

# ***Interactive comment on “The potential uses of tracer cycles for groundwater dating in heterogeneous aquifers” by Julien Farlin and Piotr Małoszewski***

## **Anonymous Referee #2**

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This manuscript presents a discussion on the use of tracer cycles in analyzing transit time distribution for heterogeneous aquifers with the problems that was figured out by Kirchner (2016). The authors attempt to show different results of hypothetical examples that were simulated with the method similar to Kirchner (2016). Further, the authors suggest the use of temperature cycle as a tracer with significant seasonal cycles. This may be a contribution for the selection of a sufficient tracer with cycle signals. However, I am confused by the presentation with the diverging information and could not capture what are highlighted and concerned from the discussions.

## Major Comments:

1. The manuscript just seems to be a discussion rather than a full-pages research

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article. The method and materials are not presented with enough contents to be followed, especially for the experimental studies and the case study of the Luxembourg Sandstone.

2. The first conclusion in the manuscript is that the exponential model is successful for the mixed signal when the mean transit times (MTT) of sub-basins are "in the same range or slightly higher than the period of the tracer cycle". This conclusion seems come from group I2 in Figure 1 but it is confused because MTTs in group-I2 are 5-20 years, exactly not "slightly higher" than the cycle (1-year). In addition, this could not be considered as a general feature because the experiments are hypothetical and special with a uniform probability distribution for the MTTs interval.

3. The second conclusion is "the tracer cycles can still be used as secondary data" to exam "the degree of heterogeneity". I don't think it is a conclusion but just a suggestion and seems to be not a substantial contribution for the topic.

4. The method of using groundwater temperature has not been clearly presented, especially for the case study. It is hard to understand why the performance of temperature is well in the studied sites. Figure 2 shows significant scatter distribution (the number of samples is also small) from which the performance is difficult to be evaluated.

Minor Comments:

1. Line 72, what is the mean of  $R > 0$ ?
2. Line 138,  $0.2 \cdot 10$  ?
3. Miss titles of coordinates and labels in Fig. 1.

Reference:

Kirchner, J. W.: Aggregation in environmental systems-Part 1: Seasonal tracer cycles quantify young water fractions, but not mean transit times, in spatially heterogeneous catchments, *Hydrology and Earth System Sciences*, 20, 279-297, 2016.

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