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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A note on leveraging synergy in multiple meteorological datasets with deep learning for rainfall-runoff modeling" *by* Frederik Kratzert et al.

Anonymous Referee #1

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The paper describes the use of deep learning rainfall-runoff models based on Long Short Term Memory networks for combining multiple forcing products and improve the model accuracy relative to using only individual input datasets. The approach is demonstrated over 531 basins in the CAMELS dataset. Overall, the approach is technically sound, the manuscript is very well written, and the general topic is interesting for HESS readership. However, there are a few of points that I would recommend to clarify before the paper is accepted for publications.

1- the main contribution of the paper should be better contextualised with respect to the existing (and fast growing) literature on the topic. the current manuscript introduc-

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tion is indeed relatively short (i.e. 30 lines) and only introduces the purpose of this study without illustrating other existing methods. while I found the idea of the proposed approach interesting, neither the use of deep learning hydrologic models or the idea of data fusion is completely new and, therefore, the paper will benefit from a critical analysis of existing methods and how the proposed model is advancing the state of the art. Moreover, I would recommend to better clarify the novel contribution of this paper wrt the sequence of previous publications by the same authors using LSTMs for rainfall-runoff models (I'm not saying this paper is not advancing the previous ones, but considering also the concerns related to the benchmarking discussed at point 2 I believe the authors should clearly demonstrate that the contribution of this paper is beyond the "minimum publication unit").

2- the set up of the benchmarking analysis is not fully convincing as the authors are comparing their model accuracy against (A) models calibrated using a single product and (B) traditional hydrologic models from Kratzert et al. (2019b). While the first analysis is the core of the paper, I don't understand the reason for the second one for two main reasons: in Kratzert et al. (2019b) the authors have already demonstrated the superiority of LSTMs wrt standard hydrologic model; if the new models that combines multiple inputs outperform the LSTMs using a single forcing as shown in (A), it comes straight that the new models also perform better than standard hydrologic models. In addition, this second benchmarking might confuse some readers who may attribute the reported improvements to the combination of inputs, whereas they are mostly due to the model structure. Rather than the comparison with traditional hydrologic models (which cannot use multiple meteo forcing data as the LSTMs), I would suggest the paper will benefit much more from a benchmarking against other state-of-the-art data driven models.

3- lastly, the paper is in my opinion a bit lengthy with 14 figures that make the narrative a bit scattered. I would then suggest to explore the option of selecting the main findings-figures worth to be discussed in the main paper (e.g. Fig. 6 and 7) and move some

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content to a supplementary material.

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