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Hydrology and Earth System Sciences
Discussions

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

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-page3, line 20-25: SWMM can be used for large catchments please refer to the following paper: https://link.springer.com/article/10.1007%2Fs41207-018-0092-7. Answer: Thanks for the suggestive comment. We have referred the following reference in the revised manuscript. This is a helpful publication.

Reference: Ai-Mashaqbeh, O., Shorman, M. (2019). Modeling of the stormwater runoff quantity and quality in Amman Zarqua Basin, Jordan. Euro-Mediterranean Journal for Environmental Integration, https://doi.org/10.1007/s41207-018-0092-7.

-page10, table-1: the maximum and minimum infiltration rates which used in the model is default values in SWMM, we have to use the exact values for the catchment area

and based on geotechnical information. Answer: Thanks for the reviewer's constructive comment. This aspect was revised according to the comment. The study area is located in urban center, where the land use has no big changes. The dense buildings exist in the study area, where more than 80% of the surface is impervious. Due to the existence of road pavement, subgrade and many municipal pipelines under the road, the water infiltration through road and subsurface under road is very small, which can be considered as impervious. Thus, soil infiltration and evapotranspiration have slight effects on surface runoff concentration during short-term flash flooding under rainstorm. The soil infiltration mainly depends on green land (combined by lawn, flower bed, and grove) and water body within the study area. In this aspect, the geotechnical information in Shanghai is as follows. The groundwater table is higher than 2 m below ground surface. The soil type at the depth 2 m is a mixed soil with of sand (5%), silt (55%), and clay (40%) according to Shanghai Geotechnical Investigation Code (DGJ08-37-2012). At the surface, sand content increased to 15%, so that the soil has the hydraulic conductivity of 2ïĆť10-5 m/s, which is 72 mm/h; at the bottom of water body, the soil has more clay (>50%) and less sand (<5%) with the hydraulic conductivity of 2ïĆť10-7 m/s, which is 0.72 mm/h (Shen et al., 2015). According to the SWMM handbook, the maximum infiltration rate is determined as 72 mm/h to reflect the characteristics of green land, while the minimum value is 0.72 mm/h to reflect the characteristics of water body. Moreover, in the study area, the blocking effects of the existing buildings have significant effects on the surface runoff generation and concentration. Therefore, the height of the existing building has been paid more attention during surface runoff redistribution. We have rewritten the section of the parameters in SWMM from line 6 to line 25 in page 10.

Reference: DGJ08-37-2012. (2012). Code for investigation of geotechnical engineering in Shanghai. Shanghai Urban Construction and Communications Commission, Shanghai. (in Chinese) Shen, S.L., Wang, J.P., Wu, H.N., Xu, Y.S., Ye, G.L., and Yin, Z.Y. (2015). Evaluation of hydraulic conductivity for both marine and deltaic deposits based on piezocone testing. Ocean Engineering, 110(2015), 174-182. doi:

10.1016/j.oceaneng.2015.10.011

Line 6-25 in page 10: The impervious parameter was determined based on the types of land use. The study area is located in urban centre, where the land use has no big changes. The existence of dense buildings in the study area makes more than 80% of the surface is impervious. Due to the existence of road pavement, subgrade and many municipal pipelines under the road, the water infiltration through road and subsurface under road is very small, which can be considered as impervious. Thus, soil infiltration and evapotranspiration have slight effects on surface runoff concentration during short-term flash flooding under rainstorm. The soil infiltration mainly depends on green land (combined by lawn, flower bed, and grove) and water body within the study area. In this aspect, the geotechnical information in Shanghai is as follows. The groundwater table is higher than 2 m below ground surface. The soil type at the depth 2 m is a mixed soil with of sand (5%), silt (55%), and clay (40%) according to Shanghai Geotechnical Investigation Code (DGJ08-37-2012). At the surface, sand content increased to 15%, so that the soil has the hydraulic conductivity of 2ïĆť10-5 m/s, which is 72 mm/h; at the bottom of water body, the soil has more clay content (>50%) and less sand content (<5%) with the hydraulic conductivity of 2ïĆť10-7 m/s, which is 0.72 mm/h (Shen et al., 2015). According to the SWMM handbook, the maximum infiltration rate is determined as 72 mm/h to reflect the characteristics of green land, while the minimum value is 0.72 mm/h to reflect the characteristics of water body, since the soil under water body is saturated clay. In addition, the blocking effects of the buildings have significant influences on the surface runoff generation and concentration. Therefore, the heights of the existing buildings were extracted to modify the elevation of the calculated grids, which have crucial influence on the redistribution of rainwater during calculation.

-page 17, figure-6: are you consider the existing drainage network in the modeling? if yes you have to show that in the text it no you have to consider it because it will have a significant effect. Answer: Thanks for the reviewer's constructive comment. We agree that the drainage network has significant effects on simulated results. Indeed,

we haven't modelled the existing drainage network directly. It is difficult to consider the drainage network directly in the model since the drainage network data is difficult to collect in such a large study area with 120 km2. Thus, if model each drainage, the calculation in such large area become time consuming. To solve this problem, we use the capacity of drainage station to reflect the function of drainage network. Fig. 2 shows the capacity of drainage station. In this model, we suppose that the rainwater is flowed from one subcatchment to another. During surface flowing, the rainwater is redistributed between ground surface and drainage station. The water quantity calculated by SWMM model is reduced by corresponding drainage capacity of each subcatchment (see Fig. 2). The reduced water quantity of each subcatchment was used to redistribute in the algorithm modelling. Moreover, we use a spreading coefficient to express the spreading process. The spreading coefficient is used for moving runoff between neighbor subcatchments. We have revised this section from line 14 to line 16 in page 8, and we have added discussions of limitations for the proposed approach from line 10 to line 15 in page 23, and line 1 to line 3 in page 24.

Line 14-16 in page 8: Moreover, the function of drainage network is reflected by the drainage capacity of each drainage station (see Fig. 2). The water quantity of each subcatchment calculated in SWMM is reduced by the capacity of the drainage station.

Line 10-15 in page 23 and Line 1-3 in page 24: It is supposed that the rainwater is flowed from one subcatchment to another. Moreover, a spreading coefficient is used for moving runoff between neighbouring subcatchments. During surface flowing, the rainwater is redistributed between ground surface and drainage station. The limitation of the integrated approach is that the existing drainage network has not been directly considered during simulation, since the complexity of the drainage network in a regional scale. Alternatively, the capacity of the drainage station (see Fig. 2) is used to reduce the water quantity of each subcatchment calculated in SWMM. The function of drainage network is reflected by the drainage capacity of each drainage station.

Figure 2: Calculated subcatchment and grid in SWMM and GIS: (a) drainage capacity

and flow direction of each subcatchment; (b) calculated grid of each subcatchment

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-28/hess-2019-28-AC2-supplement.pdf

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