Review of Uncertainty quantification of flood mitigation predictions and implications for interventions (nhess-2018-325-m)

In their study, the authors quantified the uncertainty of flood mitigation interventions on the Dutch River Waal for 39 different sources of uncertainty and 12 mitigation interventions. The goal of this study was to quantify the uncertainty in the predicted changes in river levels associated with the application of the mitigation interventions. To accomplish this goal, the authors developed a "relative uncertainty" parameter which they defined as the ratio between the confidence interval and the expected effect to assess the uncertainty in the predicted change in water levels for each of the mitigation interventions. The authors' found that uncertainty scales with discharge magnitude where there is greater uncertainty with higher discharge and less uncertainty with lower discharge conditions. However, interventions with a similar magnitude of water-level reduction did not necessarily have the same level of uncertainty. The results showed that large-scale vegetation removal had much higher uncertainty than other mitigation interventions. The authors also argue that for a "defined standard of acceptable uncertainty", interventions need to be over-designed to ensure they meet their objective.

General Comments:

This paper provides an interesting case study that illustrates how uncertainty analysis might be used to inform project element selection in a comprehensive flood mitigation project. However, I believe the paper would be improved by briefly addressing the following issues.

1. The authors should explain what they mean by "defined standard of acceptable uncertainty". It is the reviewers experience that "acceptable level of uncertainty" tends to be a very-grey area in hydraulic and other types of modeling.
2. The analyses presented in this paper is essentially focused on the uncertainty associated with the selection of the roughness parameter in the hydraulic model. Given this study's sole focus on this parameter, the analysis undertaken in this paper is an incomplete uncertainty analysis. The authors should discuss why they felt assessing just uncertainty associated in determining the roughness parameter was enough to adequately characterize the magnitude of uncertainty in the hydraulic modeling results.
3. The authors should also discuss how much uncertainty analysis is enough to adequately inform decision making on interventions for flood-level reduction.

Specific Comments:

1. Page 3 -Line 29 and Page 5 – Line 13: Spur "dams" or wing "dams" are a misnomer introduced by Pinter et al. The official terms for these structures are spur dikes and wing dikes (see Parchure, T. M. 2005. Structural methods to reduce navigation channel shoaling. U.S. Army Corps of Engineer Research and Development, Center, Coastal and Hydraulic Laboratory, Vicksburg, Mississippi).
2. Page 5 – Lines 9 and 17: I find the use of low-intensity and high-intensity confusing in this context. Are you talking about discharge magnitude or flow duration? Please clarify.
3. Page 9 – line 20: There are an extra ")." After Stefanou, 2009)
4. Page 18 – lines 10 -13: This is more of a comment than a suggestion. It would have been interesting to assess the uncertainty on the cost benefit analyses undertaken for the flood mitigation interventions. Showing the potential impact of the hydraulic modeling uncertainty

on the benefits of the mitigation interventions would be how to poignantly illustrate the authors point here to decision makers.

5. Page 18 – line 29 – Please remove the comma after evaluations