Reviewer 1

We thank the reviewer for the constructive and detailed comments. All of them were used to improve the manuscript. Specific answers to comments are included below.

The manuscript focuses on analyzing drought in Europe in the period 1902-2019 by means of the CRU TS v4.04 dataset. The paper is very interesting and presents a good analysis, however, in my opinion there are a few drawbacks in the paper, which can be eliminated by carrying out some minor revisions following the list of comments below.

My main concern refers to the use of the CRU TS v4.04 dataset for the period 1902-2019. The numbers and locations of stations contributing to any grid cell of the dataset changed over time, especially in the first half of the past century. Can the authors provide a map showing the evolution of the stations' density in the study area? Can the authors provide a comment on how station distribution could influence the analyses shown on the maps?

We agree with this concern. In the revised version of the manuscript we added some paragraphs regarding the distribution of the stations in the CRU TS 4.04 dataset over Europe. Unfortunately we do not have access to the distribution of the stations to make our own figure, but we can definitely refer to the Harris et al. (2020) paper for an overview of the station distribution for precipitation (Figure 1 in their paper) and temperature (Figure S1 in their paper). As clearly shown also in their paper the stations distribution over Europe is relatively homogenous even at the beginning of the 20^{th} century, thus we believe that our results are robust throughout the analyzed period.

In the trend analysis the authors identified significant changes but they must specify the significance level considered.

This information has been added in the figure caption in the revised version of the manuscript.

Line 301: Figures 6-8 should be Figure 8

The text has been modified accordingly.

Finally, in the conclusions the authors added a discussion to underline the added value of their work compared to other similar in the same area, but some important comparison with drought analyses performed with gridded databases are missing. For example, in my knowledge, gridded data sets have been used for drought analyses in Europe producing maps of the self-calibrating Palmer Drought Severity Index (van der Schrier et al. 2006 doi: 10.1175/JCLI3734.1) or maps of the SPI trend at different timescale (Caloiero et al. 2018 doi: 10.3390/w10081043).

The aforementioned references and a discussion regarding our results and the results from other studies has been added in the revised version of the manuscript, in the Conclusions section.

Reviewer 2

We thank the reviewer for the constructive and detailed comments. All of them will be used to improve the manuscript. Specific answers to comments are included below.

The aim of the manuscript is to analyze drought evolution in space and time over the period 1901-2019 in three European macro regions, namely South Europe/Mediterranean region (MED), Central Europe (CEU) and North Europe (NEU). In particular, a comparison between three different drought indices, that is SPI, SPEI and ScPDSI, is carried out.

General comments

The topic is interesting and fits with the journal aims and scopes. It is well written and organized. Although the study is not novel from a methodological viewpoint, overall, it is clear and well detailed. The results seem accurate and highlight some relevant differences in drought detection over Europe between SPI and SPEI, with special reference to those events occurred during the last decades, due to increasing temperature, and therefore evapotranspiration.

I suggest a few revisions before publication. Specific comments:

In the SPI and SPEI computation based on CRU datasets, it was assumed that monthly accumulated precipitation series were gamma distributed and the accumulated differences between monthly precipitation and potential evapotranspiration were log-logistic distributed. Although these are the probability distributions commonly used to calculate these drought indices, it would not be surprising if they did not fit all the data. Have you checked the goodness of fit of these distributions for all the grid cells series?

We have actually tried all the available distributions in the SPEI package and compared the results between all the distributions (e.g. log-Logistic, Gamma and Pearson III), but no significant changes have been noticed. Thus we have decide to show, in our manuscript, the results based on the widely used candidate distributions: Gamma for SPI and log-logistic for SPEI, respectively.

In the abstract (L 21), Section 2 (LL 150-151) and Conclusions (L 411), the authors talk about the application of a joint distribution to analyze compound events (i.e., drought and high temperature concurrent events). However, as they clarify at LL 155-158, they just calculate the number of occurrences of compound events based on fixed thresholds. This is rather different than applying a joint probability distribution (i.e., fit a bivariate or multivariate distribution) to model compound events. Therefore, I suggest the authors to replace "joint distribution" just with "frequency analysis of compound events".

We apologize for the misunderstanding. The term has been corrected in the revised version of the manuscript.

In the compound analysis of droughts and high temperature, the occurrence of these events is based on fixed thresholds (e.g., 80th percentile for temperature and 20th for SPEI). How these thresholds have been chosen? Besides, I wonder if a sensitivity analysis has been carried out by changing the values of these thresholds. Please provide details.

We agree with the reviewer's comment and in the revised version of the manuscript we added some information regarding the use of other thresholds. We have tested threshold of 70th, 75th, 80th and 85th

percentile for temperature and 15th, 20th, 25th and 30th percentile for SPEI, but we could not find any significant change in the compound analysis. We chose the 20th (SPEI) and 80th (TT) percentile to have enough extreme events to analyze.

There are some previous studies on drought analysis at European level identifying similar trends, which are not cited in the manuscript. For the sake of completeness, the authors should include for instance:

Oikonomou, P.D., Karavitis, C.A., Tsesmelis, D.E., Kolokytha, E., Maia, R. Drought Characteristics Assessment in Europe over the Past 50 Years (2020). DOI: 10.1007/s11269-020-02688-0
Hänsel, S., Ustrnul, Z., Łupikasza, E., Skalak, P. Assessing seasonal drought variations and trends over Central Europe (2019). DOI: 10.1016/j.advwatres.2019.03.005
Christoph C. Raible, Oliver Bärenbold & Juan José Gómez-navarro (2017) Drought indices revisited – improving and testing of drought indices in a simulation of the last two millennia for Europe, Tellus A: Dynamic Meteorology and Oceanography, 69:1, 1287492, DOI:10.1080/16000870.2017.1296226
Bonaccorso, B., Peres, D.J., Cancelliere, A., Rossi, G. Large Scale Probabilistic Drought Characterization Over Europe (2013). DOI: 10.1007/s11269-012-0177-z
Parry, S., Hannaford, J., Lloyd-Hughes, B., Prudhomme, C. Multi-year droughts in Europe: Analysis of development and causes (2012). DOI: 10.2166/nh.2012.024
Bordi, I., Fraedrich, K., Sutera, A. Observed drought and wetness trends in Europe: An update (2009). DOI: 10.5194/hess-13-1519-2009
With reference to the potential interconnection between droughts and heatwaves, I believe that the discussion could benefit by the comparison with the results of the following studies:
Markonis, Y., Kumar, R., Hanel, M., Rakovec, O., Máca, P., Kouchak, A.A. The rise of compound warm-season droughts in Europe (2021) . DOI: 10.1126/sciadv.abb9668
Bezak, N., Mikoš, M. Changes in the compound drought and extreme heat occurrence in the 1961–2018 period at the european scale (2020). DOI: 10.3390/w12123543
Samaniego, L., Thober, S., Kumar, R. et al. Anthropogenic warming exacerbates European soil moisture droughts. Nature Clim Change 8, 421–426 (2018). https://doi.org/10.1038/s41558-018-0138-5

The aforementioned references and a discussion regarding our results and the results from other studies has been added in the revised version of the manuscript, in the Conclusions section.

Minor comments
LL 91-92: provide references at the end of the sentence.
Modified as suggested.

L 234: extend must be extent.
Modified as suggested.

L 282: add "are" before relatively.
Modified as suggested.

L 294 and L 420: add "of" after consideration.
Modified as suggested.

L 329: To most must be The most.
Modified as suggested.

L 361: Change SEPI in SPEI.
Modified as suggested.

L 435: projected.
Modified as suggested.