Review of the paper, 'Impacts of future climate change on urban flood volumes in Hohhot City in Northern China: benefits of climate mitigation and adaptations [hess-2016-369]'

By Qianqian Zhow, Guoyong Leng, and Maoyi Huang

In this paper, the authors assessed the benefits of mitigating climate change by reducing greenhouse gas emissions and locally adapting to climate change by modifying drainage systems to reduce urban flooding under various climate change scenarios through a case study conducted in Northern China. As the authors commented, this study accounted for the effects of both climate change mitigation and adaptation together in a consistent framework different from previous studies related to this issue. It would be the most important research outcome of this paper.

Now, the paper presents specific and easily identifiable advance in knowledge, which can be usefully applicable to the profession. With the subject within the scope of the journal, the authors describe the paper's research purpose, main findings, and conclusions in a more concise way. However, I have still several concerns about the paper's method, data, results and conclusions, which need to be modified for final publication. The details are summarized below:

1. **Cost-effectiveness Issue**: The authors compared the reduced total flood volumes by climate change mitigation and drainage system adaptation as functions of return period in Figure 7. From this result, the authors highlight the effectiveness of system adaptations in reducing future flood volumes and comment that this has important implications for the research community and decision-makers involved in urban flood management in the 'Summary and Conclusions' part. Because this study only focused on the future changes in urban flood volume followed by the applied different scenarios, there still remains a limitation of this study related to 'cost-effectiveness issue'. In the 'Uncertainties and Limitations' part, the authors added a sentence in lines 453-454 but it seems not enough to explain the limitation of this study. Of course, there are already many meaningful discussions in the 'Uncertainties and Limitations' part but I think the main discussion issue of this part should be 'cost-effectiveness' with valuable references.

2. **Introduction**: The authors need to clarify each condition for other researchers' outcomes. Please pay careful attention to the summary of other researchers' outcomes. For example,

   - Lines 64-66: For example, in Danish design guidelines for urban drainage, a 30% and 40% increase in the precipitation intensity is expected for the 10- and 100-year return periods, respectively (Arnbjerg-Nielsen, 2012). I read this reference, Arnbjerg-Nielsen (2012) but there were research outcomes about the delta change for Denmark. It seems hard to figure out where this sentence is originated from.

   - Lines 75-77: For example, Ashley et al. (2005) showed that flooding risks may increase by almost 30 times in comparison to current situations, and effective adaptation measures are required to cope with the increasing risks in the UK. Please refer to any information about flooding risks and current situations.

   - Lines 77-79: Larsen et al. (2009) estimated that future extreme one-hour precipitation will increase by 20%~60% throughout Europe. Please refer to more specific information about the future year.

3. **Materials and Methods – a. Study region**: The authors need to re-organize the structure of this part for helping readers understand the contents clearly (For example, 1) General comments; 2) Major flood event on 11 July 2016; 3) Necessity for adaptation policies; 4) Plan for the year 2020)

4. **Materials and Methods – c. Urban drainage modeling**: The authors need to summarize only important points, which are directly used for urban drainage modeling in the Storm Water Management Model. Please move several parts to the 'Supplementary Materials' or 'Appendix' part such as Table 1, Equations 1-4 and the related explanations.

5. **4-hour rainfall time series**: Do the authors have any reasons for selecting 4-hour rainfall time series in this study? In lines 223-224, the authors commented that the annual maximum daily precipitation was determined for both historical and future periods.

6. **Figure 2**: The authors need to revise the explanation about Figure 2 (lines 236-245) and the title of the Figure 2 for helping readers understand the contents in a more concise way.

7. **Abbreviation**: Please carefully use the word abbreviation. For example,

   - Line 236: The TFV -> The total flood volume (TFV)

   - Line 282: climate change -> climate change (CC)

8. **Weighted mean imperviousness (WMI)**: Please define how to calculate the WMI.

9. **Figure 3**: The authors need to revise the explanation about Figure 3 (lines 282-292) for helping readers understand the contents in a more concise way (for example, 1) max; 2) median; 3) min; 4) multi-model ensemble median).

   - 1yr -> 1

10. **Figure 4**: Please add the x-axis title.

11. **Ratio of flood volume (RFV) in Figure 5**: Please define how to calculate the RFV.

12. **TFV reduction (%)**: Please define how to calculate the TFV reduction. In Figures 4 and 7, the readers can see the related results, mainly composed of negative and positive numbers, respectively. Especially, in Figure 7, the authors need to explain about the negative values for the return periods of 100 and 200 years.

13. **Lines 83-85**: There are already many journal papers related to this issue. The authors revise the 'Introduction' part to emphasize the novelty of this study.

14. **Lines 122-123**: Please add the related reference here.

15. **Lines 134-136**: Please add the related reference here.

16. **Lines 200-202**: Please add the related reference here.

17. **Lines 251-255**: If this explanation is about the adaptation plan for the year 2020, please clarify the plan for the year 2020 in the 'Introduction' part and this part to help readers understand the contents in a more concise way.

18. **Lines 260-261**: It seems better to start this paragraph with the explanation about the second adaptation scenario. The authors need to re-organize this paragraph.

19. **Lines 269-272**: Please give additional information on this part. It is hard to understand the meaning of this sentence.

20. **Lines 305-308**: Please explain the main reason of these results with discussions.

21. **Line 315**: Please clarify where the historical flood points are.