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Discussions

Interactive comment on "Using paired catchments to quantify the human influence on hydrological droughts" *by* Sally Rangecroft et al.

Anonymous Referee #1

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Rangecroft et al. aim to quantify the human influence on hydrological drought in two pairs of catchments in the United Kingdom and Australia. They use the paired catchment approach based on hydrological drought parameters such as drought duration, deficit volumes frequency, and total number of months of droughts and define hydrologic drought when monthly runoff is below its 20% percentile.

The article is well written, simple in the way that the methodology is straightforward and easy to replicate, the authors should be acknowledged for that. I have some suggestions to revamp the analysis, like a more thorough definition of the term "natural" and the inclusion of land and water-use characteristics in the basins, compulsory when performing a paired catchment analysis.

1. If the authors are trying to determine the presence of human influences on hydro-

logical drought, they should knowthe natural or reference influence to drought, i.e., the base hydroclimatic and basin characteristics. The authors do a rigorous hydroclimatic analysis in the way that their "paired" basins are same in size, close to each other, have same PET values, same P values. They have no similar geological characteristics but the authors are aware of this.

However, even though as the authors suggest, finding completely natural basins is difficult, their "isolation of the human influence" is coarse and undocumented, without properly accounting for differences of land use and water use between basins and without considering all the land use and water use already existing in the "natural" catchments.

Groundwater abstraction is not the only human effect that can influence drought characteristics. Just by looking in google earth at the Dun River upstream of Hungeford, UK, I see a basin that is completely agricultural, with barely any patch of natural vegetation. Since land cover/use is a control of water partitioning and runoff(Sterling et al., 2013), I don't know how "natural" is this basin. Additionally, by a quick search in google earth, I see that the river is also completely regulated by embankments and check dams/levies from beginning to end. Since flow regulation alters the partitioning of water and hence runoff (Jaramillo and Destouni, 2015), your reference conditions in terms of intra-annual variability and quantity of flow are already altered by regulation.

This means that your natural catchments are already affected and not eligible for a paired analysis for the purpose you need them. I would look harder for other basins with no water use/regulation and more pristine land covers to represent the "natural" condition, in the UK or abroad. Articles such as (Dynesius and Nilsson, 1994; Jaramillo and Destouni, 2015; Lehner et al., 2011; Nilsson et al., 2005) could help. The Authors can also choose instead of a "paired" analysis of catchments a paired analysis of two groups of catchments, this would make the analysis more robust.

Furthermore, the authors say that one of the basins suffers from groundwater abstractions while the other one doesn't, at least, for the UK pair. There is no quantification of this, how much, where, since when ground water abstraction in the human affected basin? Any evidence that in the other basin there is no groundwater abstraction, are you sure of this?

The authors should check this for the Australian case too.

2. Include some statistics of land use and water use in the Description of the area. Also, improve Figure 2, to show more information on each catchment.

3. The authors should put some statistical significance tests to support further their results.

So I like the idea, but a more thorough selection of catchments including land and water use conditions needs to be included in the study.

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