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Reply on RC2

Veit Blauhut et al.

Author comment on "Lessons from the 2018–2019 European droughts: a collective need for unifying drought risk management" by Veit Blauhut et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-276-AC7>, 2022

Dear Reviewer #2,

Many thanks for your thoughtful review of our manuscript. We highly appreciate your efforts and your positive evaluation of our work, we respond to your comments below.

Section 1.3: This section is focused on the introduction of the 2018 and 2019 droughts in Europe. Authors speak about a "summer drought" that would mean that it only lasted three months approximately. What kind of drought definition are you using here? It is not clear here that if these summer droughts refer only to a negative precipitation anomaly plus a positive temperature anomaly on summer or are they a consequence of those factors plus previous bad hydrometeorological conditions? However, in section 3 you introduce four indexes to characterize these two drought periods and it is possible to see that it is probably the same event that started in winter 2018. In order to avoid any misunderstanding, I would suggest avoiding the expression "summer drought" here or introduce an explanation here.

Many thanks for pointing this out.

Droughts are defined by index specific thresholds as presented in Table 1, starting from "moderate drought". Indeed, "summer drought" is misleading and was intended to convey that some of the most severe deficits were seen over the summer months. But as the drought conditions extended beyond the summer we have removed "summer".

Section 2. Data: The calculus of SPI, fAPAR, SM and LFI require data on precipitation, temperature, Which is the data source that have you used? And the resolution? Or are these indexes provided directly by EDO?

Many thanks for this comment. We have clarified this point in the revised paper and have changed the data description to "Detailed information on the drought indices applied herein can be found in the EDO indicator factsheets (<https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1101>)."

- *156-164 and Table 1. The criteria used to build Table 1 and classify the category of the drought should be justified and clarified. Does exist any previous reference to justify it? To be considered into a specific category, would be necessary that the three indexes would have the same or a similar value (SPI, fAPAR, SM)? What about the different SPI indexes? Do you select the worst?*

Many thanks for raising this point. Indeed, the associated drought classes could have been explored in more detail. As you know, these thresholds are often an “arbitrary choice” and focus only on the hazard anomaly. As SPI, fAPAR and SM are standardised indices, their values come with a certain return period of the drought conditions. As such, the classification for these three standardised products: SPI, fAPAR, SM is taken from McKee et al. (1993). “The Low-Flow Index (LFI) is computed from the daily streamflow values produced by the LISFLOOD hydrological model”. The drought classification scheme used for LFIs taken from the European Drought Observatory and is explained in more detail in the relevant fact sheet (<https://data.jrc.ec.europa.eu/dataset/fd18fd1d-1af4-443a-b624-e19001b91f49>).

To clarify this, we added “To increase comparability of the four indices, the EDO data was further classified into categorical drought classes: no drought, moderate drought, severe drought and extreme drought. The standardised products SPI, fAPAR and SM are categorised following McKee et al. (1993) (Table 1), the Low-Flow Index (LFI) is computed from the daily streamflow values produced by the LISFLOOD hydrological model”. The drought classification scheme used for LFI is taken from the European Drought Observatory (according to the thresholds listed in Table 1). These applied drought classes are in operational use at the EDO. Furthermore, the fAPAR was restricted to the warm season in Europe from April to August and was not monitored for Iceland. Detailed information on the drought indices and drought classes applied herein can be found in the corresponding EDO indicator factsheets (<https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1101>). ” to the text.

- *167. Which criteria have you used to select the national representatives of each country? Do you consider that it constitutes a representative sample of stakeholders? What about citizens? Have do you applied any test to validate this sample from the point of view of a sociological approach?*

Dear Reviewer #2, many thanks for raising these questions. Finding contributors was not an easy task to do. The initial idea was to have representatives affiliated to science or governmental agencies. Doing so, we expected a neutral point of view and comprehensive knowledge on the different aspects we were interested in. Furthermore, we expected such persons to be well networked and thus constitute a representative sample of stakeholders. The network of national representatives developed out of our active Panta Rhei- Drought in the Anthropocene group but also partly from the Euro-FRIEND low flow group. For countries with no contacts, we screened national and international publications in the wide field of drought research. Clearly visible in Figure 2a, we did not manage to find support in each European country. The Covid situation of the past years complicated the contribution from many national representatives.

To clarify the selection procedure, we added the following text to chapter 2:

“National representatives of each country were selected and assigned responsibility to translate, distribute and evaluate the survey and all associated communication and feedback. The network of national representatives developed out of our active Panta Rhei-

Drought in the Anthropocene group but also partly from the Euro-FRIEND low flow group. The idea was to have representatives affiliated to science or governmental agencies. Doing so, we expected a neutral point of view and comprehensive knowledge on the different aspects we were interested in. Furthermore, we expected such persons to be well networked and thus constitute a representative sample of stakeholders."

We did not test this sample from a sociological perspective. The number of replies are strongly biased by country. Likely due to very different reasons which we can only speculate about. Nevertheless, we realised that our method was not optimal, but still considered a representative and well informed sample of national representatives

- 175. *The sentence "National representatives of each country were selected" should be moved to the end of the previous paragraph (L.174)*

Please see comments and changes to the previous comment. Thank you.

- 188. *How do you use the SPI-3, SPI-6, SPI-9 and SPI-12 to define a drought? Do you apply each one to each month?*

Dear reviewer #2, many thanks for raising this question. Following up on a previous comment, droughts are defined as introduced in Table 1. The time steps of SPI are monthly, the other indices fAPAR, SM and LFI are updated every 10 days. Accordingly, the definition of drought follows this frequency.

L.220-L.225. I consider that it is not necessary to explicit the name of all the countries affected by the drought when it is possible to synthesize it with the only reference to the Balcanic Peninsula. It is to say, the text "In south- eastern Europe, winter 2018/2019 precipitation deficits were detected across much of the Balkan Peninsula, i.e., Croatia, Albania, Slovenia, North Macedonia, Montenegro and Hungary, as well as in Slovakia. Serbia was already affected by the summer drought in 2018, which persisted throughout the winter. In Ukraine, Moldova and Romania, the 2018 event was moderate in the second half of the year and further rainfall deficits accumulated during winter, which led to rising soil moisture deficits from summer 2019 to the end of 2020", could be replaced by "In south-eastern Europe, winter 2018/2019 precipitation deficits were detected across much of the Balkan Peninsula. In Ukraine, Moldova and Romania, the 2018 event was moderate in the second half of the year and further rainfall deficits accumulated during winter, which led to rising soil moisture deficits from summer 2019 to the end of 2020".

Dear Reviewer #2, many thanks for this suggestion. We adapted the manuscript accordingly.

- 227. See my comments about Figure 2.

Please see our answer regarding Fig. 2 below.

Discussion

- 342-354. *Why do you introduce here a paragraph about some meteorological/climatic conditions related with some droughts in some parts of Europe? There is not any connection with the previous sections, neither with the subject of the paper. I would propose to delete them because it only offers a very partial image.*

Thank you for your suggestion. However, we find it important to provide an explanation for drought spatial heterogeneity from a meteorological and a climatological perspective. Additionally, as the climate studies revealed an increase in the frequency of drought related to circulation patterns, we found it appropriate to mention this in the section of discussion.

- 359. *It would be useful to build a figure that could corroborate the sentence "In general, the hazard severity perceived by the surveyed stakeholders corresponded well with the hazard severity monitored by the EDO". It is not easy to compare Figure 1 with Figure 6. You can create a graph x/y, Perceived/monitored.*

Thank you for this suggestion. We revised Fig. 1 and presented there now lines or coloured areas for the different drought indices in the two drought years 2018 and 2019. We hope with that a comparison across drought indices and drought perception is now much easier. A direct comparison of perceived and monitored hazard conditions seems impractical due to the different temporal resolution of data.

- 387. *Add a parenthesis before Fig.*

Dear Reviewer #2, many thanks for this suggestion. We adapted the manuscript accordingly.

- 390. *Delete the initials of the name in the reference "Hervás-Gómez, C., & Delgado-Ramos, F.,"*

Dear Reviewer #2, many thanks for this suggestion. We adapted the manuscript accordingly.

Figures

The quality of the figures is not good. The main problem lays in the labels. Figure 1. Years 2018 and 2019 placed at the left side can be deleted. It is enough to write it in the legend of the figure. Delete the text into the figure ("Proportion of country..."). This figure has been built by you or is from EDO? What about "The timing of MAX is indicated by the number of the 10-day interval"? Any reference to MAX neither to 10-day interval is included in the main text. Why have you selected those months and SPI accumulated values? (I.e. October, SPI-9).

Thank you for this important comment. Yes, the added numbers on the countries are too much information. Therefore, we reconceptualised the figure showing now the values of the three indices over the years 2018 and 2019.

Figure 2. It is not needed to write the capital letters to identify each country. As far as I understand the information about the main water usage is provided by the people interviewed? The results really caught my attention. Would it be possible to check if that perception is correct? Why there are no data for Spain? Following the text there is enough information.

Dear Reviewer #2, many thanks for your important comment. This point was also raised by reviewer #1. Data for Spain exists. Unfortunately, the Spanish- questionnaire (which was translated to the national language by the national representatives) was "adapted" to the national needs and it was formulated differently. Even though we initially decided to have a uniform survey for all countries, this happened. Since we noticed this after the finalisation of all questionnaires, there was no chance to redo it. Reconsidering the Spanish case "regulated surface water" is equivalent to the category "surface water from reservoirs". Accordingly we have followed the Reviewer's suggestion and have used the existing categories for the rest of Europe to represent Spain's data. Please see the changes in Figure 2, as well as in the text chapter 3.2: "In the case of Spain, the questionnaire was adapted to national specificity and resulted in less water-usage categories; here "regulated surface water" falls in the category "surface water from reservoirs". Accordingly, water resources ranks are #1 regulated surface water and #2 groundwater." Furthermore, we removed the capital letters in Figure 2.

Figure 4. Although the legend says "Perception of climate change effect on drought management in Europe shown as percentage of participants in pie charts responding to question", only Figure 4b shows pie charts.

Dear Reviewer #2, many thanks for this suggestion. We adapted the manuscript accordingly.