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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Characterizing the Potential for Drought Action from Combined Hydrological and Societal Perspectives" *by* Erin Towler et al.

Anonymous Referee #2

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The manuscript by Towler et al. investigates the potential for drought action. The stated "goal of this paper is to provide an experimental methodology towards a better characterization of several components of the drought feedback loop" and the study claims to have done this by "developing an index to characterize how natural influences on drought inform potential human actions on drought." The general topic is important and deserves innovation and systematic research. Unfortunately, I do not really see this was achieved by the presented material. I found the hydrological analysis particularly weak and the relation between drought events, general wetness/dryness, and potentially water scarcity rather than drought defined and elaborated too little for a hydrology journal. The manuscript has some technical issues and lacks a thorough

discussion section on uncertainties, biases, and comparing outcomes with other studies. Nevertheless, the material is interesting and an improved version could make a valuable contribution to the topic. My overall assessment is that the manuscript may be more suitable to a journal with less demand on the hydrological science part and perhaps more focus on water resources management or hazards. I hesitate to recommend its publication in HESS.

Major comments

1) The scientific frame needs to be laid out more specifically. What exactly is meant by Drought Action (title). With the stated goal repeated above, I would first expect a clear definition of and thorough elaboration on what is called the 'drought feedback loop' in the stated goal. To me it remained unclear what is meant by that as well and what it has to do with this study - or where and why exactly is the research gap that is addressed here. In this context, the introduction and discussion ignore literature and existing experience on drought risk management and drought plans and quantitative trigger levels developed with stakeholder processes elsewhere.

2) Overall, the material is presented very much from a descriptive case study perspective, starting with a long description in Background. Each subsection in 3. also starts with a narrative of the case study region's conflicts etc., rather than theoretically presenting the approach and then briefly stating the data of the case study used to illustrate the approach. An international readership as in HESS will be interested in this, not in the case study details.

3) The manuscript repeatedly states that the study takes a hydrological view on drought. Perhaps my most substantial criticism is that the reader does not receive this hydrological view. As mentioned in the 'Background', the case-aquifer is rain-recharged and feeds springs and rivers as well as groundwater extraction - hence the aquifer's water balance is crucial. A hydrological perspective would need to provide rain and recharge data (or at least climatic water deficit) time series, spring and river flow

data as support for when there is drought, and an assessment how the groundwater levels are affected by abstraction as compared to the natural signal (if the van Loon et al. perspective is taken, proof is need what type of drought is considered here exactly). Are there trends - it looks like it? Together with some hydrogeological information, all this is missing and hence I do not see how the occurrence of drought (from a hydrological view a natural phenomenon of temporary water deficit that occurs rarely) can be distinguished from water scarcity or overexploitation. All this needs to be analysed in detail to know what it is exactly that one is feeding into such an index as the one created.

4) With the stakeholder process published previously and the very limited hydrological analysis based on one groundwater well record only, the main argument of novelty is the PDAI. For me it was not clear how "potential drought action" is linked to the 'importance' interviews (theoretically). I did not have time to read the cited publication on the stakeholder interviews, but I think the infos given here are not sufficient to understand and follow the argument for a PDAI. Generally, I am not at all convinced about the introduction of yet another index on drought as there is enough confusion over existing drought indices already. Some justification why this is an index (and not just called what it is - function of...are there precedents in other hazards?) and a thorough assessment of transferability and usefulness beyond this case would be needed to justify this as the main contribution to the current debate on the topic.

Specific or technical comments

5) Equations are not numbered and variables are not explained/defined consistently. Unnecessary use of multi-letter variable names (use z with various subs for gw levels and provide units, etc.). Please see HESS instructions for manuscript preparation regarding mathematical notation, use of equations, symbols, etc..

6) L. 277 Why smoothing by a 10-year running window? Groundwater heads are already smoothed by the dampening processes in the hydrological cycle, but more im-

portantly, any thresholds for management decisions and thus for the analysis will not use that, but actual water level. This requires justification in that respect.

7) L. 281ff What exactly is r? Pearson correlation coefficient or some rank correlation? What other indices, etc.? All computations and data need to be introduced in the Data and Methods section. Not here.

8) L. 288ff? If gw use is low, what is then used - e.g. for drinking water? Wasn't the whole point to analyse the water source that 'is used'? Very confusing. Citations from 2011 and 2006 should not be cited as 'recent' in this context, as a lot may have changed in 10 years.

9) L. 292ff The classification into wet and dry decades are nice, but what is the relation to the severity and occurrence of the actual drought events?

10) How is the link to history made? How can the stakeholder remember what they found important 4 decades ago - this may have been very different from today as life was very different. The constraints on the temporal aspects are not well introduced and not sufficiently discussed.

11) Section 4. If stakeholders worldview so clearly has opposite rankings in importance, I do not understand why the analysis was carried out on the full sample. Much more logic would be to investigate these two groups separately to obtain more useful results on PDAI or better, incorporate this somehow quantitatively.

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