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Hydrology and Earth System Sciences
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Discussions



# *Interactive comment on* "Technical Note: Testing an improved index for analysing storm nutrient hysteresis" *by* C. E. M. Lloyd et al.

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This technical note reviews some of the hysteresis-descriptor variables used to analyse high frequency storm concentration time series. Two major shortcomings of the widely used hysteresis index (Lawler et al., 2006) are highlighted: the influence of initial concentration and of initial discharge in the case of 8-shaped hysteresis. A new hysteresis index is presented to overcome these two shortcomings. It worth noting that this is one of the rare studies where uncertainty in the data is accounted for in classifying hysteresis loops.

This technical note is well-written, logically organized, and the figures are clear.

This technical note would benefit from two major improvements:



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(1) An alternative method already exist to deal with the problems of changing baseline value and 8-shaped hysteresis loops. See Rossi et al. (2005) and also Stutter et al. (2008) and Dupas et al. (2015) for examples of application. Here is an extract from Stutter et al. (2008):

"Further analyses were undertaken using the 'pollutogram' approach developed by Rossi et al. (2005) approximated by the relationship: $F(x)=x\hat{}\beta$ where F(x) is the fraction of the total mass of the determinant during the storm event and x is the total mass of water during the event. The parameter $\beta$ is a coefficient representing the relationship between the mass and water volume over time which may be plotted as the cumulative proportion of the total mass transported against the cumulative proportion of water transported. Values of $\beta$ of <1 and >1 indicate that the determinant mass arrived predominantly towards the start, or end of the event, respectively. A value of $\beta$ = 1 denotes either that the pollutant mass and water volumes are proportional, or that the pollutant concentrations stay constant over the event." Maybe mention this method.

(2) Maybe mention the fact that the new HI gives a description the size and direction of the biggest loop in the case of a 8-shaped loop but the information that it is a 'figure-of-eight' is lost. See also comment (2) Anonymous Referee #1. The method mentioned in (1) leads to the same information loss.

Minor comments:

P 7876 l2: "in extreme flow events" -> why not all storm events?

P 7877 l14: a major interest of hysteresis-descriptor variables is that they enable statistical analysis of near continuous high-frequency measurements, when the amount of data exceeds the capacity of manual analysis.

P 7881 l20-22: the hysteresis shapes are already described before using the method presented in the paper. Maybe specify that this is based on preliminary visual observation of discharge-concentration plots.



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Lawler DM, Petts GE, Foster IDL, Harper S. Turbidity dynamics during spring storm events in an urban headwater river system: The Upper Tame, West Midlands, UK. Science of the Total Environment 2006; 360: 109-126.

Rossi L, Krejci V, Rauch W, Kreikenbaum S, Fankhauser R, Gujer W. Stochastic modeling of total suspended solids (TSS) in urban areas during rain events. Water Research 2005; 39: 4188-4196.

Stutter MI, Langan SJ, Cooper RJ. Spatial contributions of diffuse inputs and within-channel processes to the form of stream water phosphorus over storm events. Journal of Hydrology 2008; 350: 203-214.

Dupas R, Gascuel-Odoux C, Gilliet N, Grimaldi C, Gruau G. Distinct export dynamics for dissolved and particulate phosphorus reveal independent transport mechanisms in an arable headwater catchment. Hydrological Processes 2015; 29: 3162-3178.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 7875, 2015.