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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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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.

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" Q0 (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 Lˆ3(1-b) * Tˆ(b-2), or, if discharge Q is divided by catchment area A, it has units of Lˆ(1-b) * Tˆ(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/ [Lˆ(1-b) * Tˆ(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.

Lastly, Q0 is defined as being the characteristic discharge at the start of the recession. It is not stated how this Q0 determined from a cloud of points consisting of recession curves from a 5-year block. Does Q0 vary among the 5-year blocks? Is there a trend in Q0? If so, what role might this also have in the perceived trends in “a”?

Sincerely, David Rupp & Ross Woods

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