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Interactive comment on "Technical note: Transit time distributions are not L-shaped" *by* Earl Bardsley

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Re: The zero–time–to–peak characteristic of a probability density function

I'd like to respond, at this late stage of open discussion period, to the clarion call from the author to banish L–shaped probability density functions from transit time modelling (see Abstract, last sentence).

The initial non–zero probability of a tracer transit time distribution is analogous to the zero–time–to–peak characteristic of a synthetic unit hydrograph.

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Discussion paper

From the latter's perspective, the L shape of a probability density function (PDF) is a logical consequence of a control volume being considered conceptually a spatially lumped catchment.

To confront, overcome or correct this inherent characteristic or shortcoming of a **single** conceptual store (or reservoir, tank, bucket, tub, etc.), I had resorted to the use of a classical concept relating an S–curve hydrograph and its instantaneous unit hydrograph (Ding, 1974, 2011).

Statistically, the former is a cumulative probability function (CPF), $F(t)$, e.g. Ding (2011, Fig. 3); the latter a PDF, $f(t)$, e.g. Ding (1974, Fig. 1); and that the PDF is the derivative of the CPF, $f(t) = dF(t)/dt$.

For a unit hydrograph, this produces an input–dependent or variable characteristic time, i.e. the higher the rainfall–excess intensity, the shorter the time of the peak ordinate (Ding, 1974, Fig. 3).

References

Ding, J. Y., 1974. Variable unit hydrograph. Journal of Hydrology, 22(1-2), pp.53-69.
Ding, J. Y., 2011. A measure of watershed nonlinearity: interpreting a variable instantaneous unit hydrograph model on two vastly different sized watersheds, Hydrol. Earth Syst. Sci., 15, 405-423, https://doi.org/10.5194/hess-15-405-2011.

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