Hydrol. Earth Syst. Sci. Discuss., 11, C3252–C3255, 2014
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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.

G. Bruni et al.

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Received and published: 20 August 2014

We thank the reviewer for his time and effort in commenting our manuscript. Our response:

RC1: P 5994 – L 15, It would be very helpful to provide a little bit more information on the X-band radar utilised in the text, rather than referring to two references about the radar: including the distance between the radar and the catchment, as well as a brief summary of the quality control algorithms that have been employed on the radar signal would be helpful.

AC1: More specifications of the radar will be added in the final version of the manuscript in the presentation of the dataset and case study section, please see Table 1. The radar

is located in Cabauw, 30 km East of Rotterdam.

RC2: Figure 1a – the y-axis is in mm/hr, yet the caption says 'date and duration, rainfall volume range: : :'? Should Y –axes be in mm, or were there originally 2 figures here (one for rainfall volume, one for rainfall intensity). In any case, the text currently doesn't include what the overall rainfall volume is, it would be useful to add this to the explanation of the rainfall events. Also, it would be helpful to get some idea of the estimated return periods of the events, i.e., are they fairly 'normal', events, or 'extreme' events, as the assumption on P 5996 L 18-19 that green areas do not run off doesn't hold for more extreme events when green areas tend to get saturated and start contributing to runoff.

AC2: the y-axis is not correct, values in the plot show what it is stated by the capture, i.e. total volume. We apologise for the typo and we will correct the plot changing "mm/h" into "mm". A more elaborate description of rainfall event characteristics will be added in the final version of the manuscript, including characteristics mentioned by the reviewer. In particular we will include the return period estimated based on total rainfall volume and on maximum rainfall volume in 5 min (maximum pixel), according to return period estimations of Royal Dutch meteorological institute (KNMI). We will include it in Table 2.

RC3: Figure 2 – right panel, runoff length 'RRL' appears to be 100m, i.e., looking at the figure it appears the runoff is calculated from 100x100 m gridcells? If so, why in table 2 is the 'mean runoff length' 28 (23) metre (and not 100?). This could do with a little bit more explanation in the text (i.e., p 5999, Line 22/23, just says, '. . .catchment is divided into sufficiently small elements. . .' is it a 100x100 m grid, except for at the subcatchment boundaries?)

AC3: The reviewer is right, there is an error in the representation of some of the lengths in Figure2, and it was also spotted by Reviewer #1 as well. The authors apologise for that and Figure 2 will be corrected in the final version of the manuscript. All the lengths

should have meters as units. The grid does not correspond to the real size of runoff areas, which are not squared cells but polygons. We represented runoff areas with a regular grid for a better clarity of the figure itself. We will specify in the capture:

" Runoff areas are represented with a regular grid for clearer illustration of the length scales; in reality they are not squared but polygons with different shapes and sizes, the average of which is reported in Table2".

RC4: P5996 L15 and also Table 1– it would be helpful to add a few more columns in Table 1, to include the runoff factor and surface storage for each type of area (as per Table 6.12, page 674 of the SOBEK user manual). Also, these are empirical coefficients, have any checks been done as to how sensitive the model outputs are to uncertainty in these coeffients? I know it was not the original focus of the paper to do a full sensitivity analysis of all other coefficients/inputs in SOBEK, but in general urban runoff models are also known to still have considerable uncertainty attached. It would be very interesting to include a few 'quick checks', i.e, for example by changing h with 1 mm in SOBEK if possible, or if that's not possible, doing a run with 'open paved stretched flat' instead of 'open paved flat' selected as area type instead (i.e., c 0.1 h 1, instead of c0.2 and h 0.5 0 a difference in surface characteristics that would in reality be quite hard to distinguish), and see if that would be likely to significantly alter the conclusions of the paper or not.

AC4: The purpose of this paper was to analyse sensitivity of urban hydrodynamic model to rainfall input resolution. We agree with the reviewer that there is considerable uncertainty associated with representation of the runoff process (runoff parameters) in the model. Putting these uncertainties in relation to uncertainties associated with rainfall variability is an certainly interesting topic, but we preferred to focus this paper on the impact of rainfall input resolution, given the unique high resolution rainfall dataset we had available.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 5991, 2014.

Radar type	FMCW
Polarization	Dual polarization
Frequency	9.475 GHz
Range resolution	3 – 30 m
Min range	230 m
Max range	< 122 km
Max unambiguous radial velocity	19 ms^-1
Temporal resolution	1 min
Beamwidth	1.8 degrees
Elevation	0.5 degrees

Table 1. Radar specifications.

Event#	Duration (min)	Total volume (mm)	Return period (years)	Max. volume in 5 min (mm)	Return period (years)
Event1	60	9.8	2 per year	8.6	3.5
Event2	40	22.4	10	13.2	30
Event3	120	11.7	2.5 per year	6.21	1.5
Event4	120	12.7	2 per year	3.33	3 per year

Table 2. Rainfall characteristics: duration of the event, total volume of maximum pixel and associated return period, maximum volume in 5 min of maximum pixel and associated return period.

Fig. 1. Table 1 and Table 2