Natural Hazards and Earth System Sciences Discussions

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Comment on nhess-2022-99

Anonymous Referee #1

Referee comment on "Comprehensive space–time hydrometeorological simulations for estimating very rare floods at multiple sites in a large river basin" by Daniel Viviroli et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-99-RC1, 2022

Review of the manuscript „Comprehensive space-time hydrometeorological simulations for estimating very rare floods at multiple sites in a large river basin"

This manuscript presents continuous simulations combing the outputs of multisite weather generators, conceptual hydrological model and routing scheme to obtain very long simulations of discharge and estimates of flood with return periods larger than 1000 years in the Aare catchment in Switzerland.

Generating long continuous simulations of discharges for estimating rare events is an important research avenue and this work presents an attempt to generate such long time series at high temporal resolution for a large catchment. However, there are several methodological details that needs clarification, especially with regard to hourly disaggregation. Below I present my detailed comments.

Detailed comments

Line 53: It could be worth mentioning here the work on wave superposition of Guse et al (2020).

Line 123: Do these 79 sub-catchments correspond to the 19 sites where the whole simulation chain was evaluated? Please clarify.

Line 129-130: From Figure 1 it seems that a portion of stations are located outside of the Aare catchment. Please indicate how many stations were located within.

Line 137-138: According to the Line 130 hourly data is available only from 1990. Please clarify.

Line 141-144 and later: It is not clear how these hydraulic simulations were used in this study. Please clarify.

Line 145: What about the remaining regulated lakes? Was information about their management not available? How their regulation was accounted in the hydrological simulations? Please clarify.

Table 1 a: Are these actually observations or simulations by a hydraulic model? Please clarify.

Line 156-159 and later: At this point the rationale for using two different weather generators is not clear. Only in Lines 710-713 the reason for using two of them is stated. Please add a clarification earlier in the manuscript to clarify the use of two methods.

Line 160: From the description later in the manuscript it seems to me that the complete years with largest events were selected and not events per se. Please clarify this to omit any confusion.

Line 163: Please indicate how these 19 sites were selected.

Line 182-183: This is not clear. Please provide more detailed information on hourly disaggregation since hourly simulations were indicated as one the main novel point of this study.

Line 200-202: Please provide more information on how hourly discretization was done. The provided references focus on daily simulations.

Line 215-216, 233-235: It is still not clear to me if the weather generators produce areal precipitation directly or at-site simulations for multiple sites that are later used to produce areal mean. Please clarify.

Line 224-226: Was the same disaggregation technique used for SCAMP as for GMEX? Please clarify.

Line 226: Should it be 2014 instead?

Line 241: Why not all of the available 65 gauged catchments were used for calibration? Please clarify.

Line 255-259: In my opinion this description is not very helpful for understanding the functionality of the routing procedure and how it was parametrized. Consider providing a more detailed description.

Line 261-262: This is rather vague. Please clarify.

Line 268: Please elaborate on the technical issues that occurred.

Line 269: Please indicate how these precipitation events were identified. Was the precipitation depth or volume considered? What was the threshold? Moreover, please also indicate how the initial conditions for these years were handled.

Section 4.1: This section only provides results for daily simulations. Since the focus of this study is actually on hourly simulations the corresponding results at this resolution for weather generators should be provided.

Figure 4: The resulting spatial pattern of annual maxima from two weather generators appear to be quite different, but very little discussion on that is provided in the text. Consider adding it and indicate what can be the reason for the discrepancies.

Section 4.4: No results for the simulations of the entire chain using SCAMP weather generator are provided. Please add.

Section 4.4: This result section provides quite a few methodological details. Consider moving them to a corresponding section in the methods.

Line 417-419: Please clarify what are these extrapolations.

Section 5.5: I miss any mentioning about the uncertainties arising from disaggregation from daily to hourly values. Please add.

Editorial comments

Line 117: the Rhine River

Line 391: the largest

References

Guse, B., Merz, B., Wietzke, L., Ullrich, S., Viglione, A., and Vorogushyn, S.: The role of flood wave superposition in the severity of large floods, Hydrol. Earth Syst. Sci., 24, 1633–1648, https://doi.org/10.5194/hess-24-1633-2020, 2020