

***Interactive comment on “Tracing the spatial propagation of river inlet water into an agricultural polder area using anthropogenic gadolinium” by J. Rozemeijer et al.***

**Anonymous Referee #2**

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This study aims at tracing the spatial propagation of river inlet water into an agricultural polder area using anthropogenic gadolinium in Netherlands between the Meuse and Waal. The authors present a coupled approach, mainly based on the Gd anomaly, together with chemical data and some fluxes calculations. This study is based on two sampling campaigns in contrasted hydrological periods. This constitutes a novative approach to trace the input of river water into a polder area.

Some remarks and suggestions are listed below to improve the manuscript. (1) We could regret that the results are not discussed in details and thus conclusions are given with few arguments. (2) The section 4 is a summary and not a discussion. Results from

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section 3 should be more discussed and argued. (3) The authors base their study on the Gadolinium anomaly, Gd is one of the Rare Earth Elements and it would be very useful to have the normalized REE patterns at least for the Meuse and some typical locations in the Polder area. (4) The authors do not refer enough to previous studies about the significance of the value of the calculated Gadolinium anomaly, i.e. above which value of Gd\* we can consider a clear anthropogenic input. (5) Comparison is made with a model, but there is no explanation on the way the fluxes are calculated. Limitations of the proportion calculations should be discussed. This is a crucial point that needs to be improved in the revised manuscript.

For these reasons and list of remarks below, I recommend the publication of this manuscript after major revisions.

Page 142 line 24: reference Bloemendaal and Roelofs, 1988 is missing in the reference list

Page 1412-1415: the introduction is very long compared to the total length of the manuscript. I suggest to reduce it.

Page 1413 line 13: Van Vliet. ... is missing in the reference list.

Page 1418 line 25: a discussion about the significance of the Gd-anomaly value is missing. See previous paper (e.g. Rabiet et al.).

Page 1419 lines 21-28: Does this method allow accurate measurements of all the REE including elements with very low contents. It is specified that the frequently applied pre-concentration procedure is not used in this study, the reason why should be explained. A presentation of the results obtained on a certified reference material is missing.

Page 1420 lines 7-21: The authors discuss the Gd-anomaly values and conclude that, according to their data, a Gd-anomaly lower or equal to 1.3 does not trace any river water input into the polder. This should be discussed according to previous studies on the use of the Gd-anomaly. Typical profiles of REE should be presented and discussed.

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Page 1421 lines 14-22: This discussion should be supported by a comparison with the bibliography results. For instance, Rabiet discussed the high temporal variability of the Gd-anomaly in wastewater treatment plant effluents.

Page 1422 lines 4-14: The presentation and discussion of the chemical contents of P, S and N are not sufficiently argued. For instance, the difference of total P measured in local drainage samples and inlet water should be discussed (P in washing powders or not?). The NO<sub>3</sub> values in local drainage samples are very low, is the hypothesis of denitrification supported by other indicators? Concentration of NO<sub>3</sub> in the inlet water are also low < 4 mg.L<sup>-1</sup> for river waters, are the concentrations expressed as NO<sub>3</sub> or N-NO<sub>3</sub>?

Section 3 needs to clearly explain how the fluxes were modelled. For each map (figure 5), the modelled proportions of the inlet water into the ditches and channels are based on a snapshot sampling campaign and thus it is assumed that the Gd-anomaly is constant in the river at least during the transfer time from the river up to the more distant channels. This should be added as a limitation of the model. This transfer time between the river and the more distant areas of the polder should be discussed.

Figure 2 could be incorporated into figure 1.

Figure 3: the figures associated to the Gd-anomaly symbols are too small, and thus impossible to read.

The references MartÄsn-Queller et al. 2010 ; Groenendijk et al., 1999 ; Kroes et al., 1999 that are listen in the reference list are not cited in the text of the manuscript.

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