

Hydrol. Earth Syst. Sci. Discuss., community comment CC1
<https://doi.org/10.5194/hess-2021-331-CC1>, 2021
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Comment on hess-2021-331

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Community comment on "Quantifying multi-year hydrological memory with Catchment Forgetting Curves" by Alban de Lavenne et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-331-CC1>, 2021

I found this a very interesting problem for consideration and possible solution. One aspect I became curious about as I thought about the proposed catchment forgetting curve is that the discharge anomaly is fit to the precipitation anomaly of each year independently of prior years (except for the need for the coefficients to sum to 1). Surely in a catchment with hydrologically relevant interannual carryover storage, the effect of anomalies of the prior years is an important factor. As I see it, the proposed method would determine the memory for a year some with kind of average history would have scatter around that average for each year's actual history. For a more complete understanding, the storage as a kind of state variable, either with a water balance model or possibly with an antecedent precipitation index, would need to be tracked. Do you agree?

I do not mean this is a criticism per se; I am mainly trying to understand the possible limits to the proposed approach.

I also had a couple more detailed questions / comments in the direction of explaining the methods better:

- The gamma distribution in figure 2 is not zero at year 0, that is, it is shifted to the left. I guess that is a feature of the method related to the discretization of the years. I'd suggest explaining more precisely how the gamma distribution is used in this respect.
- The optimization is said to be done with PSO, which I am not familiar with, but I assume it still requires an objective function to be specified. I'd suggest providing more information on the criterion that is being used in the optimization.
- Speaking of the optimization, it is stated that PSO is also used to determine ϵ_1 in equation 1. Maybe the reason for doing so would be more clear if more details were given, but it seems a simple average or median of the annual values would suffice. Is there a reason it would not?

Thank you for this contribution.