RC2: 'Comment on nhess-2021-173', Anonymous Referee #2, 28 Oct 2021

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Anonymous Referee #2: The manuscript from Calheiros et al is very difficult to read. It reads as a series of bullet points linked together and the authors did not even bother at breaking the text into paragraphs or making any effort to increase readability. This is not a result of the authors not being native English speakers (I believe paragraphs also exist in Portuguese) but rather denotes a major lack of attention to detail.

Answer: First of all, we want to thank the reviewer for his pertinent commentaries that contribute to improving this manuscript. We deeply regret the absence of paragraphs. The manuscript was written with paragraph breaks. We suspect that paragraphs were deleted by the software used for the submission of the manuscript. We will correct it in the next version of the manuscript.

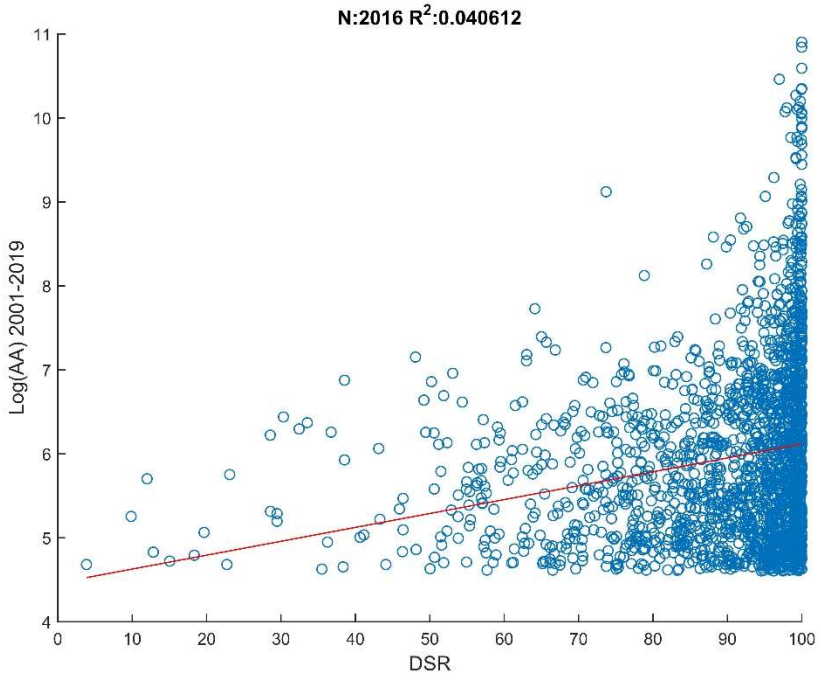
Anonymous Referee #2: The authors examine thresholds in burnt area associated with DSRp and how they differ across Portugal. The way they present the data is somewhat misleading: they make us believe that DSR has a very high correlation with burnt area. These types of correlations have been described before and they result from the ordering of values (from small to large). If that order is removed and simple scatter plot of burnt area DSR is presented, that relationship usually breaks, or is much weaker. I would thus encourage the authors to be more careful when using these types of analyses.

Answer: We disagree with the reviewer but we believe that the manuscript does not explain clearly this subject, so we will change it accordingly. In particular, we agree that the DSR vs BA scatter plot does not reveal a simple robust relationship between these two variables. Please see the figure below, where the logarithm of the burnt areas - Log(AA) - is plotted against the percentiles of DSR. This is due to several reasons (e.g., ignition source, firefighting activities, geographical/landscape features, fire barriers, limitations of the Fire Weather Index System to represent the role of fire weather drivers, humidity of live fuel moisture and the convective influence in fire behaviour, etc.) but, in essence, the most important one is that the wildfire activity does not only depend on the weather. This means that: (i) wildfires can occur in days with relatively low values of DSR; (ii) small wildfires can occur in days of high DSR, due to rapid fire-suppression activities or other constraints (especially fuel). However, it is well known that extreme wildfires only occur in days of extreme fire weather (Fernandes et al., 2016). These facts are validated by our results, revealing that only 6% of the Total Burnt Area (TBA) occurs with DSRp<80 and 12% of TBA is registered in wildfires with DSRp<90. These reasons explain all the main features of the figure below, namely: small wildfires are registered in days with almost all values of DSR, although the much small number of wildfires in the lower left quarter of the plot area, and the huge number of events near the right vertical axis, especially for DSR>DSR90p. In effect, DSR seems to act as an upper limit to the maximum burnt area. It is precisely the relationship between the burnt area and the DSR in this “region” of the plot that is investigated in this study. This is clearly explained in the manuscript and illustrated in Figure 2 and Figure 3.

Furthermore, we'd like to add that cumulative statistics are commonly used, including in wildfire science. See, for example, Cumming, S. G. (2001). A parametric model of the fire-size distribution. Canadian Journal of Forest Research, 31(8), 1297-1303.

Jiang, Y., & Zhuang, Q. (2011). Extreme value analysis of wildfires in Canadian boreal forest ecosystems. Canadian journal of forest research, 41(9), 1836-1851.

Kanevski, M., & Pereira, M. G. (2017). Local fractality: The case of forest fires in Portugal. Physica A: Statistical Mechanics and its Applications, 479, 400-410.



Anonymous Referee #2: I'm not familiar with the clustering techniques used by the authors, and I will not comment on those. I will just point out that the results are rather shocking because pretty much all clusters are distributed across all Portugal, but it is well known that fires in N PT differ substantially from S PT (the authors actually state this in their introduction as well).

Answer: A better explanation of the purpose of cluster analysis and the aim of its application in this study can help understand the results.

We want to clarify the three objectives of this study (as stated in lines 3-4 of the Abstract and lines 81-83 of the introduction) were to "1) assess if the DSR90p threshold is adequate to identify the bulk of burned area (BA) for mainland Portugal; 2) identify and characterize regional variations of the DSRp threshold that justify the bulk of BA, and; 3) analyze if vegetation cover can explain the spatial variability of the DSRp threshold ". If we had performed a cluster analysis on the number of fires or burnt areas, the results would

be clusters in regions where the incidence of fire is higher, ie in the central-north and extreme south region (Algarve) as the reviewer suggests. Results of this type of study can be consulted, for example, in:

Pereira, M. G., Caramelo, L., Orozco, C. V., Costa, R., & Tonini, M. (2015). Space-time clustering analysis performance of an aggregated dataset: The case of wildfires in Portugal. Environmental Modelling & Software, 72, 239-249.

Parente, J., Pereira, M. G., & Tonini, M. (2016). Space-time clustering analysis of wildfires: The influence of dataset characteristics, fire prevention policy decisions, weather and climate. Science of the total environment, 559, 151-165.

Kanevski, M., & Pereira, M. G. (2017). Local fractality: The case of forest fires in Portugal. Physica A: Statistical Mechanics and its Applications, 479, 400-410.

Some of these papers are already cited in the manuscript.

However, as explained in the manuscript in lines 6-7 and 132-137, the cluster analysis was motivated by the "spatial distribution of DSRp80TBA and DSRp90TBA" (lines 185-186), using a methodology described in section 2.3 (132-137), "based on the DSRp vs FTBA curves aimed to find groups of municipalities with similar fire-weather relation" (line 339) i.e., to group the municipalities that present similar relationship between DSRp and TBA and help to explain "some important differences appear among DSRp thresholds that explain 90 and 80% of the TBA" (line 358). The results were extensively described in section 3.3 (lines 215-251) which allow us to easily understand the purpose of having performed this analysis. In summary, the cluster analysis "revealed that municipalities where large wildfires occur in high DSRp present higher BA in forests and are located in coastal areas. In contrast, clusters with lower DSRp present greater BA in shrublands and are situated in eastern regions." (lines 9-11).