

Interactive comment on “Characteristics and drivers of baseflow response in 183 Australian catchments” by A. I. J. M. van Dijk

Anonymous Referee #1

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The objective of this paper is to find correlations between streamflow indices (e.g. baseflow and quickflow contributns) and catchment attributes. This idea is in general good, and refers to an important research question. However, the paper needs significant revisions to deserve sufficient attention from the hydrological community.

The title does not reflect the real objective of the paper. In fact, baseflow is just one of the streamflow response indices that is used. It should be more general.

The abstract should be more appealing. All these numbers are meaningless for a reader that does not have read the paper!

The introduction does really a poor job in reviewing the huge literature on recession

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modelling. It should also refer to aspects of catchment classification, since this should be the main driver of the paper.

In my opinion, there is a big problem in the equations used for linear and non linear reservoir models to separate baseflow from quickflow (see my comments later). Note that in equation 3 you are subtracting fluxes from storages, forgetting the division by time. These errors may have a huge impact on the results (see later).

The methods section covers some aspects, but leaves other to the imagination of the reader. Paragraph 3.2: what model was exactly calibrated against what data? Paragraph 3.3, it is stated that other factors were considered to decide which model structure to choose. How was this done exactly? Are these criteria subjective or based on some numbers? In the 'results' section all these criteria seem to disappear. . .

In section 4.1 it is stated that the k of the reservoir decreases substantially with increasing time window. Isn't it because dt was missing in the equations?

Among all catchment characteristics, there is nothing related to Geology, which in my opinion should have the main influence on recession. I think the author should verify correlation of k to storage related properties.

Overall, a paper should demonstrate the added value of something new with respect to what has been done before. What literature does this paper contradict, or what was missing in previous studies? What is the take home message?

Here my comments about linear and non linear reservoir equations:

They should follow from mass balance and $Q(S)$ constitutive relation:

Linear reservoir:

$$dS/dt = -Q$$

$$Q = kS$$

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From this:

$$dQ/dt = -kQ; \text{ and } k = -(dQ/dt)/Q$$

this is different from the equation that the author used (dt is missing!)

Non linear reservoir:

$S = aQ^b$ (here I would prefer consistency with the linear reservoir exposition, either $Q = f(S)$ or $S = f(Q)$, anyway:)

$$dS/dt = abQ^{(b-1)}dQ/dt$$

$$dS/dt = -Q = ab \frac{dQ}{dt} Q^{(b-1)},$$

from which $a = -1 / (bQ^{(b-2)} \frac{dQ}{dt})$

also here there is some difference with the equation that the author used. Can he explain why?

Minor comments:

Introduction: page 5813 line 2: substitute Equivalence with Equifinality and add reference to Beven.

Page 5814: what are the units of k and beta?

Delete measurably

Lines 15-18: please rephrase, it is unclear.

Page 5816 line 9: change catchment with catchments

Page 5817 line 13: “to avoid over weighting on either larger values or (through log-transformation) smaller values, the value of k was optimised rather than directly inferred”. (1) I don’t understand the difference between optimized and inferred in this context. (2) if you optimize, the objective function used can put larger or smaller weights on different errors. So your approach does not solve the problem.

Page 5820: why is not geology included in the catchment characteristics?

Page 5821 line 4: change attributed with attributes.

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