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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Technical note: Pitfalls in using log-transformed flows within the KGE criterion" *by* Léonard Santos et al.

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First of all, we would like to thank again Dr J. Ding for his valuable contribution to the discussion.

- Regarding John Ding's SC3 comment and the use of negative or positive inverted root we can argue that, in the context of this manuscript, the change of sign has no impact. Indeed, following the example of the inverted flows ($-J_1$ in comment SC5), the mean and the standard deviation are linked to the ones of J_1 by the following relations, respectively:

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Discussion paper

$$\begin{aligned} \mu_{-Q^{-1}} &= -\mu_{Q^{-1}} \\ \sigma_{-Q^{-1}} &= \sigma_{Q^{-1}} \end{aligned} \quad (1)$$

with $\mu_{Q^{-1}}$ and $\sigma_{Q^{-1}}$ respectively the mean and the standard deviation of inverted flows and $\mu_{-Q^{-1}}$ and $\sigma_{-Q^{-1}}$ respectively the mean and the standard deviation of negative inverted flows.

The consequence of Eq. 1 in this comment, using Eq. 2 to 4 in the manuscript is that:

$$\begin{aligned} r_{-Q^{-1}} &= r_{Q^{-1}} \\ \beta_{-Q^{-1}} &= \beta_{Q^{-1}} \\ \gamma_{-Q^{-1}} &= \gamma_{Q^{-1}} \end{aligned} \quad (2)$$

and, using Eq.1 of the manuscript:

$$KGE'(-Q^{-1}) = KGE'(Q^{-1}) \quad (3)$$

The sign of the transformation has, thus, no importance in the KGE' (and also KGE) calculation. For this reason we will keep positive transformations in our manuscript.

We show the equivalence of KGE' values for both aforementioned transformations on our data set in Fig. 1 of this answer to Dr Ding's comment.

- The choice of N in the transformations J_N proposed by Dr J. Ding can be interesting. One may choose the N value according to the weight intended on low flows. The higher N, the lower the weight on low flows. In addition, regarding Dr. J. Ding comment SC2, the value of N can also be deduced from the observation of recession curve in the simulated catchment.

- Regarding comment SC5, we will add this generic inverted root transformation in table 1 of the manuscript instead of the inverted square root as we stated it in comment AC1. We will also add a comment on its parametrization in the text.
- About the correspondence between the inverted root transformation and the Box-Cox transformation, Dr J. Ding is right arguing that, if $\lambda = -\frac{1}{N}$, a linear relation links the Box-Cox transformation and the inverted root transformation. However, to obtain this linear relation, λ has to be negative and, as much as we know, hydrologists who use the Box-Cox transformation always use a positive λ value because it allows to avoid issues with zero flows. As a consequence, we will keep the Box-Cox transformation in the table as it is.

PS: As an answer of SC2 comment sentence "For example, why the Box-Cox (1964) transformation has gone mainstream in hydrology, but the ISR (1964-66) has not, as if some of us hadn't tried or hard enough.", we can hypothesize that the greater interest for Box-Cox is due to its property to avoid the zero-flow issue. However, it is also possible that the use of Box-Cox is also due to legacy as it is the case for NSE criterion.

Léonard Santos, on behalf of co-authors

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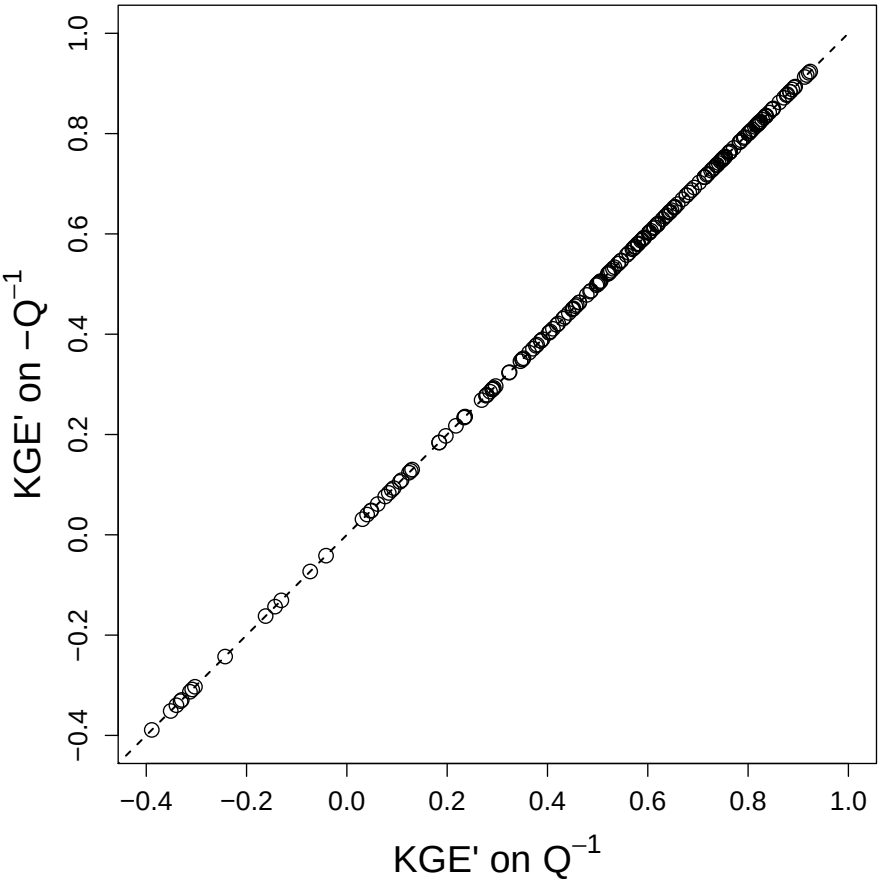

Fig. 1. Equality of the KGE' values of the GR4J simulations using inverse transformation and negative inverse transformation on the 240 tested catchments