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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Why does a conceptual hydrological model fail to predict discharge changes in response to climate change?" *by* Doris Duethmann et al.

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Comments are from the discussion during a workshop by: Yan Liu, Veit Blauhut, Amelie Herzog, Tunde Olarinoye, Ruth Stephan

The study "Why does a conceptual hydrological model fail to predict discharge changes in response to climate change?" by Duethmann et al presents a very interesting topic, which tries to find important factors that influence the prediction capability of conceptual hydrological models, especially under climate change. In this study, the HBV model was used as one representative of conceptual hydrological models. Three aspects regarding precipitation input, model calibration period, and potential evapotransporation

(LAI and NDVI were used to consider changes of vegetation dynamics and land cover) were investigated to discuss the causes why HBV model fails to predict discharge under changing climate. This study is in the scope of HESS and well written. After reading and discussing this manuscript during a workshop, we thought that posting our comments might be helpful for improving the manuscript. We have following major and specific points:

Major points: 1) Title and abstract are a bit misleading because the results are not generalising for all hydrological models but using HBV as one representative. It would be better to explicitly state that the results are based on HBV model in the abstract. Using subtitle may also help clarifying this issue. 2) The prior distribution of model parameters was assumed to be the beta-distribution. In such way, by giving shaping parameters α and β for the beta distribution, it seems that the optimal parameter ranges (high probability density part of the beta distribution) are known for the prior. That will affect the model calibration. To justify why using a beta distribution not a uniform distribution for the parameter prior distribution is needed in the method section. 3) Since the results were analyzed for the averages over 156 catchments, it would be better to see the probability density distribution of the bias (Qobs-Qsim) of all catchments for the prediction periods to support that the low predictability of the averages of all catchments is not due to several catchments that bring very big bias. Providing this information in the supplement will strongly support the results.

Specific points: 1) A northern arrow is missing in Fig.1, the elevation legend is normally vertical. Fig. 2 is not very informative, maybe merge it with Fig. 1. 2) In Fig. 4, how was the bias calculated. 3) What does the unit "mm yr-1 per 35 yrs" mean? Is that the mean discharge (mm yr-1) over the 35 years? 4) In equation 8, definition of fbeta is missing. fp was not used. 5) In Sect. 2.3.1, many model parameters were introduced, such as CR and Bmax, but these two parameters are not provided in Table 1. 6) Table 2 contains almost all the details of hypotheses. But there is also quite long text in Sect. 2.4.2 that repeats the table. Table 2 is clear, try to reduce the duplicate text in Sect.

2.4.2. 7) Hypothesis should be a result out of the introduction and be mentioned at the last paragraph in the introduction. 8) In the discussion, very good literature review was done. But it should more highlight the findings of this study and relate and compare to literatures. 9) It is not clear that how the trend was calculated when using 25 years as the calibration period. Please clarify that.

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