

Jan. 14, 2016

Review:

**Accept with minor revisions.**

**Assessing land-ocean connectivity via Submarine Groundwater Discharge (SGD) in the Ria Formosa Lagoon (Portugal): combing radon measurements and stable isotope hydrology.**

This is an important paper. As the authors recognize, problem of selecting end-member concentrations has plagued SGD studies since their inception both in transforming Rn (and Ra) data into water fluxes and in calculating contaminant deliver via SGD. The stable isotope strategy presented here is an innovative approach. I would emphasize the method rather than “the overarching aims of the study to identify the sources of SGD...” (p. 12438 1, line 28). As a demonstration of the method, one might have hoped for a simpler study site, but perhaps, the complications at the Ria Formosa Lagoon serve to demonstrate the utility of the approach.

Given the sophisticated geochemistry, I found the treatment of the tidal hydraulic overly simplistic. Although I'm willing to concede that the residual tidal exchange is unimportant in the Rn budget, I had little confidence in the results. The tides deserve a more complete treatment in the description of the study site. The tide may indeed be a "traveling wave" (p. 12445 line 7) but I would not be surprised that, in such a tortious lagoon, it is not; and why use 12 hours as the semi-diurnal period when it's no more calculation effort to use the actual semi-diurnal period (p. 12445 l 21). The issue of the exchange of water among the three inlets (p 12461 l 6-15) is important and should be described earlier in the description of the study area.

The “freshwater lens” (p. 12455 l 10) is not described. Is it possible that differences in tidal phase across the outer barrier is driving water between the ocean and lagoon under the barrier? (I believe this has been shown to happen in some sites in Florida and Venice). And what about the extensive marshlands in the lagoon (grey areas in Figure 1)? How does drainage on, off and through the marshland figure into the budget?

**A few more minor suggestions:**

1. I found confusing the use of two names interchangeable for each inlet (p. 12440 l2) especially when only one name is given in Figure 1. Is this necessary?
2. Page 12448 line 8. Because the ocean waters are Rn-poor why is the mean Rn activity higher on the flood? Here's where a more careful explanation of the tidal hydraulics might have helped.
3. Figure 3. It might be more instructive to plot Rn-flux versus the water depth rather than to plot both against time. The figure suggests a more complicated tidal modulation than the simplified flood-ebb analysis used earlier.
4. P 12451 l 25. “LEL” is not on these figures (until you get to Figure 6).
5. P. 12455 lines 3 and 7. Are “end-member source” and “source functions” synonyms or the authors mean some (subtle) difference between the two phrases.
6. Table 1 Tidal Flux. Does this make sense? More water cannot be moving in than is moving out. If the ocean water is Rn-poor how can the import of Rn be higher than the export?