

Interactive comment on “Time-series of tritium, stable isotopes and chloride reveal short-term variations in groundwater contribution to a stream” by C. Duvert et al.

Anonymous Referee #1

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General comment

This paper uses stable isotopes of water, chloride and tritium as tracers to compute and analyse streamflow transit time (TT) and groundwater residence time (RT) dynamics in a subtropical catchment in Australia. Given the recent attention to the analysis of TT in different environments and the potential offered by a multi-tracer approach for these investigations, the paper is of certain interest for the readers of HESS. The paper is well written. The structure is logical (besides some movements and reorganization, see my specific comments below), and the plots are generally clear (but see comments). Overall, the data interpretation is sound and the conclusions are well supported by the

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data.

Specific comments

-My major concern is about the sometime quite weak discussion in certain parts of Section 5 (especially 5.4). In general, the authors, should do a better job in comparing their results with those reported in previous literature on the topic, show similarities/dissimilarities in findings, and critically discuss these. Most of all, they should stress how their results go beyond the status quo and contribute to a better understanding of streamflow TT and groundwater RT in natural catchments. In this context, some sentences about the representativeness of the study catchment for the environmental and of physiographic conditions of other catchment in subtropical climates would be appreciated.

-I suggest to move Fig. 2 after Fig. 3 and perhaps Fig. 6 after Fig. 7 for a more logical organization and presentation of results. I also recommend in my comment below to move other parts of the manuscript for a more consistent and fluent paper structure.

-In general, I suggest to define the acronyms and symbols in the early part of the manuscript (typically, the introduction) and then stick to it throughout the paper. So, please, define TT, RT, TTD, RTD at the beginning and then consistently use them. Analogously, be consistent in the use of the term ‘tritium’ or of its symbol ‘ ^3H ’ (I recommend to define the symbol of tritium at the beginning and then consistently use it). The same holds for the stable isotopes of water.

-8040, 28. Here, and in other parts of the manuscript, I think that the use of the term ‘seasonal tracer’ is not clear and confusing. Please, change it or clearly state why you use this notation.

-8043, 16. The authors never mentioned iron and silicon before in the manuscript, and they appear only in Table 4. Are they really important for the results? If so, they should be introduced earlier.

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-8044, 7. Please note that the term 'concentration' correctly applies to ions (as chloride) but not to isotopes. For these, I suggest to use the term 'isotopic composition'. When referring to both tracers at the same time, you could use 'tracer signature' or a similar notation.

-8050, 13-15. It's not clear how the authors explain more negative isotopic values in stream water than in precipitation. Please, report more solid arguments to explain this observation.

-8050, 18. 'evaporation trend': was this expected when planning the sampling site? Does the difference in elevation between S1 and S2 support this hypothesis of evaporation? There could be some lateral inflow of enriched water deriving from ephemeral tributaries that are more prone to evaporation?

-8052, 15. It's not clear why the G1 sample of October 2012 suggests that groundwater in the alluvial aquifer has a modern component. Please, explain better.

-8053, 1-3. What are A2, A1 and B1? They were not introduced before. Are they different simulations scenarios? Please, specify.

-8053, 25-8054, 12. This part should be moved to the 'Results' section, it's not a discussion but just a presentation of results.

-8054, 13-8055, 2. This part should be moved to the 'Methods' section.

-8055, 3-5. This part should be moved to the 'Results' section.

-8057, 19. See comment above about iron.

-8057, 26. Typically, the term 'antecedent wetness conditions' refers to the combined soil moisture and shallow water table levels measured before the onset of an input water (rainfall or snowmelt) event. This is not the case, since only precipitation was used. So, I suggest to replace it with 'antecedent precipitation'. More conceptually, I'm not an expert in TT analyses but I find counterintuitive the increase of TT of old water

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fraction with the increase of antecedent precipitation. Can the author give a robust explanation for this behaviour?

-8059,17-8060,2. This part should be moved to the next section (Limitations...).

Minor comments and technical corrections.

8036, 1-6. A link is missing between the concept about the major limitation and the temporal dynamics of TT. The authors could even remove the first two sentences and simply start with 'In this study...'

8037, 8. 'inputs': such as? Please, specify.

8037, 12. 'recharge water'. Specify if you mean only liquid precipitation or also, as a term in a general context, snowmelt, glacier melt ect. Or state that given the climatic characteristic of the study area, you only mean rainfall (if this is the case).

8037, 26. Here, and later in the manuscript: avoid using the '/' sign meaning 'or' because it could be confused with a ratio.

8038, 17. Include a reference after 'highly non-stationary'.

8038, 18. Put a fullstop after 'time' and split the sentence in two.

8039, 4-5. Replace 'hydrogen and oxygen' with 'water'. Moreover, use the notation 'delta' when referring to the isotopic measurements, but not in a general context as here.

8040, 13. The acronym 'RT' was not defined before. 8041, 3-9. See my specific comment above about the non-consistent use of TT, RT and 3H.

8042, 11 and 13. Replace 'was' with 'were' ('data' is plural).

8042, 19. Fig. 2 should be cited before Fig. 3. In this case, for logical reasons, I suggest to move the current Fig. 2 after the current Fig. 3.

8043, 20. Please, specify the version, since there is quite some differences between

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earlier and newer generation of LGR isotope analysers. Moreover, since the author are talking about typical analytical error, they should mention if any lab procedure to achieve the maximum accuracy and precision (see, for example, Wassenaar et al., 2014) and to minimize the memory effect (see Penna et al., 2012 for both commercially available laser isotope analyzers, see van Geldern and Barth, 2012 for only one brand) was applied. Particularly, the first two reported references could be cited here.

Penna, D., Stenni, B., Šanda, M., Wrede, S., Bogaard, T.A., Michelini, M., Fischer, B.M.C., Gobbi, A., Mantese, N., Zuecco, G., Borga, M., Bonazza, M., Sobotková, M., Čejková, B., Wassenaar, L.I., 2012. Technical Note: Evaluation of between-sample memory effects in the analysis of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ of water samples measured by laser spectrometers. *Hydrology and Earth System Sciences* 16, 3925–3933. doi:10.5194/hess-16-3925-2012

Van Geldern, R., Barth, J.A.C., 2012. Optimization of instrument setup and post-run corrections for oxygen and hydrogen stable isotope measurements of water by isotope ratio infrared spectroscopy (IRIS). *Limnology and Oceanography: Methods* 10, 1024–1036. doi:10.4319/lom.2012.10.1024

Wassenaar, L.I., Coplen, T.B., Aggarwal, P.K., 2014. Approaches for Achieving Long-Term Accuracy and Precision of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ for Waters Analyzed using Laser Absorption Spectrometers. *Environmental Science & Technology* 48, 1123–1131. doi:10.1021/es403354n

8044, 5. Add 'of water' after 'isotopes'

8044, Eq. 1. I understand what the term at the denominator is but, please, define it.

8044, Eq. 2. Please, define 'g'.

8046, 2. The reference is not appropriate, because that paper is a nice review paper that includes many different methods. I suggest to remove that reference and use a classical, more appropriate one such as Pinder and Jones (1969) or Sklash and

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Farvolden (1979).

Pinder G. F., Jones J. F., 1969. Determination of ground-water component of peak discharge from chemistry of total runoff. *Water Resources Research*, 5(2), 438–445, doi: 867 10.1029/WR005i002p00438.

Sklash M. G., Farvolden R. N., 1979. Role of groundwater in storm runoff. *Journal of Hydrology*, 43(1–4), 45–65, doi: 10.1016/0022-1694(79)90164-1.

8047, 12. Include reference to Tukey filter.

8047, 21. Please, specify that the fit is a data fit.

8050, 5-9. Reformulate so that the explanation of the 'amount effect' and the reference come after the first mention at line 6.

8053, 24. Remove '(5-100 years)'.

8057, 23. 'unequivocal' is a vague term. Please, remove and give n, R² and p-value.

8057, 23. 'positive relationship': give n, R² and p-value.

8078, Table 5. In the caption, remove 'as an age tracer'.

8079, Fig. 1. Remove all sentences but the first from the caption. That information should go to the text.

8081, Fig. 3. This figure would greatly benefit from the use of color. Moreover, change the legend using the delta notation for the isotopes.

8082, Fig. 4. This figure would greatly benefit from the use of color as well. Moreover, use different symbols for S₂ and S₃.

8084, Fig. 6. What is A₂?

8088, Fig. 10. Remove the reference, it's already reported in the text.

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