

Response to comments of Reviewer 1

January 17, 2022

Thank you very much for your positive comments about our work. You can find below our response to your comments in italic. Changes made in the main paper are shown in red color.

This paper presents an interesting comparison of regionalization methods for rainfall frequency analysis. It is based on a large sample of 1176 daily stations in Switzerland and its neighbouring countries. Five models have been compared, based on local data (local EGPD) or regional data (Omega EGPD with an average shape parameter; ROI EGPD Full or Semi with ROI approach; GAM EGPD with parameters depending on covariates). The paper gives confirmation on the interest of regional approach vs local approach, and concludes that the GAM model is better for the upper tail, and the ROI model for the bulk of the distribution. The paper is clear and well written.

Response: We thank you very for much again for the constructive feedback.

1 General Comments

- *I have one requirement on additional simulation and three minor recommendations. The authors decided to use a EGPD distribution, with the advantage of representing both the bulk of the distribution and the upper tail. As the conclusion is that no model is the best on the whole part of the distribution, I would be interested to see whether a GP-ROI distribution-regional approach performs on the upper tail, compared with a GAM EGPD model.*

Response:

As suggested by the reviewer, we ran the additional simulation where we regionalize, based on the method of Region of Influence (ROI), a Generalized Pareto Distribution (GPD). Following the same methodology outlined in our paper, we assessed the performance of this model on the upper tail using the FF and SPAN criteria. We show the result in Figure 1. For clarity, we include the boxplots of the other regionalization methods, as contained in Figure 5 of the main paper. Additionally we include two models:

- ROI_GPD model: Here the GPD fitted on the POT of each station is regionalized according to the ROI method.
- GAM_GPD model: Here a GAM model is used to regionalize the parameters of a GPD

We comment that the performance of the GPD_ROI model in terms of both robustness and the reliability in the upper tail, is less compared to those of the GAM_EGPD model. The difference in performance is more pronounced in the case of robustness as measured by SPAN100, and in fact the GPD_ROI model has lower robustness compared to the other ROI models that are based on EGPD. Indeed, local GPD models (without any regionalization) have been shown to lack robustness [1]. For this reason, the fact that some stations have no neighbors identified (around 33% in the case of winter for example), it is not surprising that the low robustness of the GPD fitted on these stations will affect the overall regional SPAN100 score. The GAM_GPD model on the other hand shows high robustness and reliability in the upper tail.

We remind the reviewer that although interesting, we choose not to show these results (GPD cases) in the paper because the paper aims at modeling the whole range of precipitation and not only the extremes.

2 Minor recommendations

- *Line 152. The first time, explain PAM acronym (Partitioning around medoids)*

Response:

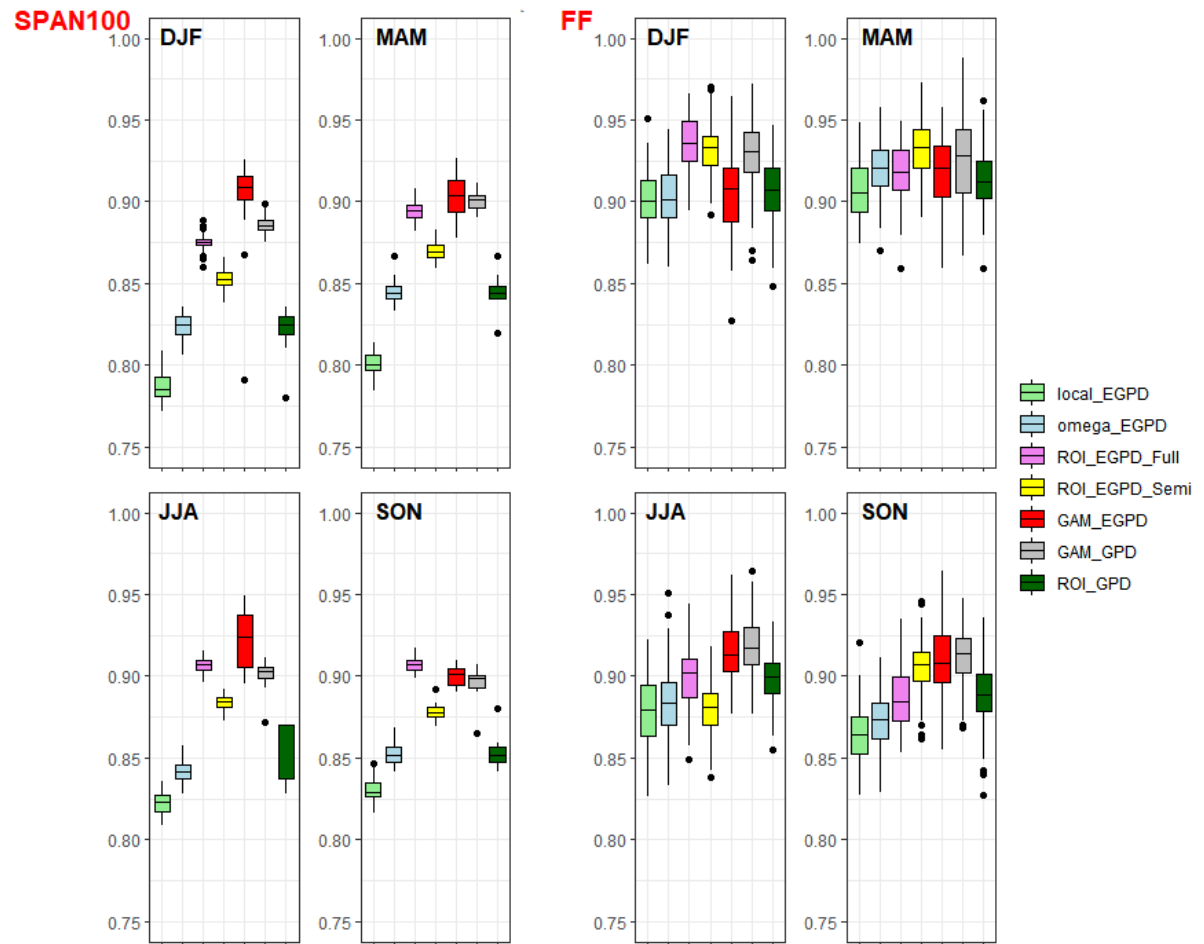


Figure 1: Criteria applied on the upper tail for each season. Left: Robustness of the local EGPD and the six candidate models, as measured by the SPAN criteria. The stability is measured with respect to a 100-year return level estimate. Each boxplot contain 50 values. Right: Reliability in prediction of the maxima as measured by the FF criteria, each boxplot contain 100 values.

Thank you very much for this correction. We have included the meaning of the acronym, see line **152**

- *Figure 3 - Histogram.* It could be interesting to add (for each class of radius) the mean number of stations belonging to the ROI

Response: We have modified the Figure to include the average number of stations identified for each class of ROI. See line **371**

- *Line 420.* “The plot of the right of Figure 5”

Response:

Thank you again for this correction. We have effected the correction. See line **420**

References

- [1] G. Evin et al. “A regional model for extreme rainfall based on weather patterns subsampling”. en. In: *Journal of Hydrology* 541 (Oct. 2016), pp. 1185–1198. ISSN: 00221694. DOI: [10.1016/j.jhydrol.2016.08.024](https://doi.org/10.1016/j.jhydrol.2016.08.024). URL: <https://linkinghub.elsevier.com/retrieve/pii/S0022169416305145> (visited on 08/25/2021).