Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-453-RC1, 2020

Hydrology and Earth System Sciences
Discussions
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Interactive comment on "Runoff sensitivity to spatial rainfall variability: A hydrological modeling study with dense rain gauge observations" *by* Clara Hohmann et al.

Anonymous Referee #1

Received and published: 20 October 2020

In their paper, Hohmann et al. studied the runoff sensitivity to spatial rainfall variability, namely they investigated the impact of station density and interpolation schemes on runoff simulations. I found the novelty of the study very limited. The effects of the density of the network of rain gauges and different interpolation methods on hydrological models have been analyzed many times in the past – as the authors mention themselves in the introduction to the paper. The research questions asked in the paper ("how many stations do we need to reliably model hydrological runoff under heavy rainfall events?" and "how large is the influence of interpolation scheme on runoff results under different station network densities?") are simply not new. I found the results to be very limited following the decision to explore only two interpolation methods (TP

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and IDW), which seems to be motivated mainly by the fact that these are the interpolation methods that are built-into the WaSiM model that was used in this study while ignoring other common interpolation methods (e.g. Kriging). Are six rainfall events enough for this type of study? Considering the authors discuss the effects of rainfall variability in space, I would expect many more events to be interpolated and simulated to demonstrate the robustness of the results. I cannot recommend the manuscript for publication in HESS in its current form. I would suggest extensive revisions of the study that include extending the number of extreme rainfall events in the analysis, exploring additional interpolation methods and, as the authors suggested in the abstract, conducting further investigation to study if a rainfall ensemble can be used to decompose the effects of rainfall records and interpolation uncertainties on modelled runoff – this might be qualified as a novel aspect that can contribute to the originality of the study, which is now missing.

Some specific comments

Line 150. What is the reason to calibrate the model with an objective function that includes both NSE and KGE? Why not simply using one of the two?

Lines 156-157. The fact that the model is calibrated using IDW2 is not affecting the results when compared later to input using IDW3 and TP? I would expect the model to be calibrated to each input separately to reduce the errors emerging from the model parameterization (as your goal is to discuss the errors emerging from the model input).

Section 3.2.2. I suggest also comparing the rainfall events using some statistics. For example, how similar how the short rainfall events in term of their spatial variability? You can, for example, plot a graph comparing the spatial autocorrelation of the storms.

Section 3.2.4. Why using only a single metric to analyze the runoff? Consider adding other metrics, pointing on the timing of the peak runoff, total runoff volume, etc.

Lines 405-406. One option to overcome the model default is to compute the IDW

outside the WaSiM model and a second option can be changing the code of WaSiM to compute the IDW the way you choose (if I recall the model as an open code policy).

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