Firstly, we would like to express our gratitude for the valuable contributions of the reviewers. We greatly appreciate them, as they have greatly improved the quality of the proposed manuscript.

Comments on the revised version of the manuscript: HESS-2023-55-AC2:

Assessment Downscaling Techniques to develop Frequency Analysis and Estimate Total Precipitation and Number of Rainy Days per Hydrological Year from CMIP6 Simulations

By David A. Jimenez, Andrea Menapace, Ariele Zanfei, Eber José de Andrade, Bruno Brentan

Thank you to the authors for addressing many of the reviewers' comments. However, this second version still needs a full revision in terms of English grammar and presentation.

The manuscript includes valuable results in terms of comparing different downscaling techniques for different rainfall properties. However, the paper is poorly written, and it needs extensive revision in its general presentation. The title also needs modification. Consider for example:

Assessing Downscaling Techniques for Frequency Analysis, Total Precipitation and Rainy Days Estimation in CMIP6 Simulations over Hydrological Years

There are still many sentences incorrectly phrased and grammar errors, as well as acronyms that are not properly defined or are used before a full description of the acronym is given. Please check for example the following lines:

- Line 45: ANN

  R//: The acronym was expanded to include not only Artificial Neural Networks (ANN) but also other Machine Learning techniques.

- Line 50: PG is used instead of GP

  R//: The acronym was changed from PG to GP

- Line 100: Please review this sentence: "The analysis allowed the identification that only 29 presented consistent series."

  R//: The text was adjusted as follows:

  "It was evident that only 29 stations had more than 30 years of consistent records, with missing data below 10%."

- Line 115: "tale 1" instead of Table 1

  R//: The text has been adjusted.

- Line 120: "are" repeated twice.

  R//: The text has been adjusted.

- Line 120: Please review this sentence: “In the case of DM, are stand out the investigations developed by Salehnia et al., “

R//: The text was adjusted as follows*:*

“In the case of DM, the investigations developed by Salehnia et al., (2020), Salehnia et al., (2019) and Teutschbein & Seibert (2012) are noteworthy.”

- Line 120: Please review: “Under SDS. “. This does not make sense.

R//: The previous text was eliminated as it didn't make sense.

- Line 125: Temperature in capital letters

R//: Done

- Line 145: Please review this paragraph. It has many errors as using “e” as a connector instead of “and”. Also, this sentence does not make sense: to developed of downscaling of satellite precipitation, the evaluation 145 showed RT as the best technique.

R//: The text was adjusted for:

“In the case of RT, the studies conducted by Khalid and Sitanggang (2022) and Hutengs and Vohland (2016) stand out. Khalid and Sitanggang (2022) compared various ML methods for downscaling precipitation, yielding that RT performed best. On the other hand, the study conducted by Hutengs and Vohland (2016) adopted RT to enhance the spatial resolution of temperature based on land surface temperature and reflectance with favourable results.”

- Line 150: Please review the whole paragraph. Consider using “Once the simulated series was obtained”, instead of “Once it was obtained the simulated series.”

R//: The text was adjusted according to your suggestion:

“A Pixel-Station downscaling approach was developed. Observational data from each station were collected along with simulated GCM data, extracted from the pixel containing that station. For all the selected pairs of time series, the temporal consistency between daily precipitation observed and simulated was guaranteed by selecting the simulated data only for the day in which the observation data are presented. Once the simulated series was obtained, the evaluated downscaling techniques were applied for each selected point.”.

- Line 160: Please review the grammar as well.

R//: The text was adjusted for:

Where: P_{SD}^{Delta} *represents the downscaled precipitation,* $P_{Mod,daily}$ *represents the simulated precipitation by the GCMs,* $\underline{P}_{obs}$ *represents the average monthly precipitation of the station and* $\underline{P}_{Mod}$ *represents the average monthly precipitation simulated by GCMs.*

- Line 200: Please review grammar as well. Consider changing “At the same way”.

R//: Changed "At the same way" to "Similarly" for better clarity and coherence.

- Line 215: Please review grammar.

  The text was adjusted for:

  "*Where X_i and $X_i^{'}$ are the observed and simulated values, while $\underline{X_i}$ and $\underline{X_i^{'}}$ the mean of the observed and simulated values, respectively. n represents the number of simulated data, $\sigma_i^{'}$ the standard deviation of the simulated values, σ_i the standard deviation of the observed records, and R the correlation coefficient between the observed and simulated records.*".

- Line 220: Hydrological instead of "Hidrological"

  R//: The text was corrected.

- There are many other that I might had missed. Please proofread your article carefully. Correct all gramma issues. If possible, have the article reviewed by a native English speaker.

  R//: A complete and careful proofreading was done.

- Line 275: There is one wrong number.

  R//: We didn't find it.

- Caption Figure 10: Please capitalize first letter.

  R//: Done.

- The added conclusion paragraphs need to be re-written. Please check grammar carefully.

  R//: A revision of the conclusion paragraphs was done. Except for the last paragraph, all of them were changed as follows:

  "This study aimed to assess the performance of using downscaled series through the Delta Method, Quantile Mapping, and Regression Trees to develop frequency analysis and estimate total precipitation and the number of rainy days per hydrological year at annual and multiyear levels.

  It was observed that the Global Climate Models (GCMs) from the sixth phase of the Coupled Model Intercomparison Project (CMIP6) underestimated the number of rainy days per hydrological year for MRBH, with a median of 78 days. When estimating the number of rainy days from the downscaled series by DM, the tendency of underestimation persists and insignificantly decreases to 73 days. It was also observed that, when employing downscaled series through the application of QM and RT, underestimation is reversed to a slight overestimation. The average overestimations were 18 days for QM and 19 days for RT. Despite the relatively low magnitude of overestimations, the low NSE and KGE scores suggest that estimating the number of rainy days at an annual scale from downscaled series using DM, QM, and RT does not guarantee accurate results.

  Similarly, GCMs underestimate total precipitation for the hydrological year, with a median of 413.84 mm. The use of a downscaled series by the DM reduces this difference to 361.42 mm. However, when

QM and RT are applied, the differences surpass those without downscaling. The median differences in those cases are 433.10 mm for QM and 434.64 mm for RT. These facts, along with the low NSE and KGE scores, suggest that annual estimations of the number of rainy days and total precipitation from downscaled series by DM, QM, and RT do not yield reliable results. This result is also due to the fact that a one-year time window is not optimal for analysing the precipitation simulated by the considered RCMs, and consequently, more significant results were found with the multiyear study.

Therefore, at the multiyear scale, the estimation of the number of rainy days and total precipitation demonstrated high performance. For the number of rainy days, the percentage errors between the magnitudes of the total estimated from reduced and observed series were less than 1.21% and 2.58% when downscaled series by QM and RT were employed. Percentage errors for estimating total rainfall per hydrological year on a multiyear scale were 1.55%, 1.99%, and 1.83% when downscaled series by DM, QM, and RT were used, respectively. "

Other issues related with the methodology are as follows:

- Please comment on why models described in Table 1 were selected. Why do you opt for selecting several ensembles from a single model, like EC-Earth3 ensembles?

  R//: the following paragraph has been added:

  "It is important to emphasize that all available simulations with a resolution of 100 km have been included in order to consider all the ensembles available for each climate model. This choice was made with the intention of utilizing all available model outputs and thus providing a more robust analysis."

- Line 215: Please explain why 156 analyses?

  R//: The text has been changed to improve interpretation:

  "78 analyses were conducted both for total precipitation for the hydrological year and the number of rainy days."

- Figures 2 and 4 are not useful for comparison if the scale in the x axis is not the same for all graphs. Please consider modifying the scale.

  R//: During the correction process, we tried to keep the same scale on the X axis. However, it turned out that this made it even more difficult to understand and analyze the figure because different values were obtained for each technique. Faced with this scenario, we decided to keep the scales as presented.

- Figures 3 and 5: There is no explanation about what the orange color means. What do you mean with "prevailing condition"? What is the message you want to communicate with these figures? Please include the meaning of the acronyms (WDS, etc.) in the caption.

  R// The caption was enhanched.

- Table 3 caption: "original datasets" means without downscaling? Please make this clear. Both words "pluriannual" and "multiyear" are used interchangeable. Please be consistent if possible.

  R// "original datasets" was changed to "without downscaling" and "pluriannual" was changed to "multiyear".

- Figure 7: Why are you having two separated panels? There is no explanation to differentiate the top from the bottom panel. Please include different labels and explanations in the figure caption.

  R//: The figures are separated because the errors for WDS are higher than those obtained when employing the reduced series using QM, RT, and DM. Thus, with the purpose of ensuring a proper interpretation, the need to separate the panels was highlighted; otherwise, it was not possible to differentiate the errors of each technique adequately.