

Authors' Responses to the Comments of Menglim Hoy

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Scenario-based inundation analysis of metro systems: a case study in Shanghai Hai-Min Lyu, Shui-Long Shen, Jun Yang, and Zhen-Yu Yin

The authors would like to thank the constructive comments from the reviewers, which are very helpful to guide the authors' revision on the manuscript. The revised parts are underlined in the revised manuscript. Authors' responses to the comments of reviewers are detailed as below, in which the paragraphs in **normal fonts (in Cambria)** are the original comments and the authors' responses are written in ***italic fonts (in Times New Roman)***.

Comments

This manuscript presented an investigation on the flooding risk of metro system, especially for the stations' inundation during severe rainstorm. The topic is interesting and within the scope of this journal. Overall quality of this manuscript is well. However, to improve the quality and readability of the manuscript, suggestions should be considered by the authors. Following comments would help the authors;

(1) Page 1 in line 18; suggest to rephrase the sentence structure "In addition, an equation is proposed to qualitatively calculate the inundation to figure out possible inundation risks of Shanghai metro system;

Answer: Thanks for the reviewer's suggestive comment. We have revised this sentence from line 17 to line 18 in page 1.

Line 17-18 in page 1:

In addition, an equation is proposed to qualitatively calculate the inundation around a metro station to predict the potential inundation risks of metro system.

(2) Page 4; in Introduction: "Begin with a broad, general statement of the topic and narrow it down to the context". Please add some introductory lines of Shanghai metro system regarding inundation or overflow problems in the past, before the objectives of the research;

Answer: Thanks for the reviewer's suggestive comment. We have revised this section from line 10 to line 11 in page 2.

Line 10-11 in page 2:

Numerous metro lines were inundated during the flood season (May to September) in 2016 in China, such as the metro lines in Guangzhou and Wuhan. The Shanghai Station of metro line No.1 was inundated on October 3, 2016 (Lyu et al. 2018a, b).

Reference:

Lyu, H.M., Sun, W.J., Shen, S.L., and Arulrajah, A.: Flood risk assessment in metro systems of mega-cities using a GIS-based modeling approach. *Science of the Total Environment*, 626, 1012-1025. doi: 10.1016/j.scitotenv.2018.01.138, **2018a**.

Lyu, H.M., Xu, Y.S., Cheng, W.C., and Arulrajah, A.: Flooding hazards across southern China and prospective sustainability measures. *Sustainability*, 10(5), 1682. doi:10.3390/su10051682, **2018b**.

(3) Page 8 in line 4; suggest to specify the tools of GIS used to measure inundation depth;

Answer: Thanks for the reviewer's comment. GIS is an analysis tool in this study, we use the tools (e.g., grid calculation, extraction analysis and extract multi values to points, etc.) to analyze the inundation risk. We have revised the sentence from line 1 to line 2 in page 8.

Line 1-2 in page 8:

The third phase, the inundation depth around a metro station was obtained using the proposed equation and GIS tools (e.g., grid calculation, and extract multi values to points, etc)

(4) Page 8 in line 17; please revise "was" with "is";

Answer: Thanks for the reviewer's comment. It has been revised as "is" in line 18 in page 8.

(5) Page 9 in line 8; which tool in GIS is used to extract sub catchments, please mention it;

Answer: Thanks for the reviewer's comment. The elevation can be extracted using extract analysis in GIS. It has been specified in line 5 in page 8.

(6) Page 14: in Fig. 4, note that SI unit for runoff is m^3/s , please recheck the unit you used is ok?

Answer: Thanks for the reviewer's comment. Here we use the total water quality of each subcatchment. Thus, the unit is m^3 .

(7) Page 18 in line 18; which four metro stations are found under high inundations risks. please specify it in your manuscript.

Answer: Thanks for the reviewer's comment. We have revised this sentence from line 8 to line 9 in page 19.

Line 8-9 in page 19:

The number of inundated stations can also be accounted from Fig. 7. It is clearly seen that with the increase in the rainfall intensity, the number of inundated metro stations is increasing. For the 500-year-rainfall intensity, the inundation depth of these stations of Xinjiangwan Cheng, Yingao east, Yangshupu Road, and Longyao Road over 300 mm (see Fig. 7c).

(8) Page 22; Fig. 8, please note flood location in 2005 in the map is indicated with circular simple but in legend it is triangular, revise the legends

Answer: Thanks for the reviewer's detailed comment. We have revised Fig. 8.

(9) Page 24; please make sure that all 3-objectives discussed in "introduction" section, are achieved in the "conclusion" as well. It would be good to add inundation depth and results for all 3 scenarios as mentioned in objectives of the study

Answer: Thanks for the reviewer's comment. We have added the inundation depth and results for all 3 scenarios in conclusions from line 18 to line 24 in page 25.

Line 18-24 in page 25:

(3) The proposed approach was used to simulate the inundation risk of the metro stations in Shanghai under 50-year, 100-year, and 500-year-scenarios. The results showed that these stations of Xinjiangwan Cheng, Yingao east, Yangshupu Road, and Longyao Road are possible to inundated. In the 50-year-rainfall intensity, these four stations are predicted to be inundated at 100 mm-depth. In the 100-year-rainfall intensity, the inundation depth of the four stations increased by 200–300 mm, whereas the inundation extent exacerbated to other central regions. In the 500-year-rainfall intensity, the largest inundation depth exceeds 300 mm, and other metro stations also undergo inundation with a depth of 100–300 mm in the central region.