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Hydrology and Earth System Sciences
Discussions

Interactive comment on "On the sensitivity of urban hydrodynamic modelling to rainfall spatial and temporal resolution" *by* G. Bruni et al.

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General comment

The authors present a study that aims at characterising the effect of spatial and temporal resolution of radar measured rainfall data on sewer modelling. For this purpose they use a set of dimensionless indices and data from four storm events.

It is a topic of great importance for future sewer management. The study tries to draw general conclusions from what must be regarded a case study with only four events. This approach makes the manuscript appear rather confusing; on one hand the hydrological model and the rain events are described too superficially to really act as good case study, on the other hand the data basis seems not to be enough to support the general conclusions that the authors would like to make.

I recommend to include (a lot) more data and to better describe the catchment and the hydrological model for the reader to understand the reasoning behind choice of sub-catchment among others. Furthermore, a more thorough reasoning on why the dimensionless indices make the evaluation is needed as they do not seem as the most obvious choice for this reader.

The use of symbols (e.g. RR) is not strict enough and differs between text, tables and figures. Furthermore, an i is introduced without explanation in equations 2 to 4 a long with a 100 that should rather be something like RR,1.

Generally the figures lack common communication. The manuscript would gain a lot from having the figures and tables harmonized in their appearance.

Detailed comments

Introduction

The introduction to the field is quite ok even though studies doing spatio-temporal analysis of rainfall based on rain gauge networks could be added as they from a methodological point of view is important; e.g. Niemczynowicz (1988, 1991). Clear research questions are posed towards the end of the section which clearly help the reader to, without doubt, understand what exactly the aim of the study is.

Presentation of the dataset

The section heading is misleading as the section is also used to introduce the case study.

The case study area and the model used in the study to represent it are both quite poorly described. A map of the area to show where it is relative to a bigger picture would be useful. Furthermore, a map including the sewer network and flow directions would also help the reader to understand how the system works under influence of rainfall.

The use of a semi-lumped model (which even does not include green areas) seems less appropriate when the systems response to fine scale spatio-temporal rainfall is to be assessed. Carter and Vieux (2012) used a fully distributed model (with the smallest investigated catchment having a total area of 4 km2) to test the influence on rainfall movement on small catchments. All in all the description of the model is to superficial for me to judge whether it is suitable for the purpose.

The rainfall data is also presented in a way which is very hard to follow. Why are these four events chosen? How do the move in relation to the catchment? There must be a lot more data available from the radar as the four events seem to be spread over at least six months and it would be very useful to include this in the analysis. It is actually not presented in this section what the native resolution of the radar is; it should be. Furthermore, spatial aggregation is discussed here; these should rather be in the methodological section and ideally be accompanied by a reason for the choices made.

I cannot see the link between figure 1a and 1b. Why are they not termed figure 1 and 2? and why is figure 1a not made in the same way as the subsequent boxplots?

Methods

In this section I expect to have a short precise description of how the proposed indices are calculated and why they are relevant. Table 2, presented early in this section, holds as I see it results and should as such be in the results section. In Table 2 Rr and RRL are both given units of meters but in Figure 2 they seem to be areas.

Directional semi-variograms are used to calculate de-correlation length of the storm events. As radar data is used it would seem very appropriate to use a cell tracking algorithm (e.g. Crane (1979) or something newer) instead and use the shortest distance across the cell as a measure for the critical distance. Also the direction of the semi-variogram is mostly interesting if it is linked to the dominant storm movement direction and to the design of the sewer system in an assessment of whether it is mowing upstream of downstream through the catchment (as done by Carter and Vieux (2012)).

You discuss how the characteristic lengths of the model is a choice of the modeller, but does it make any sense to do the analysis you do unless you have very fine-scale distributed models?

It is very unclear how the sub-catchments are chosen, and if the system is such that the water can flow in many directions depending on where there is water in the system it seems to me to be a very poor area to use for demonstrative purposes.

The dimensionless parameters presented in Table 3 appear as results and should as such belong in the results section. The methods section should rather include a clear reasoning for why they are relevant and how they are estimated.

Results and discussion

In the 'Effect of spatial resolution' section sentences like "the storm cell shift southward due to the spatial aggregation but the core of the storm remains within the catchment boundaries" (p6004, l2-3) are used and it is concluded that in general the location of the storm is of major importance. On that basis there need to be a very through description of the input data for the reader to follow your reasoning.

In Figure 5 it would help the reader a lot if each row had the same y-axis, as it is presented now it is not very clear that the spread for the first event is much larger than for the others.

In Section 4.1.3 you present quite some methodology (p6005, l8-15) which would be more suited in the methods section. Moreover, if 0 and 180 degrees are the same then only report one of them and the manuscript lack reasoning for the choice of angels and there relation to dominant wind directions (or other relevant weather variables) .

Also, I see a methodological problem in only using the 100 m resolution for determination of CD since if it can be determined that accurate there is really no reason for using coarse rainfall data. You need to determine CD for the different spatial aggregated products as it will likely change.

The results presented in Figures 7 and 8 are what are really interesting. Unfortunately, with data from only four events it is impossible to say anything general. Propagate all the data you have available through your framework and one Figure 7 plot where it can be seen that the spread/variance/scatter increases with increasing RR/CD. And the same for Figure 8: More data and discussions regarding the trend. Figure 9 has some of these elements and the conclusions you can draw is hence much clearer.

With respect to the section on the effect of the temporal resolution it should have a more prominent place in the discussion as 1 min is extremely fine scale radar measurements and 5 or 10 min are much more in line with operational radar products.

Conclusions

Generally I agree with you that "To give a more robust meaning to these sampling numbers, more storm events should be analysed to confirm the findings of this study" (p6013, l5-6), but I will actually take it a step further and claim that with only four events the actual location of the events relatively to the catchment is of such importance that no conclusions can be drawn.

References

Carter, P. and Vieux, B. (2012) analysis of storm movement and temporal distribution of rainfall and its influence on rainfall-runoff response of urban basins. 9th International Workshop on Precipitation in Urban Areas - Urban Challenges in Rainfall Analysis. 6-9 December 2012, St. Moritz, Switzerland

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