# Reply to Anonymous Referee #1

## General Comments

Winter et al. presented in their paper (“Event generation for probabilistic flood risk modelling: multi-site peak flow dependence model vs weather generator based approach”) two approaches to simulate distributed flood risk throughout rural catchments. The manuscript is well written and structured. The methods are sounds and the models used are well established. The results are clearly presented and the conclusions are supported by the results and discussion. The novelty of the paper is not with the development of new methods, but the use of available methods (that are common in hydrological sciences) in the context of risk assessments. I believe that the application presented here will be of interest to the natural hazard community and fall within the scope of NHESS. Below please find some suggestions for the authors to consider. I recommend minor revisions.

*First of all, we want to thank the anonymous reviewer for taking the time to critically read our work and to provide additional suggestions for further improvement of the manuscript.*

## Specific comments

1. Introduction – You do compare the two distributed approaches to the "traditional" approach, but this is not clear from the introduction. I suggest adding a sentence mentioning this.

*Many thanks for this comment. We will add an additional statement in the introduction section to clarify the comparison between the two distributed approaches and the spatially homogeneous approach.*

2. Discussion – Many other models, besides the HT-model and the WeGen model, can be used to estimate distributed risk. For example, one can use a different WG model (say the AWE-GEN model) and a different hydrological model (say the HBV model) with a different outcome – e.g. that the WG-hydrological model approach will systematically underestimate the risk computed by the HT-model. I suggest adding another paragraph in the discussion section, discussing how general are the results of this study.

*We agree, that the same framework with different components (weather generator or RR-model) likely lead to alternative results. The outcome of higher systematic risk estimates for the WeGen approach might not be true for other model components. We will address this in an additional paragraph in the discussion section.*

3. The WeGen model simulates temperature, but do you use it as input into the hydrological model? It is not clear from the text. If not, I would remove all text mentioning the temperature simulation to avoid confusion.

*The conceptual RR-Model HQsim is forced by temperature and precipitation. We will add this important information to the “Hazard Module II: WeGen” section.*

4. Some justification is needed for the choice of the HQsim model. Is it able to capture well extreme runoff events? Please discuss the advantages and limitations of using a conceptual semi-distributed rainfall-runoff model to simulate floods.

*Thank you for the valuable suggestions. The model was used in different studies regarding extreme runoff in alpine study areas and is inter alia applied for the prognosis system of the Inn River (e.g. Senfter et al. 2009; Achleitner et al. 2012; Bellinger et al. 2012; Dobler and Pappenberger 2013; Winter et al. 2019). Fully distributed, physical based models (e.g. WaSim) will probably perform better in describing certain hydrological process such as for example the evapotranspiration or snowmelt process by using energy balance approaches. In contrast, a conceptual description of the hydrological processes (for example in HQsim) does not need all meteorological variables to solve a full energy balance (temperature, precipitation, radiation, humidity and wind speed). A further increase in model complexity will likely compromise the model parameter identifiability, increase calibration effort and computation burden. The*

*computational efficiency is of major concern for the long-term continuous hourly discharge modelling. The advantages and limitations of choosing a conceptual model will be addressed in the discussion section and some further information about HQsim will be added to the method section.*

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5. [page 7, line 25] Terminology: an ensemble of 100 realizations, each consists of 42 members (years). Also later in the text, replace “repetitions” with “realizations”.

*We will use the term “realizations” as suggested.*

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6. Figures 3 and 7. Please use a larger font size for the axes labels.

*The Figures will be revised with larger font sizes.*

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7. [13, 27-31]. I suggest adding in Figure 5 the known losses from the records (e.g. the August 2005 event) and discussing the models’ performance in comparison to the "known" risk. It will give another dimension (from an "expert" knowledge) of the abilities of the different models in assessing the risk.

*We agree that a “traditional” validation against known losses would be of great value. Unfortunately, we do not have reliable numbers of the loss event which are directly comparable to the model output. We tried to validate the model based on an insurance portfolio. The portfolio is however only a subset of the overall elements at risk and due to rather low sublimits (maximum payouts) for most objects, the full losses remain unknown. Finally, without a larger set of loss events it is not possible to assign a meaningful return period to the 2005 event to “validate” the risk outcome in a traditional way.*

## References


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