

## ***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.***

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This is an outstanding paper making excellent progress in a timely and important field. The authors used an excellent approach to reduce uncertainty in Ra-228 global budgets. I feel the authors should be congratulated and the paper should be published after minor review. I have only a few minor suggestions for improvement:

- 1) Page 1, Line 2, abstract: “lower”. Add a short note on how much lower.
- 2) Page 2, Line 33: “raw assumptions”. I suggest the authors spell out the major raw assumptions here, or just omit this early criticism.
- 3) Page 7, Line 17: Why the Indian and Pacific Basins are so high? I looked for a

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comment on that later in the discussion but could not find. I encourage the authors to add a paragraph (probably in the discussion) offering some thoughts explaining the spatial distribution.

4) What depth of the upper ocean was used to integrate the radium observations? How does it compare to previous studies? What sort of extrapolation was made in terms of depth integration for locations with no data in deeper waters?

5) Page 10, Line 21: “A fraction” can be replaced by “Nearly all”.

6) Page 10, Line 30: A number of diffusion studies are briefly cited. Considering the emphasis on diffusion, I encourage the authors to add more information about those studies. Maybe a summary table with the source of diffusion data and how it was estimated.

7) Page 11, Line 20 and elsewhere: The comparison between SGD and river flow is appropriate and should be kept since it puts results in perspective. However, radium-derived SGD is likely to be saline water, while rivers are a source of fresh water. I encourage the authors to add a note qualifying those differences using the literature.

8) Similar to the previous comment, the comparison to seepage meters on the last paragraph of page 12 may need to be qualified. Many seepage meter deployments are made in very shallow nearshore waters and may capture fresher SGD, while Ra-228 covers a much larger scale. Consider using radium studies to build this comparison.

Overall, this is an excellent study that should be published with no delay. My comments are mostly suggestions for improvement rather than conditions for acceptance.

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