

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## Reply on RC1

Anonymous Referee #2

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Referee comment on "Extreme precipitation events induce high fluxes of groundwater and associated nutrients to coastal ocean" by Marc Diego-Feliu et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-594-RC2>, 2022

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The authors used a radium survey to assess inputs of submarine groundwater discharge (SGD) to the Mediterranean Sea in northeastern Spain following an extreme precipitation event and at base flow. They showed that terrestrial water inputs increased by an order of magnitude 4 days after the storm and returned to base flow conditions another 4 days later. The episodic terrestrial and marine nutrient inputs associated with this one event likely accounted for more than 10% of the dissolved inorganic nitrogen, dissolved inorganic phosphorus, and dissolved silicate inputs to the coast for the whole year. This highlights the importance of extreme events for nutrient inputs to the coast.

The study will be of great interest to those who study nutrients in coastal waters. It is one of a relatively small number of studies to quantify changes in submarine groundwater discharge and associated nutrients during large recharge/rainfall events. I have minor suggestions to improve the clarity of the manuscript. The most important is the need for the authors to more clearly communicate the assumptions in their Ra and nutrient budget analyses within the methods and discussion, rather than the appendix. In my view, the most severe limitations are the steady-state assumption and the lack of consideration of runoff as an input.

Regarding runoff, flow occurred in at least some of the ephemeral streams at T1, T2, and T3 during the October 2019 event (L 372). This is important information and should be stated in the main text rather than the appendix. Was runoff water sampled for Ra isotopes and nutrients? The authors argue they can neglect runoff in their Ra and nutrient budgets because the Ra delivered by overland flow may have decreased by 90% at the time of the P1 sampling, but if the total delivery was large, 10% of that total delivery could still be sizeable. Ideally the authors would perform some calculations to examine the potential scale of the runoff contribution. Did the authors collect any runoff samples for Ra isotope and nutrient analysis? The volumetric flux of runoff is likely unknown, but an estimate could probably be made based on typical runoff ratios for the region and the known catchment area. Without this kind of a calculation, the assumptions and limitations of lacking these runoff measurements should be clearly discussed. Care should be taken in attributing all terrestrial water inputs to groundwater (as in L 210) and all terrestrial

nutrient inputs to groundwater (as in L 228). A large amount of sediment-water interactions would be expected in a flowing, turbid ephemeral stream under an extreme precipitation event, so the contribution of runoff to radium isotopes and nutrients should not be readily discounted without further analysis.

The spatial relationships in the study could be clarified in a couple of places. For example, L 99 and Figure 1 refer to the Medistraes project or site. Is Medistraes an alternate name for the Argentona site? If so, it would be clearer in the figure and text to just refer to the site location by one name (or else label Medistraes project on Figure 1b). L 157 refers to "groundwater from the site of the Argentona ephemeral stream." I would suggest calling this the "Argentona site" and referring to Figure 1c-d for clarity.

L 85-Please provide the percentile for a 90-mm event here and reference Figure 2a.

L 239: It should be noted this is not necessarily a good assumption, as shown by studies like Weintein et al., 2011; Sawyer et al., 2014, Wong et al., 2020, and many others, but it is understood that it is not very feasible to mobilize a high-resolution sampling effort near the sediment-water interface on the tail of an extreme precipitation event, and this is what would be needed to alleviate the assumption.

Figure 5: Rather than showing the portion of nutrient fluxes attributed to terrestrial and marine SGD with bullseyes, consider coloring the bars below directly (i.e. stacked dark and light blue bars) to condense the information into one graphic style.

## References

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