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Comment

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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Dear Editor,

The authors suggest characterizing recession dynamics for a catchment by defining “the timescale for which half of the initial reservoir storage is depleted.” This is a rational approach for a nonlinear reservoir, but has the disadvantage that since every recession has a different implied initial reservoir storage, every recession also has a different timescale. This does reflect reality, but does not provide a single timescale for each catchment.

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The authors then equate a characteristic timescale of recession T to a function of the power-law recession parameters “ a ”, “ b ”, and a “characteristic discharge at the start of the recession” Q_0 (Eq. 5). They claim that because T is proportional to $1/a$, $1/a$ indicates a recession time scale.

However, they ignore that the units of “ a ” in Eq. 5 are a function of “ b ”; “ a ” has units $L^{3(1-b)} \cdot T^{(b-2)}$, or, if discharge Q is divided by catchment area A , it has units of $L^{(1-b)} \cdot T^{(b-2)}$. “ a ” is therefore not a recession time scale except for the case of “ b ” = 1.

(Note: we did not find where the authors state that Q was divided by A , but it is implied by the units of discharge in Figure 1).

We observe that the units of $1/a$ in Figure 4 are given as days, regardless of the value of “ b ”. This is erroneous. Even if the units of $1/a$ were labeled correctly as $1/[L^{(1-b)} \cdot T^{(b-2)}]$, this figure would be problematic. What does it mean to order values along an axis when their units are not identical? Such a figure implies, for example, that $1/a = 2$ m is more than $1/a = 1$ day, yet the comparison is nonsensical.

More importantly, because of the non-physical dependence of “ a ” on “ b ”, no physical interpretation can be made of the relationship between “ a ” and “ b ” from Figure 4. There may be information in the differing distributions of “ b ” between catchments with different land covers, but since “ a ” depends in a non-physical way on “ b ”, it is not physically meaningful to extend this interpretation to also include “ a ”.

Trends in “ a ” will be similarly affected by trends in “ b ” because of the non-physical relationship between these two parameters. To attribute any biophysical mechanisms to any perceived trends in “ a ” without first accounting for the (artifactual) dependence on the trends in “ b ” is not justifiable. In the manner in which the analysis was done here, only when “ b ” is constant over time can attribution of some cause to a trend in “ a ” be attempted.

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Lastly, Q_0 is defined as being the characteristic discharge at the start of the recession. It is not stated how this Q_0 determined from a cloud of points consisting of recession curves from a 5-year block. Does Q_0 vary among the 5-year blocks? Is there a trend in Q_0 ? If so, what role might this also have in the perceived trends in “a”?

Sincerely, David Rupp & Ross Woods

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