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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A virtual hydrological framework for evaluation of stochastic rainfall models" *by* Bree Bennett et al.

Anonymous Referee #3

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OVERVIEW

The manuscript proposes a "virtual hydrological" framework useful for the performance evaluation of stochastic rainfall generators (SRGs). Differently from other studies involved on this topic, this work proposes 1) to evaluate the rainfall performances directly in terms of discharge by considering as benchmark the "virtual observed streamflow", i.e. the streamflow obtained by running the observed rainfall into the hydrological model, 2) to use two different tests to highlight discrepancies between observed and

simulated rainfall for a specific site or month.

GENERAL COMMENTS

Although the topic is surely of interest for the readership of HESS, a major revision is required before to consider the manuscript suitable for the publication. Indeed, throughout the manuscript some important information are missing (for details see specific comments below) whereas the section 2 and details about the virtual hydrological framework should be shortened. Moreover, the outcomes of this study seem linked to the specific case study and the authors should discuss how the results could be generalized for different SRGs and hydrological models.

Abstract section. This section should be made clearer concerning both the explanation of the virtual hydrological framework features and the results obtained in the work. Specifically, lines 12-15 and 18-20 in page 1 are not clear without reading the paper.

Section 2. This section should be shortened deleting multiple repetitions about the framework description in sub-sections 2.2 and 2.3. Moreover, Figure 1 and 2 could be merged into one figure. Conversely, the section 2.4 should be improved (also adding a flowchart) to allow the readers to easily follow the section "results".

Section 3. Some important details are missing in this section. In addition to the area of the catchment and the temporal resolution of the simulated rainfall, the authors should specify how the GR4J model is forced by observed rainfall and how it is calibrated. Is the observed catchment average rainfall used to force and calibrate the hydrological model? How many years of observed discharge data are used for calibration? is this set of parameters used to simulate streamflow within the unit and integrated test?

Finally, major details should be added to this section about the rainfall statistics used for the calibration of the SRG of Bennet et. al. (2018).

Section 4. In this section the authors should address the following points:

1) as the authors know, the rainfall simulated by the SRG are function of the rainfall statistic properties used to estimate the model parameters. According to the authors, in which way the rainfall statistical properties and the results obtained by the unit and integrated test are linked? if different rainfall statistical properties are used for the SRG calibration, are the results different? For instance, is the identification of the 10 "poor" sites sensitive a variation of rainfall statistics? If different statistics are used for SRG calibration, is it possible to reduce the streamflow errors? These aspects should be demonstrated/discussed by the authors in order to provide to the readers a general framework not tailored for a specific case study.

2) as the streamflow generation is a results of the mean areal (rather than single-site) rainfall over the basin, before to apply the integrated test to identify sites for which the rainfall simulation is not good, it could be interesting to estimate the streamflow errors coming from the mean areal rainfall, evaluated as average over the 22 sites. How good are these streamflow time series with respect to the "virtual-observed" ones (obtained by the rainfall observed over the 22 sites and averaged over the catchment)? More interesting, the authors should highlight the benefits deriving from the use of integrated test. For instance, they should show what are the streamflow errors if only the 12 "good" sites are retained to evaluate the mean areal rainfall. Is it better than using all 22 sites?

SPECIFIC COMMENTS

Page 2, lines 19-21: the example of Bennet et al. (2018) is not clear without reading the paper.

Page 7, lines 14-15: This sentence is not clear. Please rephrase it.

Page 8, line 24: Why the authors write "13 errors to compare"? Are the authors considering also the integrated test? It is not clear.

Page 8, lines 27-28. This example related to the integrated test is difficult to understand in this section. The reason is that in the previous section, where the authors describe the test there is no mention to the fact that the evaluation of the integrated test is carried out also at the monthly scale.

Figure 4: the position of the streamflow gauging station should be added in the figure.

Page 15, lines 19-20: the conclusion about the transitional months should be drawn carefully. Indeed, moving from dry to wet conditions the process of formation of flood is very sensitive to the antecedent soil moisture conditions. Is the hydrological model able to reproduce observed streamflow in the transition period?

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