Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2022-21

Anonymous Referee #1

Referee comment on "A gridded multi-site precipitation generator for complex terrain: an evaluation in the Austrian Alps" by Hetal P. Dabhi et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-21-RC1, 2022

This article suggests a novel GLM-based space-time rainfall generator for Alpine region. While the suggested model shows the limitations in reproduction of reality, I think this is a meaningful attempt in our field given the extreme challenging nature of the space-time field generation. The model is original, and the article is well structured. Therefore, I believe that the article is suitable for publication in this journal after a few revisions.

- I suggest authors to compare extreme values too. e.g. extreme values by the model of this study vs. AGPD, both point values and areal values. This is because one of the primary reasons of developing weather generators is to analyze disaster (from a probabilistic viewpoints).
- Please consider excluding trivial precipitation (e.g. less than 1mm) from your analysis to calculate occurrence-related values (Pww, Pdd, Pw, etc), and reanalyze your result. This is a common issue with all stochastic rainfall generator drawing rainfall depths from a modelled mathematical distribution. You may get better results.
- L181-184. I would like to see the map of the interpolated scale and shape parameter. Interpolating parameter, in many cases, causes problems. The map should look smooth and should show dependency to the terrain. In addition, I suggest authors to consider obtaining these parameter maps based on the AGPD data or the KED-based rainfall map from your point observations to exclude the process of spatial interpolation.
- Figure 7 and Figure 18. I would also like to see the shades of the observed precipitations, which may be significantly greater than the current blue shades. This is not because I want to criticize, but because I would like you clearly show and mention the challenges of the stochastic rainfall generators (underestimation of large-scale variability) and to suggest potential remedies. Park et al. (2019) and Kim et al. (2020) discusses this issue in detail.
- Figure 9. Why not show on the log-log axis? Too many small value pairs.
- Figure 12 and Figure 15 look like a collection of chessboards rather than a heat map. Would you remove the white squares?
- Figure 11, 12, and 13 (Figure 14, 15, and 16 too): No need to show all the months. Please consider squeezing into one figure showing simulation (1st row), AGPD (2nd row), and differences (3rd row) for 4 seasonal months (columns)
- L 300-302, Figure 17. I am not sure which of the two variables that the authors are

precisely comparing. Would you let me know how, for example, correlation coefficients were derived (e.g. x and y values of the scatter plot)?

Park, J., Onof, C., & Kim, D. (2019). A hybrid stochastic rainfall model that reproduces some important rainfall characteristics at hourly to yearly timescales. *Hydrology and Earth System Sciences*, *23*(2), 989-1014.

Kim, D., & Onof, C. (2020). A stochastic rainfall model that can reproduce important rainfall properties across the timescales from several minutes to a decade. *Journal of Hydrology*, *589*, 125150