

***Interactive comment on* “Scenario-based inundation analysis of metro systems: a case study in Shanghai” by Hai-Min Lyu et al.**

Anonymous Referee #2

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The topic of the manuscript is interesting and relevant. However, I have strong concerns about the proposed methodology because (perhaps) its poor description in the manuscript: - By including "Scenario-based..." in the title of the manuscript I was expecting something else than considering rainfall events of different return periods - this is classic in hydrology and I would not consider it a "scenario-based" analysis.

- The way the EPA SWMM model is connected to the GIS "model" is not clear. Also, EPA SWMM has two main parts: hydrology (lumped catchments) and hydraulics (pipes). How can EPA SWMM be used to estimate water depth on the terrain surface (see e.g. Page 4, line 8)? from EPA SWMM simulations one can obtain "flooding" results in each model node (representing e.g. a manhole), but it is a flow rate and not a depth (for the reasons indicated above).

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- The literature cited in the manuscript is rather old. For example, the authors cite the 2002 study from Horrit and Bates. More than 15 years have passed since this study was published and significant developments in terms of computational power have occurred. The authors should include more recent studies that might contradict their argument: "... models can only simulate inundation in a small range.". Also, this is not entirely true, because in two-dimensional flood simulation the model computational limitations result from a combination of the simulation domain size and the spatial resolution of the data used.

- On the complexity of the model presented in this manuscript: if I understand well the maps presented in Figs 5 and 7, the number of catchments and the number of nodes is relatively small and should not be a problem for EPA SWMM model to handle. Perhaps I am missing something of the proposed method...

- On the spatial (elevation) data used: is a DEM of 30 m spatial resolution adequate to perform the proposed "detailed" analysis? what is the vertical and horizontal error of the DEM? Is the calculation of the average elevation and slope for the sub-catchments appropriate or does it create large errors? E.g. the slope calculation including the artificially added buildings to the DEM will increase the average slope for every sub-catchment (the slope at the edge of the buildings will be close to infinity!)

- there are a few questions about the equations presented (the equations are key to understand the proposed methodology): (1) in Page 7, Line 10, how was "r" defined?, (2) in "Step 1" (page 11, lines10-15), I do not see the difference between the two conditions... (3) Equation 6 seems to be wrong: how can variables of different units be subtracted (hi is a height (m) whereas p seems to be a flow rate (m³/s))

- the tools used in some steps of the proposed methodology are not clear. For example, (1) "flow direction for each sub-catchment was calculated..." in Page 9, Line 6). But how? based on what tool? (2) how was catchment "width" (Page 10, lines 4) calculated? (3) how was the set of "optimal parameters" defined (Page 10, line 6)? How

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was the calibration carried out?

- Results and conclusions: the results are somewhat expected, i.e. more rain -> higher flood depth. So, there is nothing novel here. In my opinion, the conclusion points reflect the problems mentioned above: – Point (1) it is not clear how EPA SWMM results are converted into flooding depth, – Point (2) Equation 6 is most likely wrong, – Point (3) English is very poor compromising the understanding of the text and the areas are not highlighted in the figures presenting the results – Point (4) it is obvious.

The quality of text can also be strongly improved, which may help the reader to follow the manuscript and understand the proposed methodology.

MINOR COMMENTS Page 1. 1st sentence of Abstract: "floods result (...) in recent years.". Recent years is in the Past, so the verb "result" needs to be conjugated accordingly.

Page 1. "Schemed" scenario: what does "schemed" mean?

Page 1. Do metro stations have a pre-defined "drainage capacity"? how is it defined? do authors refer to existing pumping capacity? or something else? authors should explicitly define it.

Page 1. Lines 23-25: these sentences are not clear.

Page 2. Line 4: what exactly do authors mean by "geological" environment?

Page 2. Lines 11-12. "urban planning" is for the future and "prediction" is for the current urban layout. So, these sentences are not very coherent.

Page 3, line 14: what are "characteristics of the landform"?

Page 3, line 18: most of the hydrological studies and also urban flooding studies that I know take into account the catchment boundary as the boundary condition for the model. therefore, I disagree with the authors here. If the authors want to show their point, they should refer to previous studies including the appropriate references!

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Page 4, 2nd paragraph: the 1st and last sentences of this paragraph do not match as they present opposite ideas.

Page 4, Line 24: what is "drainage station"?

Page 5, lines 6 and 7: is a reference needed to say where the Metropolitan area of Shanghai is?

Page 5, lines 9-13: the English quality of these sentences is very poor, compromising the understanding of the text.

Page 6, Line 6: Chicago design storm method does not "produce precipitation" but generates design hyetographs instead.

Page 7, line 4: who did the "documentary investigation"? who derived the IDF curves?

Page 8, line 25: what is "attention point"?

Page 9, Fig 2: where are the pumping stations presented in Fig 2? are they the same as drainage stations? flow direction arrows are not visible. How is sub-catchment drainage capacity calculated?

Page 13, line 10: why 2 hours for the simulation duration?

Page 17, line 1: how are "inundation ratios" calculated? this is not clear to me.

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