Major comments

Request:

While the Standardized Precipitation Evapotranspiration Index (SPEI) was proposed by previous studies, it would be better to present the basic technical details of this index in Section 2.3.

Response:

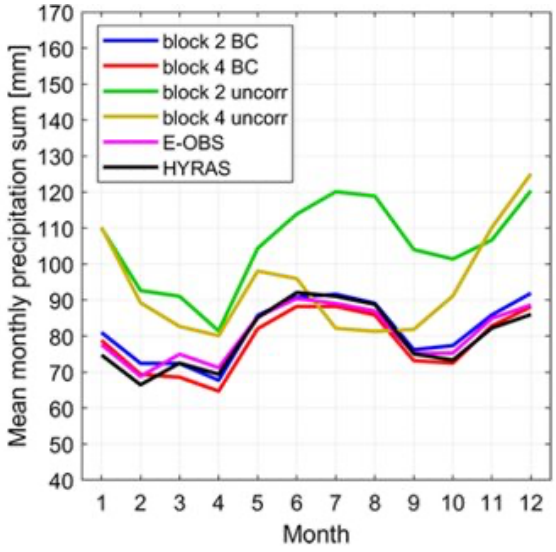
We thank you for your comment. Indeed, the methodology for obtaining SPEI values has been published in many studies. However, we cited the original publication in L138 and the description of the formulas for obtaining the SPEI values in lines L145-L168.

Request:

Lines 109 and 140: What is the correlation coefficient (Pearson, Spearman, or any other) used in those studies? How statistically significant is the correlation?.

Response:

Thank you for this comment. For the L109, we will change the word correlation with "good agreement". Ehmele et al. (2022) stated that the LAERTES-EU dataset, specifically after applying the bias correction (BC), has significantly improved the spatial mean temporal variability, as shown in the figure below, where the closeness of the precipitation values from LAERTES-EU to the observed data is evident.



Spatially mean monthly precipitation for blocks 2 and 4 in LAERTES-EU for uncorrected (uncorr) and bias-corrected (BC) data in comparison with two observed data E-OBS and HYRAS. Source: Ehmele et al. (2022)

In L140, Erfurt et al. (2020) used Pearson's method to assess the strength of correlations among the different drought indices. The results show that the higher correlation indicates a direct link between meteorological and hydrological droughts based on historical data. Therefore, we can use it to determine the meteorological events from LAERTES-EU that are more likely to propagate into a hydrological drought.

Request:

Section 2.4: The model performance in both the calibration and validation (if any) periods should be presented.

Response:

Thank you for your comment. This manuscript cited a scientific publication that was under review (**L177, 179, 180**) at the time of manuscript submission, which contains the model description, calibration, and validation process. Originally, we submitted the final draft for the reviewers as additional information. In the meantime, the calibration/validation study has been published and can be accessed at https://doi.org/10.1080/15715124.2025.2581608. As the calibration/validation was an extensive work, we kindly ask the reviewer to refer to this publication regarding calibration and validation questions. The updated reference will be included in a revised version of the manuscript.

Request:

Line 211: How were the SPEI ranking values combined?

Response:

With the goal in mind to find the most extreme drought events in the data set, we combined the SPEI rankings as follows: First, we separately calculated the SPEI3, SPEI6, and SPEI12 values for each LAERTES-EU year. Separately for each SPEI, every year was ranked, with 1 being the most severe drought (SPEI <- 2). Subsequently, each year's ranking values for the SPEI3-, SPEI6-, and SPEI12-month were summed. Finally, the top ten years with the lowest combined values (e.g., 3, the lowest possible) were selected for further hydrological simulation. We will add this detail in the revised version of the manuscript.

Request:

Figure 2: Several SPEI-12 values (Jan and Feb) for EV 6 events in sub-figure c) are missing? Also, use the same term "SPEI-3" or "SPEI3" in both the text and the figures.

Response:

Thank you for your comment. The figure will be modified to add the missing months and to correct the text.

Request:

Lines 366-367: "In Section 3.2, EV2 was not ranked as the most severe event because the analysis was an average streamflow value of a fixed period." Does this imply that SPEI cannot capture the severity of drought? If so, how should the current form of SPEI be refined?

Response:

We appreciate your comment. In this paragraph, we compare streamflow analysis, not the SPEI. It is noted that in the severity ranking of hydrological droughts, EV2 did not rank highly, despite

having the longest duration, because the severity analysis was based on the average streamflow over a fixed period (June-November). We will add this rephrased text to the revised manuscript.

Request:

Figure 6: Please increase the value range for streamflow in Kaub.

Response:

We appreciate your comment. We will change the figure in the updated version of the manuscript.

Minor comments

Request:

Line 16: "…to identify meteorological droughts,"

Response:

The word "drought" will be changed to "droughts".

Request:

Line 20: To avoid confusion, it is suggested not to use "GlQ20" in the abstract.

Response:

We will omit the threshold name in the abstract.

Request:

It is not necessary to repeat the full term of SPEI after its first appearance in the manuscript, e.g., Lines 82 and 138.

Response:

Thank you for pointing it out. The full name of SPEI will be omitted in L82 and L138.

Request:

Line 97: Change "12.000" to "12" ?

Response:

The value is twelve thousand, not twelve. The number will be written for clarification in the new version of the manuscript.

Request:

Figure 1: It is suggested to add a legend to present the meanings of the different lines and points, and add a north arrow to all the maps.

Response:

We appreciate your comment. The suggested details will be added in the corrected version of the manuscript.

Request:

Lines 130-132: Keep the format of the references consistent.

Response:

In a revised version of the manuscript, the references will be corrected.

Request:

Lines 145-150: Keep the font style of the variables consistent in both the text and the equations.

Response:

The font of the equations will be changed to match the text.

Request:

Lines 269-271: Please rephrase the text here.

Response:

We appreciate your comment. The text will be changed to “A similar behavior is shown in Fig. 2c, where some events, namely, EV1, EV6, EV7, and EV9, display SPEI12 positive values at the beginning of the year.” The next sentence will be kept as is. The rephrase will be in the updated version of our manuscript.