Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-122-RC2, 2020

Geoscientific Model Development Discussions

Interactive comment on "Modeling long-term fire impact on ecosystem characteristics and surface energy using a process-based vegetation-fire model SSiB4/TRIFFID-Fire v1.0" *by* Huilin Huang et al.

Anonymous Referee #2

Received and published: 22 July 2020

General Comments

This paper describes the coupling of a fire model introduced by Li et. al. (2012;2013) into a biophysical model (SSiB4) with dynamic vegetation from TRIFFID. SSiB4/TRIFFID-Fire is used to provide new analysis on changes in vegetation and surface energy budgets resulting from fire. It builds on previous work, from the Li et. al. fire model that used constant vegetation, and SSiB4/TRIFFID that used constant fire disturbance. The coupling and analysis is therefore novel, and is a useful addition to existing fire model analysis performed with other models.

The paper is mostly well written and the methods are clearly described. The results are generally clear and support the conclusions, with the exception of a few small areas that could benefit from further clarification as outlined below. There are some sections that could also be expanded slightly to improve the interpretation of the results. Referencing and credits is thorough and comprehensive. In general I believe the paper is well presented and would be a useful publication in GMD, once the specific comments below are addressed.

Specific Comments

Lines 85-88 – can you clarify if there are any new processes that you are looking at here, or are they the same processes as Li et al (2017) but now updated with dynamic vegetation?

Line 146 – you could cite Bistinas et al (2014) here, who looked at trends in cropland fires Bistinas, I., Harrison, S. P., Prentice, I. C. and Pereira, J. M. C.: Causal relationships versus emergent patterns in the global controls of fire frequency, Biogeosciences, 11, 5087–5101, doi:10.5194/bg-11-5087-2014, 2014.

Line 194-214 – The burning of litter is not mentioned. How is this treated in the model?

Line 269 – how long was the model spun up for? Spin-up is usually carried out over pre-industrial years to remove the effects of climate change later in the 20th Century. As the period used in this study and for the spin-up is over the mid-20th century, how is climate change mitigated in the spin-up?

Line 270 – please clarify what 'quasi-equilibrium' is and how it is measured / defined

Line 288 – please clarify if the lightning data is scaled for cloud-to-ground strikes

Line 294 – can you include more of an explanation of the treatment of agriculture in the model. The source of agricultural fraction is from GLC2000; does this represent agriculutral fraction from 2000, or earlier? It looks like the agricultural fraction is constant and does not vary over time – please state this explicitly in the description. It is

worth pointing out that the change in agricultural fraction will alter burnt area, which is not taken into account here. I partly agree that this may be implicitly included by including suppression to population density and GDP (line 371), but the spatially and temporally varying agricultural fraction will be different to population and GDP, and thus will have a different impact on the spatial pattern of burnt area.

Line 315 – It is misleading to state that there is an effect on the climate here. If I understand correctly, the climate is prescribed, but the surface temperature can vary? So you don't actually get full climate feedbacks as you would in an atmosphere or full Earth System Model?

Line 330 – Why is the magnitude of burned area underestimated in Northern Africa savannah?

Line 333 - this sentence seems contradictory. Please clarify. Do you mean that humidity counteracts high fuel, resulting in a smaller peak?

Line 410 – I can't see which part of West Africa is referred to here. Please clarify

Line 416 – It looks like this should be May instead of April. Does this change the conclusion of the sentence, which refers to the wettest month in the model?

Line 419 – we generally don't see much burning in cropland areas (see earlier reference to Bistinas et. al. 2014), so I don't see that this would be a driver of the low correlation in the two regions mentioned here.

Line 485 – nice comparison of biomass compared to GLC2000. I think it would be useful to include maps of vegetation cover without fire and from observations as well to help show the spatial pattern

Figure 4b – the axis text is very faint and difficult to read. Please change text to black instead of grey (and in all relevant figures). The caption mentions an asterisk for positive correlation, which also appears to be denoted by red text – please state this in the caption as well.

Figure 10 – what causes the changes in tree cover, LAI and vegetation height in the north Africa (Libya and Egypt, and far west across Mauritania and western Sahara)? It doesn't look like there is any burnt area simulated here.

Lines 541- 544 - I don't follow what the authors are saying here. Line 541 – what variable is being referred to here in terms of the reduction, evapotranspiration or latent heat? How is it accounted for by the increase in soil evaporation? Line 544 – this sentence is referring to the wet season, but says that latent heat increases after fire. Is there much fire in the wet season?

Technical Corrections

Line 28 – asses *the* long-term fire impact

Line 50 – *the* hydrological cycle

Line 77 – Lasslop et al submitted is now published. References can be updated throughout

Line 83 – only *the* fire model developed by Li et al

Line 87 – only annual energy *flux* changes

Line 94 – by incorporating *the* fire scheme of Li et al

Line 112 – should GPP / NPP be production / productivity rather than products?

Line 450 – model and *observations*

Line 469 – suggest reword to 'modelled impact of fire. . .'

Line 472 – *observations* and model

Line 524 – vegetation height area *decreased* by

Line 539 – fire *region*

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