

***Interactive comment on* “Comparison of statistical downscaling methods for climate change impact analysis on drought” by Hossein Tabari et al.**

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We thank the reviewer for the detailed and constructive review. In the following, we express our view on the raised points, and illustrate our plan on how to improve the paper.

GENERAL COMMENT

The paper presents a comparative analysis of four (4) Statistical Downscaling Methods (SDMs), namely, Bias Correction (BC), Change Factor of Mean (CFM), Quantile Perturbation (QP) and Event Based Weather Generator (EBWG) to assess climate change impact on drought by the end of the 21st century (2071-2100) relative to a baseline period of 1971-2000. The SDMs were applied to downscale daily precipita-

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tion from 14-member ensemble of CMIP6 GCM at the Uccle weather station in Belgium for four future scenarios, namely, SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5. Various drought indices have been calculated and used in the comparison of SDMs' results for the future period with the drought indices estimated from the observed precipitation for the baseline period. The paper is well organized, written and comprehensive. However, there are a few points that should be clarified and addressed. Overall, the paper merits publication in the HESS after the moderate comments are properly addressed.

Reply: We thank the reviewer for the encouraging assessment and helpful comments.

SPECIFIC COMMENTS

1) Title: The title of the paper should include the word "precipitation". Precipitation is the variable downscaled from GCMs in the paper. Additionally, drought phenomenon is affected by other meteorological variables, for example temperature, evapotranspiration and others. It should be clear from the title that the work presented in the paper deals with the downscaling of precipitation for the estimation of climate change impacts on droughts.

Reply: We agree with the reviewer that the title of the paper should show that precipitation and its lack are investigated in this study. The title will be revised accordingly.

2) Abstract: It should be made clear in the Abstract that the downscaling exercise was made for the weather station of Uccle located in Belgium. This information is missing from the stand-alone abstract of the paper.

Reply: The weather station information will be added to the abstract.

3) It is usual to calibrate/validate the SDMs during the historical base period (1971-2000 in the paper) and, then, apply them for the future period(s). The authors although mentioned that the methods have been calibrated using the observed precipitation at the Uccle weather station, they do not present any results (i.e. statistics, graphs) about the calibration of the SDMs. The presentation of the calibration results are necessary to

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assess the validity of the downscaling methods before using them to the future periods.

Reply: We agree that assessing the validity of the SDMs is important. In the next version of the manuscript, we will present the calibration results of the SDMs.

MINOR COMMENTS

4) Lines 46-48. It is written “Precipitation and the number of wet days were found to increase during summer and to decrease during winter, while evapotranspiration was found to increase for both seasons. This suggests drier summers and wetter winters.” This statement is quite vague and needs further explanation on the ratio of precipitation and evapotranspiration to generate drier summers and wetter winters.

Reply: The statement will be clarified by adding more details on the precipitation and evapotranspiration changes.

5) Line 130. The equation of m should be written better. The equal sign is not shown properly.

Reply: A space will be added before the equal sign.

6) Table 3. What is WLDS? Although the term is presented in the text of the paper, it should be written in full. Tables are stand-alone elements of a paper.

Reply: VLDS refers to very long dry spell. It will be written in full in the table. The abbreviations in the other tables and figures will be either written in full or (wherever it is not possible due to a space limitation) defined in the future caption and table title.

7) Figure 2. The color bars and the reference lines should be explained

Reply: Sorry for the missing legend. The legend will be added to the figure.

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