Interactive comment on “Sensitivity of Hydrologic and Geologic Parameters on Recharge Processes in a Highly-Heterogeneous, Semi-Confined Aquifer System” by Stephen R. Maples et al.

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Received and published: 25 November 2019

GENERAL COMMENTS

COMMENT: “The manuscript “Sensitivity of Hydrologic and Geologic Parameters on Recharge Processes in a Highly-Heterogeneous, Semi-Confined Aquifer System” describes an interesting study on local and global sensitivity analysis in the framework of Managed Aquifer recharge, using a realistic case study. Overall, the manuscript is well written and the results are illustrated in a clear manner. Although the research work heavily relies for the creation of the geological model and the setting up of a flow model and MAR on two previous works, the additional research performed in this study and the new findings justify a new publication. I only have a couple of minor suggestions and some technical details.”

RESPONSE: Thank you for the comments. We have addressed your comments, and have provided responses to each specific comment below.

SPECIFIC COMMENTS:

COMMENT: “Control volume and connectivity metric (lines 179-188; 331-333) Please double check the definition of the control volume and the need for a 6-points connectivity metric: if the control volume is defined as “encompassing vertically-coincident cells” (line 179), then there is probably no need to require a 6-points connectivity metric. For example, with a 6-points connectivity, you can have 2 very horizontally extended layers of a conductive material, separated by a rather impermeable aquitard; if only one cell of the aquitard is conductive, then the 6-points connectivity guarantees connection. Maybe I missed the definition of the control volume. Is it defined by only one cell in the horizontal directions?”

RESPONSE: We agree that the definition of the control volume was unclear, and have made substantial changes to section 2.4.2 to re-frame and add detail to how site characteristics are presented. For example, we have added the sentence (lines 187-189): “Percolation was evaluated for a control volume encompassing all cells from the land surface to the initial water table depth (i.e., unsaturated-zone cells) at the 25 x,y cell locations encompassing each site.” Because each control volume incorporates both vertically- and horizontally-connected cells, the 6-connectivity metric is necessary to evaluate percolation. We believe that the clarification regarding the definition of the control volume will make this clear to the reader.

COMMENT: “Linearity (197-200) As your aquifer is not confined, maybe the fact of separating the contribution of each recharge/no-recharge scenario would not work properly as in the case of a linear problem. Please comment on this.”

RESPONSE: Thank you for pointing out some of the limitations associated with the differencing approach we use to post-process the results. We have added several sentences to the Discussion section to acknowledge the limitations of this approach for non-linear models, and also
noted that we did not encounter spurious recharge stresses or unrealistic model noise when using this approach with our model. (lines 517-521)

COMMENT: “r sign In general, for a negative correlation a negative r is used (line 315, but also the corresponding figures).” RESPONSE: Thank you for catching this mistake. We added text to point out that R_10d, R_30d, and P_30d were positively correlated with all simulated outputs, but V_fines, 90d was generally negatively correlated with simulated outputs. We made changes throughout the text to report negative correlations appropriately, and have modified Fig. 5 to make clear that correlations are reported as the absolute value.

FIGURES

COMMENT: “Fig.1 and Fig.3 Please report the original publication source of the figure.” RESPONSE: We have reported the original source of Figure 1 (Maples et al., 2019), but Figure 3 is unique to this publication, and thus does not have a publication source, so the Figure 3 caption was left as-is.

COMMENT: “Fig.8 Do you also have a map of IVF? It would be nice to see it on the side of the R30d (see also line 370).” RESPONSE: We chose not to overlay a map of IVF on our stochastic geologic model because our findings are presented as a proof-of-concept of a hypothetical, but physically-realistic domain (see lines 515-517). Instead, we rely on citations of the relevant studies that have identified IVF in this region and encourage the reader to seek those publications for additional information.

TECHNICAL CORRECTIONS

COMMENT: “line 63 :1640 m²” RESPONSE: Thank you for catching this mistake. We have changed “1640m²” to “1640 m²”

COMMENT: “Parenthesis: Double check journal guidelines for parentheses (i.e. lines 67, 76-77, 87, 91)” RESPONSE: We have checked the manuscript preparation guidelines for HESS and did not find specific guidance for these instances of parentheses.

We will defer to the associate editor and copy editor to provide guidance on these instances.

COMMENT: “Units repetition. It would be more correct to report units close to each number, for example 1 × 2 × 3 m should be something like 1 m × 2 m × 3 m (see lines 99, 101). This is also valid when a list of numbers (with unit) is reported. See for example line 308, 309, 320.” RESPONSE: Thank you for catching this mistake. We have made changes here and elsewhere throughout the manuscript to correct unit repetition issues.

COMMENT: “Subscript fonts In general, subscripts that are not index should not be in italic font (i.e., Ss should be Ss instead) (see line 110 and other locations in the text)” RESPONSE: Thank you for catching this mistake. We have made changes here and elsewhere throughout the manuscript to correct italicization mistakes in subscripts.

COMMENT: “lines 123-124 Check ‘0 m amsl’.” RESPONSE: We are leaving the acronym as-is because above mean sea level (amsl) is introduced previously in Section 2.1 (line 77)

COMMENT: “UZ (line 141) Please introduce this acronym.” RESPONSE: Thank you for catching this mistake. We have changed “near-surface UZ cells” to “near-surface unsaturated-zone (UZ) cells”

COMMENT: “line 165-166 Ss or SS?” RESPONSE: Thank you for catching this mistake. We have changed “K_S” to “K_s”

COMMENT: “Vfines,90d Double check the consistency of this symbol within the documents (see for example Fig.5).” RESPONSE: Thank you for catching this mistake. We have fixed the figure accordingly, and have double-checked the consistency of its usage throughout the text.

COMMENT: “line 479 “to be fully...”? ” RESPONSE: Thank you for catching this mistake. We have changed “challenging to fully captured” with “challenging to fully cap-
COMMENT: "line 538 "to incorporate a measure" RESPONSE: Thank you for catching this mistake. We have incorporated the edit.


Fig. 1.