

## Reply to Reviewers and Editor

We sincerely thank the Editor and the Reviewers for providing very insightful comments. We have now addressed all the comments raised by the Reviewers and accordingly modified our manuscript. With this revision, we believe our manuscript is more focused and clear, and we are hopeful that it now satisfies the proposed requirements for successful publication. Additional minor modifications of typographical, and tense nature are made to the manuscript in order to improve its legibility. We would like to mention that after implementing all these changes in the revised manuscript and supporting information, the final findings and conclusions remain unchanged.

### Reviewer 1

#### Minor Comments

L56 'the old'

**Author's Response:** The text was updated.

Table 1: Missing - at the end of the sentence

**Author's Response:** The caption text was updated.

Table 1: (CE) — relevant?

**Author's Response:** Yes, it is necessary to show common era time period .

L117 section → Sect

**Author's Response:** The text was updated.

L118 section → Sect

**Author's Response:** The text was updated.

L121 'forcing validation'

**Author's Response:** The text was modified as,  
"—evaluating the accuracy of meteorological forcing reconstructions used for hydrological simulations"

L127 Second → This

**Author's Response:** L128 → The text was updated.

L155 presented → in the presented

**Author's Response:** L156 → The text was modified accordingly.

Figure 3 and 4 : Remove → The left- and right- most figures represent the approximate minimum and maximum for the corresponding indicator.

**Author's Response:** In both figures, the following text in the caption was removed.

L210 Bias → all uppercase

**Author's Response:** L211 → The text was corrected.

L236 double space here?

**Author's Response:** The text was corrected.

L241 NSE 0.76 → here missing the / other value

**Author's Response:** We just consider 0.76 because the results for LSTM and BRNN are identical for the case of [P, T, PDSI].

L246 in → in the

**Author's Response:** L247 → The text was updated.

L276 are driving → employed

**Author's Response:** L277 → The text was updated.

L276 LSTM → LSTM model

**Author's Response:** L277 → The text was updated.

L277 was best in one case → resulted the best in just one case

**Author's Response:** L278 → The text was modified according to the Reviewer's suggestion.

L277 four → timeseries reconstructions

**Author's Response:** L278-L279 → The text was updated.

L291 Reformulate → while in the past century (1900-2000) to be 1921

**Author's Response:** The text was modified as,

L292-293 → "... the year 1921 in the past century (1900-2000)"

L292-293 I would remove this. Or "worse" year is not appropriate term ...)

**Author's Response:** L294 → The text was removed.

L302-305 → I just noticed in Fig S5 an apparent bias of GRUN. I wonder if the difference is also due to the catchment polygon used to aggregate the GRUN runoff ... How did you delineate and validated the catchment out of curiosity?

**Author's Response:** During this process, each grid cell value was subjected to a time-series conversion of GRUN monthly runoff data into yearly scale. This annual runoff data has been spatially aggregated to include all grid cell values within each catchment polygon (shapefile). I agree with Ghiggi's observation that the resolution of GRUN data is 0.5 degree, which could result in a spatial mismatch across the catchment region, resulting in a slight discrepancy.

L355 Remove → Because the tree-ring proxies involved in the developed reconstruction were the same, which could reveal the true nature of hydroclimatic shifts.

**Author's Response:** L356 → The text was removed.

L360 analysed

**Author's Response:** The text was modified as,

"performed an exploratory analysis of decadal runoff ... "

L363 throughout → in annual runoff !!!

**Author's Response:** The text was added.

L364 runoff → annual runoff

**Author's Response:** L365 → The text was added.

L376-377 Reformulate → deficiencies in the driving input fields

**Author's Response:** The following text was added.

L372-373 → "—there is high uncertainty in the forcing meteorological data. "

L378 the → hydrological

**Author's Response:** L374 → The text was added.

L386 runoff → annual runoff

**Author's Response:** L382 → The text was added.

L388 (GHCN) → provided by GHCN station,

**Author's Response:** L384 → The text was added.

L389 ed → ion of the

**Author's Response:** L385 → The text was replaced.

L389-390 I would remove this. You cannot assert inconsistencies in OBSERVED runoff based on the ESTIMATED RE-CONSTRUCTED FORCING

**Author's Response:** The following text was removed.

L386 → "—leading to inconsistencies in observed runoff (e.g., demonstrated by the poor results of GR1A for some catchments)."

L393 remove "the"

**Author's Response:** L392 → The text was removed.

L393 the → years with

**Author's Response:** The text was changed.

L395-399 I would move this before discussing about the issue of the resolution of the reconstruction. Here you are still talking about uncertainties related to input data ....

**Author's Response:** The following text was moved.

L388-392 → "The skill of precipitation and temperature reconstructions across the selected catchments to derive annual runoff is still fairly good. In addition, the data-driven methods that were used in the paper were capable of removing systematic bias. We cannot be sure, though, that the link between reconstructed forcing and annual runoff is stationary when going back in time. Moreover, when the number of natural proxies included in the derivation of the forcing dataset decreases, the uncertainty increases. The reconstructed data should, therefore, always be considered with caution."

L406 at free → on the public

**Author's Response:** L401 → The text was added.

L408 at website via link → at

**Author's Response:** L403 → The text was modified.

L409 → I would remove all this. (GHCN) data can be accessed at ....

**Author's Response:** The following text was removed.

L404 → "— provides revision and updated version (V4) for temperature and (V2) precipitation which"

L437 Replace 'predictions'

**Author's Response:** L431 → The text was updated.

L453 Remove → a function

**Author's Response:** L447 → The text was updated.

Figure A2: Maybe could be nice to color bar above 0 in blue, and bar below 0 in red ;)

**Author's Response:** Thank you for your suggestion, the color bar was modified accordingly.

Table A2: Why there are always info for double periods? What they refer to? I don't understand the table Make no sense to me to report the slope statistics I would not add this to the manuscript. Out of scope.

**Author's Response:** The twofold period displaying both a negative and a positive trend for particular catchments. According to the Dr.Ghiggi recommendation, we have also realized that the table lacks relevancy; therefore, the table and its associated text have been deleted from the discussion section.

### Reviewer 3

The only minor issue I could pick up is a slight inconsistency in tense in a few parts such as in Section 2 where there is a mix of past and present tense.

**Author's Response:** According to the Reviewer's recommendation. We carefully revised Section 2 content and edited to maintain consistent grammatical tense.