Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-352-RC2, 2017

Hydrology and Earth System Sciences Discussions
Open Access

Interactive comment on "Increase in urban flood risk resulting from climate change – The role of storm temporal patterns" *by* Suresh Hettiarachchi et al.

Anonymous Referee #2

Received and published: 28 July 2017

This manuscript entitled "Increase in urban flood risk resulting from climate change – The role of storm temporal patterns" draws readers' attention towards importance of storm temporal pattern in urban flood modeling under altering climatic scenario. Given the frequent reporting of urban floods across the globe this study provides useful insight to urban flood modelers. The manuscript fits the aim and scope of HESS quite well, and can be accepted provided authors address the following comments with required modifications and justifiable responses.

Major Comments:

Comment 1:

Why did authors choose a 50-year return period storm? Why not 10, 20, or 25 years return period that is much common for urban flood modeling studies? Or why not 100 year return period?

Comment 2:

RCP 8.5 scenario is derived using the most pessimistic assumption and is very unlikely given the ongoing worldwide efforts to curb the carbon emission and green initiatives. Though such studies using RCP 8.5 gives mind boggling figures, these remain very unlikely. A more likely scenario could be RCP 4.5 should have been used along RCP 8.5 to encompass the effects of climatic change. Secondly, authors carried out the study for projected period for 2081-2100 skipping the intermediate time frames. Is there no significant results during 2025-2050 or 2051-2080? Though the results would be much pronounce in the later part of the century, intermediate time frame should also be discussed. Authors must explain the rationale behind selecting worst case climatic scenario i.e., RCP 8.5 and also come up with the reasoning to skip RCP 4.5 and selection of specific time frames for such modeling exercises for potential users. Additional details related to exercise can be provided in supplementary materials.

Comment 3:

The study employs the modeling component in a big way to derive the conclusions, however, there is no discussion made on how the modeling framework was setup. Catchment sizes in the modeling setup varies from 0.25 sq km to 22 sq km that makes almost 90 times change in smallest and largest catchment. Interestingly, unlike river basin scale studies in urban drainage modeling catchment boundaries are not demarcated by their natural topography as the interceptor drains divert the runoff water omitting the natural stream lines. How the authors have discretized such vastly different sized catchments?

Authors should discuss how the impervious area is estimated to include in modeling framework, and other parameters used in the modeling exercise should be tabulated. Did authors fed the existing storm sewage network into the model to rout the flow from a particular sub-catchment to outlet or directed them directly to the outlet from the sub-catchment? Also discuss how the model was calibrated and validated. A separate section on model setup is highly warranted to make the manuscript more informative.

Comment 4:

Line 266-267 and Figure 4: “The rainfall-temperature pairs were binned on 2 degree temperature bins . . .”

Does it mean that binning was done by counting the number of rainfall events and their corresponding magnitudes at each 2 degree temperature interval? What does the height of each bin depict? What do the count and precipitation magnitudes from primary and secondary y-axis show?

Comment 5:

In Line 339-340 authors say “The flood depths extracted from the model were first analyzed to compare variability between temporal patterns and total rainfall depth. . .”

SWMM is a 1-dimensional model and does not simulate the flood extent or flood depth. Though it simulates depth of water being flooded from a node, it depends on the adequacy of drainage network. While discussing the flood depth in relation to urban scenario, the depth of flood inundation should be used rather that the depth of total water flooded from a particular node or from the entire system. This aspect need some clarification.

Comment 6:

In Line 342-343 authors say “These sub-models show the variation in catchment response to runoff generated by different land use types. . .”

There is no provision of feeding LULC information in SWMM, rather it takes percent pervious and impervious area. Different land use types gives a notion that model is simulating overland flow explicitly for residential, paved surfaces, parks, grassed land etc. How the different land use land cover type were incorporated in the model?

Similarly, in Line 360 and 368 authors talk about “local storage/ local natural storage”. How these storage was incorporated into the modeling exercise.

Comment 7:

Line 399-411 does not helps much and as a reader I find it less convincing how Fig 6(a) is different than Fig. 6(b) and how pronounce the difference is for temporal pattern case and total rainfall volume case. Moreover, visually Figure 6(a) and (b) are seems more or less identical with little change. It would be better if author can redraw them to convey their point. Perhaps, comparison of Q1-50 and Q3-50 in same graph for temporal pattern variation or total rain volume variation will help the readers' understanding. Also specific markers for different cases should be provided, as of now there are 4 squares and each belong to which requires a thorough reading. Make the image self-explanatory.

Comment 8:

Fourth conclusion suggests the ‘increase in potential flood risk purely due changes to “how it rains” as a result of climate change impacts’.

This conclusion is drawn from the analysis shown in Fig 6 and Fig. 7. How the temporal pattern variation has a pronounce effect on flood risk as from the Fig. 6 gives almost same picture for temporal pattern for Q1 and Q3 rainfall, whereas from Fig. 7 also not much significant change can be noticed in the standardized flood depth due to current temporal patterns and projected patterns unlike Fig. 8, where the difference is really remarkable. An elaboration would help the readers' understanding.

Comment 9:

Temporal pattern or distribution used from NOAA ATLAS should be discussed in short. It's not clear what does nth quartile at mth percentile means. It would be insightful if authors show it in figure.

Comment 10:

In Line 283, what does author mean by "current industry standard temporal distributions"?:

Authors may like to use supplementary material space for elaborate discussion to clarify the doubt.

Minor Comments:

(1) First line of abstract [Line 8-9] i.e., "Warming temp . . ." is almost repeated in [Line 18-19] i.e., "Current literature . . ."

(2) Fix the citation formats throughout the text, for example in [Line 89] the citation should be like Milly et al. (2007).

(3) Delete 'an' before EPA-SWMM in [Line 182], delete '2016' after EPA in [Line 185]

(4) Line 64: Correct the "Intensity/Duration/Frequency" as "Intensity-Duration-Frequency"

(5) Line 114-116: It would not be apt to link Uttarakhand and Kashmir floods in India with poor stormsewer design from Bisht et al. (2016). As these floods were caused by cloud burst and moreover the topography is hilly in that place. However, Bisht et al. (2016) discussed the Mumbai flood that can be aptly link with flood risk caused by inadequate storm drainage.

(6) Line 165-168: These line should come in the last of introduction section where authors generally list down the objectives or novelty of their work.

Printer-friendly version

Discussion paper

(7) Line 231-232: Cite the NOAA ATLAS like any other technical report and list in the reference. Table 2: Use consistent unit for all the design rainfall.

(8) Line 291: There is no reference for Figure SPM7(a)(IPCC 2014) in reference section. This Figure can be adopted from the source in the manuscript.

(9) Figure 1: What do those lines in Orange, magenta, and Black depict? Proper legends discussing each feature must be included with the figure to make it meaningful. The backdrop can be removed as it is making the image complex to understand.

(10) Figure 6: Figure caption can be shortened as "Comparison of total volume of rainfall and temporal patterns variability impact on peak flood depth. Flood depth variation due to the 6 different temporal patterns with 160 mm of rain compared to 110, 160 and 210 mm of total rainfall over 24 hours distributed over (a) Q1-50 temporal pattern (b) Q3-50 temporal pattern. Flood depths were standardised by subtracting the mean at each location for ease of comparison"

(11) Figure 7: Increase the font size of legends.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-352, 2017.

Printer-friendly version

Discussion paper