Dear Drs. Skøien and Zehe,

We thank you for your very careful evaluation of every detail in our work. Your evaluations and suggestions have helped us greatly in not only improving the clarity of this work but also the very correctness of our results. Following your recent suggestions, we have re-examined our calculation routines/programs and found two mistakes in our Matlab routines used in the hydro-interpolation. We have corrected those errors and redid all calculations. Our new results are more consistent and in-line with what you have expected. They provide stronger support to our previous conclusions that the coupled method gives better interpolations of the runoff. These improved results have been included in our revised manuscript. The details of how they are included in the revision are described in the attached point-to-point explanation.

Sincerely yours,

Xi Chen
On behalf of all co-authors

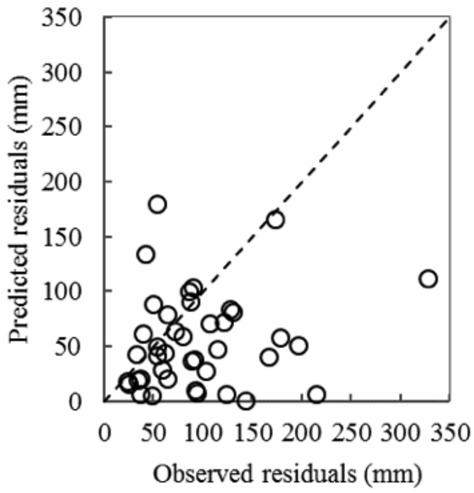
Reply

Comment: "*Now that you have included the observations in Figure 7, I am still very puzzled by the poor results of the hydro-stochastic interpolation alone (Fig 7b). Having worked quite a bit with this type of interpolation myself, I think the method should be able to achieve better results than what can be seen in this figure, and that the difference between the methods might be too large.*"

Reply: We re-examined our analyses and found a mistake in our Matlab program for the hydro-interpolation computation. Being specific, in making predictions and cross-validations at a target station we mismatched the weights of neighboring stations. After correcting this mistake, we made recalculations. In the revised results, the error of predicted hydro-stochastic runoff is considerably reduced. The determination coefficient of the cross validation is now 0.71, much higher than 0.58 in the previous result. We also found that we misused the positive and negative signs of the residence values (observed runoff minus the Budyko prediction) in our Matlab program for our combined method. That mistake has also been corrected. The corrected determination coefficient of the cross validation in our combined method is 0.87 (lower than 0.93 in previous result) (see Table 1 in the revised manuscript). Except for these two programming mistakes, we found our calculations are correct.

Comment: "*I still think it should be possible to achieve better results with your combined method, but when both methods appear as mediocre (as in Fig 7a and 7b) then it is surprising to see an improvement as in Fig 7c, particularly as the two methods seem to overestimate and underestimate at the same locations. I think the interpolation worked better for the residuals, but it would be good to know if this is because the residuals are actually easier to interpolate, or if this is because the interpolation of raw data failed for some other reason. If it is the first case, this should be better explained in the manuscript, as it would point out a weakness with these type of interpolation methods. If it is the second case, then the interpolation of raw data would get a better result, but still most likely not as good as the combined method, and most of the manuscript can be left as it is.*"

Reply: After we corrected the calculation routines, overestimated and underestimated runoff from the Budyko and the hydro-stochastic interpolation are not happening at the same locations (shown in revised Figs. 7a and 7b). The interpolation for the residuals works no better than the interpolation using the raw data, as indicated in the scatterplot on the next page (also shown in our revised Figs. 5b, 6a and 6b). We found that the accuracy of the interpolation relies heavily on how well the raw data match with the Budyko curve, and coupling the residual interpolation can improve the spatial interpolation (see revised Table 2 and Fig. 6).




Comment: "*I'd be happy to give you some support in this process, either regarding interpretation, or to check the interpolation. Just to give some examples of results I find puzzling:*

*- Station ZK is observed to be in the lowest runoff category, the same is the case with all upstream and downstream neighbours. Still it is predicted to be in in the category with more runoff.*"

Reply: This observation could be because of the mistakes in our previous computation routines. In our revised calculations reported in the revision (Fig. 7b), the predicted runoff at station ZK agrees with the runoff at its neighboring stations , e.g., upstream stations GC, XZ, and ZM as well as downstream station BB (seen in revised Fig. 7b).

*"- Almost all stations in the Northern half of the study region are overestimated"*

Reply: In the revised results, this overestimate is not seen.

*"- It is expected that the tiny catchment HWH is underestimated, but it is surprising that it is predicted to have a lower value than all its neighbours."*

Reply: In the revised results, this underestimate is not seen.

Comment: "*I'm not sure which software you have used for the interpolation. Would it be possible to output the weights for some of the catchments above? That would maybe give some insight in why the results are as they are. Maybe for both the interpolation of raw data and for the interpolation of the residual. It would also be good to see a plot of the residuals.*"

Reply: We carefully checked our software for the interpolation and outputs, including weights at sub-basins. As an example, the table below gives our computed results of the hydro-stochastic interpolation at HWH.

| No. of Basins | Basins | Obs. Runoff (mm) | Weight | Predicted runoff (mm) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 12 | HPT | 764.05 | 0.38952 | 297.614 |
| 23 | QL | 969.78 | 0.31724 | 307.656 |
| 24 | HNZ | 640.04 | 0.21893 | 140.125 |
| 15 | WJB | 293.77 | 0.04260 | 12.515 |
| 11 | ZQ | 117.86 | 0.00661 | 0.779 |
| 3 | SQ | 168.26 | 0.00616 | 1.036 |
| 13 | XX | 367.09 | 0.00577 | 2.119 |
| 21 | ZC | 837.91 | 0.00432 | 3.616 |
| 8 | ZK | 122.58 | 0.00270 | 0.331 |
| 9 | JJJ | 512.69 | 0.00268 | 1.374 |
| 35 | GZ | 342.14 | 0.00094 | 0.322 |
| 40 | HK | 227.05 | 0.00091 | 0.207 |
| 33 | YZ | 235.15 | 0.00090 | 0.211 |
| 36 | DPL | 331.29 | 0.00043 | 0.143 |
| 17 | NLD | 438.87 | 0.00040 | 0.176 |
| 37 | XX2 | 605.85 | 0.00039 | 0.238 |
| 22 | BQY | 693.35 | 0.00019 | 0.128 |
| 6 | XC | 225.24 | 0.00012 | 0.026 |
| 39 | HC | 453.73 | 0.00005 | 0.022 |
| 30 | JZ | 583.17 | 0.00001 | 0.008 |
| 28 | ZT | 437.31 | 0.00001 | 0.006 |
| | Sum | | 1.00000 | 768.650 |