

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2021-364

Anonymous Referee #2

Referee comment on "Contrasting lacustrine groundwater discharge and associated nutrient loads in different geological conditions" by Xiaoliang Sun et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-364-RC2>, 2021

The present study aims to investigate the lake water balance and the nutrient load balance in the East Dongting Lake (EDL) with a special attention given to the contribution from groundwater. The study was carried out first by taking water samples from the lake and the surrounding aquifers, then using lab analysis to determine the content of stable isotopes in the water samples, especially ^{222}Rn , which can be seen as an indicator of groundwater inflow. Subsequently, ^{222}Rn mass-balance model was applied for lake water constituents. The paper was written in a clear and concise way, the language was easy to understand, and the method used and the conclusion drawn was scientifically sound. Based on my assessment, I would recommend that the paper is returned to the authors for minor to intermediate revision before it can be accepted for publication by HESS.

Major comments.

1, There is no clear indication of research novelty in the manuscript. It seems to me that the method used in the study is very mature and the conclusion is somewhat expected. So, I would suggest adding a few sentences clearly stating the current research gap in comparison to previous studies, and the innovative aspects of the present study in the Introduction section.

2, Based on the results shown in the study, the ^{222}Rn concentration was much higher (larger than 5000 Bq/m³) in the groundwater at the east side of the lake where karst aquifer dominates, and much lower in the west bank (2000-5000 Bq/m³) where porous aquifer dominates. This makes sense since karst groundwater usually has higher radon content, and the groundwater discharge rate calculated is thus 38.66 mm/d to the west and 92.82 mm/d to the east. However, contrary to our expectations, the ^{222}Rn concentration in the lake water in the West EDL is much higher than it is in the East EDL.

The paper tried to find possible explanations to such phenomenon observed, and it was suggested that preferential pathways in the west may have existed which increased the inflow from groundwater. But this claim is less convincing because there is no evidence that the preferential flow pathways only exist in the west, and in principle, the fractured rock in the east is more prone to have preferential pathways.

My question is, could there be another explanation to what's observed, that the porous aquifer to the west connects to the lake more on the side, but the karst aquifer to the east connects to the lake more on the lake's bottom? Your samples were taken at 0.5 m below lake surface, and the lake is quite deep. Fast flow-through in the lake also encourages mixing when groundwater enters the lake. Therefore, the groundwater discharge to the lake is much easier detected closer to the lake shore. If this is the case, then it explains why there is larger inflow from groundwater in the east but lower concentration of ^{222}Rn captured in the lake. Please discuss.

3, The LGD is controlled by both lake and aquifer materials. Maybe add a table or figure explaining the spatial distribution of e.g. conductivity of both materials.

Minor comments.

L. 4-6. The numbering is inconsistent, after the names there are 1 and 2, but below the names there are a and b.

L. 12. in two side => on the west and east side of the lake.

L. 22. There is no clear evidence that the LGD is controlled by preferential flow, it is only a reasonable guess, so I suggest removing this sentence.

L. 77. Resources, with "s". Status, without "es".

L. 165-166. Differential Global Positioning System (DGPS), please use capital letters instead.

L. 239. Maybe use groundwater "head" instead of "level". Is the elevation above sea level? If so, then use m.a.s.l. instead.

L. 445. Here it says, "under the long-term flushing by artificial dredging, the EEDL is also characterized by deep flowing". I don't quite understand this sentence.

L. 488. Here it says, "it has been widely the permeability of the lake..." I don't understand this sentence.

L. 518. The conclusion is rather short, maybe consider including more quantitative results.

Figures and tables.

Fig. 1. The dotted black line is confusing and not really needed.

Fig. 4. Is the flow path about groundwater or lake water? Why the flow direction is parallel to the shore?

Fig. 5. Is it possible to flip the figures left to right? It is more common that the flow direction is from left to right.

Fig. 8. There are three panels, what are they? On the blue and orange bars, how the confidence intervals were calculated? Please add legend.