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Interactive comment

Interactive comment on "Fire danger rating over Mediterranean Europe based on fire radiative power derived from Meteosat" *by* Miguel M. Pinto et al.

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R1.1: I have just one relevant concern: the locations of energy release and static probability of exceedance in fig. 5 and fig. 7. seem quite marked by specific fire events, e.g. the very large and severe fire in Arouca, Portugal, 2016. Isn't the validation period too short, and did this affect calibration and consequently the general applicability of the procedure? Reply: This point was raised by both reviewers (see R2.7) and is indeed a relevant concern. We therefore decided to assess the robustness of our approach by using all data currently available from the LSA SAF Fire Radiative Power (FRP) product. The study period was accordingly extended from January 2010 – August 2017 (almost 8 years) to January 2004 – September 2017 (almost 14 years). This implied redoing all the computations and changing Tables 1 and 2, and Figures 4 to 14 with the new results. As expected, extending the database of FRP has an impact on the distributions of energy released by wildfires, especially at the level of upper quartiles and extreme values (Figs. 4 and 6) as well as on the geographical distribution (Fig.5) where there is a better enhancement of regions affected by severe wildfires (namely Northern Portugal and Galicia, and Greece) and changes in the distributions of static probability (Figs. 8) are again noticeable in the upper quartiles and extremes. When fitting a GP distribution to the extended database of daily released energy, the impact is nevertheless quite low. When comparing the old and new versions of Fig. 9, the fitting is still very good for values of exceedances below 2×10ˆ4 GJ; for values above this threshold, discrepancies between model and sampled quantiles are now more prominent but, as previously mentioned, besides representing only 1% of the sample, they are attributed to sensor saturation. The dependence of daily energy released on static probability and FWI anomaly is now clearer (Fig. 10) and the dependence of the scale parameter of the Pareto distribution on these two parameters (Fig. 11) presents a similar functional relationship, although with a steepest gradient in the region of high values of static probability and FWI anomaly. The quality of fitting of the final model (Fig. 12) is nevertheless virtually the same and changes in the partitioning of the domain of probability of exceedance versus the respective anomalies are minimal (Fig. 13). New results obtained are consistent with previous ones and, as shown in the updated Tables 1 and 2, the characteristics of the product are the same, in particular the ability to discriminate fire events in terms of released energy and an Extreme Class of fire danger containing a very large fraction of fires releasing very high values of daily energy (above 10 000 GJ).

R1.2: P1, L19. Replace “that is more than the double of the” by “that more than doubles the”. Reply: The expression now reads “that is more than one and a half times the”.

R1.3: P2, L7-9. I know this is a common assumption but I would prefer to see this sentence removed or toned down. Studies in Europe that examined this assumption by considering other variables in the analysis, namely confounding effects, could not find evidence that the assumption holds. Both ecophysiology and fire behaviour disprove the assumption. Plant productivity depends also of temperature and easily saturates under the influence of either higher temperatures or higher rainfall, and created biomass is different from fuel, or different from fuel available to burn in the same year. Additionally, this assumption is true in fuel-limited ecosystems or grass-dominated fuel complexes, and neither is the case in Mediterranean Europe. Reply: This issue was raised by both reviewers (see R2.5) and therefore the sentence “A severe fire season is often triggered by a wetter-than usual winter that increases the amount of biomass, followed by a warmer and drier than average spring that leads to higher levels of vegetation stress (Pereira et al., 2013).” was removed.

R1.4: P2, L9-10. “high temperature, strong wind, low fuel moisture and low relative humidity”. Temperature and RH have no direct effect on fire ignition and spread and are only relevant in their effect upon fuel moisture. To avoid redundancy and confusion between short- and mid-to-long-term processes I advise rephrasing as “strong wind and low fuel moisture” or as “high temperature, strong wind, low relative humidity and drought”. Reply: The authors agree with the suggested clarification and therefore the expression was replaced by “high temperature, strong wind, low relative humidity and drought”

R1.5: P2, L30. Be clearer as this sentence can be interpreted in distinct ways. Fires are always dependent on fire weather, regardless of their size. In fact, because fire size is dependent on landscape properties, fire weather will be increasingly less relevant as minimum weather thresholds for attaining certain fire sizes are crossed. Reply: The sentence now reads: “The rationale is that fires are always dependent on fire weather and meteorological conditions become more relevant for large fires (Ruffault et al., 2016)”.

R1.6: P3, L10. State up-front why this is information needed. Reply: The sentence now reads “Since fire intensity and behaviour depend on the vegetation type (e.g.: Moreira et al., 2011; Fernandes, 2013; DaCamara et al. 2014), the GLC2000 database (Hartley et al., 2006) was used as the source of information about vegetation cover/land use.”

R1.7: P4, L7. “cumulated”, replace by “cumulative” or “accumulated”. Reply: The word was replaced by cumulative.

R1.8: P4, L17. The equations have not changed but for ease of calculation see the current programming codes in Wang et al. (2015). Reference: Wang, Y., Anderson, K. R., & Suddaby, R. M. (2015). Updated source code for calculating fire danger indices in the Canadian Forest Fire Weather Index System. Information Report NOR-X-424. Canadian Forest Service Northern Forestry Centre. Reply: Thanks for providing the reference to the current programming codes for the CFFWIS. The reference was updated to Wang et al. (2015).

R1.9: P5, L13. If you are referring to forest, shrubland and agriculture it’s land cover type rather than vegetation type. Reply: The text was changed accordingly.

R1.10: P6, L26. A more accurate heading would be “Fire danger rating classes”. Reply: The heading was changed accordingly.

R1.11: P7, L1-8. Please explain the rationale for the partition criteria. How does it compare with other common criteria, e.g. Andrews et al. (2003)? Reference: Andrews, P. L., Loftsgaarden, D. O., & Bradshaw, L. S. (2003). Evaluation of fire danger rating indexes using logistic regression and percentile analysis. International Journal of Wildland Fire, 12(2), 213-226. Reply: An overview of calibration procedures is now provided in the Introduction (see R2.1). A brief explanation of the rationale was also included in the manuscript at the end of Section 3.5: “It may be noted that the adopted approach to calibration differs from other common methods like those based on logistic regression and threshold setting based on a geometric progression that were mentioned in the Introduction. The present approach based on a partitioning of the space of probability versus probability anomaly by exponential type functions was motivated by the distribution of the daily energy released of observed fire events in that space during the study period (Fig. 13)”.

R1.12: P8, L8. And yet what made the Pedrogão Grande event unique is that the fatalities and fast fire growth happened on the 1st day of the fire. I suggest a brief reference to this as well as discussion (advantages or disadvantages of the developed classification) of the fact that the atmospheric conditions responsible for the event (gust front from a thunderstorm and highly unstable atmosphere that jointly allowed PyroCb development) are not captured by the FWI. Reply: These aspects were pointed out by both reviewers (see R2.4). Therefore, the following paragraph was added before the last paragraph of the Conclusions: "It is worth noting that the proposed approach is based on FWI that is defined at the daily level. Classes of fire danger are accordingly computed on a daily basis, and the same happens in the cases of the LSA SAF and the EFFIS products that also depend on FWI. The daily scale of the classes of fire danger may sometimes constitute a shortcoming, namely because local atmospheric conditions of short time duration cannot be captured by FWI. This was indeed the case on the first day of the large 2017 fire event at Pedrógão Grande-Góis, when the unstable atmospheric conditions favoured the formation of thunderstorms and gust fronts that jointly allowed pyrocumulonimbus development and played a crucial role in the extremely fast initial-spread of the fire, causing a large number of fatalities. Inaccuracies in the forecasts of precipitation at the local level may constitute another shortcoming given that they may lead to incorrectly low values of FWI. These two limitations may be circumvented, at least partially, by means of intraday high-resolution fire weather forecasts combined with the use of ensemble forecasts that will allow a better assessment of the uncertainties of fire danger predictions. Both aspects are currently being studied and results are expected to bring developments of the current method to be operationally implemented in the future".

R1.13: P8. L8. “extremely”, not “extreme”. Reply: The word was modified accordingly.

R1.14: P8, L9. Use “at the nearest station”. Reply: The text was modified accordingly.

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R1.15: P19, L13-14. Replace “fire prevention” by “fire management”. Fire danger rating is important for a variety of activities, including prevention, preparedness and suppression planning. Reply: The text was modified accordingly.

R1.16: P20, L23. There’s a 2017 paper in the IJWF that explicitly relates FRP with fireline intensity. Reply: Reference to Johnston et al. (2017) has been included.

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