

	Comments	Submitted Answer
Editor		
General comments	<p>Many thanks for revising the paper. You have convincingly addressed the critical points raised in the first review round. The paper brings unique empirical evidence and combines state-of-the art flood assessment with damage modelling. I now only have two minor issues as raised by reviewer 2:</p> <p>Pls. specify more concretely the differences of this paper from earlier contributions and stress more clearly its additional value and contribution.</p>	<p>We are very grateful for the editor’s kind and helpful comments. There has been already research in this field with several papers published in the past focusing on Shanghai, specifically Wu et al. (2019) and Shan et al. (2019). However, it's important to note that the specific objectives under flood risk differed between these studies: In the study by Wu et al. (2019), the hazard was defined as a 1/10,000-year fluvial flood scenario (river flood from the Huangpu River), whereas we use several hazard scenarios to cover a broader range of low probability – high impact flood events. For exposure, the building asset value in Shanghai was calculated based on the building floor area, which was obtained from the building floor area per district, and the population density per sub-district. Our approach is based on this method however with improvements in spatial resolution and methodology. We adjusted section 5.1 to make this clearer. In another study by Shan et al. (2019), which focused on the same hazard and vulnerability subjects, exposure was determined by considering residential buildings and household properties, using the market price of residential buildings. We explain the advantages of our approach compared to this method in “section 5.1 Uncertainties and limitations” (Line 286-295<sup>1</sup>).</p>
Other general comment	<p>In respect to the applicability of the methodological approach to other mega cities, I wonder whether you could discuss context-specific challenges of doing this.</p>	<p>Thank you for this point. Many studies address the three subjects, hazards, exposure, and vulnerability in risk assessment, however, at the same time, due to the different subjects assessed, the resulting risk estimates differ. It is important to clearly specify the subject or subjects under discussion in the flood risk assessment, as one or many subjects change can alter the objectives. This answer is also an echo to the last question, that the different between the flood risk assessment for the same city (Line 295-301).</p> <p>Another major challenge is the availability of data: we have access to a rich dataset and extensive research on hazard, exposure, and vulnerability, allowing us to undertake risk analysis chain in Shanghai. This availability of resources can pose a challenge for other cities that may have limited data and research in conducting their own risk assessments. We revised this point in “Section 5.1 Uncertainties and limitations” (Line 317-319).</p>

<sup>1</sup> The line numbers in the author’s response match the manuscript track-changes file.

Referee #3

<p>General comments</p>	<p>The paper presents a flood risk assessment for Shanghai, providing an indication of the potential damage of different building types in low-probability/high-impact flood scenarios in a well-written manner.</p> <p>While, given the speed with which climate change is progressing, analysing extreme case scenarios can be considered a valuable addition to the field of flood risk assessment, it remains unclear which additional contributions the paper makes. This becomes particularly apparent, as very similar papers have been published in the past, using the same methods and also focussing on Shanghai (Wu et al., 2019, Shan et al., 2019). I would recommend that the authors further differentiate this paper from these two previous ones by clearly articulating its additional value and contribution.</p>	<p>Thank you so much, Franziska, for your kind comments.</p> <p>As the question also concluded with Editor: There has been already research in this field with several papers published in the past focusing on Shanghai, specifically Wu et al. (2019) and Shan et al. (2019). However, it's important to note that the specific objectives under flood risk differed between these studies: In the study by Wu et al. (2019), the hazard was defined as a 1/10,000-year fluvial flood scenario (river flood from the Huangpu River), whereas we use several hazard scenarios to cover a broader range of low probability – high impact flood events. For exposure, the building asset value in Shanghai was calculated based on the building floor area, which was obtained from the building floor area per district, and the population density per sub-district. Our approach is based on this method however with improvements in spatial resolution and methodology. We adjusted section 5.1 to make this clearer. In another study by Shan et al. (2019), which focused on the same hazard and vulnerability subjects, exposure was determined by considering residential buildings and household properties, using the market price of residential buildings. We explain the advantages of our approach compared to this method in “section 5.1 Uncertainties and limitations” (Line 286-295).</p>
	<p>Generally speaking, the paper is empirical in nature and, so far, is missing a well-developed theoretical and conceptual foundation (and chapter). Positioned between physical (flood assessment) and economic geography (asset damage assessment / flood management), it has not yet been given a real focus for its conceptual contribution. While interdisciplinary research has its merits, it would be helpful if the authors could clearly articulate which part of the work is linked to which area of the field and engage more strongly with relevant literature.</p>	<p>Thank you for this point.</p> <p>The strength and innovative part of our paper is the (equal) combination of exposure assessment and vulnerability analysis. In order to make our interdisciplinary approach and conceptual framework clearer, we have revised “Section 1 Introduction” in order to align our concept and adapt the risk concept framework by the IPCC (Line 23-25). Based on the conceptual framework and adapt to the low probability-high impact flood scenarios in Shanghai, we have developed this study (See Line 80-82).</p>
	<p>As an economic geographer, I am unable to comment in greater detail on the flood assessment part of the paper. However, given the papers aim of providing a foundation for scenario-based decision-making, cost-benefit analysis, and flood risk management, I believe that it could be more strongly integrated into discussion in the field of urban planning. For instance, the contribution of the paper could be strengthened by incorporating Shanghai's current flood management measures into the GIS analysis.</p> <ul style="list-style-type: none"> <li>• At which point will the current measures fail to protect?</li> <li>• How would these measures have to be adapted to reduce potential</li> </ul>	<p>Thank you for your kind comments.</p> <p>We improved several sections to address your comments:</p> <ul style="list-style-type: none"> <li>• The present protection level of the levees along the Huangpu River for the lowest sections is around 1/50-year flooding scenario (Ke et al., 2018) (Line 42-46).</li> <li>• Thank you for this point. Table 6 provides potential measures could be adapted in Shanghai, but it is not calculated in the flood risk assessment.</li> <li>• For instance, in its Master Plan 2017-2035, Shanghai is going to further develop its five new district centers at Jiading, Songjiang, Qinqpu (Songjiang-Qinqpu low-lying area), Fengxian and Nanhui. These five</li> </ul>

	<p>damage? How much would this cost?</p> <ul style="list-style-type: none"> <li>• Are there areas which should be prioritised when implementing new protective measures?</li> <li>• Are there areas that could not be protected in an economically (cost-benefit) sustainable way? Implementing such discussions would truly increase the real-world impact of the paper.</li> </ul>	<p>district centers are planned to be nodal areas in Shanghai and provide more public services for the growing population. However, based on our findings, the Songjiang-Qingpu low-lying area protected by levee with 1/50-year flooding scenario along the Huangpu River, is a hot spot of flood damages. In recognition of this vulnerability, local stakeholders have acknowledged the necessity of implementing levee enhancements in the Songjiang-Qingpu low-lying area. Therefore, future flood protections in these locations, particularly the drainage system and the building structures, must be designed to a higher standard (Line 350-353).</p> <ul style="list-style-type: none"> <li>• Thank you for this point. As of now, we have not conducted a cost-benefit calculation for buildings in Shanghai. However, we acknowledge the potential for such analysis to be explored in future research.</li> </ul>
	<p>Finally, the authors claim that their study can be replicated in other megacities. However, an in-depth discussion of the context-specific challenges of conducting the study and how they might differ and, consequently, have to be addresses differently in other megacities is missing so far. Providing a list of recommendation for other researcher and urban planner who would like to replicate this study in other megacities would be a potential additional contribution to research and planning practices.</p>	<p>Thank you for this point.</p> <p>This work can be replicated in other megacities by adhering to two guidelines. Firstly, it is crucial to clearly define the risk assessment objectives. Secondly, adequate datasets, such as flood hazard maps, or data for calculating asset value for buildings, infrastructure, etc. should be prepared to facilitate the risk assessment process. The awareness and challenge with adhering to these guidelines are discussed in the other general comment from Editor.</p>