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Interactive comment

Interactive comment on "Assessing reliability of hydrological simulations through model intercomparison at the local scale in the Everest region" *by* Judith Eeckman et al.

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Author's response to Review2

The review is indicated in italic letters and the corresponding answer is given just below.

Major comments:

- *The issue of the "extreme climate heterogeneities" is central to the justification of this paper but is not documented by the authors: only basin-averaged precipitation rates are provided (Figs 4 and 5). Since the Kharikhola precipitation are captured at five locations, the authors could have explored its heterogeneity, especially since the repetitiveness of the precipitation information for that basin is questioned by the authors in page 13.*

The spatial distribution of precipitation and temperature for the two catchments has been extensively explored, based on the observation at the available stations. The method developped to generate precipitation and temperature fields is described in Eeckman et al., 2017 (Providing a non-deterministic representation of spatial variability of precipitation in the Everest region). Not to repeat material from this previous study, as required by the editor's first review, this method has not been repeated in the text.

- *In page 3, the authors wrote that "the comparison of two models is particularly of benefit to estimate structural uncertainties in the modeling approaches". I am not convinced that comparing the annual volumes (Table 4) and the daily time series (Figs 4 and 5) of simulated variables is enough to tackle the issue of structural uncertainty. Without longer time series and verification observations in addition to streamflow, the authors are limited to identifying similitudes and differences in both model simulations.*

The authors agree with this comment. The sentence 'A more complete assessment of uncertainty associated with model structure would include more data sets and would test other complementary model structures.' (p18-l26) precises that structural uncertainties can not be quantified extensively in this work. The comparison of the two modelling approaches is used to highlight close results between the two models (i.e. periods and/or variables for which robustness of the results is fair) and discordant results (i.e. periods and/or variables for which robustness of the results is weak).

- *The Base Flow Index is at best an empirical tool. I am surprised that it is used here to evaluate the quality of a land surface model (ISBA) that should reflect physical processes (page 16). I am not much more convinced that it is a good idea for the J2000 model. This needs much further justifications, including verifications in heterogeneous basins such as the Himalayas.*

The Base Flow Index (BFI) is used in this work as an additionnal informative criteria. The authors agree that this empirical method can not be used as a validation criteria. Consequenly, the reference to the BFI (p10-L8-11 and p16-L21-25) will be removed without any consequence on the paper.

- *It is important to know which score was used in the calibration process of both models – I guess that it is probably one of the five ones used for verification. The list of selected scores could also be improved. First, r2 is not really a performance indicator and may be removed from the paper. Second, NSEsqrt is an all-purpose score without too much emphasis on low or high streamflows (Oudin et al., 2006). It does not reflect low flow performance as written in the paper. It is NSEinv that is the best option for low flow applications (Pushpalatha et al., 2012). I suggest that the authors consider it as well. Third, NSEhigh is much less common and possibly risky with short duration time series.*

For the routing module coupled to ISBA, the three global parameters are calibrated against the observed discharge using the three criterias : NSE, the relative bais and the NSE of the root square of the discharge, computed at the daily time step. This sentence will be added p4l3. The optimization method used for the J2000 model is extensively presented in Nepal et al., 2014 and is not repeated in this paper. The NSEinv criteria will be computed for both catchment and will be added in the text to the other criterias used.

Minor comments:

- *No justifications are provided for the model selection.*

A review of other modelling approaches recently applied in the central Himalayas is presented in the introduction, from p2l20 to p3l4. In particular, the ISBA and the J2000 models have been previously applied in this region by the authors (see Nepal et al., 2014 and Eeckmanet al., 2017). The ISBA approach represents physical processes and do not rely on validation data. However, this approach requires a important amount of data to physically characterize the environment. On the contrary, the J2000 approache requires only a few physical knowledge of the environment but it relies on validation data. In Himlalaya region, on the one hand, a few characterization of the soil and vegetation and on the other hand, validation data (mainly discharge) are associated with important uncertainties. Consequenly, the question to know whether a calibrated model performs better than a non calibrated model has not been answered in other studies. This paper presents a case study in order to clarify this issue.

- *The authors should clarify what they meant when writing that “a local observer indicated that the river was frozen”. Was it frozen from top to bottom? Air* *temperature does not seem quite cold enough for it to happen. Otherwise, why impose zero flow during that time?*

The local observer indicated that the flow was frozen at the point of the water level measurement. No flow was visible from the outside. We considered that this observation means a null flow at the outlet of the catchment. However, it is indeed possible that a very small flow still remains, especially under the surface ice layer. In this case, a strategy could be not to consider these periods in the efficiency criterias.