

Response to reviewers' reports for hess-2022-53: Hunt et al., Using a long short-term memory (LSTM) neural network to boost river streamflow forecasts over the western United States.

We are grateful to the reviewers for giving their time to review our revised manuscript and for again providing detailed feedback to improve the quality of the manuscript. We respond to the comments of both reviewers in turn below. Reviewer's comments are in black and the authors' responses are in blue.

Report #1: Frederik Kratzert

Given the current state of the manuscript, I think the paper is acceptable for publications. Congratulations to the author team.

[Thank you for your comments throughout the review process which have been invaluable.](#)

Two nit-picks (line numbers are referring to line numbers in the track changes manuscript):

L: 324 "...giving an input vector of length 28..." I think "input sequence" instead of "input vector" is a better fit. You are talking about a sequence of input vectors here (shape [sequence length, input features]), which is a matrix/tensor but not a vector.

[We have made this substitution on line 324, and on lines # and # to maintain consistency.](#)

L: 341 "tht" -> "that"

[We have corrected this error.](#)

Report #2: Lennart Schmidt

Generally, the authors have addressed all my comments in an adequate manner. They greatly improved the introduction, doing a great job of contrasting the paper against the nature of hybrid modelling - which, as they correctly point out, is not well defined. While I would challenge their comment that "LSTM is in some way replicating the hydrological processes, as in the Kratzert papers cited throughout" as these papers did not include any streamflow forecasts as inputs (at least to my knowledge), I would leave further debate on this and the nature of hybrid models in hydrology to the open scientific community. Also, the methods section has improved a lot, making all the steps of the experiments a lot clearer. The discussion has also been extended, now sufficiently contrasting the work against current research.

[Thank you for your helpful comments throughout the review process.](#)

However, while the conclusion summarizes the key methods and results in a precise and short manner, it ends rather abruptly without providing 2-3 sentences to put the results into the broader context as outlined in the introduction (streamflow forecasting using ML, complementing the current surge of ML in hydrological sciences, one of multiple possible applications of hybrid modelling or similar). I would suggest the authors to smoothen this out in the final manuscript.

[We have edited the final paragraph in the conclusions to put the work into greater context and potential future implications of the work. Please see the responses to the comments below regarding lines 619-625 for more details.](#)

Below, some formal or minor comments:

I.84 are DiscusseS above

We have corrected this error.

I. 85: is the abbreviation NWP introduced before?

It was not. We have expanded the abbreviation.

I. 89: Boucher et al - Year missing

Thank you we have corrected this reference.

I. 96: "by sequentially"?

This has been corrected to "This can either be sequentially ..."

II. 99-101: Please revise citation formats

We have changed the citations within this sentence to improve readability.

Fig. 2 greatly facilitates understanding what was done, thank you for adding it. For completeness, one could differentiate between the Training/Testing and operational period here, i.e. indicating that it is either ERA5 or IFS that is used as input

Thank you. We have added the difference between input data for the training/testing and operational periods.

I. 349 - Training period was previously noted to be 1990-2019

Thank you. We have corrected this discrepancy.

II. 356-67: The reference to "early stopping" is not quite clear to me. How would that make models less sensitive to initial weights?

We have replaced this with "The sensitivity... to initial weights... could be reduced in future work by using regularisation techniques such as weight decay"

II. 620-623 - redundant with figure caption. For me, this does not have to be repeated here.

We have removed the repetition of the figure caption.

II. 620-625: While valuable information, this paragraph does not use it to place the results into broader perspective. I suggest concluding this paragraph by an extended version of I 619, quickly getting back to the broader context and contribution of this work to it.

Thank you. We have combined the paragraphs to put the work in broader context.

Table 6: Caption - Aren't better performing gauges placed towards the right?

Yes. Thank you this has been corrected.

References: Random find: Frame 2022 is listed twice

Thank you. We have removed one of these entries, however, this is only visible in the new manuscript and not the tracked changes document.