

Interactive comment on “An updated estimate of radium 228 fluxes toward the ocean: how well does it constrain the submarine groundwater discharge?” by Guillaume Le Gland et al.

Guillaume Le Gland et al.

guillaume.legland@univ-brest.fr

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Dear referee #2 Thank you for the thorough reading of our manuscript and your constructive comments. As requested, the manuscript will be proofread again for typos and grammatical errors. Here are the answers to your comments:

1) The title should reflect three aspects: a) We have shown that parameters such as the number of source regions and the cost function matter a lot in inverse modeling, b) By using appropriate parameters, we produce a more precise estimate than previous studies, c) However, this is not immediately usable for SGD studies as this source still have to be separated from diffusion. The current title might not emphasize the first aspect enough but finding a better one is difficult. The title could be changed to

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“Improving the inverse modeling of a trace isotope: how well does it constrain radium-228 fluxes toward the ocean and Submarine Groundwater Discharge?”.

2) Riverine dissolved radium-228 is less than 1% of the total radium-228 flux. This figure, similar to that of dust, will be added in the introduction (Page 2 line 30). More explanations will be given at page 10, using the annual river discharge and the average concentration in dissolved radium.

3) Page 7 line 17. It would indeed make more sense to compare river discharge to the other large fluxes of water and nutrients to the ocean, Submarine Groundwater Discharge (SGD), rather than to radium-228 fluxes. The problem is that SGD suffers from high uncertainty, as highlighted in the article. Average basin-wide SGD fluxes can be compared, but this is implicitly assuming that diffusion per unit of surface is nearly the same in both basins, which is far from certain. This issue will be moved to the end of 3.4, where we will compare the distribution of river discharge with both radium fluxes and SGD, and explain why the latter is imprecise, although more interesting. The ratios are very close anyway.

4) Page 8 line 11: You are right: the figure called here is Fig. 6. It will be changed and this change will solve the numbering problem at the same time.

5) Page 14 line 28: Indeed, the figure called here is Fig. 9.

6) Conclusion lines 14-15: The difference between the three cost functions and between the underlying assumptions on error statistics will be described explicitly in the conclusion, so that a reader skipping to the conclusion can understand what it is about and why it is important.

7) Conclusion lines 24-25: This sentence will be removed from the conclusion, as it is not a main focus of the paper. This possibility of improving a circulation model using the residuals of inversions is already mentioned in 3.2 and 4.2 and there is not much to add.

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8) Evaluating the SGD is the goal of several studies and radium-228 has often been used as a tracer for this purpose. One important conclusion of this article is that using radium-228 in an inventory or in inverse model is very imprecise because SGD and diffusion are poorly separated. This will be stated more explicitly in 3.4 and in the conclusion.

9) NEMO website will be included (<http://www.nemo-ocean.eu/>).

10) The references of the data sources will be included in the supplement.

11) The Fram Strait section will be corrected.

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