Thanks a lot to Anonymous Referee #2 for your questions and suggestions for our manuscript, which are all important in improving our manuscript.

Below are our responses to the anonymous Referee #2' comments.

Major comments.

-About the comment (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.

-Response: Thanks for your good suggestion. We have added the information to the introduction to state the current research gaps in comparison to previous studies, and the innovations in this study.

The detailed revisions are as follows.

"However, the influence of geological conditions on spatial differences in LGD and associated nutrient inputs have not been well understood. Particularly, the geological factor could be inter-played with hydrogeology, groundwater quality and even super-surface factors mentioned above, which may collaboratively lead to spatial variability in LGD and associated nutrient inputs. Therefore, a comprehensive analysis from the perspective of geology is needed to advance related understanding on spatial variability in LGD and associated nutrient inputs."

"The present study aims to identify and quantify the spatial differences in LGD and associated nutrient inputs in the EDL, and discuss the influence of multiple factors on the spatial differences from a comprehensive perspective of geology, through ^{222}Rn mass-balance model, water chemistry coupled with existing geological data. The present study provides an updated understanding of the influence for geological conditions on the spatial differences in LGD and associated nutrient inputs, thus serving as a new reference for ecological protection of EDL. The knowledge from this study could be applicable for other large freshwater lakes under humid climate worldwide."

-About the comment (2): Based on the results shown in the study, the ^{222}Rn concentration was much higher (larger than 5000 Bq/m^3) in the groundwater at the

east side of the lake where karst aquifer dominates, and much lower in the west bank (2000-5000 Bq/m^3) 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.

-Response: Thanks for your good suggestion.

1) The fractures are indeed likely to be used as preferential channels for LGD in EEDL, but the water-richness of the aquifer is also a key factor. Even if a preferential pathway exists, it will not be sufficient to support a greater LGD rate if there is relatively little water in the fractured rock.

2) We fully agree that there is a potential for greater ^{222}Rn concentrations in the deeper lake water. However, it is very unfortunate that we did not measure ^{222}Rn concentrations and other indicators that may be influenced by groundwater at different lake depths during the sampling period. While, a study of LGD at Poyang Lake (Liao et al., 2018), another large lake connected to the Yangtze River in the central Yangtze catchment (extremely similar to the lake in this study), showed that the water at different depths had similar temperatures and salinities, indicating good vertical mixing. Therefore, we speculate that the lake water should also have a good vertical mixing in the EEDL. As you mentioned, the fast flow of water in the EEDL would exacerbate the mixing of groundwater with lake water, resulting in ^{222}Rn

concentrations in the lake water obtained at different depths that may not be significantly different. By comparing the ^{222}Rn concentrations in the lake water (the radon concentration in EEDL is lower than that in WEDL), we can only roughly determine that the LGD rate in WEDL is greater than that in EEDL. After calculation by the ^{222}Rn mass balance model, it is found that the groundwater discharge intensity in WEDL is 2.05 times that in EEDL, which proves that the rough assumption is correct.

-About the comment (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.

-Response: Thanks for your good suggestion. We agree that a table listing the differences between the WEDL and EEDL parameters is a very good suggestion. The following table reflected the differences in these parameters, which were listed as Table 2 in the revised text (we have rearranged the original Table 2).

Table 2. Differences in relevant parameters between WEDL and EEDL

	WEDL	EEDL
Lake area (km^2)	173.22	88.62
Average depth (m)	0.8	3.9
Lake water retention time (d)	11	5
Topography around the lake	Plain	Mountains and hills
Type of aquifer	Porous aquifer	Fissured aquifer
Hydraulic gradient	0.0002-0.0015	0.004-0.006
Hydraulic conductivity (m d^{-1})	15-100	2-5
Average LGD rate (mm d^{-1})	71.47 ± 52.16	34.76 ± 23.36
Average Si concentrations in groundwater (mg L^{-1})	12.10	12.62
Average NH_4-N concentrations in groundwater (mg L^{-1})	2.61	2.13
Average P concentrations in groundwater (mg L^{-1})	0.34	3.33×10^{-2}
Si input loads originating from LGD (g m^{-2} d^{-1})	0.87	0.44
NH_4-N input loads originating from LGD (g m^{-2} d^{-1})	0.19	7.42×10^{-2}
P input loads originating from LGD (g m^{-2} d^{-1})	2.40×10^{-2}	1.16×10^{-3}

-About the comment (4):

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.

-Response L. 4-6.: Thanks for your remainder. We have corrected them as you proposed.

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.

-Response L. 22.: Thanks for your good suggestion. This sentence has been removed.

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.

-Response L. 239.: Thanks for your good suggestion. Yes, the elevation is above sea level. We have replaced it with m.a.s.l..

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.

-Response L. 445.: Thanks for your good suggestion. I am very sorry for some language expression and wording problems in the manuscript, which have brought much trouble to your review. What we want to say is: The EEDL was originally deeper and had become even deeper under the influence of long-term artificial sand dredging.

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

-Response L. 488.: Thanks for your reminder. I am very sorry for some language expression and wording problems in the manuscript, which have brought much trouble to your review. We would like to thank you for marking the existing problems, which brings convenience to our modification.We have rewritten the sentence:

"Alternatively, on a smaller scale, it has been widely accepted that the permeability of the lakebed is not only determined by grain size, but also by the roots of vegetation."

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

-Response L. 518.: Thanks for your good suggestion. The conclusion section has been enriched by our final revised manuscript.

Here is the revision for addressing this comment.

"This study used radon mass-balance model together with water chemistry and existing geological data to identify and quantify the spatial differences of LGD and associated nutrient inputs in two sides with contrasting geological conditions of East Dongting Lake within central Yangtze catchment and discuss the influence of geology on the spatial differences. It was found that LGD rates were 34.76 ± 23.36 mm d^{-1} in the east EDL which is characterized by hilly geomorphy, deep/fast/narrow flowing, coarse-grained lakebed and large hydraulic gradients (0.004–0.006). The west EDL is characterized by alluvial-lacustrine plain geomorphology, shallow/sluggish flowing, clayey or silty lakebed and low hydraulic gradients (0.0002–0.0015), which makes it seem impossible to have high LGD rates in the west EDL. However, the LGD rates were determined to be remarkably higher in the west EDL (71.47 ± 52.16 mm d^{-1}). The remaining factor responsible for the higher LGD rates in the west EDL is the permeability of the porous aquifer connected with the lake, which is enlarged by some preferential pathways including large-scale buried paleo-channel and small-scale plant roots. The significantly greater hydraulic conductivity of porous aquifers (15–100 m d^{-1}) compared with fissured aquifers (2–5 m d^{-1}) is a key factor on the larger LGD rates in the WEDL.

The geological conditions were further inter-played with hydrogeological environment and groundwater quality. The groundwater around the east EDL existed in a less confined environment, and frequent flushing led to low concentrations of nutrients. On the contrary, rapid burial of sediments during the Last Deglaciation and deposition of paleo-lake sediments during the Holocene formed an organic-rich and reducing environment, which facilitated the enrichment of geogenic nutrients. The loads of Si, NH_4-N and P input associated with LGD in WEDL were 0.87 g m^{-2} d^{-1}, 0.19 g m^{-2} d^{-1} and 2.40×10^{-2} g m^{-2} d^{-1}, respectively. The loads of Si, NH_4-N and P input associated with LGD in EEDL were 0.44 g m^{-2} d^{-1}, 7.40×10^{-2} g m^{-2} d^{-1} and 1.16×10^{-3} g m^{-2} d^{-1}, respectively. The loads of LGD-derived nutrients in the west were determined to generally exceed that in the east by one order of magnitude. In practice, future water resource management and ecological protection of Dongting Lake should focus on groundwater discharge in west EDL."

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.

-Uniform response: Thanks for your good suggestion. We have modified both the figures and the tables.