

Review Comment hess-2022-94

Title: Projected changes in droughts and extreme droughts in Great Britain strongly influenced by the choice of drought index

Thanks to the authors for implementing the extensive revisions, the manuscript has improved a lot. The revised version brings out the most important findings of the study much more clearly. Part of these are primarily of regional interest (changes in drought for study region of Great-Britain, GB) and another part of wider relevance – the sensitivity of drought assessments to the choice of drought index (in this case, precip only or precip and PET, SPI vs SPEI). Especially for the second part, the study has potential to draw additional conclusions to the ones presented so far, that can make the manuscript more attractive and of wider relevance.

Hereby I provide a couple of recommendations to push the study a bit further to enhance its general relevance and interest, for consideration by the editor:

1. The first 2 research questions focus on changes in Precipitation and PET (as expressed in drought indices SPI and SPEI) due to global warming for the region of GB. The authors conclude that droughts increase in all respects (frequency, extent, intensity), with regional differences across GB. However, they do not elaborate on the novelties of their study: what are the new conclusions thanks to the “new level of detail by in-depth analysis of different drought characteristics...” Similarly, in the Discussion section, the authors state their results “are in broad agreement” with earlier studies without providing much detail on the novelties brought out by the “in-depth analysis”.

This is a missed opportunity: surely, the in-depth analysis brought new insights that are worth discussing (how they go beyond the existing literature) and reporting in the conclusions?

2. This brings up the 2nd point: the authors mention an interesting point of interest for GB as their study area: the fact that “GB sits in the transition between humid, radiation-controlled N-Europe and more arid, precipitation controlled S-Europe.” So, one expects regions along this transition to be affected differently by global warming in terms of precipitation and especially PET. It’s almost imperative to discuss the results in this light: how do the regional differences in drought changes relate to this transition in climatologies? How do the contributions of precipitation and PET to changes in droughts relate to the climatology?
3. The stark differences in drought effects between SPI and SPEI presented in e.g. Fig 5 and Fig 8 clearly suggest that changes in PET have a far stronger contribution to droughts than SPI, especially in SW- and E.-England. This raises the question what causes the strong contribution of PET? Is it changes in radiation (global warming is expected to result in more cloudless days in the region), in specific humidity, temperature? The authors have only isolated the effect of temperature which seems to be very large, comparing Fig 5-bottom versus Fig5-middle. This is a surprising result, since SPEI is calculated based on specific humidity, so the only remaining temperature effect is caused entirely by its effect on the slope of the CC-curve?. This definitely merits more extensive discussion. And it would be very interesting to see how changes in radiation play a role here, especially given that we are looking at a radiation-controlled to moisture-controlled transition.
4. The insight in contributions of climatological variables to changes in PET and thereby changes in SPEI compared to SPI along the climatological transition over GB would be a very interesting conclusion to report and of relevance beyond the regional study of GB.

In summary, I believe the results of this study enable drawing some very interesting additional conclusions and I invite the authors to push a bit further the interpretation of their results to bring these out.