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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evaluating the effect of partial contributing storage on storage–discharge function from recession analysis" *by* X. Chen and D. Wang

Anonymous Referee #2

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GENERAL ASSESSMENT

This ms addresses catchment-scale storage dynamics and their interactions with evapotranspiration in a set of catchments in the US. Specifically, the authors infer rates of evapotranspiration from streamflow recessions and compare them to estimates based on satellite remote sensing. The authors use the discrepancies between the two estimates of evapotranspiration to infer the fraction of catchment storage that is actively contributing to streamflow. They propose that the changing fraction of "active" catchment storage is one explanation for the multi-valued storage-discharge relation.

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Interactive Discussion
Discussion Paper

Over the last few years, the study of storage dynamics has become a key focus of research in the catchment hydrology community, and the linkage between evapotranspiration and streamflow recession behaviour has also been a focus of recent research. The topic of the ms is, therefore, of current interest to the readership of HESS. However, the ms requires revision to address the specific comments, below, before it should be considered for publication.

SPECIFIC COMMENTS

1. In its current form, the introduction does not make a compelling case for the originality and significance of this contribution. The original contribution of this work would be clearer if the introduction were revised to provide a more focused review of the literature to identify specific gaps in our existing understanding, which could then be used as a context for framing clearly articulated questions or hypotheses.

2. The underlying conceptual model needs to be introduced more clearly and explicitly. For example, the parameters b_1 and b_2 are referred to before they are formally defined, which makes it difficult for the reader to follow the description of the analysis.

3. In addition to explaining the underlying conceptual model more clearly, the authors need to identify the key assumptions it is based upon, and then to address the validity of these assumptions – and the sensitivity of the results to violations of the assumptions – as part of the discussion.

4. As one specific example of point 3, above, the authors assume that, in the absence of evapotranspiration, the storage-discharge relation (as expressed in the plot of |dQ/dt| vs Q) should be single-valued and be defined by the lower envelope of the observed values. However, multiple-reservoir models can generate multi-valued storage-discharge relations even in the absence of evapotranspiration (Moore, 1997). As far as I can tell, the validity of the estimates of both α and β, and hence of the inferences from the analysis, hinges on the validity of the underlying assumption of a single-valued storage-discharge relation.

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5. A major goal of this study was to examine the role of connectivity between the stream and upslope area. The authors should cite Ewen and Birkinshaw (2007), who made an important contribution to the understanding of the role of connectivity as a control on the form of the storage-discharge relation.

6. In addition to the potential errors in the values of E inferred from the recession analysis, the authors need to consider uncertainties in the "observed" values of evapotranspiration.

TECHNICAL POINTS

7. p. 5015, line13. comma splice: "headwaters, however ..."

8. p. 5032, line 23. insert "is" to follow "but also"

REFERENCES

Moore RD. 1997. Storage–outflow modelling of streamflow recessions, with application to a shallow-soil forested catchment. Journal of Hydrology 198, 260–270

Ewen, J. and Birkinshaw, S.J. 2007. Lumped hysteretic model for subsurface stormflow developed using downward approach. Hydrological Processes 21, 1496–1505.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 5767, 2013.