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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.

William Rust et al.

w.d.rust@cranfield.ac.uk

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We would like to thank Anonymous Referee #2 for their detailed review comments. We found them to be insightful, and, through our responses to them set out below, we believe that they have resulted in a much improved paper.

Major comment 1: - In general the interpretation of trends by aquifer type is tricky for Oolite and Greensand sites as there are only 2 and 3 observation boreholes. I recommend clearly stating the number of observation boreholes in the introduction (somewhere the introduction between line 110 and 117) and afterwards avoiding (over)interpretation of statistic measures in these two aquifer types (e.g. lines 262, 277-278, 290-292, 325- 326 . . .). Furthermore there is no strong differences between

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the aquifer types, at least I don't see these e.g. in Figure 6, in my opinion these differences are not shown in your results (line 365 – 369). Consider rephrasing to make a less strong claim.

Response to Major comment 1: We agree that it is difficult to interpret patterns in response as a function of aquifer type, particularly for the Oolites and Greensands where there are only a couple of observations from each aquifer; that we should avoid over interpreting any of the aquifer specific results. Consequently, we have revised the text at L110-116 to explicitly state how many observations there are for each aquifer, and have added cautionary statements in the appropriate sections of text noting the relatively small sample sizes and the consequent difficulties in unambiguously identifying systematic differences in responses between the different aquifers, e.g. Lines 264 – 266, and we have avoided group-specific interpretation in the discussion for these groups.

Major comment 2: The drought events used for comparison, do not occur in the 7-year cycles that are proposed for potentially predicting groundwater droughts in the UK. These drought events occur in different time intervals

Response to Major comment 2: We agree that the wording around the recurrence of drought events was too strong and did not account for the different time intervals between recorded droughts. In response we have now included a further review of drought mechanisms and have updated the text to refer to reflect drought risk, e.g. Lines 443-475, rather than the definite timings of drought. In addition, Figure 4 has been modified to better illustrate the drought start/end dates, although there is inevitable spatial uncertainty in these.

Major comment 3: To support teleconnection influences of larger scale climate phenomena you need to further elaborate on this. The claims in the discussion on the relation of NAO and EA to the 7 year and 16-32 year cycles of droughts are very strong considering the results; consider reformulating it.

Response to Major comment 3: We have now softened our claims regarding the NAO and EA control on groundwater and rainfall in the discussion, and included further literature review about the potential causes for these signals, see Lines 419 – 420, 427 – 432 and 480 - 492

Major comment 4: Key for the interpretation of section 3.2 is additional information on the drought periods you are referring to (green bands in Figures 4&5). It would be helpful to provide some background on these events (on magnitude and durations), this potentially also helps to improve the discussion on climatic teleconnections.

Response to Major comment 4: We have now included additional information on the drought periods in the Discussion at Lines 443 - 492

Major comment 5: The discussion can be (and should be) considerably shortened by removing the first, very general and summarizing paragraph, also the last parts of the discussion are a little more messy than the rest of the manuscript, please consider re-organizing the discussion a little bit (see also minor comments)

Response to Major comment 5: We agree that this paragraph is not required and have removed the text, and have reworded the final paragraph.

Major comment 6: In my opinion, the quality of the Figures is not sufficient for publication: please change size of labels, axis labels, legends e.g. in Figures 2, 3, 4 and 5. Add a scale bar to all GB maps (Figure 1, Figure 6 and sup. Figure 1)

Response to Major comment 6: Figures have been updated to include the suggested changes

Major comment 7: Also in the conclusions we find some very strong statements that are in my opinion only partially supplied by your results: line 509 “we quantify, for the first time globally” (as pointed out before this is not the first time, see interactive comments); line 517 – 523 “. . . allowing the estimation of future drought. . .” (I would suggest changing this very strong claim accordingly, you show potential control of NAO

and EA on groundwater droughts in the UK); line 527-529 “it is clear from our results . . . drought prediction and its management across the North Atlantic region” (inn my opinion you cannot say that from your results, you mostly qualitatively analyse the coinciding timing of drought and climate across the UK); I’d skip Interactive comment line 524 – 527 at it is not very informative;

Response to Major comment 7: We have amended the text throughout the document to focus more on the contribution to the existing knowledge base rather than claiming anywhere to be the first study to produce such findings. See, for example, Lines 495 – 516.

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