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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Stream flow recession patterns can help unravel the role of climate and humans in landscape co-evolution" *by* P. W. Bogaart et al.

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Introduction

In this paper the a and b values of the (Brutsaert and Nieber, 1977) analysis method are determined with the aim to learn if these values for 200 Swedish catchments differ over a 50 year timescale. By finding the recession behaviour of the parameters they aim to determine if physical properties of a catchment are affected by climate and humans. This is an important topic that is named in several studies. (Troch, 2013) States that an overarching theory of catchment response based on the idea of catchment co-evolution

has yet to emerge. Despite the clear results the paper shows, I don't really agree with the description in the title and the fitting and extracting methods used. Finally I would like to see a stronger analysis of the effect of evaporation, possibly in combination with other fitting and extracting methods. In my view, the paper can benefit from a different approach regarding extraction and fitting methods. This might also help diminish the influence of evaporation on the results.

1 Title and co-evolution remarks

In my opinion the title does not reflect a research with strong and certain outcome. 'can' is most easily interpreted as 'might be possible, but we aren't all too sure'. I would advise to leave out the 'can' in the title.

Furthermore co-evolution is not defined anywhere in the text. It is mentioned that 'correlations between soil ,vegetation, atmosphere and humans are taken into account as a measure for co-evolution', yet this is only described at the end of the introduction (p. 9869/2). Moreover, except for the human influences on co-evolution that are named in the introduction(p. 9867/13), it might be worthwhile mentioning how hydrological properties are affected by coevolution over what timescales. Do all co-evolving factors cause noticeable differences within the 50 year measurement period? Can some of the factors be neglected because these small changes are insignificant compared to the entire catchments' properties? I would like to refer to (Harman Troch, 2014) for an elaborated view on this topic.

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2 Extraction and fitting errors

In contrast with this research, (Biswal Marani, 2010) find that the exponent b for a specific catchment remains fairly constant. Yet, they also state that to avoid severe underestimation of b, recession analysis should be performed separately for each event, rather than binning all recession data together. Although the data in this research has not been binned because of the results of (Stoelzle et. al., 2013), (Biswal Marani, 2014) claim that superimposing of data can also lead to a significant underestimation of b. This effect might be visible in figure 1, E, F and G. It is clearly visible that the data in these plots are not necessarily distributed linearly. For example in figure 1.E, the data points < 1Q show a larger slope than the data points >1Q.

Another cause for this error in this data might be because (Vogel Kroll, 1992) and (Stoelzle et. al., (2013) both define a recession period as a period of at least 10 consecutive days with a decreasing 3-day moving average. For this research a recession period of at least 5 days is used (p. 9874/23). The difference in assumptions of the recession length between this research and the comparative research of (Stoelzle et. al., 2013) might make the extraction method far less reliable rather than the extraction methods proposed by (Brutsaert, 2008) and (Kirchner, 2009). Further analysis might be required to validate if this assumption was made justly.

3 Effect of evaporation on recession curve

(Wang Cai, 2010) find a very big difference between recession shape and baseflow between summer and winter, likely caused by differences in evapotranspiration. They agree with the fact that precipitation does not have a direct impact on recession slopes, yet they claim that evaporation does. (Federer, 1973) shows great differences in recession curves in transpiring (forested) catchments and cleared catchments without tran-

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spiration. Furthermore, (Wittenberg Sivapalan, 1999) shows that evaporation greatly influences the shape of the recession curve in his research. According to above named researches, evaporation cannot be neglected regarding recession curves. This error can be fairly well corrected by usage of a different extraction or fitting method.

4 Minor Remarks

p. 9868/24: “catchment catchment”.

p. 9873/9: “DEM” not specified as Digital Elevation Model elsewhere in the text.

p.9874/22: “day-22”. Please explain why the recession per 22 days has been used here.

p. 9889/23 “-dQ/dt for higher discharge),” Bracket should be placed between dt and for.

p. 9894/21 “upto” should be ‘up to’.

p. 9907 a, b, c, d, e, f and g are used as capitals in the figure but not in the reference to it.

5 References

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