Comments to Editor – HESS-2023-1911

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Dr. Anne Van Loon

Handling Editor

Hydrology and Earth System Sciences

Dear Editor,

We extend our sincere appreciation for your efficient handling of our manuscript and, once again, for providing insightful and concise feedback following our response to your comments. In the subsequent paragraphs, we provide a summary of the changes implemented in the manuscript based on your valuable suggestions. Thank you for your support and for helping us improve the manuscript :)

Sincerely,

Oscar Manuel Baez-Villanueva

(on behalf of all authors)

Editor comments

E–C1: Thanks for the revisions. I think the manuscript has improved in terms of clarity and discussion.

We appreciate your insightful feedback, and we are pleased to hear that the revisions have enhanced the clarity and discussion in the manuscript.

E–C2: I understand your point about the SMRI. However, I do think that snow needs to be considered more carefully in your study. You mention in the revised manuscript that: "Finally, the median correlation values for SWEI are all lower than 0.4, with the highest values obtained for SWEI-1 at lags from zero to five months, suggesting that snow accumulated during the cold season has a relatively small influence on Q observed in the subsequent warm season" (l.344-345; in the tracked changes version of the manuscript) And in the conclusion that "meteorological drought indices are better proxies of streamflow drought events than SWEI index over snow-influenced catchments". (l.562-563). I think these statements are a bit misleading. In Figure S24 in the Supplementary Material there is an increase in correlation with SWEI lag times around 3–6 months for the nival catchments with median values above 0.5 (which is higher than the SPI1 and SPEI1 correlations for the same group of catchments). You mention this in Section 4.2: "SWEI showed relatively high values in nival catchments" (l.472), but it is a bit hidden. I would therefore strongly suggest that you rephrase the conclusion to state that for snow-dominated catchments, snow-accumulation and -melt processes are important drivers of streamflow, as can be seen by the high correlation of SSI with the snow accumulation index lagged 3-6 months or the precipitation-based indices accumulated over 6 months.

We agree with the Editor that the statements mentioned earlier may create confusion. Regarding the first sentence (L328–331), please refer to EC–C3, where we have clarified that the median correlation values of the SWEI consistently average below 0.4 for all catchments.

Additionally, we have elaborated on the sentence found on L472 (L455–459 in the recently revised manuscript), which now reads:

While the SPI, SPEI, and ESSMI generally exhibited higher values across all regimes, the SWEI showed relatively high values in nival catchments (see Fig. S24 of the Supplementary Material) for lags from 3 to 6 months (75th percentile < 0.60 and median values ≥ 0.50). These values are higher compared to the P-based indices at the same temporal scales, indicating that snow accumulation and snowmelt processes are important drivers of Q.

Finally, guided by the insights from Figure S24, we have rephrased the conclusion as recommended, and it now reads:

Snow-dominated catchments have a larger memory and consequently, larger temporal scales of the drought indices can be used as proxy of streamflow drought. In general terms, snow accumulation and snowmelt processes are important drivers of Q. This influence is evident in the relatively high cross-correlations observed between the SSI and the snow accumulation index lagged 3–6 months or the P-based indices accumulated over 6 months.

E–C3: I also suggest some minor changes in these statements:

- "Finally, the median correlation values for SWEI are all lower than 0.4, with the highest values obtained for SWEI-1 at lags from zero to five months, suggesting that snow accumulated during the cold season has a relatively small influence on Q observed in the subsequent warm season" (l.344-345) » Here you need to add "on average for all catchments".

- "The larger time lags of SPI and SPEI over snow-dominated basins, as opposed to shorter lags in pluvial basins, are consistent with how catchment memory modulates the propagation of precipitation into the hydrological cycle, which in turn determine the time until a streamflow drought is influenced by the meteorological drought precursor." (l.480-483) » Here you need to mention snow, when you are talking about catchment memory, because in the nival catchments the catchment memory you are talking about is seasonal.

Thank you for your suggestion. We have revised both sentences, and they now read as follows:

1. *Finally, the median correlation values for SWEI are all lower than 0.4 on average for all catchments, with the highest values obtained for SWEI-1 at lags from zero to five months. This suggests that, when considering all catchments collectively, snow accumulated during the cold season has a relatively small influence on the observed Q in the subsequent warm season. [L328–331]*; and

2. *The larger time lags observed for SPI and SPEI over snow-dominated basins, in contrast to the shorter lags in pluvial basins, along with the increased lag for SWEI, are consistent with how catchment memory modulates the propagation of solid and liquid precipitation into the hydrological cycle. This, in turn, determines the time until a streamflow drought is influenced by rainfall and snow-related processes (Alvarez-Garreton et al., 2021). [L465–468]*

E–C6:And finally some minor textual suggestions for you to change: - l.14-15: there is no a single drought index > there is not a single drought index OR there is no single drought index - l.620: Supplement Material > Supplementary Material

Thank you for your textual suggestions :) The sentences have been revised as follows:

1. ... *there is not a single drought index* ..., and
2. ... *Supplementary Material*...

References

Alvarez-Garreton, C., Boisier, J. P., Garreaud, R., Seibert, J., and Vis, M.: Progressive water deficits during multiyear droughts in basins with long hydrological memory in Chile, Hydrology and Earth System Sciences, 25, 429–446, https://doi.org/10.5194/hess-25-429-2021, 2021.