Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-223

Anonymous Referee #2

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-RC2, 2023

This work evaluates the performance of 16 CMIP6 models in reproducing historical fire weather indicators represented by the Canadian Fire Weather Index System by comparing the results to those produced by GEDD-ERA5. This paper is written in a concise manner, it is well structured and provides a robust and insightful analysis that allows a better understanding of the performance of CMIP6 models in capturing fire related weather. In my opinion, this work provides a useful contribution to the scientific community, aiding model selection for future related studies focused on the use of these for future climate driven fire projections. However, before this is considered for publication, there are several clarifications which should be provided by the authors.

Lines 125 – 129 – The work by Vitolo et al. (2020) describes GEFF-ERA5, the reanalysis dataset of FWI fire behaviour indices based on the ERA5 reanalysis, including the impact of resolution by comparing to GEFF-ERAI. Please consider including a reference to this work.

(Vitolo, C., Di Giuseppe, F., Barnard, C. et al. ERA5-based global meteorological wildfire danger maps. Sci Data 7, 216 (2020). https://doi.org/10.1038/s41597-020-0554-z)

Lines 150 – 155 – My understanding is that this paragraph is highlighting that this work will be focused on the fire-prone areas of the world, as defined in GFED4. It's not clear to me how the last sentence of this paragraph is relevant for this work, as no further mention to GFED (other than the regions) is made throughout this work.

Section 3 – Throughout this section the authors analyse the differences in the fire indices between the different CMIP6 models and GEDD-ERA5. While this provides a useful insight and understanding on the FWI components bias, further expanding these to the fire weather components (e.g., temperature, wind, precipitation, etc…) would provide a better

understanding of the drivers of said bias, strengthening the evaluation provided by this work. This is especially relevant at regional level and may help with model selection, as well as inform future model development.

Figure 2 and 3 – The caption refers to these figures as Annual means, however subtitles on each top tile refer to mon_mean. This should be reviewed and made consistent.

Figure 4 – Figure label are not legible, please consider increasing the font.

Lines 344 – 346 – Although it is stated that it is difficult to identify systematic reasons for inter-model differences, having an analysis of the meteorological driver (e.g., temperature and precipitation) between models may help better understand the inter-model bias.

Lines 346 – 350 – It is mentioned that there is little evidence on the impact of spatial resolution, but it is mentioned that MPI-ESM1-2-HR consistently performs better than MPI-ESM-ESM1-2-LR and MPI-ESM-1-2-HAM. Comparing the impact of resolution using different models may not provide the robust framework to draw conclusions, as the effect of different resolution may be impacted by different model formulation (e.g., different dynamics, physics, inputs, etc…). Furthermore, Vitolo et al. (2020) shows the benefits of resolution in FWI between GEFF-ERAI GEFF-ERA5.

Line 390 – resolution should be considered a caveat, especially following the mention of the fire regimes vary substantially at the intra-regional scale in lines 402 – 405.