

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC2
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Reply on RC2

Sarra Kchouk et al.

Author comment on "A geography of drought indices: mismatch between indicators of drought and its impacts on water- and food securities" by Sarra Kchouk et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-152-AC2>, 2021

We thank the reviewer for the careful reading and comments aiming to improve the quality of our manuscript.

We respond to all concerns raised by the reviewer in this Author's response.

We acknowledge that the title we chose for our paper may have been suggestive of a different content than what was actually reported. We agree than the initial title mentioning "a review of drought indices" could be misleading, hence the unfulfilled expectations raised by the reviewer.

The study expected by the reviewer, i.e. "*the pros and cons of each index related to different aims and regions*" was not the focus of our paper. Our bibliographic search showed that the pros and cons of each index related to different aims have already been extensively covered in the literature (e.g. IDMP, 2016 ; Bachmair et al., 2016; Bachmair et al., 2015 ; Zargar et al., 2011 ; Sivakumar et al., 2011 ; Yihdego et al., 2019). We also believe that it would be difficult to summarise an in-depth analysis of drought indices by region in a brief paper. Instead, we targeted our study to review some of the most used drought indices for meteorological, hydrological and agricultural drought. With regard to drought impacts we decided to focus on impacts related to food security and water security.

IDMP (2016). Handbook of drought indicators and indices, (M. Svoboda and B.A. Fuchs). Integrated Drought Management Programme (IDMP) Tools and Guidelines Series 2. World Meteorological Organization (WMO), Geneva, Switzerland and Global Water Partnership (GWP), Stockholm, Sweden.

Bachmair, S., et al. (2016). "Drought indicators revisited: the need for a wider consideration of environment and society." Wiley Interdisciplinary Reviews: Water 3(4): 516-536.

Bachmair, S., et al. (2015). "Exploring the link between drought indicators and impacts." Natural Hazards and Earth System Sciences 15(6): 1381-1397.

Zargar, A., et al. (2011). "A review of drought indices." Environmental Reviews 19: 333-349.

Sivakumar, M. V., et al. (2011). Agricultural Drought Indices. Proceedings of an Expert Meeting: 2-4 June, 2010, Murcia, Spain, WMO.

Yihdego, Y., et al. (2019). "Drought indices and indicators revisited." Arabian Journal of

Geosciences 12(3): 69.

Since we took a human-centered perspective, we believe that our findings contribute to the field of socio-hydrology and to the science of drought indices showing how local and contextual circumstances channel the choice of which drought indices to use. This constitutes for us the relevance for the scientific community.

We also posit in our study that the integration of local context and impacts into drought indices would add benefit, leading to more accurate drought monitoring. We believe that this is a significant outcome of our study and a conclusion that is applicable for mitigation and adaptation strategies, as the Reviewer mentions.

Therefore, we have reformulated our title to "A geography of drought indices: the mismatch between drivers and impacts". We believe this new title more accurately frames the content of our study.

When we have the opportunity to revise our manuscript, we plan to incorporate all the reviewer's suggestions, as specified below.

On behalf of all co-authors,

Sarra Kchouk

- Did you use the NHESS templates for the manuscript and bibliography? especially the references look weird

We did use the NHESS template available from their website for the manuscript and we used the reference style "Copernicus publications" (in EndNote) that we also downloaded from NHESS website. We will manually assess the references and check individually for any errors.

- Line 40ff. You state, that the initial driver for agricultural and/or hydrological droughts always comes from meteorology. I do not agree. You can have normal precipitation conditions but excessive land use and water extraction that could lead to AD and HD.

Typically, *in the literature*, the propagation of drought is depicted as a linear process rooting from meteorological drought and leading to AD and HD. We agree with your comment and will re-write it more clearly.

- For Table 1 you made a selection. Is there a chance to estimate the dark numbers of indices, that exist and that are not listed in this Table? I also miss relative indices like the effective drought index by Byun and Wilhite (1999). Furthermore, the table caption should be at the top of the Table not at the bottom. At the end of the Table some lines are highlighted in yellow, is there a reason for that?

Indeed, we have not included all existing drought indices, which would be an impossible task. Rather, we selected those indices that have been listed in two main publications summarizing the most utilised drought indices. These two publications are : the IDMP handbook of drought indicators and indices (Svoboda and Fuchs, 2016); and a scientific study (Bachmair et al., 2016) where the authors gathered the most used drought indices in EWS by drought managers.

It was an error to place the caption below the table. It will be placed at the top of the

table.

The lines highlighted in yellow were aimed to attract the attention of the reader and emphasise how some categories of drought indices and the impacts groups were studied through the social science scope; a crucial point mentioned in our discussion. We can make a clearer reference to this detail of the results in the discussion section.

Bachmair, S., Stahl, K., Collins, K., Hannaford, J., Acreman, M., Svoboda, M., Knutson, C., Smith, K. H., Wall, N., and Fuchs, B.: Drought indicators revisited: the need for a wider consideration of environment and society, *Wiley Interdisciplinary Reviews: Water*, 3, 516-536, 2016.

Svoboda, M. D., and Fuchs, B. A.: *Handbook of drought indicators and indices*, World Meteorological Organization Geneva, Switzerland, 2016.

- Line 100ff. The reasons how you select the studies and indices is definitely not clear to me

We selected all the studies where the drought indices of Table 1 were mentioned in a drought-related study. The reasons **why** we selected these indices are the reasons mentioned in the answer to the previous Reviewer's comment (#3). The reasons **why** we selected these studies was to retrieve their (primary) country of application. The exact queries showing **how** we proceeded are available in the Table A1 of the appendices. We propose to make these two points clearer in the methodology section.

- For the figures like Fig.5, there should be a short explanation in the text of what this type of displaying represents and how to interpret such figures. Also, what do the squares in the bottom left corner of each figure stand for?

Indeed. We will add a short explanation of how to read the cartograms. The squares are the legend indicating the number of studies according to the size of the country. We will add this to the explanation in the text and the figure caption, in addition to the world "legend" above those squares.

- There are some error messages in the text for missing references. Lines 241 and 278

The error messages have been corrected in the preprint that is downloadable on the NHES website.

- Lines around 250, I was expecting the total study more in this way like it is done for the SPI

We decided to go into such detail for the SPI as it is globally the most used drought index while being one requiring the fewer variables. Providing this level of detail for all the other indices would not have been feasible in a brief paper. Also, as we explained in our short response, this was not the aim of this paper; rather we aimed to explore the impacts component and the geography of both drivers and impacts.