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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Influence of measurement errors on the results of the Brutsaert–Nieber analysis of flow recession curves" *by* Jacek Kurnatowski

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Dear Referee,

Thank you for the review. I refer to the matters raised by you in the order in which they appear.

General #1: Yes, this is the paper essence.

General #2: On the basis of a real data set Thomas et al. (2015) analyzed (among other issues) six different finite-difference estimators of the dQ/dt comparing them with the spline algorithm results. I analyzed the single case of centered finite difference

only, but compared the results with the analytical solution, not any other numerical smoothing procedure, so the conclusion is as general as possible and not related to any field data set. Additionally, I presented the results referring them to the frequency of stage/flow measurements in a recession and proved that the simplest scheme of the centered finite difference can be applied practically always without damaging accuracy of the assumption concerning discretization applicability, so both the method and the form of the obtained results presentation are different from those published by Thomas et al. By the way, I needed this conclusion afterwards only to justify the replacement of the analytical derivative by the finite difference quotient whilst moving from Eq. (15) to Eq. (16), nothing more.

General #3: I am not sure whether I understand properly the statement: "...the same would be the case for a fixed increment in discharge". The application of constant increments in discharge leads to the unavoidable spread of the BN77 points – the lower flow values appear in the latest phase of the recession, the bigger is the variance. On the other hand, constant increments in stage result in variable flow increments, due to the nonlinearity of river rating curves. Thus, I see no justification for such a supposition, unless there is an interpretation of this statement which I cannot notice. In terms of the solution proposed by Rupp and Selker – you are right saying that this solution is similar (or at least the search direction is similar), but not identical. Rupp and Selker proposed a method of "variable time step", i.e. increasing time increments along the recession period in order to diminish the impact of measurement noise. This idea was developed later by Roques, Rupp and Selker (2017) as the method of the exponential time step (ETS). I perceive this method as a fundamental progress in the BN77 errors analysis, but still not completed. ETS arbitrarily introduces exponential increase of time increments in a form of the function with the exponent coefficient that is obtained by some pre-processing of the entire recession curve under an assumption of linear behavior of a catchment (there is also additional user-defined coefficient assumed, which limits the time interval). Thus, ETS introduces at least two strong assumptions – linearity of a catchment and exponential increments of the time step, both without any

analytical justification. My solution is, I dare say, much more universal, since it does not impose any restrictions on the catchment behavior nor the function of the time step increase.

General #4: Well, I promise that I will do my very best to polish the final text up and make it free from disabilities and grammar awkwardness.

Specific #1: I apologize; I understand that the transition from Eq. (7) to Eq. (8) may be unclear for a reader. I forgot to mention that the analytical derivative of flow was calculated in the center of the time interval Δt. The amended version of this text is given in the Supplement.

Specific #2: Of course, I shall try to develop this sentence and make it more clear.

Specific #3 and #4: You are right saying that the intercept value after the bias removal is shifted as well. I did not pay attention to this value since this is (in my opinion) meaningless. The basic parameter indicating the catchment behavior is the exponent "b" and its proper recognition allows to sentence (or saying more gently – to facilitate the conclusion formulation) in a basic and still unresolved dispute over linearity/nonlinearity of catchments. Both parameters, i.e. "a" and "b", are the conceptual model ones and do not have to be physical quantities, just like in the majority of the models of this type. I am of opinion that the intercept should be adopted as it appears after the bias removal, with all its consequences.

Sincerely,

Jacek Kurnatowski

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-413/hess-2018-413-AC3-supplement.pdf

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