

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 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. 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? 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.
- 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). In the reviewed paper no downscaling seems to be applied hence the title of sub-section 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. The rainfall-runoff model PERSiST is cited for the first time at the beginning of sub-section 2.3. Maybe a sentence to introduce the model could be added with the meaning of the model acronym. 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.
- 3) In the Results section what does the acronym SI mean and to what does it refer? 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. Maybe, in sub-section 3.2 the words “Results showed” could be paraphrased or written in a different way to avoid repetition. What are the metrics AD and Var mentioned in sub-section 3.3? They were not introduced in the revised paper. 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. 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. I do not understand the sentence in sub-section 3.6 (lines 243-245). Can you explain, please?

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

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.
- 2) The word error is missing in line 146 on page 5 and the metric R2 is not defined.
- 3) I suggest to add “that” between showed and both in line 221 on page 7.
- 4) Please correct “parametrizations” in line 248 on page 8.
- 5) A verb like “seen” is missing in line 267 page 9.
- 6) In the second paragraph of section 4.3 (lines 334-343 page 11) the repetition of however could be avoided.
- 7) A point is missing at the end of line 399 page 13.
- 8) In references section, line 505 page 15 Peralta-Tapia et al. (2015) should start a new line.
- 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.
- 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 .
- 11) A point is missing at the end of the caption of Table 4 page 20.
- 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 mean of the runoff in panel b of Figure 3?
- 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.
- 14) A point is missing at the end of the caption of Figure 7 page 27.
- 15) A comma and a space are missing in reference on line 314 page 10.

References

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