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Biogeosciences Discussions

Interactive comment on "^{226}Ra and ^{228}Ra in the stratified estuary of the Krka River (Adriatic Sea, Croatia): implications for submarine groundwater discharge and its derived nutrients" *by* Jianan Liu et al.

Anonymous Referee #2

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comments on "226Ra and 228Ra in the stratified estuary of the Krka River (Adriatic Sea, Croatia): implications for submarine groundwater discharge and its derived nutrients" by Liu et al.

The authors applied 3 models, the three-end member mixing model, the mass-balance model, and the time-series model to estimate the SGD flux to the Krka River estuary. In calculating the flushing time, the river discharge is not included, which should be considering the great river discharge of the Krka River during the investigation. In the three end-member mixing model and the mass-balance model, desorption of radium as a Ra

source in estuaries is not included or evaluated. In the time-series model, the assumptions are not substantiated. Ra and water depth at the time-series station change with tide/time. These changes are not only due to SGD, but also due to seawater into the estuary. The estuarine Ra background thus changes with time. All these changes are not considered in the time-series model. Only when these models are corrected, can the results and discussion be assessed and evaluated. There is not much discussion on implications for SGD-associated nutrients. It's better for the authors to turn to an English editor to go through all the texts.

Minor comments Page 1 Line 17: 'in tidal period' specify the time frame: 24 hours or 12 hours. Line 21: '9.5-38.3% to the total DSi flux' can't be taken as 'a major source'. Line 22: 'likely' is not proper to be used here. Quantitative results should allow the authors to determine whether SGD is a major source or not. This is no longer a possibility. Line 26: what is a river-dominated estuary? The sentence "It is the primary pathway. . ." is awkward. Rewrite it. Page 2 Line 23: what is tidal amplitude? Tidal range? Tidal height? Line 27: "have" to "has"; "transporting" to "transported". Line 34: "transect" to "transects". Page 3 Line 5: "24 hours-time" to "24-hour time" Line 9: dissolved oxygen (DO) measured using a multi-parameter probe needs to be calibrated with DO measured using classic Winkler titration. Otherwise, DO data are questionable. Line 13: the pore size seems too big to do the filtration. Double check the pore size of the cartridge. Line 17: the sentence "the 228Ra activities. . ." needs to be revised. Line 24: Briefly explain the method used to measure these nutrients. Provide the detection limits of these nutrients. Line 28: "investigated" to "investigation". Fig. 5 Line 15: "It was particularly pronounced for 228Ra that had lower effect than in the open Adria Sea". What effect? Line 16-18: how about adsorption of radium from particles as a source? It is not included in your three end-member mixing model and its effect should be evaluated. Fig. 6 Line 3: give the values of each fraction to support the statement "the fraction of the river water was higher than those of the open seawater and groundwater". Line 4: "lower changes" is an awkward phrase. Is 28-37% the change in the fraction or the fraction? Line 10: This physical model is not proposed by

Moore et al. (2006). Cite the original paper. Moreover, the model used here is suitable for estuaries with low river discharge, so river discharge is not considered. In your case the river discharge is not negligible and should be included in calculating the flushing time. Refer to the original paper for the proper formula to use here. Line 27: Every parameter on the right hand side of Eq. (8) is given as an average value with a standard deviation. How is the value on the left hand side of Eq. (8) calculated to be a range of values? Page 7 Line 6: The sentence is broken. Line 12: Again in Eq. (10) desorption of radium from particles is a source of dissolved radium that needs to be included in the mass-balance model. Line 27: the estuarine background changes with tides. When a minimum is chosen to be the estuarine background, an overestimate of SGD may result. Page 8 Line 1-3: the time-series Ra activity changes with tide. I suspect that the surface layer depth changes also with tide (the observation of water depth at the time-series station will verify this). Then the excess Ra inventory calculated with a constant water depth is not appropriate. Figure 1. Groundwater sampling stations are not shown. Figure 7. Only one groundwater point is shown. From Table 1 two groundwater samples were collected for Ra and both should be shown here.

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