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Comment on hess-2022-348

Anonymous Referee #1

Referee comment on "Machine Learning and Committee Models for Improving ECMWF Subseasonal to Seasonal (S2S) Precipitation Forecast" by Mohamed Elneel Elshaikh Eltayeb Elbasheer et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-348-RC1, 2022

This study compared two approaches: (1) five machine learning models and (2) a committee model, to build categorical classification correction models for S2S precipitation forecasts categories, defined as above normal, near normal, and below normal using the 0.67 and 0.33 quantiles. Model inputs were objectively determined by a spatial (semivariance) and temporal (autocorrelation and cross-correlation) correlation analysis, which as a consequence led to four models with different input datasets. Model results were finally assessed in three selected regions. The analysis was generally performed following the AI competition guidelines proposed by the S2S project and the World Meteorological Organisation. I think this paper will make a useful contribution and deserves publication in Hydrology and Earth System Sciences, once the detailed comments given below have been addressed. I recommend a major revision and will be very glad to re-evaluate it.

1. The research question is absolutely the hotspot for S2S forecasts. However, in the introduction, the authors only briefly described the S2S AI challenge. The latest progress in S2S forecasts, S2S forecasts correction especially correction by AI were poorly addressed. The authors should clarify why the study is necessary (not only for the competition) and what is the novelty of their research.
2. The paper is written in a loose style. One sentence for a paragraph is too casual. For example, Lines 232-233:" The prepared spatial and temporal datasets used for the training and validation of the ML models and CMs are shown in Table 1." should be incorporated in the above texts. Lines 254-260 should be organized in one paragraph. The authors should carefully check the whole paper and avoid this similar problem. I suggest the authors improve the paper to more fit like a scientific paper.
3. I am not sure whether there is a limitation for figure numbers in HESS. I am concerned that the figures are too redundant in the paper, and some of them are unnecessary or can be merged. Meanwhile, all the figure quality should be improved. For example, Figures 6-7 can be reorganized as 2*3 rather than 2*4. Figures 9-11 is hard to figure out the texts inside. The lower subplots in Figure 13 are incomplete. Figures 15 and 16 are not necessary to be shown as Table 2 and 3 has depicted the same information.
4. Generally, sections 3.4.7 and 3.4.8 are only straightforward descriptions of results. I don't see any further physical explanations. For example, why the Model 4 is not the best model although it incorporates all the relevant inputs? Why do Regions 2 and 3 gain more improvements than Region 1 though the cross-correlation is higher between tp and t2m in

this region? I think the authors should try to explain the AI model and the results rather than a simple description. This is the way to accelerate AI development and to give guidelines for subsequent research.

Specific Comments:

1. Line 221: could you explain why there is a fluctuation when the gamma approaches the sill?
2. Lines 275-279: It is not clear how the 0.67 and 0.33 quantiles are defined for ECMWF hindcasts. It seems that it is not defined for each member as there is only one line in Figure 14.
3. It is reasonable to assess model performance in selected regions. According to Figure 12, at least 9 cells were investigated for each region. It would be great if the spatial results are present in the manuscript.
4. Contents in sections 3.4.1-3.4.6 are more like methods, but the authors put them in the results section. It would be more appropriate to include them in Section 2.5.
5. Line 344: I don’t see the reason why the authors select MLP to construct the committee model. Please add the reasons.