Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "Understanding the potential of climate teleconnections to project future groundwater drought" *by* William Rust et al.

Anonymous Referee #1

Received and published: 13 April 2019

The paper analyses cyclic variations in groundwater levels across 59 boreholes in the UK, classified according to aquifer type. Cycles of 1, ~7 and 16-32 years were recognized using the wavelet transform method. The most significant oscillatory component is the ~7-year cycle, which is driven by the North Atlantic Oscillation. The minimum phases of this component coincide with some of the major droughts in the UK. The connection between groundwater level/rainfall variability and both the teleconnections and droughts is qualitative but based on substantial evidence from published literature. The topic of groundwater drought forecasting is vital in the actual context of climate change, and the paper is adequately structured and well written. However, it has several shortcomings that need correction, namely:

1. It is not correct to say that this paper quantifies the teleconnections contribution to

the absolute groundwater variability for the first time (line 346, 392, 449, 509). The authors claim that all previous studies performed low-pass filtering or some averaging of groundwater level time-series before wavelet transform or PCA methods. This is not so, at least in the case of Tremblay et al., 2011 and Neves et al., 2019.

2. The proportion of groundwater variability driven by teleconnections in the UK seems indeed much lower than in other parts of the world. Blaming the amplification of low-frequencies in other studies (that does not happen) is therefore not valid, and the authors should seek other explanations. The results may probably be a consequence of the specific climate and hydrogeologic conditions in the UK, but may also be a consequence of the different methodology used to compute the percentages of variance. Do the authors get the same results using SSA or PCA? One alternative method should be used in order to be sure.

3. A closer look at Figure 4 shows time intervals between droughts of approximately 2.5, 3, 5, 6 and seven years. Therefore, it seems excessive to declare that the approach presented in this paper can be used to predict droughts with a recurrence of seven years (line 492). Moreover, the authors do not even mention the non-stationarity of teleconnections and ignore the effects of global warming on the predictability and statistics of extreme events. The authors need to re-write some parts of the text and elaborate more on these issues.

Minor points: - Please increase the font size of text and labels in the pictures - Line 283: can you explain better why the 7-year cycle has greater significance values in rainfall than in groundwater? - Line 315: do you mean misalignments amongst borehole records? Are there consistent misalignments amongst aquifers? - Line 321: figure 6 instead of figure 4? - Lines 342-354: the whole paragraph is redundant and would better be omitted.