Review of manuscript hess-2022-356 (revised version)

Technical note: High density mapping of regional groundwater tables with steady-state surface nuclear magnetic resonance – three Danish case studies

General assessment

The authors touched many aspects of the first review in their revision. By consequently showing the elevation of water tables instead of depth below surface as in the first version, the estimates from the SNMR data can be assessed as being much more plausible than before. The discussion of the results has been extended by introducing possible reasons for the remaining discrepancies between the different data sets.

However, there are still inconsistencies that need to be clarified, and, unfortunately, the manuscript still has significant linguistic deficits that have to be corrected before publication. Thus, I suggest moderate revisions.

Details

The page and Line numbers refer to the document with marked changes (hess-2022-356-ATC1_comments.pdf)

P4L96: The sentence “Furthermore,…” can be erased or should be reformulated.

P4L97: with > at

P4L102: redundant information

P4L103: What do you mean by “having relaxation time and spatial overlapping”? A tradeoff between resolving spatial information and discovering the relaxation times of the signals? Please clarify.

P4L101-103: As already suggested in my first review, I would prefer a figure with an example of a sensitivity function or at least the reference to Griffith et al. (2022). You replied to the corresponding comment by giving detailed information on the sensitive depth ranges related to specific pulse lengths. Please include this information also in the manuscript, at least.

P5L117: As stated later in the manuscript, the water tables in the boreholes have been acquired up to a few decades ago. It is necessary to mention this important detail already here in the Section “Methods” together with a statement on the plausibility of comparing this data with the recent estimates from SNMR.

P5L121: Please give information on min and max values of layer thicknesses in the kernel.

P6L145: “north-east” > Seems to be “north-west” according to Fig. 2a.

P6L152: “The elevation varies…” Reformulation is necessary.

P6L152: ”The middle field…” Sentence is redundant and unnecessary.

P6L156: “The data…” Reformulation is necessary. SNMR measures water content instead of pressure head. “Rather” is the wrong word in this context.

P7L157: “The borehole…” > “Borehole data in this area…”

P7L171: Please comment on the fact that this underlying till is obviously not resolved by the TEM data.

P7L185: Include Grombacher et al. (2022) here as a reference for this procedure.

P9L188: Fig.3a shows a decrease of elevation of water tables towards west, not north.

P9L191: “borehole data has been acquired …”

P9L194: Not “uniform” at all, the water table varies within 10 m from east to west.

P9L104: Reformulation is necessary. I do not understand what this statement is pointing to.

P11L218: Please reformulate and clarify, “flow path” is not the correct feature in this context.

P11L219: “northern most” > “most northern”

P11L223: Please explain: Why did you not use a different resolution?

P11L237: Less saturated or unsaturated conditions are not possible beneath the water table. An increasing clay content is the only reliable explanation.

P11L239: wrong word in this context: “perturb” (the same for P16L309)

P12L244: Reformulation is necessary: “Therefore,…”

P12L251-257: In other words, the comparison of TEM and NMR in Fig.5b is meaningless. As already mentioned in the first review of this manuscript, it is not necessary to show this data. We do not learn anything from it.

P13L274: “decrease amount of…” > “decreased number of…”

P15L284: Reformulation and clarification is necessary: clayey layers are conductive but most likely appear with high water content in reality. However, we do not see this clay-bound water with SNMR.

P15L286: As you explained in the reply of my first review, such development is planned for future research. You should give this information also here as an outlook.

P15L292: There are some examples in the literature demonstrating that this combination is indeed promising. Please cite at least one or two of them here.

P16L296: I question this statement. Some water table estimates in your study are consistent with the borehole data, and some are not. I acknowledge the explanations and discussion on the differences, but the terminus “consistence” points to a conclusion that cannot be given at this state for various reasons.

First of all, as you also mention at some point in the manuscript, the water table in boreholes is actually a pressure head that, from a physical viewpoint, cannot be in consistence with the elevation of the saturated zone that is measured by SNMR – even for unconfined aquifers you have to consider the capillary fringe. The difference might irrelevant in your areas but we do not know for sure. Second, we are not yet able to identify the confidence bounds of the water table estimates from SNMR. As you explained in your reply on the first review, the corresponding analysis is still ongoing and I am very curious about it. Last but not least, your data does not show ground truth, because there are years and decades between borehole data acquisition and the NMR measurements.