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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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Re-ranking the transformations

The NISR (negative inverse square-root) transformation can be generalized to a NIR (negative inverse root) one defined below:

$$J_N(Q) = -\frac{1}{\sqrt[N]{Q}} = -\frac{1}{Q^{1/N}}, \tag{1}$$

$$J_0(Q) = \log Q, \tag{2}$$

Some may dismiss the J_2 transformation as simply a sign change of the classical ISR

(inverse square-root) one. Indeed they are correct. But as Leonardo Da Vince (1452 - 1519) once said, "Simplicity is the ultimate sophistication."

For example, J_2 happens to be a subset of the 1-parameter Box-Cox (1964) transformation (Eq. 6 in Santos et al. paper) when parameter $\lambda = -1/2$,

$$f_{BC}^{\lambda=-1/2}(Q) = \frac{Q^\lambda - 1}{\lambda} = 2(1 + J_2), \tag{3}$$

The difference between these two ISR-type transformed values is:

$$f_{BC}^{\lambda=-1/2} - J_2 = 2 + J_2 = 2 - \frac{1}{\sqrt{Q}}, \tag{4}$$

This has a maximum value of 2.

Figure 1 shows the modifications of the four transformation methods being considered in the authors' Table 1. These are the original logarithmic, a fixed-parameter Box-Cox, the inverse negated, and the square root both inverted and negated, and labelled J_0, $f_{BC}^{\lambda=-1/2}$, J_1, and J_2, respectively. All four transformation curves share the same inverted U-shape, being an advantage for comparison purposes. These show their relative impact on the transformed flow values, most obviously on the lower ends.

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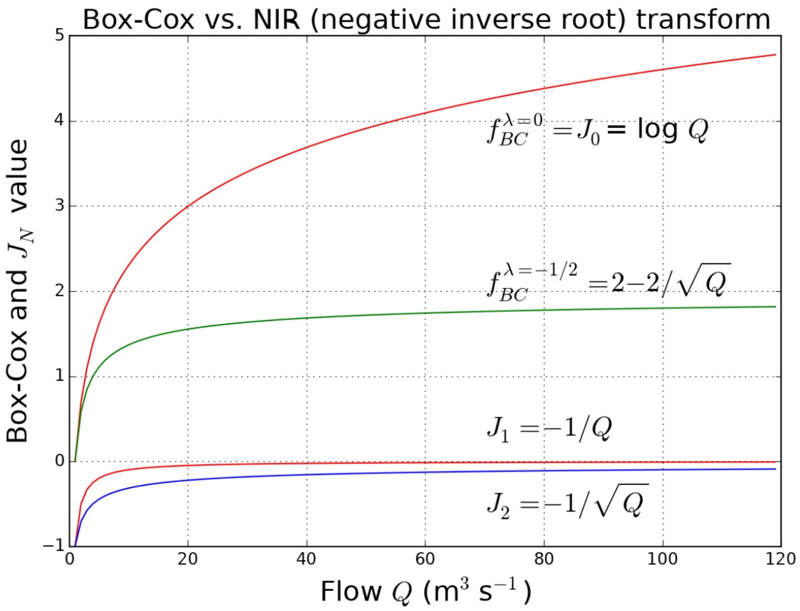

Fig. 1. Comparison of Box-Cox and NIR (negative inverse root) transformation methods.