Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-22-RC2, 2020

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Asymmetric impact of groundwater use on groundwater droughts" *by* Doris E. Wendt et al.

Anonymous Referee #2

Received and published: 14 April 2020

This paper investigates the impact of groundwater use on groundwater drought for a case study in the UK.

Overall, I found the paper to be well-written, with some interesting results supported by some nice figures. The work represents a useful contribution to better understand how groundwater use affects groundwater drought and how groundwater levels have changed over time in the UK.

My main suggestions for the paper are to improve the clarity of the methods and reflection of the variability in groundwater levels. I agree with reviewer 1 that there is a lot of uncertainty in the results and some of the links between groundwater use and groundwater drought are somewhat arbitrary. I sympathise with the authors as I know how difficult it is to gain groundwater use data that may help make these findings more

Printer-friendly version

Discussion paper

robust, nevertheless, I believe the authors could make more efforts to discuss the limitations of their results and report the uncertainty/variability in their results.

Please see more detailed comments below:

Main Comments

Calculation of SPI and comparison with SGI –

In the methods/discussion please add some comment on the choice of gamma distribution used to calculate SPI. Other studies have shown that this is often not the most appropriate distribution for precipitation data and it would be good to discuss the impacts of this (see Svensson et al. 2017 for example).

From the methods section, it seems that you compare the SPI from a single grid cell with the corresponding groundwater well location (this should be clarified in the text). It would be good to add to the discussion the impacts of comparing a 1km2 grid cell of SPI with SGI that is a product of a regional groundwater aquifer system and regional rainfall patterns.

Methods and terminology

The methods (in places) were not clear – in particular, the SPI_SGI correlations and the use of the near-natural wells, uninfluenced and influenced monitoring sites. It would be useful to have a worked example of how the SPI-SGI correlations work in practice (showing an example for two sites – one influenced and one non-influenced and how they compare to the near natural reference cluster). It would also be useful to have a map of the influenced and non-influenced wells (this is maybe already included in Figure 1 but this figure is quite busy so it is hard to tell!) – are there any spatial patterns?

Reflection of uncertainty/variation

There is a lot of variation in the groundwater levels between sites and this needs to be

Printer-friendly version

Discussion paper

better reflected in the results. I suggest that the authors report the min/max or 5th/95th percentile of their results alongside the average in Table 2 and elsewhere in the text.

Like Reviewer 1, I am somewhat sceptical of attributing the shorter droughts in Lincolnshire, Shropshire and the Chilterns to water use and/or hotter Summers. Firstly the years that were identified in L263-265 did not have particularly hot summers (or this is certainly not consistent for these years) and many of these drought events can also be identified in the uninfluenced wells. These uncertainties need to be reflected in the discussion or the methods for identification need to be more robust.

Minor Comments

1. The abstract is quite long – I would shorten it and just highlight the key results. Currently, your more interesting results get a little lost in all the text.

2. P3 L80 It would be good to name these four water management units in the text

3. P5 L117 – What accumulation periods did you calculate SPI over, you need to be more specific here.

4. Table 1 – what time period were the long term precipitation and PET calculated over? It would be good if this was consistent with the time periods used in your study.

5. P7 L194 – Were these the climate time series from a single grid cell?

6. Table 2 - I was a little surprised that the average drought frequency for the Midlands cluster is significant when the values are quite similar (9.5 for uninfluenced and 9 for influenced) – is this correct?

7. Section 4.3 – in this section you don't distinguish between 'influenced' and 'uninfluenced' wells. It would be useful know whether the strong trends are just in the 'influenced' wells? If they are not, then your 'uninfluenced' wells may be more affected than suggested.

References Svensson, C., Hannaford, J., and Prosdocimi, I. (2017), Sta-

tistical distributions for monthly aggregations of precipitation and streamflow in drought indicator applications, Water Resour. Res., 53, 999– 1018, https://doi.org/10.1002/2016WR019276.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-22, 2020.

Printer-friendly version

Discussion paper