EGUsphere, referee comment RC1
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Comment on egusphere-2022-342

Anonymous Referee #1

Referee comment on "Differentiating fire regimes and their biophysical drivers in Central Portugal" by Rafaello Bergonse et al., EGUsphere,
https://doi.org/10.5194/egusphere-2022-342-RC1, 2022

The authors characterize fire regimes over Central Portugal and investigate the degree to which the differences between fire regimes are influenced by a set of biophysical drivers, namely slope, summer temperature and spring rainfall, land use/land cover (LULC) type and patch fragmentation, and net primary productivity. The authors rely on a cluster analysis followed by a classification tree model to assess the capacity of a set of potential biophysical drivers to discriminate between the different parish groups for 44 yrs period.

Results allowed to distinguish four types of fire regimes and show that these can be significantly differentiated using the biophysical drivers.

The subject discussed in the present article is of high importance, and the paper is well structured and easy to follow. The introduction is very clear and includes interesting and recent references. The objectives are very well presented. Although this study draws on prior studies with similar objectives, the authors try to presented the novelty, namely the use of a large dataset regarding the study of Oliveira and Zêzere (2020) and the study from Bergonse et al. (2022) which assumed a similar fire regime all over the study area. Although the usage of a longer dataset and different fire regimes over Central Portugal might improve the knowledge robustness on that area and topic, the authors need to better address the novelty of this paper comparatively to previous works.

The limitations of the study are not identified nor discussed. This is an important point, as one of the caveats relates to the fact that the datasets used don’t have the same length nor analyse more recent years. Therefore, there are points that need further attention. I believe that this document should be considered for publication after major changes, and if the authors agree to test for different datasets including recent periods.

Below I point some comments and suggestions, which hopefully can help the authors to enhance the manuscript.

C**omments:**

- **Methods: Figure 1:** Please add LULC information on this figure (as an additional panel).

- **Methods: Line 77-79**, Please briefly explain how the High and Very High wildfire hazard classes were determined.

- **Methods: Line 108-109,** "Prior research developed for the study area indicated an association between fire regime parameters and particular biophysical conditions (Bergonse et al., 2022)." Please remove as it was already mentioned.

- **Methods:** How do you justify using RFAJ and TPJS was calculated from monthly

rainfall data obtained from the Worldclim database (reference 1970-2000)? Was the data used for the same period? Why not using a drought indicator like the standardized precipitation and evaportranspiration index (SPEI)?

- **Methods: Lines 127-129:** How do you aggregate the information from the different LULC maps from the different years? You only mention how you aggregate the classes not the different years of information. How do you cope with the Land use change? Please clarify.

- **Lines 144-146:** Please change these lines above as they answer to my question

- **Methods: Lines 161-164: MAJOR CAVEAT:** databases used for NPP and climate variables.

Why don't you use NPP from MODIS which reaches present-day? Why do you rely on precipitation and temperature data which account for a period between 1970-2000 knowing that the last years have been record years in this area (Turco et al., 2019; sousa et al., 2019) and that drought conditions have been increasing (Vicente-Serrano et al., 2014)?

Ruffault et al. (2020), identified fire weather regimes objectively by dynamic k-means clustering based on the values of the weather and climate variables associated with each wildfire record, namely, temperature, relative humidity, wind speed, DMC and DC. Their results show that fire risk is higher when short-term meteorological extremes (warm and dry air, strong winds) combine with long-term summer drought, i.e. under the *Hot drought*, *Heatwave* and *Wind-driven* fire weather regimes. Therefore, wind is one of the drivers which is highly correlated and should not be discarded as also pointed by Vieira et

al. (2020), nor the combination of factors. Moreover, the authors highlight that the frequency of heat-induced fire-weather is projected to increase by 14% by the end of the century (2071–2100) under the RCP4.5 scenario, and by 30% under the RCP8.5, suggesting that the frequency and extent of large wildfires will increase throughout the Mediterranean Basin. Thus, using more recent data which can account for the latest years is important.

Some additional important references on the topic focusing on the Mediterranean or the Iberian Peninsula:

Turco M, et al. On the key role of droughts in the dynamics of summer fires in Mediterranean Europe. Sci. Rep. 2017;7:81.

Turco M, et al. Climate drivers of the 2017 devastating fires in Portugal. Sci. Rep. 2019;9:13886

Ruffault J, Moron V, Trigo RM, Curt T. Objective identification of multiple large fire climatologies: An application to a Mediterranean ecosystem. Environ. Res. Lett. 2016;11:075006

Ruffault J, Curt T, Moron V, Trigo RM, Mouillot F, Koutsias N, Pimont F, Martin-StPaul N, Barbero R, Dupuy JL, Russo A, Belhadj-Khedher C. Increased likelihood of heat-induced large wildfires in the Mediterranean Basin. Sci Rep. 2020 Aug 14;10(1):13790. doi: 10.1038/s41598-020-70069-z. PMID: 32796945; PMCID: PMC7427790.

Identifying large fire weather typologies in the Iberian Peninsula, M Rodrigues, RM Trigo, C Vega-García, A Cardil - Agricultural and Forest Meteorology, 2020

Vieira I., Russo A., Trigo R.M. (2020) Identifying Local-Scale Weather Forcing Conditions Favorable to Generating Iberia's Largest Fires . Forests 11(5), 547

Sousa P., Barriopedro D., Ramos A.M., García-Herrera R., Espirito-Santo F., Trigo R.M. (2019) Saharan air intrusions as a relevant mechanism for Iberian heatwaves: The record breaking events of August 2018 and June 2019. Weather and Climate Exetremes, 26, 100224, DOI: http://doi.org/10.1016/j.wace.2019.100224

Vicente-Serrano S. M., Lopez-Moreno Juan-I., Beguería S., Lorenzo-Lacruz J., Sanchez-Lorenzo A., García-Ruiz J. M., Azorin-Molina C., Morán-Tejeda E., Revuelto J., Trigo R., Coelho F., Espejo F. (2014) Evidence of increasing drought severity caused by temperature rise in southern Europe. Environmental Research Letters, doi:10.1088/1748-9326/9/4/044001

How do the usage of more recent databases influence the results as temperature is rising and weather temperature extremes are mounting in this area? And the influence of wind? These need to be tested and compared.

- **Methods:** when using the CT model you are using a spatial and temporal varying information to assess which is the most important variables in each of the 3-4 clusters? Or the information is aggregated spatially and then related? These options would rely on not so recent meteorological characterization and might not reflect the actual

influence of temperature. How do you account for that?

- **Discussion:** Citing authors previous works on the same area and with similar approach is not a strong comparison. I would suggest the authors to look for similar results from other authors or different areas to support this point (e.g., lines 338, 345).

- **Discussion:** Lines 409-410: The authors say that "It is therefore possible that the potential effects of summer temperature in burned area are constrained by fuel availability". As the authors certainly know from the basics of the **fire triangle** or **combustion triangle, which** is a simple model for understanding the necessary ingredients for most fires, three elements are needed for a fire to ignite: heat, fuel, and an oxidizing agent (usually oxygen). A fire naturally occurs when the elements are present and combined in the right mixture. A fire can be prevented or extinguished by removing any one of the elements in the fire triangle. Therefore, we can have all the necessary weather and vegetation conditions but if we don't have ignitions, although the fire weather risk is high, the fire might not even start. Here the authors need to check for the presence of the conditions and not just suggest a possibility.

- The authors lack to show the limitations of the data used and also other aspects which were not addressed in their study.

- The authors don't highlight how the conclusions on their current and previous work (Bergonseet al., 2022) are different.

Rafaello Bergonse, Sandra Oliveira, José Luís Zêzere, Francisco Moreira, Paulo Flores Ribeiro, Miguel Leal, José Manuel Lima e Santos, Biophysical controls over fire regime properties in Central Portugal, Science of The Total Environment, Volume 810, 2022, 152314, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2021.152314.

- The usage of NPP and temperature seem to be mostly disregarded in the discussion. Justify the usage and discuss their importance.

- When applying for the classification tree model, the importance of each of the parameters is determined based on a linear or non-linear relation? How does that affect the identification of the most important factors?