Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2017-242-RC2, 2017

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Comparison of the impacts of urban development and climate change in exposing European cities to pluvial flooding" *by* Per Skougaard Kaspersen et al.

S. Thorndahl (Referee)

st@civil.aau.dk

Received and published: 1 June 2017

The authors present a novel approach to compare the impacts on urbanization and climate change on pluvial flooding in four European cities.

The paper is well written and easily read and understood. Results are interesting in that sense that the impact of urbanization and climate change on flooding is in the same order of magnitude.

There are some assumptions, which in my opinion need to be clarified in order to justify the simplifications of models and inputs. However since focusing on relative comparisons between the four cities and different climate scenarios, the effect of these

assumptions on the final results and conclusions might be small - however still relevant to discuss from a scientific point of view.

Comments

In the abstract and the introduction the presence and impacts of an urban drainage system in terms of pluvial flooding is not mentioned. The first pages would benefit from a clarification on this.

In section 2.1 on the framework, it would be worth noting which type of precipitation input is used in the modelling concept.

Line 1, page 6: Why the near-linear relationship. In eq.1 the relationship is linear.

I think the assumption on assuming fully saturated soils at all times, thus simplifying Horton, might need some more clarification. If you have a dry soil the initial infiltration capacity might easily be a decade larger than the end infiltration. In that case you risk overestimating the surface runoff. For some of the sandy soils, e.g. the example for Odense, has a saturated infiltration capacity of ∼30 mm/h. If the initial capacity is ten times larges, it is doubtful that the soil will ever get saturated, since you would need rainfall intensities larger than 300 mm/h (for a longer period). But as you write in the discussion the problem decrease for larger return periods, thus larger rainfall intensities.

In the "method section", page 8, the assumption of subtracting the rainfall intensities with a 5 yr return period needs more clarification. It is discussed later on, but it could be relevant to discuss here also. I think neglecting the drainage system, by subtracting the rainfall from a 5 yr return period might be too simple an approach. Partly due to the fact that not all parts of the drainage systems might be designed for a 5 yr return period, and partly due to the fact that even designed for a 5 yr return period, there might be lots of local capacity left in the drainage system, depending on the rainfall dynamics. Furthermore, what about capacity of bassins, channels, recieving waters, etc.?

Page 12, top. The construction of precipitation events needs to be detailed. Are you using design storms e.g. the Chicago design storm constructed from the IDF-curves? These types of storms require a very linear rainfall- flood response in order to be valid. Has this been investigated? Also, why limit the duration to 4 hours – you might underestimate the role of storage bassins, and natural waterways, only looking at the very short durations, thus high intensity, rainfall.

Page 12. You state that you include the total rainfall amounts in the supplementary material, but I think it would be relevant to present here along with the max. intensities over different durations. In that case it would be possible to compare the infiltration rates to rainfall intensities.

Section 3.4. I guess that you assume all surfaces to be impervious during the flood, meaning that you only account for the infiltrating water to the soil in the rainfall input to the model. In reality you might have a flood where water flows from impervious surface to pervious surfaces and infiltrated, but a I guess this is not accounted for. Please comment on this.

Line 12, page 15: I think the limit of 10 cm water levels considered flooding needs some clarification. If you have grid cells of 25 x 25 m2 and with a min water level of 10 cm you discard 62.5 m3 of water. This is a significant amount! Please comment.

In fig. 6 you use km2 and in fig. 7 you use ha. Please apply same units.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2017-242, 2017.