Hydrol. Earth Syst. Sci. Discuss., 12, C4257–C4259, 2015
www.hydrol-earth-syst-sci-discuss.net/12/C4257/2015/

Hydrology and Earth System Sciences Discussions
Open Access

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.

H. McMillan (Referee)
h.mcmillan@niwa.co.nz

Received and published: 15 October 2015

This paper examines changes in the recession parameters over time for 200 Swedish catchments, and attempts to relate these changes to changes in climate or human impacts on physical catchment properties. This is an interesting concept, and well-suited to HESS. I will not comment further on the question of flow normalisation, as this issue has been comprehensively covered by the previous reviewers. However, I have some comments on the remainder of the paper for the authors to address, particularly focused on results relating to the b values which are unaffected by this issue.

1.Screening

The authors perform a second iteration of screening to remove catchments where b is uncertain when fitted over the whole time series. However, does this in fact remove catchments where b changes significantly over time?

b values are also subject to uncertainty in the flow series, as I investigated in a recent HESS paper (Westerberg and McMillan, 2015), it would be useful if the authors commented on the likely magnitude of this uncertainty in their catchments, and its potential to impact on comparisons between catchments.

2.Mechanistic interpretation of recession parameters

The authors discuss in depth the physical meaning of different b values with respect to the type of aquifer represented. However, as discussed in the Clark et al paper already cited, high b values can result from a combination of multiple hillslopes each with lower b value. I would imagine that this could be the cause of catchments containing wetlands having high b, because the wetland is behaving very distinctly from the rest of the catchment. It may also influence the results for changes in b in snow-influenced catchments, where snow areas are acting differently to non-snow areas, and the spatial/temporal patterns of snow are changing over time. Changes in seasonal precipitation patterns may similarly change the relative depths of water in different catchment stores, again changing b. I would like to see the authors comment on how this alternative interpretation of b affects their various conclusions.

3.Sections 4.1.2 to 4.1.5

These sections are reporting mainly negative results (i.e. no dependency of recession parameters on various explanatory factors) and could therefore be shortened.

4.Evapotranspiration

The discussion in this section is based on the finding that b is negatively correlated with E/P. However, given that this is due to the fact that both have a strong North/South gra-

HESSD

12, C4257–C4259, 2015

dient, it is quite likely not a causative relationship. Please could the authors comment on this.

5.Soil conductivity profiles

The effect of agriculture versus forests on near-surface conductivity profiles is suggested as a cause for changes in b. However, I would expect the main changes in soil conductivity with land use to be in the upper ∼1m of soil, which would be typically unsaturated during the main part of a recession period. Therefore, will this really impact on the fitted b value?

6.Figure 3

A note that I was interested to see that the fraction of clay soils was one of the most significant predictors of b. In my previous work looking at predictors of b on a smaller scale (McMillan et al., 2014), then a similar index (% high hydraulic conductivity soil) was also the characteristic with the highest predictive power.

References:

Westerberg, I., McMillan, H. Uncertainty in hydrological signatures, Hydrol. Earth Syst. Sci., 12, 4233-4270, doi:10.5194/hessd-12-4233-2015, 2015.

McMillan H, Guegen M, Grimon E, Woods R, Clark M, Rupp D, (2014). Spatial variability of processes and model structure diagnostics in a 50 km2 catchment. Hydrological Processes 28(18): 4896–4913.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 9865, 2015.