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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Using hydroclimatic extremes to guide future hydrologic predictions" *by* S. K. Oni et al.

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Paper summary: The reviewed paper presents the possibility to evaluate future climate change impacts based on current hydro-climatic extremes. The study focused on a boreal headwater catchment located within an experimental unit in the North of Sweden. Using a semi-distributed bucket type hydrologic model, the authors showed the effects of different parameters sets, obtained calibrating the model on wet years, on dry years and on mean long term data. The parameters sets were selected based on multi-criteria goodness of fit indexes. They assessed the uncertainty of an analyses based on long term series compared to an analyses focused on wet and dry years and provided future hydrologic response to an ensemble of climate models using both wet and dry years model parameterizations. According to the authors, results demonstrated that future hydrologic projection should be based on parameterization obtained

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in conditions similar to the predicted climatic one. The manuscript also stated that, nevertheless, the uncertainties in Regional Climate Models projections remained larger than uncertainties due to different model calibration strategies. Recommendation: In my opinion the paper, introducing the separation between extreme yearly conditions, shows an alternative and interesting way to conduct hydrologic simulations aimed to study the effects of climate change at the basin scale. According to me however, before the publication in HESS the article should be improved making more clear some aspects. I suggest the authors to address some points which are listed in the following.

1) The introduction can be improved. The first paragraph (lines 30-43 on page 2) seems to introduce the problem of climate change in northern latitudes and high altitude catchments. Being not the study area of the paper an high altitude basin, I would avoid to refer to high altitudes.

Response: Thank you for calling our attention to this. This will be revised in the manuscript.

I do not understand the sentence in lines 33-35 “These trends. . . continues.”, could you please explain and/or better relate it with the rest of the paragraph?

Response: We agreed that this does not fit in properly here. We will revise this in the revision

The second paragraph speaks about uncertainties and conceptualization of hydrologic models. The usual methodology when setting the hydrologic models for the evaluation of climate change effects is to use different conditions for their calibration and validation (e.g. Klemes, 1986, Wilby, 2005), for example calibrate parameters in wet years and verify them in dry years. According to me, this should be cited in the paragraph and better related to the presented work.

Response: Thanks for your suggestion. We will revise this paragraph to incorporate necessary sentences.

2) I suggest to rename the second section as “Data and methods”. In the description of the study site I think it is better to specify the length of the available observed dataset (line 88 page 3).

Response: The second section of the manuscript will be renamed as data and methods accordingly. The length of the data is 1981-2012 and will be added to the appropriate place in the manuscript.

In the reviewed paper no downscaling seems to be applied hence the title of subsection 2.2 should be “Climate models” instead of “Climate downscaling”. Downscaling (Wilby and Wigley, 1997; Maraun et al., 2010) is different from bias correction of regional climate models (Christensen et al., 2008), so this term is not appropriate.

Response: This will be noted and corrected in the manuscript. Thanks

The rainfall-runoff model PERSiST is cited for the first time at the beginning of subsection 2.3. Maybe a sentence to introduce the model could be added with the meaning of the model acronym.

Response: The full meaning of the acronym will be added to line 109 in the manuscript. Thanks

The second paragraph (from lines 124 page 4 to line 136 page 5) is not clear: maybe Table 3 could be introduced before and a sentence to state the adoption of a Monte Carlo approach could be included. In paragraph three the reference to Futter et al. (2014) should be added in line 141 to make more clear why the Nash-Sutcliff metric must be close to zero instead of 1 as in other works (Senatore et al., 2011, Mascaro et al., 2013). Furthermore, I think it is better to add some details of the Monte Carlo runs (e.g. the total number and the number of model runs in each chain) in this specific case.

Response: We are working on this section as suggested to make it more clear but concise.

3) In the Results section what does the acronym SI mean and to what does it refer?

Response: The acronym SI refers to Supplementary Information and this will be written in full in line 161 where it first appeared for clarity

I think that in Figure 3 it is not enough clear that the patterns in wet and dry year refers to present day conditions while the ensemble mean to future ones.

Response: This has been noted and will be implemented in Figure 3 caption. Thanks

Maybe, in sub-section 3.2 the words “Results showed” could be paraphrased or written in a different way to avoid repetition.

Response: This section will be reworded accordingly.

What are the metrics AD and Var mentioned in sub-section 3.3? They were not introduced in the revised paper.

Response: Thank you for calling out attention to this. We realized that these were not introduced in the method section. We will amend appropriate section of the method section in the revised manuscript.

Probably, Figure 4 becomes more clear if it is specified that observed series refers to wet years also in the caption and legend of the figure.

Response: This has been updated in both the caption and figure legend.

The style of Figures 4 and 5 is different from the style of Figures 2 and 3 (see also Minor points). In my opinion, it is preferable to use the same style.

Response: Grid lines have been removed from Fig 2 and 3 to make them conform to style used in Fig. 4 and 5.

I do not understand the sentence in sub-section 3.6 (lines 243-245). Can you explain, please?

Response: Many studies projected wetter conditions for boreal region. In our analy-

ses, present day wet year appeared to be the closest to such future conditions. This suggests that wet years could drive the uncertainty in future projections. However, the uncertainty in present day long term simulations is mostly driven by processes in dry year conditions. This was revealed in our study as parameterization in dry long term and close. We hope this clarifies the statement. This will be explained better in the manuscript as well. Thanks.

4) Also the Discussion section should be clarified in some points. The references cited in lines 255-256 page 8 are some of the authors dealing with climate change impacts on hydrology, hence I suggest to add “among the others”. Brown and Robinson (2011) is cited twice in two consecutive sentences, is this necessary?

Response: These have been implemented in the manuscript. Thanks

In sentence on lines 279-281 (sub-section 4.1) the authors refer again to downscaling, could you better explain, please?

Response: This has been amended. Thanks

I do not understand the reason of the first sentence of paragraph 4.3 lines 325-327 on page 10, could you be more clear, please?

Response: This will be removed since the paragraph can do without the statement.

Minor comments: 1) In line 68 on page 3 I suggest to avoid the repetition of the preposition “to”: “The objectives of this study were to. . .” which is rewritten at the beginning of each following point.

Response: Thanks for taking note of this. This will be corrected in the manuscript.

2) The word error is missing in line 146 on page 5 and the metric R2 is not defined.

Response: These will be corrected. Thanks

3) I suggest to add “that” between showed and both in line 221 on page 7.

Response: This has been noted and implemented in the revised manuscript.

4) Please correct “parametrizations” in line 248 on page 8.

Response: This will be corrected. Thanks

5) A verb like “seen” is missing in line 267 page 9.

Response: This is also noted for correction.

6) In the second paragraph of section 4.3 (lines 334-343 page 11) the repetition of however could be avoided.

Response: These are noted for correction in the revised manuscript.

7) A point is missing at the end of line 399 page 13.

Response: Thanks for observation. We have noted this for change during manuscript revision.

8) In references section, line 505 page 15 Peralta-Tapia et al. (2015) should start a new line.

Response: This error will be corrected.

9) In the caption of Table 1 page 17 “List of RCMs from EU ENSEMBLE project used in study and their driving GCM.”, this is missing.

Response: This will be corrected. Thanks

10) According to me it is better to add Marcov Chain Monte Carlo before its acronym in the caption of Table 3 page 19 or to cite this procedure previously in the text .

Response: This will be added to the text as well as Table 3

11) A point is missing at the end of the caption of Table 4 page 20.

Response: This is noted and will be implemented. Thanks

12) Maybe, for a better readability of Figures 2 and 3 also in black and white printed versions of the paper, it is better to use not only different colors but also different types of lines. Why there is no the ensemble means of the runoff in panel b of Figure 3?

Response: Figures 2 & 3 have been amended as suggested. Ensemble mean of runoff was not introduced into Fig 3b at this point because 1) we are comparing the bias corrected series from RCMs here and 2) runoff projection is one of the principal object of discussion from this point onward and especially in Fig 8.

13) In the caption of Figure 6 interception is missing after "c) is. . .". I would avoid to detail the meaning of the soil time constant in the caption.

Response: The interception will be inserted in the caption. We agree that removing the meaning of time constant is necessary since the term is explained in the method section

14) A point is missing at the end of the caption of Figure 7 page 27.

Response: The point is now inserted. Thanks

15) A comma and a space are missing in reference on line 314 page 10.

Response: Thanks. This has been noted for correction.

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