

Interactive comment on “Technical note: Water table mapping accounting for river-aquifer connectivity and human pressure” by Mathias Maillot et al.

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We thank the reviewers for their valuable review of our manuscript and for their constructive comments, which substantially helped improving the quality of the paper. Please find hereafter a point-by-point rebuttal with a new version of the manuscript (supplementary pdf file) where the correction has been made. Changes to the text in the manuscript are highlighted.

"It also appears that questions (i) and (iv) stated at the end of the introduction are left without an answer. These questions call for a comparison of different methods (or different levels of refinement), but no such comparison is presented. I think it would

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be very informative to do so; indeed, without such a comparison, the benefits of the various refinements are not obvious."

This is a relevant point raised by the referee N°1. We propose to change the first addressed question of the introduction to "(i) what are the appropriate steps for water table mapping of superficial aquifer?"

We think the comment pertaining to the fourth question meet up with the second referee's comment which is about the interpretations of the produced map in terms of SW-GW flow rate and groundwater flow dynamics. These aspects are not developed in this study. We believe that such a development should constitute further works of the application of this study that we want to keep focus on the mapping issue.

List of changes:

P1 L14: Suggest adding reference to a classic publication (e.g. Winter et al. [1998]) to support the first sentence. => P1-L15: adding winter et al. 1998 reference

P1 L14-15: This sentence is confusing. In this case, the water table is not below the riverbed: it is at the river water level. => P1-L15: indeed there is no need to mention the riverbed, removing the confusing "below the riverbed"

P1 L19-20: Suggest also mentioning topography as a controlling factor and adding reference to Bresciani et al. [2016]. => P1-L20: adding Bresciani et al. 2016 reference

P2 L3: What do you mean by "usual estimators"? => P2-L4: change "usual estimators" to "linear estimators"

P2 L.-14: Also note that Bresciani et al. [2018] obtained good results with the diffusion kernel interpolation method. => P2-L15: adding Bresciani et al. 2018 reference

P3 L5: What "drawback" are you referring to? Obviously, the water table is always largely controlled by recharge. I do not see what point is being made here. => We thank you to point out this mistake which is a remaining artifact resulting from former

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version of the study. We propose to remove the two sentences since the methodology does not require to identify or quantify recharge.

P4 L2: Reference needed. Also note that this is not rigorously true. Namely, Desbarats et al. [2002] suggested that this assumption is not appropriate at the scale of a single catchment. => P2-L26/28: adding one sentence about the topography - water table correlation and corresponding Haitjema and Mitchell-Bruker 2005 reference

P3 L12: What do you mean by “define the SW-GW connection status”? Maybe you rather mean “determine the SW-GW connection status”? => P3-L11: change “define” to “determine”

P3 L20: What does “the dataset analysis” refer to? Figure 1: Arrows are missing. This makes the figure difficult to understand. Figure 1: What is “Water profile of river”? Do you mean river water level? => P3-L19/20header: changed “Firstly, the dataset analysis is achieved in order to constitute the raw dataset” to “Firstly, the raw dataset is composed of each measured unsaturated zone depth for the corresponding measurement campaigns” => Arrows were added to Fig.1 between each item.

P4 L5-7: Please explain the reason for smoothing the DEM, and clarify the sentence “the search radius is relevant with the average width value of the stream network”. => P4-L7/13: adding explanations for the DEM smoothing and the smoothing effect correction: “ The smoothing of the DEM is required to avoid the occurrence of high frequency topography signals that would not be relevant with the water table signal. The search radius is in agreement with the average width value of the stream network in order to ensure that the river water level is kept after smoothing. The difference between rough DEM and smoothed DEM may be important in locations where the topographic slope is the most important. These locations include crucial areas nearby the riverbanks. Therefore, this difference is calculated at each sampling points. Due to the use of UZD, this generates a biased estimation of water table at these locations, given that this difference is not yet accounted for into the UZD measured value.”

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P4 L5-7: Please explain the reason for smoothing the DEM, and clarify the sentence “the search radius is relevant with the average width value of the stream network”. => P4-L23-29: adding explanation for the data selection step: “The second category is composed by the other samples. Information about the locations of pumping wells is required to identify these samples. The observed minimal UZD of depreciated areas can be use as a threshold value to differentiate affected points from non-affected points. In this study, the samples with UZD value greater than 10 m are grouped in this category. Note that this value may vary according to the case study. This differentiation is required to elaborate a geostatistical tool (i.e. variogram model) that only depends of natural variability. Therefore, all the variographic studies are performed on this second category called unaffected UZD dataset.”

P4 L8-13: Unclear. => P4-L31/33: adding explanation for better comprehension: “The Gaussian score variable used for Gibbs sampling-conditionnal simulation steps is described in next subsections. UZD is the variable ultimately used for ordinary kriging.”

P2 L23: Shouldn't it be simply “large uncertainty in the estimation” instead of “large standard deviations of the estimation errors” (this would be the error of the error)? Same comment on L27. => P7-L21/P8-L3: adding ordinary kriging equation system and description. The strictly speaking outcome of kriging are the standard deviations of the estimation errors.

P6 L22: And riverbed thickness? => We assume that there is no vertical stratification between riverbed and aquifer considering that the riverbed is periodically dredged

P6 L23-24: “is submitted to”: I guess you mean “is subject to”. => changed at P6 L31-32

P6 L26: “At a station”: I guess you mean “At point scale”. => Point scale refers to a very localized spot, such as a hyporheic zone scale. Here we consider multiple information coupling river hydraulic head and a nearby piezometer. We prefer to call it a station than a point.

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P6: L28: What does “such criteria” refer to? Same for “optimization procedure”. => P7-L3/4: Adding criteria description before mentioning it => P7-L7/8: Adding reference to optimization procedure description to the corresponding further section

P6 L23 – P7 L6: I am getting a bit lost here: which method did you use in the end? I think I ultimately understood, but the organization of ideas could be improved. => P6-L31/P7-L4: Improving text readability with previous modifications

P7 L11: What are the “selected UZD data”? => P7-L19-20: Adding a better description of the used dataset, referring to previous section

P7 L11: Fig. 5 is referred to before figures 2-4; please correct this. Fig.2: Indicate river names on the map. => Figures: moving Fig.5 to Fig.2

P8 L7-8: “The study of...”: What study are you referring to? => P8-L22-23: changed word “study of” into “interpretations about . . . described further”

P9 L 6: Not sure about the meaning of “up” and “down”: this is confusing. Suggest using “open” and “closed” instead. => P9-L17: changed word “down” into “open”

P9 L29: Why 0.57? This seems totally arbitrary. => The 0.57 value results from a classification of the relation between water table and river water level timeseries among two classes of piezometers of which two representative piezometers are showed into Fig.4.

P9 L30-31: Repetition of previous sentence. => Repetition removed.

P10 L10-11: I think it would make more sense to maximize the total number of sections for which the connectivity status is correctly predicted. => P10-L29: This is what has been done. Thank you to point out the need for clarification. P10/L29-31 has been reworked.

Figure 4b: Out of how many cross sections in total?

Figure 4: (b) is not announced in the caption. => Fig.5: (b) description added

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Figures: Fig.6: adding river names, adding new color for connected river and points to avoid confusion between water table color bar and other features of the map, and improve contrast.

Please also note the supplement to this comment:

<https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-101/hess-2019-101-AC1-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-101>, 2019.

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