

Interactive comment on “Using Long Short-Term Memory networks to connect water table depth anomalies to precipitation anomalies over Europe” by Yueling Ma et al.

Anonymous Referee #2

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In their paper, Ma et al proposed to investigate the link between water table depth anomalies (wt-da) and precipitation anomalies (pra) using Long Short-Term Memory networks (LSTM). To test the proposed approach, they use a dataset generated with the Terrestrial System Modelling Platform (TSMP) over Europe and compare the results provides by both approaches (TSMP and LSTM). The effect of several factors on the performance of the approach are also investigated. Cross-wavelet transform are also used to analyze the response of the network regarding time frequency. Overall, the paper is well written and organized. The approach proposed is interesting and its novelty is clearly explained in the introduction as this type of networks used is not commonly used to examine the response of groundwater. The study has a specific focus on

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response to drought which is of importance for groundwater management. The results presented are promising but the presentation/discussion should be improved. In my opinion, the results are not discussed thoroughly especially when the performance of LSTM is not so good. My issues with the paper, and some additional minor comments and corrections, are detailed in the following. - The dataset generated with TSMP is the foundation of the proposed methodology as the evolution in time and space of all the variables used in the study are simulated ones. Although the reader is sent to relevant references to have further information, I think some key features need to be presented to make the paper self-consistent. I especially would have liked to know how the TSMP was calibrated (or not) against observed values to have an idea of how reasonable or relevant the simulated evolutions are.

- I think that the figures with maps are very hard to interpret owing to the extension of the study area and the spatial resolution of the approach proposed. The authors state that the agreement is good visually (Line 302) which is in my opinion not so evident and not enough. I would have liked (if possible) some indicators to be presented – maybe for each PROVIDENCE regions – to have a quantitative diagnostic rather than a visual one.

- Overall, the performance of the LSTM approach is not discussed with enough details. Especially when the performances are poor. Line 334 – 335 is an example where some more details are needed. Table 4 demonstrates that the agreement is not good in some specific PRUDENCE regions (for instance MD or IB) and no specific explanations are provided. The same goes for the discussion of Figure 8.

- The conclusion is a bit misleading, as it may convey the message that the LSTM approach is relevant all over Europe when the results are very good only in specific conditions (as specified line 406-407). Some rephrasing may be needed here.

Specific comments:

- Line 84: Should be RNN and not ANN here

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- Line 110: It is mentioned here that “Areas with surface water are not taken into account”. I wonder if or to what extent this assumption could impact the results of the study.
- Figure 6 can be improved: the color legend that specifies the PRUDENCE regions should be bigger and placed elsewhere.

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