Comments on "*Contrasting lacustrine groundwater discharge and associated nutrient loads in different geological conditions*" by Sun et al.

This paper mainly investigated the LGD and associated nutrient inputs in two sides with contrasting geological conditions of East Dongting Lake (EDL) during the dry season. First, the authors identified the occurrence of LGD based on stable isotopic characteristics, EC and ^{222}Rn distribution in lake water and groundwater. And then the LGD rates and associated nutrient fluxes of Si, NH_4-N and P were estimated using ^{222}Rn mass balance model. They finally discussed the influence of geological conditions on LGD and associated nutrients into the EDL. Overall, the field sampling and analytical approach are well designed and appropriate. Results from this study represent an important contribution and highlight the importance of geological conditions in determining groundwater discharge rates.

However, the manuscript requires significant grammatical corrections and editorial improvements. Based on this, I would like to recommend the acceptance of the manuscript for publication after major revisions. Below are my comments that may help with this process.

Major comments:

1) I have serious concerns with the uncertainty of the ^{222}Rn concentrations in lake water. The water samples for ^{222}Rn analysis were collected into 40 ml sampling bottles. From my point of view, the water volume for ^{222}Rn analysis in surface water is usually > 1L. In this paper, the small volume of 40 ml may lead to large uncertainty (even up to 100%) of ^{222}Rn measurement by Water-40 with RAD7 in lake water and river water. I would recommend reporting the uncertainty for each ^{222}Rn data in Table S1. Was the uncertainty of LGD rate assessed by propagating radon measurement uncertainties throughout the entire calculation?

2) Lines 165-166, The groundwater and lake levels have been measured in this paper. I would recommend calculating the LGD rate using Darcy's law for comparison. Lines 238-239, The groundwater levels around the EDL ranged from 23.2 to 41.9 m,

whereas the lake water levels varied from 21.2 to 22.4 m. Please mark the location of the groundwater monitoring station in Fig. 1. Also it would be better to show the groundwater levels and lake water levels in a figure. Did groundwater levels vary from 23.2 to 41.9 m only during the sampling period? Please clarify.

3) The study indicated that the groundwater discharge transported large inputs of nutrients into WEDL. Unfortunately, there is little discussion on the significance of groundwater nutrient fluxes into the lake. I was hoping this would be further discussed (such as Zhang et al., 2020; Wang et al., 2018). Is LGD acting as a driver of lake water deterioration? Is there EDL water eutrophication due to the large inputs of nutrients from LGD?

Zhang, et al. Submarine groundwater discharge drives coastal water quality and nutrient budgets at small and large scales. *Geochimica et Cosmochimica Acta*, 2020, 290, 201-215.

Wang, et al. Submarine groundwater discharge as an important nutrient source influencing nutrient structure in coastal water of Daya Bay, China. *Geochimica et Cosmochimica Acta*, 2018, 225: 52-65

4) This paper lacks comparison with LGD rates and nutrient inputs with previous study in EDL and similar lake systems worldwide. It would be better to include a table for comparison.

5) The lake water samples were collected only near the shore of the WEDL. Moreover, the distributions of groundwater and surface water sample locations were extremely uneven with low-resolution sampling. The high ^{222}Rn concentration near the shore would produce a considerable ^{222}Rn inventory, which may result in a overestimation of LGD in WEDL. Please clarify.

Minor comments

1) Lines 24, 466, 531: “On the contrast” should be “By contrast” or “On the contrary”.
2) Line 9: please change “is” to “are”.
3) Lines 34~37: “… **groundwater is** an important **component of** lake water and **lake chemistry** …” This is incorrect. Please modify.

4) Line 38: “impacts **on**” not “impacts **to**”. In formal writing, it is forbidden to use phrase abbreviations (like LGD here) as the beginning of a sentence. Please include the recent study such as Zhang et al. (2021) (Control factors on nutrient cycling in the lake water and groundwater of the Badain Jaran Desert, China. Journal of Hydrology 598, 126408)
5) Lines 43, 54, 57, 81, 85, 102, 105, 512, etc.; “nutrients input” should be “nutrient inputs”, keeping consistence with title.
6) Lines 52~53: “whereas small-scale patterns correlated with grain size distributions of the lake sediment.” Please modify.
7) Line 55: “could be internally inter-played” . Please modify.
8) Line 57: Please change “advancing” to “advancement”.
9) Lines 66~67: It could be more concise, if change “the quality of this groundwater” into “the groundwater quality”.
10) Line 72: Plus “been” after “yet”.
11) Line 80: Please simplify this sentence “The ecological sensitivity and important ecological role of the EDL…”.
12) Line 104: Plus “a” before “new”.
13) Line 114: Delete the second “annual average”.
14) Lines 117 and 119: Change “originate” to “originating”.
15) Lines 133~137: Modify “first”, “second”, “third” into “upper”, “middle”, “lower”, respectively. Please simplify the description, like following, from “The ... aquifer is a phreatic/confined aquifer...” to “The ... aquifer is phreatic/confined ...”.
16) Line 143: “... shores of both ...”
17) Line 152: Delete “from”.
18) Line 157: Change “are” to “were”.
19) Line 158: Change “in” to “at” before “the lake shore”.
20) Line 161~162: Modify “... contained no captured air.” to “captured no air bubble”.
21) Lines 163~165: Modify “(GPS)” to “(DGPS)”. The accuracy of DGPS is likely to be lower than the level differences between groundwater and lake water. So is it

reliable to identify the exchange directions between groundwater and lake water?

22) Line 171: Modify “were” to “was”.
23) Lines 176~177: The units should be given for λ and t.
24) Line 195: Simplify the sentence! “The following equation is used to estimate groundwater discharge rate ...”.
25) Lines 207, 230: should be “Eqs. (...)”.
26) Line 213: There is no need to repeat explaining λ^{222}Rn.
27) Lines 240~241: Don’t repeat phrase abbreviations already explained above, such as Eh, DO.
28) Line 253: Brackets should be half-width symbols.
29) Line 318: Change “both” to “by”.
30) Lines 346-347, 409-411: Please rewrite.
31) Line 398 and similar problems above and below: Please **uniform** the expressions of “Figure/Fig.”, “Equation/Eq.” throughout the paper.
32) Line 478: Modify “makes” to “make”.