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Hydrology and Earth System Sciences Discussions

Interactive comment on "Quantifying water and salt fluxes in a lowland polder catchment dominated by boil seepage: a probabilistic end-member mixing approach" *by* P. G. B. de Louw et al.

Anonymous Referee #2

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GENERAL COMMENTS Generally, the idea to apply a probabilistic end-member mixing approach to quantify water and salt fluxes in the study catchment is interesting. The finding that preferential seepage via boils is the main salinization pathway in this particular environment is of high importance and has direct practical implications. The conducted scenario analysis adds further value to the paper. However, given the complexity of the system (unique environment, large number of model parameters), the appropriateness of the applied methodology/ chosen model needs to be demonstrated

in more detail to support the drawn conclusions.

SPECIFIC COMMENTS 1) The probabilistic end-member mixing approach heavily relies on adequate measurements of the end members. In this respect there are some questions/ remarks: a) One main outcome is that preferential seepage via boils is the main salinization pathway. At the same time boil flux and concentration were found to be the most sensitive parameters (page 171). The authors conducted a parameter sensitivity analysis to determine for which parameter the quality of field measurements should be improved. Given the importance of boil flux and concentration a better assessment of boil seepage in the field would have been desirable. The location of 48 boils is presented in Fig. 2 – so the boil locations are known (?!). Was there no possibility to measure boil flux/concentration for few example boils to get a better picture? This would have helped to validate the EMMA approach since the model is then used for a scenario analysis. Considering boil concentration measurements once over the two years – how about representativity over longer time scales? b) 150 small inlets of "boezem" water (according to Table 1) are controlled by farmers (as stated on page 165). Is there information available about the management of these small inlets? Since the sensitivity analysis later shows that admission of "boezem" water in summer and winter are sensitive parameters (page 168 and Table 5) - is this something that should be considered in the model? c) Many measurements are point measurements in time: Is the sampling frequency adequate? How about diurnal variation? Are the measurements always taken at the same time? It would be nice to have a pre-analysis of representativity of point measurements for continuous time series. d) For clarity – there are 12 clusters of monitoring wells with 4 groundwater wells each and one upper aquifer hydraulic head measurement? e) How exactly is the chloride concentration of boils, paleochannel seepage, and diffuse seepage measured?

2) The GLUE method is an essential part of the study's approach. To assess whether the conclusions drawn from the analysis are valid the methodology has to be clear and easy to follow. There are several assumptions and subjective decisions within the ap-

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plied GLUE method that are not well described in the present manuscript. The steps in the GLUE procedure that require subjective decisions have to be elaborated in detail. Moreover, terminology that is different from the standard GLUE method should be clarified. a) How were the cut-off criteria for behavioural parameter sets (Table 3) determined? Why these threshold? b) Why do you choose two different parameter ranges for the uncertainty and the sensitivity analysis? c) "The interdependencies of the model parameters were quantified by an autocorrelation analysis between the behavioural parameter combinations." (page 163) Please Explain. Autocorrelation analysis in this context is not common. Fig 6: Are these graphs not simply dotty plots of two parameters? Why auto-correlation?

3) Scenario analysis: The scenarios 1 and 2 are well selected since they have direct practical applications. However, is scenario 3 not solely underpinning the already known great influence of boil seepage? 4) Is Figure 5 necessary? Isn't the relevant information summarized in Table 5?

TECHNICAL CORRECTIONS 1) p. 157 line 14-15: Sentence structure unclear 2) p. 157 line 19: "of" instead "the driving force for" 3) Figures 1 and 2: enlarge font size 4) Table 2: I suggest you add parameter names to the abbreviations 5) Table 5: Why are both small and capital letters used for concentration? (e.g. Cs,d and ca,w) 6) Figures 3 and 7: It is hard to identify details concerning shorter time scales in Fig. 3 – maybe select only one example year? The differences between scenarios in Fig. 7 are also not easy to identify – generating separate graphs might help.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 151, 2011.