Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2019-263-RC2, 2020

Geoscientific Model Development Discussions

Interactive comment on "The interactive global fire module pyrE" *by* Keren Mezuman et al.

Anonymous Referee #2

Received and published: 15 January 2020

Review for Mezuman et al., The interactive global fire module pryE

General comments: The present paper presents a new fire module as implemented in the GISS ModelE ESM. The fire module relies on previous fire model developments. It is nice to see new developments in fire modeling, here focusing on fire emissions. Overall the manuscript is well written and the results presented clearly. PyrE does not seem to outperform existing fire models (which was clearly not the objective either), but its performance is neither bad compared to the performance of other fire models. My main issue with the current manuscript is that it is assuming fire numbers and active fire counts to be the same thing, which is confusing and can lead to wrong interpretation of results. While I don't have any problem with the chosen approach of moving directly from fire count to emissions, the authors should present their methods in a more coherent way. Below are some comments which I hope will explain in more detail where I think the issues are.

Detailed comments:

L35: pyrE: Is this an acronym? If so, indicate this.

L40: ". . .as is commonly done in other interactive fire modules. ", this is not true.

L98-123: It is unclear to me why you have here such a huge emphasis on regional seasonality of fires. It distracts a bit from the main message you want to bring here, which is presented in the following section where you do explain the reasons why you are so much interested in incorporating a fire module within your ESM.

L216: "fire counts" are not really a much-used term within the fire community, thus making it hard to understand what you mean. Use "number of fires" or similar to avoid confusion. Fire counts could be interpreted as thermal anomaly detections from satellites etc., which is something completely different.

L220-223: while I think I know what you want to indicate here (flaming fase compared to area burnt), I don't agree with this. While this could be a computationally faster way (which can be an argument), there are also inconveniences associated, with e.g. no fuel gradient driving your emission amounts within each region. Again, I don't have anything against your approach, but you should explain things clearer to avoid confusion.

L370-373: may add this to section 4 and change that name to "datasets", as it has nothing to do with ModelE.

L372: "and on future projections (not used in this study) for years past 2010 ". If it is not applicable here, no need to mention it.

L375-379: This is not really accurate, as some models here just assign a fixed fire size instead of a dynamic one, others are completely empirical and hence don't simulate fire numbers etc.

L379-380: This is confusing: during the methods you indicate that you produce number

of fires and that you incorporate a fire growth method to obtain burnt area. Hence your fire counts = fire numbers. However, here it seems to indicate that the authors of the manuscript use two completely different concepts “fire number” and “satellite observed thermal anomalies” indiscriminate while they cannot be compared one-to-one. Thermal anomalies/active fire counts are detections of whether within a pixel at the time of the satellite overpass there is an fire actively burning (or smouldering), so you can have 100s or 1000s of active fire detections within 1 single fire (and hence number of thermal anomalies is closely related to burnt area and not number of fires at a regional scale). So, one would expect to have more active fires than number of fires, and hence the need of a scaling factor. This is a problem within this manuscript and should be fixed. As you need an even much larger scaling factor for burned area it mainly seems that your fires don’t grow large enough? As a side note, and again, no problem if you ignore this. Have you thought about ignoring burnt area completely, as it barely used (no terrestrial impact as far as described in the manuscript) and doesn’t seem to influence your results much?

L403: why 2005 and not a climatology as well ? Now you focus on a specific year which its peculiarities (El Niño with much fire in the amazon).

L409: This is personal, but I find this section way to detailed for just describing some of the reference datasets used. Especially considering the brief introduction to modelE, which I think is more important (at which time resolution do you run?), Especially the integration of the fire module within the land surface model. Does the fire model change albedo? Carbon stocks? LAI? I don’t think these important parts are covered, and would prefer that compared to these detailed descriptions of external datasets.

L471: GFED4s starts in 1997 (1995 is mentioned a couple of times more in the manuscript)

L522: This is great and the first time I see (output) of sub-daily fire model results. I think it would be nice that it is indicated in the methods as well. So, this is completely driven

by changes in VPD, which seems indeed to capture the expected sub-daily dynamics surprisingly well. Have you thought of comparing this to GFED 3h estimated emissions or thermal anomalies from some geostationary satellite? Just a thought, so don’t feel obliged.

L554-555: I guess you divided these numbers by accident by 10. GFED4s burnt area is somewhere around 450Mha (did you use GFED4 instead which is around 350Mha?)

Table 2: Indicate time period.

Figures: increase fond size of most figures, as many legends and axis are now barely readable.

Figure 3 can go to supplementary, as burnt area is anyway not the main focus of the fire module.

Figure 5: why didn’t you indicate the values for Terra and Aqua instead of a star. If you don’t want to show the values, I think the stars are a bit misleading as they are put straight on the mean model output, so you better draw a shaded box, line or something similar.

Figure 7-9: indicate which map indicates what, be it with letters or a description above each subplot.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-263, 2019.