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Discussions

Interactive comment on "Aggregation in environmental systems: seasonal tracer cycles quantify young water fractions, but not mean transit times, in spatially heterogeneous catchments" *by* J. W. Kirchner

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I really enjoyed reading this paper, however, I have to admit that it took me a while to find enough time to read through over 100 pages of the two papers combined. The paper nicely and very elegantly addresses the question how TTD in heterogeneous catchments will change the MTT, a question I have also thought a lot in the past, but I was unable to come up with such a great way to address this question. The paper is very well written, however, too long and is certainly of high relevance to the readers of

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HESS. I have a couple of concerns and ideas and hope that JK can resolve these so the paper can be published in HESS.

General comments:

1) James Kirchner (JK) uses a simple convolution version to compute concentrations in the stream (eq 1) without considering inflow (precipitation) variation and/or evapotranspiration (e.g. Steward and McDonnell, 1991; Weiler et al., 2003). Particularly in catchments with a strong seasonality, this will markedly change the resulting tracer signal – a very strong change can be observed in snow dominated catchments (e.g. Seeger and Weiler, 2014). Under those conditions, the simple sine wave approach JK selects for his analysis may be flawed, since the observed sine wave in precipitation is very different to the input concentration into the catchments. Most success with the sine wave approach was in humid catchment without a strong seasonality (Scotland, Wales, East Coast US). It would be helpful to frame the results of this paper either by additional analysis in the context of these kind of catchments or at least discuss this in more detail with the related assumptions and consequences.

2) It was very interesting to see, that age of the young water fraction of 0.2 years JK derived from his analysis is very close to the duration Seeger and Weiler (2014) derived for the time all catchments and models produce a very similar "discharge fractions after certain elapsed times", which is equal to the young water fraction of this paper. In S&W we came up with a so called young water fraction of 2-3 months based on observations and applications of different convolutions models. WE also argued that this young water fraction should be used instead of the MTT. So I believe this supports greatly the results of JK and he may be able to strengthen his paper including these additional information.

Specific comments:

Title: not sure if aggregation really captures the main idea to other people and reflects the main message of the papers – see also paper 2. In addition, I would remove the

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-but not mean transit time-

Equations 3a-3d are not necessary since they are not used again in the paper.

The implications are quite long and it may help to provide subheading to better structure them.

The figure captions are very long and often too detailed – I agree that a figure should be understood only with the figure caption, but JK sometimes includes interpretation of the figure and could shorten the captions in general..

Summary and Conclusion: Since the paper is already very long, I would highly recommend to shorten the S&C. I think it is not necessary to repeat the main ideas and steps and relate them to the figures – which is a very uncommon format anyway.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 3059, 2015.