

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2022-223

Anonymous Referee #1

Referee comment on "Evaluation of CMIP6 model performances in simulating fire weather spatiotemporal variability on global and regional scales" by Carolina Gallo et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-223-RC1>, 2022

Synopsis

This paper evaluates the skill of 16 CMIP6 models in reproducing historical observed fire weather conditions as viewed through the CFDRS. The paper is well-written, well-structured and the methodology is robust. I think the paper has the potential to be published but I have a few comments below that need to be addressed before publication.

Major comments

Section 2.3 – Are authors aware of the hot model problem in CMIP6 ? See the paper below. This should be discussed and acknowledged.

<https://www.nature.com/articles/d41586-022-01192-2>

Line 166-170 – Defining a unique fire season for each GFED region is questionable given their spatial extent. The timing of the fire season has already been reported in a number of previous studies and has been shown to be much variable in space. The present coarse-scale analysis is thus likely to mix a number of different seasonalities within each GFED region. I would suggest to define a fire season locally (e.g. at the pixel scale) as done in most previous studies. Moreover, the model ranking (currently based on GFED region) would be much more relevant if authors would consider the spatial extent (number of pixels) where a model falls within a specific tercile. The current ranking is dependent on the size of each GFED region (a small region contributes as much as a large one).

Minor comments

Line 65-68 - GCMs have also been used in attribution studies of FWI to quantify the current risk

Barbero R, Abatzoglou J T, Pimont F, Ruffault J and Curt T. 2020 Attributing increases in fire weather to anthropogenic climate change over France. *Frontiers in Earth Science*

<https://doi.org/10.3389/feart.2020.00104>

Line 130-131 – I am not sure to understand how links between fire events and fire weather trends relate to the performance of ERA-5 in reproducing observed fire weather conditions Two independent variables can follow similar trends !

Line 150-155 – As stated by authors, the record length of GFED is a bit short to draw such conclusions. What about using a land cover map to define what is burnable or not?

Line 157 – why this specific time period? This needs clarification

Line 158 – Are you referring to the 90th percentile of daily values?

Figure 2 – the title indicates (mon_mean) while the caption reads annual mean. Please use the same terminology for consistency.

Figure 2 and 3 – I wonder if the (minor) differences between average and extreme statistics need to be reported. Please consider moving Figure 3 to the supplementary information and reduce the text accordingly.

Line 197-198 – Given the (rather expected) similarities in the results, I suggest moving DSR results to the supplementary information.

Line 217-219 – this belongs to the methods

Figure 4 – please increase label size (x and y labels) as well as the colorbar. They are very hard to read.

Figures 5-6 – Would that make sense to add the MMM for comparison with each individual GCM?

Figure 5-6 – Please indicate the RMSE error on the figure for clarity

Figure 6 – please consider moving this figure to SI given the similarity with figure 5

Line 349-350 – this is a very interesting result

Line 355-358 – Does it mean that a model performing well in reproducing historical variability is more credible in simulating future changes to fire weather conditions? I am just asking.

Line 402-405 – Yes, other regionalization such as the pyroregions presented in Galizia et al. (2021) over Europe would be more relevant in terms of fire activity and management.

Galizia, L. F. C., Curt, T., Barbero, R., Rodrigues, M. (2021). Understanding fire regimes in Europe, *International Journal of Wildland Fire*, 31, 56-66.
<https://doi.org/10.1071/WF21081>

A future interesting research question would be to examine what meteorological variables (temp, prcp, RH and wind) are responsible for the difference between observed and simulated CFDRS components. This could be discussed somewhere in the paper.