

General comments

The present manuscript proposes to study the link between teleconnection patterns and drought index/discharge over a historical period and under future climate projection. The study focuses on 6 catchments located in southern France.

Although the results presented are interesting and the methods seem adapted, it is not clear what the authors want to put emphasis on. On one hand, the study explains the link between teleconnection patterns, « observed » meteorological variables and « observed » drought index/discharge during the historical period. On the other hand, the authors define a statistical model to produce discharge over future periods, but results and validation only appear during the discussion, which is confusing. The link between the two parts is not clear, making the manuscript sometimes hard to follow.

Specific comments

1 Introduction

52-64 : Rather than presenting the results, you could highlight clearly what is done in the article. You could also add a summary of the article.

2 Materials and method

81 : Figure 1, please add the location of the gauging stations.

87-89 : Safran is a reanalysis, a combination of in situ observations and a background (ERA-40 or climatological values for precipitation). See, the definition of the Safran reanalysis in Quintana et al., 2008 and Vidal et al., 2010.

92 : The PET not computed inside the Safran reanalysis. It is computed externally (for example, with the Penman-Monteith formula) or through the combination SAFRAN -ISBA (see Habets et al., 2008)

94 : The variable needed to compute the PET are available in most of the GCM even in future projections. Hence, this is not a sufficient argument to the selection of the formula from Folton and Lavabre (2007).

101-108 : This part could have its own sub-section as this is an important feature of your study.

120 : Please mention the fact that the teleconnection patterns are computed using reanalyses.

<https://www.cpc.ncep.noaa.gov/products/wesley/reanalysis.html>

<https://crudata.uea.ac.uk/cru/data/moi/>

122 : Please the fact that the monthly historical values NAO/Scand is not computed with the same formula as the NAO/Scand of the GCM (see the NOAA website).

143 : Please justify the choice of the Morlet wavelet rather than another method.

148 : In Table 2 there are only information about 5 RCM and not 4.

3 Results

169 : In order to have a clearer view of the results section could be reorganized (see an example below).

3.1 Analysis of the link between teleconnection patterns and discharge during historical period : K-mean clustering / Wavelet analysis / Correlation analysis / Variability of teleconnection patterns in the past

3.2 Validation of the RCM and empirical hydrological modeling over the historical period

3.3 Analysis under the RCP8.5 scenario : Variability of teleconnection patterns in future climate simulations / Change in T, P and Discharge under future climate simulations / Evolution of discharge between eastern and western cluster

170 : Why did you only try k=2, and k=3? Furthermore, please justify the fact that you used RDI-03 and not another index for the clustering.

217 : In Figure 3, RDI-03 and P seem to give similar results. Can you comment on that.

264-265, Figure 4a : In the text you talk about average values of teleconnection patterns and in the caption of variability. Please clarify this.

281 : It is important to mention the values from different GCM to take into account the uncertainty. Please provide the range of the trends as well as the mean.

288, Figure 4a et Figure 4b : Teleconnection patterns computed using the reanalyses are noted « Obs », please find another name as teleconnection patterns are not observations nor coming from observations (see comment below).

288, Figure 4b : In this figure format, it is hard to really tell if the teleconnections patterns from GCM are coherent with the teleconnections patterns from the reanalyses. It would be better to compare it through a table (as in Table 3) or a boxplot (as in Figure 4b). You can include comparison of trend, mean, standard deviation, min, max compute during the 1950-2005 period for both the teleconnection patterns from reanalyses and the teleconnection patterns from GCM.

299 : Please mentioned the correction of RCM using the ADAMONT earlier, in the data presentation (subsection 2.6).

4 Discussion

362 : As I mentioned in the general comments, I think it would be better to put this part in the results section and then discuss the results here. Maybe you could still put the result of the projection here, but validation of the hydrological empirical model needs to be addressed earlier.

400, Figure 6 : It is not clear what you are plotting here. In the legend you mentioned linear trends, but it seems rather to be the mean change over the 2006-2100 period in respect to the 1950-2005 period? Furthermore, what is the reference, the simulated discharge the observed discharge.

404, Table 4 : As in Figure 6, it is not clear what you are displaying on the table. Mean changes in annual series?

5 Conclusion

Bibliography :

Quintana-Segui, P., Moigne, P. L., Durand, Y., Martin, E., Habets, F., Baillon, M., Canellas, C., Franchisteguy, L., and Morel, S.: Analysis of Near-Surface Atmospheric Variables: Validation of the SAFRAN Analysis over France, *Journal of Applied Meteorology and Climatology*, 47, 92–107, <https://doi.org/10.1175/2007jamc1636.1>, 2008.

Vidal, J.-P., Martin, E., Franchistéguy, L., Baillon, M., and Soubeyroux, J.-M.: A 50-year high-resolution atmospheric reanalysis over France with the Safran system, *International Journal of Climatology*, 30, 1627–1644, <https://doi.org/10.1002/joc.2003>, 2010.

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