

Interactive comment on “Quantifying uncertainty in urban flooding analysis caused by the combined effect of climate and land use change scenarios” by I.-W. Jung et al.

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The authors would like to thank the reviewer for helpful comments on the improvement of this manuscript.

- This is a very interesting paper but with quite long sections in some places. For example the methodology section is very long. Many methods are presented in detail; it is however very well written and structured but I wonder if the different subsections could be shortened? For instance, some paragraphs such as the first paragraph in section 2.5 and 2.7 could be substantially shortened or even omitted. → The first

paragraph of section 2.5 is omitted. The first two sentences were removed in section 2.7. Now the section starts as “To consider possible future land use. . .

More specific comments are given below. -Line 4, 5373: please put ‘is expected to help’ → We changed it.

-Line 23, 5373: please write out ‘PRMS’ → PRMS stands for Precipitation Runoff Modeling System. We changed it.

-Line 21, 5378: This sentence is not really clear, as one expects the most sensitive parameters to be the most important. The authors might consider reformulating this to something like: ‘We consider these parameters most important as they have been shown to be the most sensitive in previous studies’ → We changed it using the suggested sentence.

-Line 5, 5379: This NS value of 0.6 is quite low for daily flows; how might this affect the final result and conclusions of the study? → The reviewer is right. But the NS is generally more sensitive to high flow than low flow. Thus, NS (above 0.6) can be appropriate for our goal because this study focuses on the flood frequency regarding with high flow.

-First few lines in section 2.5: Is this description of natural variability really needed here? → We removed the first paragraph.

-Section 2.8 is rather vague and might thus not be clear to every reader → This section was rewritten. “To examine the main source of uncertainty, we compare the maximum ranges of flood frequency changes according to each uncertainty sources (Jung et al., 2010). For instance, to determine the effect of GCM simulations (GCM structures), we first calculate the differences in flood frequency changes that are derived by different GCM simulations while holding the other forcing data such as land use changes, emission scenarios, PRMS parameters, and natural variability constant. We then rank these differences and determine the maximum value at the top 5%. The same methodology

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is repeated to determine the maximum range for each uncertainty source.”

-Line 23, 5382: please replace ‘closeness’ with ‘fit’ → We changed it.

-Lines 15-20, 5384: This statement is of course very debatable → The reviewer is right. We modified this statement. “They show that one catchment is highly dominated by natural variability, while the other catchment is strongly affected by climate change. Hulme et al. (1999) explain that if a region is dominated by natural variability than climate change, adaptation management that takes into account natural variability may be sufficient to withstand climate change. However, it is uncertain whether natural variability will change by climate change in the future. Our results show that future flood management in the Fanno and Johnson creek catchments should consider climate change impact as well as historical natural climate variability”

-Lines 26-28, 5384: This might be an anticipated result; the authors might want to state this somehow → We modified this sentence.

-Lines 1-5, 5386: This is a rather interesting finding → Thank you for your interesting.

-I particularly appreciate section 3.5 → Thanks.

-The conclusion (section 4) is quite long; please consider shortening → We removed some sentences and shortened the conclusion. This study examines the potential changes of flood frequency and their uncertainties in the two catchments exhibiting different rates of urbanization. Here, the important conclusions are summarized.

(1) In the 2050s period, flood frequency is projected to slightly increase in both catchments, although there are substantial uncertainties. Changes in flood frequency are more sensitive to climate change (A1B scenario) than land use change. Land use change impact is only significant in the less developed Johnson catchment, which is projected to be more urbanized in the 2050s. (2) For the combined scenarios, GCM uncertainty highly affects shorter term flood frequency, while longer term extremes are more controlled by natural variability. Hence, the uncertainties due to future GHG emis-

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sion scenarios and land use change scenarios are less important than natural variability. Also, hydrologic model parameter uncertainty is smaller than natural variability and GCM uncertainty. (3) The combined impacts of land use change and climate change scenarios induce significant changes in the shorter term extremes in both catchments. Flood frequency change demonstrates the highest increase under the A1B with the development scenario and the lowest increase under the B1 with the conservation scenario. (4) Our results indicate that realistic land use change scenario is critical for urban flood frequency analysis under climate change condition, particularly for a developing area.

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