Hydrology and Earth System Sciences Discussions

Interactive comment on "Are streamflow recession characteristics really characteristic?" *by* M. Stoelzle et al.

Anonymous Referee #2

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Overview:

The authors make the point that investigators have used a variety of techniques to estimate recession parameters in the recession model dQ/dt =aQˆb. Even within these techniques, a variety of ways of censoring the data have been applied. The authors estimate recession parameters use 9 ways (3 estimation methods by 3 censoring methods) and show that a wide range of parameter values results. They recommend a multi-method estimation approach for further studies, where appropriate.

The results merit publishing, but the manuscript needs some attention. In particular, more discussion of how the different objectives of the original investigators (and the methods they, in response, subsequently developed) would seem to explain much of

the variability in results.

Comments:

1. Title: I appreciate the desire to have a title that grabs attention, but this title is not very informative of the content. Recession parameter estimation methods are compared that were devised towards different ends, so to what extent do the authors truly address this question?

2. Abstract: The abstract would be more informative if the type of RAMS were briefly given. For one, they are all variations on the dQ/dt –Q method. This at least could be said.

3. p. 10566, line 9: Units of "a" should be $[L]^{(1-b)} [T]^{(2-b)}$

4. p. 10571, Section 2.1: While it was easy to recall what le, reg, and bin refer to as I read the paper, it was a challenge to remember all the details of BRU, VOG and KIR, even after more than one reading. It would be very helpful if the long paragraph on page 10571 were summarized in a table so important differences in the methods could be easily seen by the reader.

5. p. 10572, Section 2.2: Because Q appears in both sides of the linear regression equation, both the dependent and independent variable contain errors. For this reason, use of orthogonal regression, or total least squares regression, has been used by some to estimate "b" (e.g., Brutseart and Lopez 1998). Moreover, the regression is not being used to predict y from x, but to estimate "b", so the choice of which variable (dQ/dt or Q) to use as the dependent and independent variable is arbitrary. Use of standard linear regression may be resulting in an underestimate of the underlying value of "b". The authors should comment on this.

6. p. 10572, lines 8-10: Have the authors found another study where quantile regression was used to estimate the lower envelope? If not, the authors could state that this is a novel application of the quantile regression technique to dQ/dt-Q analysis.

7. p. 10574, line 8: Reporting the range of values of "a" here has no meaning since they all have different units (which are a function of b). I would leave it out here, and leave out "a" out of Figure 3 and report only the recession time and storage depletion estimates. Same for page 10582, lines 27-30.

8. p. 10577, line 25-27: "The intercept can be seen as an estimator of the storage volume whereas derived slopes are more related to the rate and dynamic of storage depletion". For one, a groundwater theory-based examination of "a" (e.g. BN77) shows the intercept to be a function of a rate term and storage, so, in that context, the above sentence is incorrect. For another, it is not clear to me what the authors mean by "dynamic of storage depletion". Moreover, some have also shown the slope to be a function of spatial heterogeneity in aquifer parameters (e.g. Rupp and Selker 2005; Harman et al. 2009).

Citations:

There are several instances where citations could be improved by change, elimination, or addition:

9. p. 10566, lines 10-11: BN77 introduced this. That one citation is sufficient. No need to cite all four references.

10. p. 10566, line 15: No need to cite Kirchner (2009) here. BN77 had already plotted the curves on log-log scale, obviously because the values spanned orders of magnitude.

11. p. 10566, lines 20-23: Suggest rewriting to something like "Rainfall data can be used to exclude streamflow recession during periods with precipitation". No need for 4 citations here. BN77 would be sufficient, as they used rainfall data to filter streamflow data.

12. p. 10566, line 27: Inappropriate citation of BN77. They included data starting at first 5 days after rainfall, not 5 days after first declining of streamflow.

13. p. 10567, lines 10-14: I understand the point is to demonstrate that many cutoffs have been used, but I would just say they range from 2 days (e.g., Mendoza...) up to 10 days (Vogel...) and leave out the rest of the citations.

14. p. 10567, lines 1-14: Rupp et al. (2009) used yet another method to censor the data through longitudinal observations of streamflow.

15. p. 10568, line 2: Citation of Rupp and Selker (2006a) is unnecessary here. Rupp and Selker (2006a) describe a different explanation for an upper envelope (numerical artifact). Another physical explanation of the upper envelope is given Wang (2011) who explains it as bedrock seepage.

16. p. 10568, line 14-15: Parlange et al. (2001) do not consider a "linear" model.

17. p. 10569, line 22: Aksoy and Wittenberg (2011) is not an appropriate citation here. They only have two catchments, so they could not really do an analysis of recession characteristics against other catchment characteristics. I suggest replacing this citation (e.g., Krakauer and Temimi 2011).

18. p. 10569, lines 1-8: It has been applied also to a lowland plain with a deep aquifer (Rupp et al. 2009).

19. p. 10569, line 10: Did Dewandel et al (2003) apply the dQ/dt-Q method? Would a more appropriate reference be Troch et al. (1993)?

20. p. 10573, line 7-9: This sentence and these citations are not necessary.

21. p. 10578, lines 14-16: Excessive citations. I would remove a couple that do not add anything new.

22. p. 10579, lines 27+: Another source of bias is the use of time averaged values instead of instantaneous values; the latter is what the method strictly assumes (e.g. Rupp and Woods 2009).

23. p. 10581, lines 19-20: The authors cite Brutsaert and Lopez (1998) as an example

of a study of temporal variability in aquifer response. I do not believe this paper dealt with this topic. The authors should find a more appropriate study to cite.

24. p. 10582, lines 8-10: Eng and Milly (2007) assume b = 1, so they are an inappropriate citation on the topic of "b" versus catchment area.

Minor edits:

p. 10568, line 1: Comma after "envelopes".

p. 10568, line 26: I would remove the word "successfully". That's a subjective judgment and its unnecessary here.

p. 10568, line 29: Missing a word between "(1977)" and "good"?

p. 10577, line 19: "Flattening" could be replaced with a more precise term. I assume the authors mean a reduction in slope?

p. 10580, line 9: Remove "successfully".

References (not included in manuscript)

Rupp, D. E., J. S. Selker (2005), Drainage of a horizontal Boussinesq aquifer with a power law hydraulic conductivity profile, Water Resour. Res., 41, W11422, doi: 10.1029/2005WR004241.

Rupp, D. E., R. A. Woods. 2008. Comment on 'C.-P. Tung, N.-M. Hong, C.-H. Chen and Y.-C. Tan, Regional daily baseflow prediction. Hydrological Processes, 18(2004) 2147-2164', Hydrological Processes (22), 883-886, doi: 10.1002/hyp.6924.

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