Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-686-RC1, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Do streamwater solute concentrations reflect when connectivity occurs in a small pre-alpine headwater catchment?" *by* Leonie Kiewiet et al.

Anonymous Referee #1

Received and published: 6 February 2020

This paper investigates spatio-temporal variability of end-member chemistry in a mountainous catchment. In a second step, EMMA is performed for four runoff events determining that soil sources contribute in addition to baseflow and precipitation, but groundwater being the dominating component. Additionally, the authors tested whether concentration of geochemicals could be calculated from conservative mixing. This was not the case. The authors also discussed the potential link between chemistry and changing hydrological connectivity.

I find the study and the data set quite interesting. The paper is well written and data analysis is clearly described. While I like to overall paper good, there are several

limitations. 1. While I like the research questions and the introduction, I do not think that the research gaps for questions 1 and 2 are convincingly presented. For question 3 (first part), I believe that literature shows that this is not the case for most catchment where three component EMMA is performed. 2. The connectivity part is a little bit weak. It is only loosely linked to the results and could be made stronger in results and discussion. The study also lacks a clear definition of hydrological connectivity. Is it mass transport here? As connectivity here is linked to GW level rising close to the surface. Several recent papers challenged such a simplified assumption (e.g. Jackson et al., 2014, Klaus and Jackson, 2018, Gabrielli and McDonnell, 2020). I guess this is still somewhat in the debate, but clearly data on bedrock permeability should be presented to check whether the assumed connectivity from GW levels can be realistic. Maybe other proof can be provided that GW level can be used to infer connectivity? 3. While I think that the paper is quite good, the discussion is currently weak. While the authors are discussing the data and their variation in detail (which is appreciated), I miss discussion of the broader impact of the study, as well as a better link to the introduction or the literature in general. Right now, the discussion refers to only a few studies, mainly related to processes in the same catchments. The authors need to present the broader implication of their work, and make their general contribution to the state of the art outside their study site clearer. At the end of the read I was a little unsure on the take home message. I really think the impact of the paper would be much better if that is achieved. 4. The majority of the figures need to be reworked (3, 5, 6, 8). They lack the quality that is needed for publication.

Minor comments: L35: typo "McGuire" L47: The authors present catchment size and location for the Maimai; one could do the same for the Rietholzbach. The introduction generally good; the research gaps for the first two research question should be made more clear. L92: Why should it only be baseflow? The literature is quite clear that, if tested, this is barely the case. So why asking a question we know to be not true? L150: That is a valid assumption; but how variable is soil water chemistry (yes, the data is partly presented, but it could be stated)? Additional some more information on the

choice of geochemicals and their commonly observed behaviour would be nice. L188: A clear definition of connectivity is needed, especially when not investigating the mass flux directly. L198/199: You can only assume connectivity in cases where one have a low permeable of underlying bedrock (cf. Jackson et al., 2014; Klaus et al., 2018; Gabrielli and McDonnell, 2020). L219: Define “similar” L251ff: There is a nice paper by Harris et al. (1995) that looked into changing end-member contributions. The idea is not too different from the one here. L251ff: There is a range of studies that looked (e.g. McCallum et al., 2010), related to hydrograph separation, how GW chemistry is different from baseflow chemistry. L345: Or does that indicate a much less pronounced connectivity compared to the model? L365: Is that surprising? The spatial variability is the maximum extend of the mixing diagram of endmembers. Thus, changes in the stream must be smaller, if the sampling was representative. Discussion I am missing the bigger picture here. The discussion is very detailed and evolves around the data being non-conclusive. It would be nice to expand this section and discuss what the key contribution to the field of runoff generation is. How do you go beyond studying this catchment? How does your work related to previous work? What is the key novelty? You may also think of linking your discussion better to the introduction and the used references there. L448: but for some? And what do you infer from that? Figures 3, 5, 6, 8 are not very well done. While the content is fine, the presentation, choice of colours, font size, and point type should be revised.

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