

Review of “Improved understanding of regional groundwater drought development through time series modelling: the 2018-2019 drought in the Netherlands” by Esther Brakkee et al.

The manuscript greatly improved. The methods are better explained, and methodological choices are better justified and evaluated with an elaborate sensitivity analysis according to multiple criteria. Also, results and conclusions are more complete, although I had two (optional) suggestions that might be worth showing or exploring a bit further. Finally, I had a couple of minor remarks that need to be addressed.

Suggestions:

- For the simulation performance (Table 5) you only use absolute evaluation metrics (RMSE and ME). However, your purpose (in this study) is to derive the SGI. For this SGI, it does not really matter if you get the absolute GW values right, especially if you use a non-parametric one. What matters is that you get the ranking right. Therefore, I would still like to see a relative evaluation metric, preferably Spearman's rank correlation. This could be added as extra column to table 5.
- You did a great effort of data validation and classification, and grouped groundwater series into „typical“, „atypical“, „deep“ (4.1.1). However, you then more or less pull all classes together again for the remaining of the manuscript, while information about the different subgroups might contain some important information. It might be worth to derive response time (Fig. 7) for each of the 3 classes, like you now also do with the density functions for the different regions (which is nice!). Also, model performance (Table 5) and SGI performance (Fig. 8) could be evaluated for each class separately.

Minor remarks:

- Line 22: abbreviation TSM not yet defined.
- Line 117: abbreviations P and ET_{REF} are not yet defined.
- Line 117: not mm jaar but mm year⁻¹
- Line 127: what does „consecutive“ mean here. At least one observation in each month for a consecutive period of 10 years? Or?
- Line 128: brackets around (2018) can be removed.
- Line 128-130: Fig. 3 is introduced before Fig. 2.
- Figure 2. Nice workflow Figure! Possibly add an arrow pointing from step 1 to step 2 and one backward from step 2 to step 1, to indicate that you repeat these steps to improve models.
- Section 3.1: I wrote down a note after seeing your EGU presentation that I really liked your explanatory Figure of the method. For me, such a Figure would be very helpful to quickly understand the method and where which parameter is involved. But I realize that it would also take quite some more space, so feel free to ignore.
- Eq 1: ET_{ref} also a function of (t)
- Line 156: not Appendix A but Appendix A1
- Line 158: „five parameters“ contradicts with the „four parameters“ stated in Appendix A1.
- Line 159: „1 mm“ is this 1 mm per time step? If so, please add.
- Line 173: appendix A3 introduced before appendix A2.
- Line 242: GWL not defined.
- Line 248: WTD already defined a few paragraphs above.
- Line 268: Why „for simplicity“?
- Table 1: Isn't f a positive factor, give the minus sign in eq. 1?
- Line 304: correlation instead of „regression“?

- Line 400-404: I like the addition to Fig. 7, but think this deserves a little bit more attention in text.
- Appendix: Might consider moving some of those (e.g. A2 & A3) to the supplementary material to limit the length of article.
- Line 588-590: To save a few lines, you might just reference eq. 1 in the main text.
- Line 596-599: repetition.
- Table A1: Isn't f a positive factor, give the minus sign in eq. 1
- Appendix A3. Nice examples!