

***Interactive comment on* “Human influences on streamflow drought characteristics in England and Wales” by Erik Tijdeman et al.**

Anonymous Referee #2

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Review Tijdeman et al. 2017 HESS

This manuscript nicely introduces an important topic, anthropogenic influences on streamflow drought, and outlines and investigates a core challenge when studying, identifying and monitoring streamflow droughts in the Anthropocene: human influences potentially changing the normal relationships, characteristics and descriptions of drought.

The paper is well written and fits the scope of HESS. Overall I believe that it gives a good outline of the issues involved in investigating the human influence, however there are a number of small changes which I believe should be addressed before acceptance.

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The main changes that I believe are important are all listed below, and involve either some rewording, clarification in the methods section, small wording edits, and some suggestions for change or improvement on the figures. I think it is an important message and topic to address, however I think that the phrasing of the results and the main messages might need to be reconsidered slightly. Upon checking through the methods and figures of the paper, it raises the question of the length of all data that was used? Were all catchments analysed for the time period 1974 -2013, or did they vary in length (as the supplementary figures suggest). Furthermore, it is mentioned how many catchments were useable after the missing data criteria (187), however it would be useful to be more transparent about how many catchments were used for the analysis in this paper specifically. Figure 8 shows all 23 that are identified in Figure 7, however these 23 are not just the groundwater abstraction and storage FAR-codes that the paper has a focus on, and which are mentioned in the results section.

Please see below a list of the recommended changes.

Title: I would suggest a small edit to the title as you are not only looking at streamflow drought characteristics, but also at relationships. Perhaps this can be incorporated into the title if the authors agree that it is important too?

Abstract: Page 1, L16: You currently introduce BFI but this should be changed to introduce BFIHOST as you use this in the paper. L24: Change 'towards the end of record was found...' to 'towards the end of their records was found...' L26: Change 'screening approaches were successful' to 'screening approaches were sometimes successful' L30: Change 'approach' to 'approaches'

Introduction: Page2, L2: Change 'They are monitored...' to 'They are identified and monitored...' Page 3, L16: Change 'A first approach' to 'One suggested approach' L19 – 27: Please reword these sentences to be clearer, in particular lines 19-21 – do you mean 2 discharge stations or 1 discharge station and 2 time periods? L27: Change 'However, the above described approaches...' to 'However, all these approaches...'

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L29: Suggested paragraph break at “An alternative” Page 4, L18-10: rephrase L12: Change ‘here we propose a screening approach that seeks to’ to ‘here we propose screening approaches that seek to’ given that you use three different approaches, in varying results. L15: Change ‘This study used a diverse’ to ‘This study uses a diverse’

2. Study area and Data Page 5, L1: Introduce the abbreviation for NRFA here L8: 1973 – should that be 1974 as that is the date used elsewhere and on the plots? L12-15: You introduce BFIHOST, but it might be useful to explain that it runs from 0 to 1 and what these mean to help the reader interpret your figures (Fig. 3 and 4) later on. Page 6, L6: typo?: NRA., 1993

3. Methods Page 6, L13-15: be clearer about introducing the streamflow and then the precipitation data. A suggestion for this would be in insert ‘For precipitation droughts’ in front of ‘monthly accumulated precipitation $P(t)$...’ on line 14, to have that clear distinction to the reader. L15: Reference McKee et al. 1993 when you introduce SPI L19: Reference Yevjevich 1967 when you mention threshold level approach Equation 2: I would question if this is needed Page 7, L1: suggested break or slight rearrangement to separate ‘The following two characteristics were used in the ...’ from the text before. L5: I would recommend keeping point 2 as brief as point one, and finding a way to explain it separately like you did for the duration Page 8, L14: you mention the 5th quantile here, but elsewhere you mention the 95th quantile.

4. Results In general – look to relate this section more to your hypothesis, in the structuring and/or the statements you make. I also believe that you don’t state enough that the results from the other human influences do not seem to be outside the N 95% confidence ellipse. Page 8, L7: change ‘the remaining catchments...’ to ‘the remaining G catchments’ L9: Look to add that the other FAR (other than G) fit within the N 95% confidence ellipse. Page 10, L7: after 24.3 add ‘(indicated on Fig. 7)’

5. Discussion L22-24: state which figure/figures show this. L27: typo: bracket before Rangecroft should actually be before 2016. Page 11, L22-24: interesting, do you have

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any abstraction rate data that can help illustrate this point? Page 12, L4: add in the word ‘meteorological’ into ‘severe 995-1997 drought’. L6: add ‘meteorological’ into ‘1976 drought’ if that is what you are referring to. L9: Suggest ways forward here after mentioning this risk of false alarm or misses of relevant drought conditions? L31: typo: Vicente-Serrano et al. (2014) Page 13 L7-9: add in ‘and different types of groundwater abstraction’ as they can affect the impact. L14: typo: brackets missing for Van Loon et al. (2016a).

6. Conclusion L29: make into: ‘National River Archive (focusing on “groundwater abstractions” and “storage or impoundments”).’

Table 1: Suggestion to add some visual marker/flag to the FAR codes used in this study (N, S and G)

Figure 1 and 7: Suggestion to use different shapes as well as different colours to represent the different FAR-codes due to the consideration of black and white printing, if the authors deem this a good idea. [What is the spatial distribution spread of the BFIHOST categories? Just curious] Figure 4 and 5: the plots could be labelled on the top outside margin above each one as headings instead of needing a colour key to the right? Figure 5: Y axis could have clearer outside margin labelling – P1 and P12 Figure 6: Consider adding data points and data lines to legend Figure 7: Specify the use of the 95th quantile in the caption (you currently state the threshold value used, also useful) Figure 8: I would suggest moving the catchment codes to the left hand side of each plot to be closer to their labelling. You focus on FAR-codes G and S for most of the paper, but then in Figure 8 you include a whole series of different activities. Furthermore you only make reference to the G and S plots of Figure 8 in the text (section 4.3) so do you need all 23 plots?

Supplementary What I gather from the supplementary data is that a lot of the catchments have different periods of data availability, they were not all 1974 – 2013? If this is correct, that it might be worth making this clearer in the methods. Where the thresh-

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olds all calculated using the ~40 years data, or were some done using much shorter time periods? (e.g. S2, S3, S4)

Overall, the supplementary data could be more obvious about the FAR-code at the start of each one. I recommend having the FAR-code with the current heading of catchment code for each catchment, e.g. S1 Mimram at Panshanger Park (38003) 38003 (FAR = GI)

Typos and comment through supplementary: S2: only 1 year S3: label the two catchments better S4: mismatch of dates. 1994-1998 in the plot but 1984 – 1998 in the caption/text S5: Add dates to figure caption S6: Add dates to figure caption, and add a horizontal line to indicate when the reservoir was build/ introduced into the catchment S8: Add dates. Y axis on top plot needs to be in full S9: change your location of legend to be consistent with S8. Y axis same as S8.

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