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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assessing hyporheic zone dynamics in two alluvial flood plains of the Southern Alps using water temperature and tracers" *by* E. Hoehn and O. A. Cirpka

Anonymous Referee #1

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There is growing (renewed) interest in the use of temperature as a tracer for river-groundwater interaction. This manuscript presents results from the study of river and groundwater temperature time series at two field sites and analyses these data in order to determine residence times of hyporheic zone water in loosing sections of a river. The concept is straightforward and not new but there is value in publishing these data as I am sure several other groups are actively involved in attempting to derive similar information. The authors argue that other information should be used to support the temperature derived estimates of residence times. I fully agree with this, but the authors do, however, fail to do this for one of their study sites!

The English is generally very good but I found too much information missing in the manuscript. I feel that the manuscript in its current form is not publishable because

of this. The authors make many bold assumptions about the uniformity of the system and the one-dimensional nature of the system but they do not state clearly their assumptions nor discuss the limitations. Radon is used naively as a means of determining residence times. I believe that the uncertainty in the processes lading to radon accretion along a flow path as so high that the authors should recognise this.

The authors provide no information about what they have assumed for heat transfer properties and do not state any values. Again, these values will be uncertain and, like radium (as the source of radon) will vary along the flow path.

Finally, I am unsure about the appropriateness of the title. I'm not convinced that the authors really do assess "hyporheic zone dynamics" within the manuscript. In fact, much of what is done assumes stationary processes.

In summary, I like the general approach but I would be uneasy about seeing such claims of accuracy as this may lead to inappropriate use of these techniques in parts of the community. I urge the authors to pay much more attention to defining their uncertainty in estimates and offering a more realistic assessment of errors in their estimates.

Specific comments

P328, line 1. Remove "," after "show"

P339. The heat transfer equation used ignores thermal dispersivity. The authors need to comment (and justify) why they have neglected this.

P340. The heat transfer properties are assumed uniform over path length x. Justify.

P340. Why use "s" as frequency? "f" is the universal symbol for this.

P343. It is assumed that the radon source is uniform along the path length. This is a bold assumption and needs to be justified.

P345, line 15. Why use a "2m length" screen section? This appears far too long for

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point sampling (important for the temperature signals).

P345, line 15. How do the authors account for the affect of changes with the water column?

P345, line 23. It appears that the river temperature series is obtained at only one location at site1 (and not at site2). How do the authors know that is doesn't vary within a site and between sites?

P345, line 28. The reach is "100m" in the figure, not "400m".

P346, line 3. 0.2m is still a long section for point measurements. Again, how do the authors justify this?

P346, line 12/13. The last sentence needs to be expanded. Do the authors mean that some of the loggers failed and they only have shorter periods for all loggers except 1,5 and 6?

P346. Explain the scatter in Figure 2 for the stream. It looks as though the authors have stream data for a very limited period, or that during a particular period there was more scatter. The figure does not really show the data logged period well.

P346. Need to give sample depths in a table so that the reader can interpret depths of the series shown.

P347, line 1-8. I don't fully understand the reasoning here. It looks to me as though the processes that lead to this shift must be accounted for.

P347, line 9. What is the "accuracy of 0.4 days" based on? Much more information is needed on this. Do they mean errors based on assumed processes? Expand.

P347. No heat transfer parameters are given and no statement about the assumptions of uniformity are given.

P347. What about 3-dimensional flow (e.g. river - sediment - river flow)? The assump-

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tions must be explicit.

P348. Equation (15) must assume a constant velocity. But the authors state in the manuscript that the velocity changes over time!

P348, line 12. Why compare high and low frequency estimates when those from low frequency data have been discounted?

P348, line 24. Table 2 does not show the “sulphate and radon data” - it shows estimates based on these data. The data are needed, however, and more information to allow the reader to assess the validity of these estimates. It is naïve to assume that residence times can be extracted from radon data alone without making very bold assumptions about processes.

P350, line 1/2. How to the authors know that the minor flood lead to removal of “clogging layers”?

P350. Some comments on the water levels in Figure 5 are needed. Also, the figure needs to show the levels clearer (to differentiate and label different sites).

P350, line 23. Why was a well used as a means of getting river temperature?

P350, line 26. Why assume a unit hydraulic gradient?

P350, line 28. River bed sediment hydraulic conductivities will vary over a much wider range! Is Landon et al. referring to the same sites here?

P351, line 1-13. It is argued that temperature alone should not be used. It appears that it is for site 2 !

P352, line 9. The effect of ignoring multiples of 24 hours is not a conclusion as it has not been discussed until this point. It should, however, be raised earlier and the implications explained.

P352, line 17-21. Again, the authors say that temperature should be used with other

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tracers. But they don't for site 2! How can this be a conclusion???

Interactive comment on Hydrology and Earth System Sciences Discussions, 3, 335, 2006.