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Comment on nhess-2021-298

Anonymous Referee #1

Referee comment on "Hotspots for warm and dry summers in Romania" by Viorica Nagavciuc et al., Nat. Hazards Earth Syst. Sci. Discuss.,
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REPORT FOR THE NHES_2021-298:

GENERAL COMMENTS

The paper presents an assessment of the spatio-temporal variability and trends of hot and dry summers, over the last fifty years, analysing the physical mechanisms driving the occurrence of hot summers in Romania. For this, the heatwave duration index (HWDI), the Standardized and Precipitation index (SPI) and the compound hot and dry index (DHD) are computed for this region. I consider that this work is interesting, however, I also need to say, that I find the manuscript difficult to read, especially because the reader is constantly referred to supplementary material. Many of the figures in the supplementary material are necessary to follow the results. In this sense, I consider that a reorganization of the Methodology and Results sections is necessary. I think that an improvement of the paper is need previous to publication in order to reach the expected international standards requested by the journal.

SPECIFIC COMMENTS

1. Firstly, I think the authors are wrong in their attempt to extend their work on eastern Europe. All the calculations of the indices are made considering only data from Romania, and all the results shown in the manuscript are based on these indices. Although it is true that Romania is part of eastern Europe, the results obtained for just a country cannot be generalized to the complete eastern Europe. In my opinion this is an error, because from the title of the article the reader expects to find results referring to a much broader region. However, this fact does not detract from the value of the work, since Romania's geographical position, as well as its topographic characteristics, make it a very interesting region from a climatological point of view.

2. Other important point is about the use of the standardized precipitation index (SPI) to analyse drought events. I know that the SPI is a robust index widely used since it has a clear computation procedure and multi-scalar character. Nevertheless, the SPI only uses precipitation data to detect drought events. However, in the context of global warming is important to consider the effects of the temperature on drought. In this sense there is a new drought index, similar to SPI, that has the additional benefit of taking it into account. This is the Standardized Precipitation-Evapotranspiration Index (SPEI; Vicente Serrano et al., 2010), which combines the benefit of using the reference evapotranspiration with the simplicity, robustness, and the multi-scalar properties of the SPI. The increasing pattern of evaporation by global warming is not a negligible factor for drought assessment. So, SPEI is relatively better for drought monitoring compared with SPI. Taking this into account, I consider that the comparative study of regional applicability of these indices is highly required for suitable applications.

Vicente-Serrano, S. M., S. Beguería, and J. I. López-Moreno (2010), A multiscale drought index sensitive to global warming: The Standardized Precipitation Evapotranspiration Index, *J. Clim.*, 23, 1696–1718, doi:10.1175/2009JCLI29091.

3. About the use of ROCADA dataset, I don't understand the advantage of using it because it has the same $0.1^\circ \times 0.1^\circ$ spatial resolution than EOBs and shorter temporal cover.

4. Page 1, lines 24-26: Authors literally conclude "that our study can help improve our understanding of the spatio-temporal variability of hot and dry summers, especially at the regional scale, as well as their driving mechanisms which might lead to a better predictability of these extreme events". I think that this cannot be a specific conclusion of this work. I suggest to change this with:

"The results from this study can help improve our understanding of the spatio-temporal variability of hot and dry summer over Romania, as well as their driving mechanisms which might lead to a better predictability of these extreme events in the region."

5. Page 2, lines 82-88: A first summary about the main objective of the paper is made, and then this sound repeated in the description of the two main objectives. I suggest rewriting this by linking the two paragraphs.

6. Page 3, lines 97-98: Figure S1, which shows the temporal evolution of the heat wave duration index (HWDI) averaged for Romania for different durations, is introduced without explain the specific definition used for HWDI. Along with this, Figure S1 results are not relevant for the study, so I would suggest not showing this figure, especially considering the high number of figures in the manuscript (plus 12 figures in the supplementary material).

7. Page 4, line 11: "(values <-1)" is referring to the values of SPI, which is cited later in the sentence. I suggest to eliminate this parentheses.

8. Page 4, line 121: the text in the parentheses is redundant. I suggest to change this with only (August SPI3 < -1).

9. Page 5, line 139: Figure 2 shows the HWDI averaged at the country level. ¿What is the meaning of that? ¿Is this the heatwave duration index averaged for Romania? If this is the case, the title of section 3.1 (summer heat waves in eastern Europe), must be changed by summer heat waves in Romania. I think that the complete analysis is centred in Romania, not using data from the rest of the countries of eastern Europe. So I think that even the title of the manuscript must be changed in order not to confuse to the reader.

10. Page 5, line 148: In table S1 results of the trend analysis for HWDI are shown. The trend analysis uses de Mann-Kendall test to detect the trend, but what method is used for trend estimation? All this information should be described in Methodology Section. A review of the methodology section is necessary.

11. Page 5, lines: 160-161: the average duration of HWs during the period 1950-1970 shows in Fig. 2g is lesser than 10 days.

12. Page 7, lines 220-223: This is repeated and was already explained in the methodology section.

13. Page 7, lines 228-235: I think that there are some errors in Figure 5. For example, in Figure 5a is stated June 2002 as one of the driest years. However I find from Fig. 5a that is 2003. ¿Is this correct? Similarly, from Figure 5g for SPI3, years 2002 and 2018 are established as driest summers. I find in this Figure that the years correspond to 2003 and 2012, respectively. Also, the quality of the Figures should be improved.

14. Page 7, line 233: Again authors are referring to the eastern part of Europe. However, the analysis is just for Romania.

15. Page 8, lines 264-268: I consider that this paragraph should be in Introduction section, and not in the results.

16. Page 9, line 307: The methodology used for ranking maps is explained in the supplementary material. I suggest to change it to the methodology section.

17. Page 9, line 318: In Figure S6 the location of the 2D atmospheric blocking is shown. The algorithm for the 2D atmospheric blocking index is also described in the supplementary material. I suggest to change it into the Methodology section.

18. Page 10, lines 316-324: In this paragraph is established that the pattern resulting from the atmospheric conditions is an increase in the number of hot days, especially in the southern and eastern regions of Romania. I cannot see this from figures 10e and S5. The evolution of the Tx anomaly (Figure S5) shows that this is maximum for the northern Romania.

19. Page 11, line 374: I suggest to introduce a briefly description of the stability map methodology in the Methodology section. In summary, almost all the methodology used is explained in the supplementary material, which presents almost the same number of figures as the manuscript itself. Also, all the figures in the supplementary material are described in detail in the manuscript text, because they are supporting the results, so it is logical to think that they should be a specific part of the manuscript, and not supplementary material. In this sense, I consider that a restructuring of the manuscript is necessary.

20. Page 11, lines 363-368: If Figure S11 shows the composites maps of Z500 and wind for the years when the HWDI index (averaged for Romania) was > 5 days I consider not appropriate the figure caption for it, which establishes the occurrence of monthly heat waves in the central part of Europe.

21. Page 11, lines 380-382: The spatial structure of Z500 anomalies (Figure S11a) is indicating advection of air from the north-eastern part of Europe into Romania, not from the south-eastern.

22. Page 12, lines 420-427: Conclusion section begins with a paragraph with conclusions from other studies and for other regions in Europe. I think that this information could be appropriate to introduce the need of making this study in Romania, in the introduction section, but not here. Additionally, later in the conclusions the Figures showing the different results found are again mentioned. These figures have been previously described in detail in the Results section, so I consider that they must not be mentioned here again. Also, I suggest to change this section by Conclusion and Discussion section.

TECHNICAL CORRECTIONS

Page 1, line 17: "2020and" should be "2020 and".

Page 1, line 18: "HWs" should be "Heat Waves (HWs)".

Page 2, line 40: "favors" should be "favour".

Page 2, lines 80-90: "The paper is structured as follow in Section 2 we give a detailed description of the data and methods used in this study. In Section 3 we..." should be "The paper is structured as follow: in Section 2 we give a detailed description of the data and methods used in this study; in Section 3 we..."

Page 5, line 158: "centuries" must be changed by "decades"

Page 7, line 216: To add (Figure 4c).

Page 7, line 217: to add (Figure 4d)

Page 7, lines 238-239: (Figure 6a) was already indicated at the beginning of the sentence.

Page 10, line 322: Figure S6d-S6g should be Figure S5d-S5g.

Page 10, line 335: In figure 11e contours indicating the countries are in white colour and this does not permit to visualize them correctly.

Page 11, line 370: "map s" should be "maps".

Supplementary material:

In Figures from S6 to S12 the longitude and latitude labels must be indicated, at least in the maps of the lowest row.

In Figure S8, the contour lines indicating persistent atmospheric blocking system are very difficult to appreciate.