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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A multi-tracer approach to constraining artesian groundwater discharge into an alluvial aquifer" *by* Charlotte P. Iverach et al.

Anonymous Referee #3

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The presented study is well designed and informative for regions, where different water bodies seem to exist and mix in ratios, which are unknown yet. Thematically the paper fits to HESS, although I see some points of weakness, mainly related to formulation (or omitting) of hard facts. I guess, with considerable revision, that manuscript has the potential to be of interest for a wide audience. In general, the manuscript should be shortened and particularly the geological part must be clarified for readers outside Australia. In the following, I give some specific remarks to points, where I see difficulties:

Hydrographs in Figure 1 are not very informative, despite the information, that gw-

tables are fluctuating. the legends of hydrographs are not explained and it becomes not obvious, why red-texted hydrographs are representative for GAB contribution. Instead of showing relative depths of screen bottoms (bgs), it would be more distinctive, when depths would be given relative to msl., to explain the absolute depth.

Hydrogeological setting The entire paragraph is very hard to understand, since local formation names are abundant and the hydrogeological context is not clear. Why are all these details neccessary for the reader of the manuscript (e.g. lines 191-193)? Paleogeorgraphic features are very difficult to understand. It would be of more importance to reduce the (doubtless interesting) geological context and focus on the formations, which are hydraulically relevant. Probably a stratigraphic table would help a lot, showing thickness, lithological composition and phreatic/confined conditions in each of the relevant formations.

221 Water balance modeling for recharge That paragraph explains a series of MODFLOW attempts to define various sources for recharge. I believe, the paragraph is to long, since the basic and neccessary information are the outcoming numbers (ratios) for the different proposed sources. The authors use a unit (ML/a) which is unknown to me (Megalitres/year?)

3.2 Geochemical analysis Line 302: what is the reason to use pmc and pMC?

4 Results line 358: whic 2 processes are meant? ET leads to enrichment of all elements, leading eventually to Cc-saturation. Na/HCO3 increases only, when calcite precipitates.

line 360: I suggest to be careful in interpreting Cl/Br ratio changes in these context. Cl/Br ratio will change only, when degree of evaporation results in supersaturation of the water in respect to halite, otherwise there is no change observable. Since Cc-precipitation is discussed, it might be worthwhile to compare Ca/Mg ratios and (Ca+Mg)/HCO3 ratios? Cl/Br ratio might change due to geological reasons...

line 390: delete charges. What means “closer”? compared to what?

line 399-401: that sentence is not helpful, since the reader does not know which parameters you refer to. From Figs 3 and 4 it is not given, that 273314 resembles river water, it is obviously just fresh water. line 401 ff: from that moment it becomes highly difficult to follow: you refer to the only sample from the Jurassic Fmt. Why is it strange to have fresh water in there? The base of the well is just above a Napperby fmt. Which indicators suggest recharge through a formation, which is even below Napperby? And which river is referred to? Why should Pilliga Sandstone contribute? The explanation lacks from facts, which give an overview about the hydraulic concept, which obviously led to the formulations. Latest here a regional W-E geological cross-section, showing Fmts. of GAB and their regional confined and phreatic conditions (piezometer heights) is urgently needed to understand the hydrogeological context of the region. In addition, it would also help, to (i) show Fmt. and (ii) add water table heights of the different aquifers in the cross-sections of Fig. 2. Situation becomes harder due to the jumping between formation names.

line 407 ff: again, why do the authors claim for contact between that river and deeper Triassic Fmt.? According to Fig. 2: Napperby is the uppermost Triassic. Where is that river situated and why is the river the only option of fresh-water supply? Are these ideas consistent with hydraulic?

4.2. Mixing

line 412f. : To be very critically: I don’t see clear indications for that statement from Figs. 3 and 4. Major elements in samples >80 m (blue) spread over the entire range and only a few blue samples fall in the same region as GAB analyses from Radke et al. (2000). Is there a geographic link?

4.3 Extend of interaction

line 517f. : Why is not a sample chosen, which was not evaporated at all or even better,

a recent rainfall sample, giving the precise input signal for Cl and 3H?

lines 521-523: I do not understand the reason of that thought: “...to consider overall transport of Cl from shallow groundwater.”

line 532/fig. 8: Actually these percentages are calculated on Cl-mixing approach only. Within the description, “multiple geochemical tracers and major ion data” are mentioned. Which exactly were used and how does the respective results fit to the described Cl-mixing?

According to that figure, it strikes, that heterogeneity of GAB contribution might be related to structural features or any other elements that provide preferential flow? Are there any tectonic lineaments or other indications, which could be responsible for the different contributions from the GAB?

5. Conclusions

lines 619-621: That sentence is very vegetarian, it gives no information at all. Please prevent to use such phrases, instead of describing which reason will result in which effect.

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