Climate of the Past Discussions

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Comment on cp-2021-36

Anonymous Referee #2

Referee comment on "Reconstructing burnt area during the Holocene: an Iberian case study" by Yicheng Shen et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-36-RC2, 2022

This is an interesting, if challenging, exercise in numerical data transformation. The results are worth reporting, even if the exercise does not appear to have been especially successful. What should be removed is the claim in the conclusion/abstract that "this new method opens up the possibility of reconstructing changes in fire regimes quantitatively from pollen records" in regions where charcoal data are lacking. The pollen-burnt area relationship that they established for the Iberian peninsula is not transferrable to other geographical regions, even to adjacent regions such as France. For example, wildfire in most of Iberia is fuel-limited so that burning increases at times of wetter climate, when biomass increases. In contrast, in most of France, there is abundant plant biomass so that fires are caused by drought conditions when vegetation becomes more flammable. There are some specific plant taxa that are fire-sensitive or fire-tolerant such as Cistus monspeliensis, but these indicator species are the exception not the norm. In reality, what the authors have done is to use pollen and charcoal data in combination to fill spatial gaps in coverage within Iberia. They have not shown that charcoal can be replaced by pollen as a palaeo-fire proxy in other regions (e.g., Greece) where charcoal data are lacking. The analysis carried out for Iberia could, in theory, be scaled up to cover larger regions, but they are not transferable from one part of the planet to another. Sub-Saharan Africa, for example, is deficient in charcoal records although African savannahs account for almost half of all wildfires globally. This deficiency cannot be resolved by using the pollen-burnt area relationship in, for example, North America, and transferring it to African pollen records.

At a more fundamental level, trying to use pollen data as a fire proxy also means that pollen cannot then be used to test vegetation-wildfire dynamics and relationships, in the way that Connor et al (2019) did for Iberia during the Holocene. Pollen data, on their own, are not able to provide both cause and effect without falling into the trap of circular reasoning.

How successful was the Iberian test case? Not very successful, as far as I can see. The authors report that pollen data predict charcoal abundances through time "relatively well (R2 = 0.47)". However, as Figure 4 in the original version of this manuscript shows (Fig. 5 in reply to reviewer comments) this is almost entirely due to a long-term trend during the Holocene towards increased burning. Centennial or millennial scale peaks and troughs in this graph (no longer included in the paper, nor is the helpful flow chart of methodology – why?) are mostly mis-aligned, a point made already by reviewer 1. In their reply to her/him, the authors also report the results of CCA which shows that burnt area alone explains only 1% of the variability, while other factors explain a much higher share. My guess is that much of this is due to the fact that most of the 29 sites with coupled pollen-charcoal analyses come from two relatively small mountain areas of central Spain (see Figure 1 map in the current manuscript version), so that other regions and biotypes are under-represented in the "training set".

In summary, with modified conclusions, this exercise is worth reporting, but largely because it highlights the difficulties and challenges of using pollen data on their own as a palaeo-fire proxy.