009) should be also discussed. Finally, the recent work by Bazin (2013) merits to be discussed.

Paquier, A., Tachrift, H., Riviere, N., El kadi Abderrezzak, K. 2009. Assessing the effects of two non-structural flood mitigation measures using laboratory and real cases. Road map towards a flood resilient urban environment, 26/11/2009 - 27/11/2009, Paris, FRA. Proceedings Final conference of the COST action C22. 8p.

Bazin, P.H. 2013. Flows during floods in urban areas: influence of the detailed topography and the exchanges with the sewer system. Phd dissertation, https://hal.inria.fr/tel-01159518/document

- I find the literature review of experimental studies on urban flows too long. It is not necessary to provide the findings of each study. Please, shorten.
- P.4, L8: "..with respect to the main modelling characteristics". Unclear sentence. Please reformulate

Experiments

- It is not clear where water profile was measured? In the central axis?. If yes, this limits the interpretation of the results and drawing of conclusions. Why not measuring near the intersections, where the flow is 3D in character.
- Authors are invited to explain why velocity measurements were not performed during the experiment.
- Please explain how the experiment was scaled according to the Froude similarity.
- I think that Colebrook formula was proposed for rough turbulent flow. Setting k = 0 in this formula yields the Von Karman formula. May be replace Colebrook by Von Karman.
- A description of the hydraulic structures (if any) in the street intersections would be interesting. Authors may discuss the observations according to the existing ones (Mignot, Rivière…).
- Authors are invited to explain why the outflow partition remains virtually independent of the total inflow discharge.

Numerical simulations

- Specify the time step of the numerical simulation.
- Discrepancy observed in the curved streets are attributed to the Cartesian grid used, which relies on a "staircase" approximation of the obstacles not aligned with the grid. In practice, urban areas are more complex (presence of different obstacles, street angles…) than the "author" experimental set-up. In what extent, the used Cartesian grid (which induces extra flow resistance) can be recommended in field cases?
- Why a particular 2.5 mm grid was tested for the particular total inflow of 20 m^3/h?
- Does the grid impact the computation of the hydraulic structures in street intersections?
- Porosity model: is it an isotropic porosity model?
- The used porosity model includes two porosities (storage and conveyance), which is in my opinion sound. However, so such detailed model cannot be easily applied to field cases, because the spatial distribution of porosities is needed. In what way can a model of this type contribute to flood risk studies based on the scale and accuracy at which flow attributes (depth, velocity) are predicted? How the model would be constructed to account for spatial distributions of porosity which might be required for practical applications?

Conclusions

- Too long. Please shorten and keep only the most important findings.
- Use only one tense to summarize: either present or past.