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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Identifying flood recharge and inter-aquifer connectivity using multiple isotopes in subtropical Australia" *by* A. C. King et al.

Anonymous Referee #3

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The paper uses a multi tracer approach to assess the importance of flood recharge to the alluvial groundwater, the recharge processes, and the influence of recharge by bedrock groundwater. The paper is of clear interest for the readers of HESS, and the multi tracer approach and the generated data set is really interesting and valuable. Nevertheless, the manuscript needs some additional work before I can recommend it for publication in HESS. My biggest concern is the structure and content of the discussion section, and in parts of the result section. Both sections are, in my opinion difficult to read and the argumentation and the story line hard to follow. To me reading these section feels a little bit like the reader should figure out the story line and filter impor-

tant things on her/his own. I do think the authors need to do a better job in leading the reader through this huge amount of data, filtering the important points and leading the story based on the outlined research questions. Right now I don't see how the research questions have guided the results and discussion sections, but this is crucial for readability. A second limitation of the discussion is the pure focus on the current case study and only very limited discussion in the frame of general research about stream-alluvial aquifer-recharge topics in ephemeral or intermittent stream systems. How are processes similar, how is the work going beyond previous work, etc. Lot of work was done in different environments like Israel and Southern Africa (Lange, 2005, JoH; Dahan et al., 2008, Groundwater; Klaus et al., 2008, JoH; Morin et al., 2009, JoH; and more to find with a quick search) that focussed on the importance of transmission losses and also included the role of diffusive recharge by bedrock groundwater to the alluvial aquifer. Also I would recommend the recent paper of Baudron et al (2014 HP), that also employeda multi-tracer approach (14C, 13C, 2H, 18O, 3H) to determine aquifer recharge in semiarid southern Spain. Further I was wondering how the different tracers add understanding to the recharge processes. Would we achieve the same results if not using C14 or tritium? Further, some quantitative work would add clear value to the current manuscript, e.g. presenting GW levels, perform mixing calculates, etc. What could be interesting would be longitudinal chemistry/isotope profiles in the alluvium? This might allow a better way to visualize the results.

Detailed comments 3713 L6-9: Please reformulate 3713 L10: I don't think that in regions with strong seasonality the recharge as being constant in time. 3714 L12: Reading the intro to this point I was not completely convinced that these are the pressing research questions that we need to tackle. Please try to be more convincing. 3714L 26ff. See citations above, and many more work that focussed a lot on transmission losses and related recharge of alluvial aquifers in ephermeral streams. Although in usually drier environments. 3715L3-4: Is there a chance that this work can be relevant beyond the specific catchment? I think there is, but that needs to be outlined by the authors. P3716L6: "infiltration" I am not sure about the way the authors use the

term. Do they mean actually the infiltration of water into the soil, or more percolation and potential recharge to the underlying aquifer. Because infiltration itself is a very fast process, while recharge and percolation can then be influenced by ETP from the soil. P3717L16: Terms as “generally low” can be found throughout the manuscript (e.g. fresh), and I think that this is very subjective. I think the authors should avoid such terms. P3721ff. Please lead the reader and present what you regard as important information and how they connect. What is important and what is not? Possible to add some groundwater well data? P3721L20-3722L13: What is the slope of the evaporation line? If you do a regression based on the sample points do they intersect with the MWL at the point of rainfall? P3722L15ff. What is the uncertainty introduced in your interpretation by the missing of local input data? P3723L4: I do think the authors could try to give the mean residence times tritium and c14 based. P3724L9: How were the facies determined? By eye, cluster analysis? P3726L4-8. These lines are painfull to read. Please try to avoid such long nested sentences; more concise. P3727L19ff. What is the amount of dam release water in the hydrograph event? Can the slope of the evaporation line be a relic from the enriched lake water? P3728L4ff. The language and style of these lines should be improved. Often confusing. P3731-3732: How does this study go beyond the status quo? What is new? Please present that in the conclusions. There is a lot of potential here. P3731L22-24: No need the repeat research questions. But please give the answer to the research questions clearly and concise in the conclusions. P3732L9: How is infiltration linked to travel time of groundwater? StorageCapacity/Recharge=Residence time? The infiltration should be again replaced by recharge. Bc only the amount of water that arrives in the alluvial groundwater body would play a role. Not every water that in the surface recharges to groundwater. L16: What about mixing? Was groundwater body mainly “dry” before the event, what is the approx. ratio between water stored in the GW and water recharged by the event? References Good overview of literature, but rather than outlining the work on stream-gw interactions in perennial streams, authors should look more into the papers that dealt with the interaction and recharge in dryland environments, since that seems to fit more

from the processes to this work. I gave some expamples, but lots of work done all over the world. Tables If the authors introduce the separation of the catchments in sub catchments, this labelling should be included in tables Figures Fig.3, it is difficult to find and read sampling points. Maybe leaving out geology (or its color) since it is already presented in fig2? Or any other way that makes this figure more user friendly. Figure 8b. This figure is rarely explained in the manuscript (i.e. how you infer your interpretation on it). I also wonder how the cluster were determined?

Thanks for the read, it is a great data set you compiled there.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 3711, 2014.